U. S. Bureau of Commercial Fisheries.

UNITED STATES COMMISSION OF FISH AND FISHERIES.

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# PART XX.

# REPORT

OF

# THE COMMISSIONER

FOR

THE YEAR ENDING [illegible] 30, 1894

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# National Oceanic and Atmospheric Administration

## Report of the United States Commissioner of Fisheries

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# REPORT

OF THE

# UNITED STATES COMMISSIONER OF FISH AND FISHERIES

FOR THE

FISCAL YEAR ENDING JUNE 30, 1894.

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The appropriations for the work of the Commission for the period covered by this report were as follows:

| | |
|---|---|
| Salaries | $172,120.00 |
| Miscellaneous expenses: | |
| Administration | 9,000.00 |
| Propagation and distribution of food-fishes | 92,181.94 |
| Maintenance of vessels | 30,500.00 |
| Inquiry respecting food-fishes | 10,800.00 |
| Statistical inquiry | 5,400.00 |
| For completion of the following stations in— | |
| Texas, at San Marcos | 8,300.00 |
| Montana, at Bozeman | 6,400.00 |
| Vermont, at St. Johnsbury | 8,500.00 |
| For repairs to Armory Building occupied by the United States Fish Commission | 7,100.00 |
| Rent of temporary offices and transfer of records | 2,000.00 |

Detailed report of the expenditures under these appropriations was made to Congress December 3, 1894 (House Mis. Doc. No. 19, Fifty-third Congress, third session).

## REPAIRS TO OFFICES.

The building known as the Armory Building and occupied by the offices of the United States Fish Commission was built in 1855 for the care and preservation of military trophies of the Revolutionary and other wars, and for the use of the volunteers and militia of the District of Columbia. In 1874 it was condemned by Col. O. E. Babcock, in charge of public buildings and grounds, as old and unsightly, and its demolition was recommended. From 1877 to 1888 it was used by the United States National Museum for the storage of articles transferred from the Centennial Exhibition at Philadelphia, and the Secretary of the Smithsonian Institution states that the four floors, containing 5,000 square feet, were filled with these articles from top to bottom. These heavy loads had caused the floors to settle to such an extent as to cause apprehen-

NOTE.—The operations of the Commission during the period under consideration were under the direction of Commissioner Marshall McDonald, whose declining health, however, prevented him from preparing a report covering them. His death occurred September 1, 1895. The accompanying report, prepared by the chief clerk of the Commission and the assistants in charge of the divisions, shows the work of the Commission during the fiscal year 1893-94.

sion as to the safety of the building, and it became necessary to make a thorough inspection of it. The examination showed the building to be in a very unsafe condition. Estimates of the cost for its repair, with a detailed report of the condition of the building, were transmitted to Congress, and an appropriation of $7,100 was made for its repair, to be done under the supervision and direction of the Architect of the Capitol.

On February 19, 1894, the offices were temporarily moved to the Atlantic Coast Line Building, corner Sixth street and Pennsylvania avenue. Soon thereafter the work of repairing was begun and was pushed so energetically that the building was ready for occupancy by June 6, and the offices were moved back to it, the Commission occupying the entire building, the Smithsonion Institution having vacated the portion formerly used by it.

## OFFICE OF ARCHITECT AND ENGINEER.

The following is a condensed report of the work of construction at the different stations of the Commission during the year:

*Green Lake Station, Maine.*—The construction of new rearing ponds, supply flumes and pipes, drains, and grading of the grounds, begun in the preceding fiscal year, was finished. An ice-house was built and a number of minor repairs to the station made.

*Craig Brook Station, Maine.*—Finishing the constructions begun but not completed during the last year, viz, ice-house, food room, settling reservoir, new supply pipe for outdoor rearing troughs, grading, and making other minor repairs in superintendent's residence and barn.

*Woods Hole Station, Massachusetts.*—A new coal hoist and run was built in place of the old one, which had become decayed and unsafe.

*St. Johnsbury Station, Vermont.*—This station comprises 24.65 acres of ground on the west shore of Sleeper River, 1½ miles from St. Johnsbury, Vt. After all plans and specifications were made, the development of this station was begun with the construction of a dam across Sleeper River, from which to supply the hatchery and ponds with river water. The construction of a hatchery and barn was given out by contract; a railroad siding was provided, and roads through the grounds were built; a portion of the grounds was graded, some fencing was done, and the springs on the grounds were partly developed.

*Battery Island Station, Maryland.*—The damage done by extraordinarily high storm tides in September and again in October, 1893, was repaired. It consisted in repairs to the foundation, floors, porch, roof, and chimney of the dwelling house, the erection of a coal shed, a new front incline to hatchery building, and new foundation for water supply tank.

*Fish Ponds, Washington, D. C.*—A 2-inch supply pipe was laid from the foot of Seventeenth and B streets NW. to the new northeast pond. The office of the superintendent, which showed some settlement in the floor and partitions, was repaired.

Preliminary plans and an estimate of cost were made for the improvement of the Potomac Flats by a number of large and small ponds, a boulevard, and sea wall, a hatchery building, and extensive landscaping, all of which was laid before Congress with a view of obtaining an appropriation to carry the improvements into effect.

*Northville Station, Michigan.*—Several of the various ponds of this station were provided with new supply pipes; separate drains for all these ponds were laid; a new supply pipe of wood was substituted for one formerly of terra cotta; a number of springy places in the grounds were drained by blind ditching; and twelve new rearing ponds were constructed, complete with supply pipe, overflow, and drains. A number of repairs to the former pipe lines and reservoirs was also made, and a survey for a proposed new spring-water supply.

*Neosho Station, Missouri.*—At this station two small reservoirs, formerly of wood, were replaced by a construction of concrete. Two new ponds were constructed and some minor repairs were made to ice-house, pipe lines, and ponds.

*San Marcos Station, Texas.*—This station comprises 25 acres of land at the head of San Marcos River, close to the city of the same name. A supplementary topographical survey of the grounds was made. The new dam constructed by a committee of citizens at San Marcos was inspected and reported upon unfavorably.

*Leadville Station, Colorado.*—A survey was made with the view of constructing a dam across Rock Creek, thereby filling several large natural depressions in the hills above the hatchery for storage purposes and for obtaining a larger spring-water supply for the hatchery. The result of the survey showed the impracticability of said proposed construction. Steps were then taken to purchase additional adjoining land in which the Evergreen lakes are situated, and to control, through a new Executive order, all of Rock Creek above said lakes. The purchase of said land was consummated.

*Bozeman Station, Montana.*—This station comprises 77 acres of ground at the lower entrance to Bridger Canyon, 4 miles from Bozeman. A supplementary survey was made of the grounds, and plans for a hatchery and pond system were prepared.

## OFFICE OF MECHANICAL ENGINEER.

The following report exhibits briefly the work done during the past fiscal year in the nature of repairs, alterations, and new work to and in the steam engineering departments at the different stations, upon the cars and in the steamers of the Commission, together with the work done in connection with aquarial exhibits at the different stations and the World's Columbian Exposition:

During the past fiscal year there has been a large amount of work done in the machine shop at Central Station by the machinists and firemen who have been detailed for duty there from time to time. This

work has consisted not only in the machine work incident to the necessary overhauling and repairs to the steam launches and machinery of Central Station, Fish Ponds, Bryan Point Station, and Battery Station, but considerable machine work has been done in the above-mentioned shop for the Put-in-Bay, Duluth, Gloucester, and Woods Hole stations, as also repairs, alterations, and new work to the circulating and steam plants of cars Nos. 1, 2, 3, and 4.

For many years there was located on the third floor at Central Station a cylindrical wooden supply tank for supplying fresh water to the hatching tables. It was found advisable to discontinue this weight upon the floor. The tank was therefore removed, and a 3-inch Watson & McDaniel water-pressure regulating valve was purchased and connected in the main supply system, which proved entirely satisfactory.

The small vertical launch boiler, which was located in the machine shop at Central Station to assist the 15-horsepower horizontal boiler in heating Central Station and the general offices of the Commission, was removed from the shop and erected on car No. 4 to furnish steam for the water and air circulating plants on that car. This boiler being too small to properly assist in heating Central Station and general offices, it was found necessary to make some new arrangement for the increase of boiler power of this station. It was therefore decided to build a new boiler house of sufficient size to allow the introduction of a new 30-horsepower boiler. This boiler was purchased, but after its purchase it was found that the new boiler house could not be erected; and as such a boiler was needed at Woods Hole, it was transferred to that station and there erected.

The steam launch *Blue Wing* was hauled out on the railway and several seams in the hull were calked. The old cabin of this steamer was torn down and a new one erected, the inside and outside were thoroughly painted, the boiler and pumps were overhauled, and extensive repairs were made to the engine.

The steamer *Petrel* was hauled out on the railway, several pieces of rotten plank were removed, and new plank substituted. The moldings around upper deck were renewed, the forward part of the hurricane deck was cut, and a pilot house built. The side curtains were altered. The engine, pumps, boiler, and their attachments were thoroughly overhauled and repaired. The steamer was painted and varnished inside and out. A set of automatic water-glass gauge cocks were put on the boiler. A new steering gear was made and introduced.

The steamer *Canvasback* was hauled out on the railway and the hull repaired. The boiler of this steamer being old and worn out, a vertical steel boiler was purchased, erected, and connected, and the engine and pumps were overhauled and thoroughly repaired.

In order to haul the steamers and other boats out at Battery Island Station, Maryland, a marine railway was constructed and introduced. During a heavy gale here the steamer *Plover* was sunk by having a hole punched through the planking in her hull below the water line.

The steamer was raised, hauled out on the railway, and hull repaired. Extensive repairs were made to its engine and pumps, and a new propeller wheel was purchased and put on. The boiler being old and worn out, a new one was purchased and introduced.

The independent air and feed pump in the steamer *Curlew* not being satisfactory, a new one was made in machine shop at Central Station.

The steamer *Cygnet* was hauled out on the railway and necessary repairs made to the hull. The boiler and pumps were thoroughly overhauled, and extensive repairs were made to the engine.

A new Scotch boiler was built for steamer *Shearwater*, to take the place of the Ward boiler now in the steamer.

Since the introduction about eight years ago of boiler and pumps for the water-circulating and steam-heating plants in car No. 2, it was found necessary to increase the capacity of this car for transporting fry and hatching eggs en route, and as this necessitated an increase of water circulation larger boiler and pumps were purchased, erected and connected in same, the car almost entirely repiped, and the air pump which was removed from car No. 4 erected and connected in order to furnish aeration for transporting tanks.

The 25-horsepower horizontal boiler, which has been in use at the Woods Hole Station for the past nine years, needed such extensive repairs that it was condemned, and the 30-horsepower horizontal boiler which had been purchased for Central Station was transferred to the Woods Hole Station and erected in the boiler room.

The 6-inch wooden suction pipe for the salt-water circulation at the Woods Hole Station, which had been in continual use for the past nine years, was in such bad condition that 225 feet of it was dug up, and new pipe of the same make was laid.

The 6-inch water cylinder of the main circulating pump at Battery Island Station being worn out, a new water cylinder, 10 inches in diameter, was purchased, and will be connected as soon as opportunity offers. There was also purchased and erected at this station a 6,000-gallon wooden supply tank for hatching apparatus, the old tank having been washed away during one of the floods.

As the water around the station at Lake Erie contains so much lime in solution, which causes the accumulation of scale in large quantities in the boilers, a pipe condenser was made in order to condense the exhaust steam from the pumps and radiators, and a small air and feed pump was transferred from the Woods Hole (Mass.) Station, and connected to this condenser. This arrangement allowed the station to be heated by the exhaust steam from pumps and the condensed water to be pumped back into the boilers. The arrangement has worked very satisfactorily.

As the gravity supply of the Duluth (Minn.) Station failed on several occasions on account of drought or freezing up, the steam pumping plant at this station was increased by the transfer from Battery Station of a pump which was there in stock. The wells located on the shore of the lake would not, during the severe cold of the winter, furnish

enough water to supply the necessary amount required in the hatchery, and about 350 feet of 6-inch iron pipe was purchased and laid from the pumps, extending out into the lake about 250 feet into a depth of water of about 12 feet. This pipe was well anchored to the bottom, and since its introduction there has been no trouble in obtaining all the water required. It was found advisable to remodel the hatching apparatus, etc., of this station. A new system of jar battery, hatching and rearing troughs, etc., was made and erected, and the whole piping in the hatchery was rearranged. After the remodeling of the hatchery, it was found that a greater amount of work could be done with considerable saving in water, which has caused a saving in fuel.

## WORLD'S COLUMBIAN EXPOSITION.

The exhibit of the Commission at the World's Columbian Exposition, the report covering which appears as an appendix to this volume, had for some time been in complete working order at the opening of the fiscal year. Dr. Tarleton H. Bean continued in charge as representative, assisted by W. DeC. Ravenel, as chief special agent; Prof. S. A. Forbes, as director of the aquarium, and other persons.

The section of Scientific Inquiry, prepared under the direction of Mr. Richard Rathbun, contained illustrations of the marine laboratory of the Commission; models of illustrations of vessels; specimens of seines, trawls, nets, dredges, and sounding machine used in deep-sea work; instruments used in making physical observations; a large series of flexible casts illustrating, chiefly, important economic species; charts and models of the ocean areas investigated, and specimens preserved in alcohol or in a dry state.

The section of Fish-Culture was directly in charge of Mr. W. DeC. Ravenel. In addition to what has already been mentioned it contained apparatus used in modern fish-culture, as well as an historical series showing the changes through which fish-cultural methods have passed; apparatus for collecting and transporting eggs and spawning fish; models and pictures of hatching and rearing establishments; collections showing methods and results of fish-culture; eggs in various stages of development preserved in brine or alcohol; illustrations of the food and enemies, and a collection of fish-cultural literature.

In the hatchery the eggs of the pike perch, yellow perch, and common sucker had all been developed, and about 7,000,000 of fry were planted in Lake Michigan near Jackson Park, and elsewhere. In July a consignment of eggs of the black-spotted trout was received from Leadville, and 70 per cent of them were hatched early in the month. Notwithstanding the high temperature of the water, the fry were kept without considerable loss until an accident to the machinery caused their death.

In the Fisheries section were shown models prepared under the personal supervision of Capt. J. W. Collins, illustrative of vessels and boats now engaged in the fisheries of New England, the Great Lakes,

Chesapeake Bay, Gulf of Mexico, and the Pacific and Arctic oceans, as well as types of historical interest showing the development of fishing craft. This section was also materially improved by the addition of pictures of fishing operations, as well as statistical charts.

The aquarium contained marine fishes and plants obtained along the east and west coasts and the Gulf of Mexico, while the fresh-water supplies were secured from the Potomac, Mississippi, Great Lake basins, and the hatching stations of the Commission.

In the aquarium the salt water reached the very high temperature of 70° early in July, as it had done in the preceding month, and continued very warm, with an occasional fall of a few degrees, until about the middle of August. In September, again, the same difficulty was encountered, but the appliances for perfect aeration and circulation of the water prevented serious loss. In the fresh-water tanks the difficulty was very much greater, the high temperature being accompanied by an outbreak of a fungous disease and a scourge of parasitic protozoans. The fungus destroyed large numbers of catfish, trout, black bass, crappie, pike perch, and other species, while the protozoan was particularly fatal to trout and catfish. Notwithstanding all the drawbacks, the aquarium was one of the most frequented places in the Exposition, and the exhibit was in every way highly creditable.

Immediately after the close of the Exposition such of the aquarium contents as were not required by the Commission were, upon the direction of the Commissioner, transferred to Prof. S. A. Forbes for the State Laboratory of Natural History at Champaign, Ill.

The preparations for the World's Fisheries Congress began shortly before the opening of the Exposition, and were actively continued during the summer. The Commissioner associated with himself Dr. G. Brown Goode, Prof. S. A. Forbes, Dr. T. H. Bean, Mr. E. G. Blackford, Mr. A. Booth, Mr. N. K. Fairbank, and Mr. R. E. Earll as members of a general committee, and upon the invitation of Mr. C. C. Bonney, general chairman of the World's Congress, a large number of men prominent in fish-cultural investigations in various parts of the world were invited to form an advisory council. Invitations were sent out requesting attendance at the sessions of the congress and the preparation of papers to be read at the meetings. Numerous responses were received, and the communications brought together were of a very important character. They form the entire volume of the bulletin of this Commission for 1893.

The formal sessions of the congress were opened in a hall in the Memorial Art Palace, Chicago, October 16, 1893, the Commissioner making the opening address as chairman of the congress, Dr. G. Brown Goode, Hon. E. G. Blackford, and Dr. Hugh M. Smith acting as chairmen of the principal sections. The meetings were brought to a close on December 19 by a fish banquet in the banquet hall of the New York State building, Jackson Park.

*Foreign visitors.*—A great many persons from foreign countries made a special study of the apparatus and methods employed by the United States Fish Commission. Several of these visitors made reports to their Governments, embracing in them an account of the exhibit of the Commission.

*Courtesies.*—In addition to the articles deposited by the Commission in the National Museum that institution lent for exhibition numerous objects illustrating fish-culture and the fisheries.

The Bureau of Engraving and Printing furnished a supply of macerated greenback pulp for making casts.

The Department of Agriculture detailed a specialist to investigate a fish parasite which proved very destructive during the progress of the Exposition.

Through the instrumentality of the late Hon. F. B. Stockbridge a number of tank cars belonging to the Standard Oil Company were gratuitously lent for the purpose of conveying salt water from Morehead City, N. C., to Jackson Park, Chicago, the arrangement having been completed through the agent of the company, Mr. Howard Page.

The following railroads granted free transportation to United States Fish Commission cars while engaged in World's Fair work during the fiscal year 1893–94: Chesapeake and Ohio; Chicago and West Michigan; Chicago, Burlington and Quincy; Cleveland, Cincinnati, Chicago and St. Louis; Flint and Pere Marquette; Louisville and Nashville; Michigan Central; Wabash; Burlington, Cedar Rapids and Northern; Chicago and Northwestern; Des Moines, Northern and Western; Illinois Central; Lake Harbor; and Chicago, Milwaukee and St. Paul.

Acknowledgments are due to numerous parties for gifts or loans of models of vessels and boats, apparatus of capture, whaling apparatus, fish-cultural apparatus, angling apparatus, publications, etc., to which reference is made in the report upon the exhibit.

At the close of the Exposition the fishery exhibit of Japan was presented to the United States Fish Commission through Commissioner C. Matsudaira. This was one of the most interesting exhibits in the Fisheries building.

The total expenses of the exhibit to September 30, 1894, amounted to $89,789.60.

The affairs of the exhibit were wound up before the close of the fiscal year ending June 30, 1894, and the representative returned to his duty in charge of the division of fish-culture.

## LIBRARY AND PUBLICATIONS.

The accessions of books to the library, mainly secured by exchange for the publications of the Commission, and by gift, numbered 958 volumes. The policy of distributing the various special papers forming parts of the annual reports and bulletins in advance of the issue of the completed volumes was continued.

The papers issued during the year were as follows:

Report on the European methods of oyster culture. By Bashford Dean. (Bulletin 1891, pp. 357 to 406.)

On the classification of the myxosporidia, a group of protozoan parasites infesting fishes. By R. R. Gurley. (Bulletin 1891, pp. 407 to 420.)

Report upon the investigations of the United States Fish Commission steamer *Albatross* from July 1, 1889, to June 30, 1891. By Z. L. Tanner. (Report 1889–1891, pp. 207 to 342.)

Report of observations respecting the oyster resources and oyster fishery of the Pacific Coast of the United States. By Charles H. Townsend. (Report 1889–1891, pp. 343 to 372.)

Report on the coast fisheries of Texas. By Charles H. Stevenson. (Report 1889–1891, pp. 373 to 420.)

A review of the sparoid fishes of America and Europe. By David S. Jordan and Bert Fesler. (Report 1889–1891, pp. 421 to 544.)

On fish entozoa from Yellowstone National Park. By Edwin Linton. (Report 1889–1891, pp. 545 to 564.)

Plankton studies: A comparative investigation of the importance and constitution of the pelagic fauna and flora. By Ernst Haeckel. Translated by George Wilton Field. (Report 1889–1891, pp. 565 to 641.)

The fishes of Texas and the Rio Grande basin, considered chiefly with reference to their geographical distribution. By Barton W. Evermann and William C. Kendall. (Bulletin 1892, pp. 57 to 126.)

A study of the fyke nets and fyke-net fisheries of the United States, with notes on the fyke nets of other countries. By Hugh M. Smith. (Bulletin 1892, pp. 299 to 355.)

The oyster industry of Maryland. By Charles H. Stevenson. (Bulletin 1892, pp. 203 to 297.)

Summary of the fishery investigations conducted in the North Pacific Ocean and Bering Sea from July 1, 1888, to July 1, 1892, by the U. S. Fish Commission steamer *Albatross*. By Richard Rathbun. (Bulletin 1892, pp. 127 to 201.)

List of fishes collected at Sea Isle City, N. J., during the summer of 1892. By H. F. Moore. (Bulletin 1892, pp. 357 to 364.)

Economic and natural history notes on fishes of the northern coast of New Jersey. By Hugh M. Smith. (Bulletin 1892, pp. 365 to 380.)

On the viviparous fishes of the Pacific Coast of North America. By Carl H. Eigenmann. (Bulletin 1892, pp. 381 to 478.)

Notes on two hitherto unrecognized species of American whitefish. By Hugh M. Smith. (Bulletin 1894, pp. 1 to 13.)

Extension of the recorded range of certain marine and fresh-water fishes of the Atlantic coast of the United States. By W. C. Kendall and Hugh M. Smith. (Bulletin 1894, pp. 15 to 21.)

Notes on fishes from the basin of the Mackenzie River in British America. By Charles H. Gilbert. (Bulletin 1894, pp. 23 to 25.)

An American fish in Finland. By Oscar Nordqvist. (Bulletin 1894, pp. 27 to 28.)

Two fertile cyprinoid hybrids. By Karl Knauthe. (Bulletin 1894, pp. 29 to 30.)

A report upon explorations made in Eel River basin in the northeastern part of Indiana in the summer of 1892. By Philip H. Kirsch. (Bulletin 1894, pp. 31 to 42.)

Notes on the fresh-water fishes of Washington County, Me. By William C. Kendall. (Bulletin 1894, pp. 43 to 54.)

World's Fisheries Congress. Report of the secretary of the general committee, by Tarleton H. Bean, and address of the chairman of the general committee, by Marshall McDonald. (Bulletin 1893, pp. 1 to 16.)

The assimilation of the fishery laws of the Great Lakes. By G. A. MacCallum. (Bulletin 1893, pp. 17 to 20.)

The decrease of food-fishes in American waters and some of the causes. By A. M. Spangler. (Bulletin 1893, pp. 21 to 35.)

The sea and coast fisheries. By Daniel T. Church. (Bulletin 1893, pp. 37 to 38.)

Our ocean fishes and the effect of legislation upon the fisheries. By J. M. K. Southwick. (Bulletin 1893, pp. 39 to 45.)

The past, present, and future of trout-culture. By W. L. Gilbert. (Bulletin 1893, pp. 47 to 48.)

The relation of scientific research to economic problems. By George Brown Goode. (Bulletin 1893, pp. 49 to 58.)

Biological research in relation to the fisheries. By John A. Ryder. (Bulletin 1893, pp. 59 to 63.)

On the influence of light on the periodical depth migrations of pelagic animals. By Jacques Loeb. (Bulletin 1893, pp. 65 to 68.)

The investigation of rivers and lakes with reference to fish environment. By Barton W. Evermann. (Bulletin 1893, pp. 69 to 73.)

The habits and development of the lobster, and their bearing upon its artificial propagation. By Francis H. Herrick. (Bulletin 1893, pp. 75 to 86.)
The origin of the food of marine animals. By W. K. Brooks. (Bulletin 1893, pp. 87 to 92.)
Atmospheric and other influences on the migrations of fishes. By J. J. Armistead. (Bulletin 1893, pp. 93 to 99.)
Some observations concerning fish parasites. By Edwin Linton. (Bulletin 1893, pp. 101 to 112.)
On the food of the menhaden. By James I. Peck. (Bulletin 1893, pp. 113 to 126.)
Some plankton studies in the Great Lakes. By Jacob E. Reighard. (Bulletin 1893, pp. 127 to 142.)
The aquarium of the United States Fish Commission at the World's Columbian Exposition. By S. A. Forbes. (Bulletin 1893, pp. 143 to 158.)
Description of the fresh and salt water supply and pumping plants used for the aquarium. By I. S. K. Reeves. (Bulletin 1893, pp. 159 to 161.)
Observations and experiments on saprolegnia infesting fish. By G. P. Clinton. Bulletin 1893, pp. 163 to 172.)
Report on a parasitic protozoan observed on fish in the aquarium. By Charles Wardell Stiles. (Bulletin 1893, pp. 173 to 190.)
Statistical review of fish-culture in Europe and North America. By N. Borodine. (Bulletin 1893, pp. 193 to 196.)
Some notes about American fish-culture. By Oscar Nordqvist. (Bulletin 1893, pp. 197 to 200.)
Fish-culture in Michigan. By Hoyt Post. (Bulletin 1893, pp. 201 to 211.)
History and methods of whitefish culture. By Frank N. Clark. (Bulletin 1893, pp. 213 to 220.)
Methods employed at Craig Brook Station in rearing young salmonoid fishes. By Charles G. Atkins. (Bulletin 1893, pp. 221 to 228.)
The propagation of black bass in ponds. By William F. Page. (Bulletin 1893, pp. 229 to 236.)
Fish and fishing in British Guiana. By J. J. Quelch. (Bulletin 1893, pp. 237 to 240.)
Fish-cultural investigations at St. Andrews marine laboratory, Scotland. By W. C. McIntosh. (Bulletin 1893, pp. 241 to 256.)
Description of the marine hatchery at Dunbar, Scotland. By T. Wemyss Fulton. (Bulletin 1893, pp. 257 to 262.)
The past, present, and future of the oyster industry of Georgia. By A. Oemler. (Bulletin 1893, pp. 263 to 272.)
Deep-water oyster culture. By H. C. Rowe. (Bulletin 1893, pp. 273 to 276.)
Breeding natural food artificially for young fish artificially hatched. By A. Nelson Cheney. (Bulletin 1893, pp. 277 to 279.)
What we know of the lobster. By Fred Mather. (Bulletin, 1893, pp. 281 to 286.)
Remarks on the maintenance and improvement of the American fisheries. By Hugh M. Smith. (Bulletin 1893, pp. 287 to 292.)
Reforms and improvements suggested for the fisheries of Great Britain and Ireland. By J. Lawrence-Hamilton. (Bulletin 1893, pp. 293 to 310.)
Foul fish and filth fevers. By J. Lawrence-Hamilton. (Bulletin 1893, pp. 311 to 334.)
Recent experiments in sturgeon hatching on the Delaware River. By Bashford Dean. (Bulletin 1893, pp. 335 to 339.)
The fisheries of Canada. By L. Z. Joncas. (Bulletin 1893, pp. 341 to 348.)
The fishing industry of Lake Erie, past and present. By C. M. Keyes. (Bulletin 1893, pp. 349 to 353.)
Notes on the Irish mackerel fisheries. By William Spotswood Green. (Bulletin 1893, pp. 357 to 360.)
Past and future of the fur seal. By Joseph Stanley-Brown. (Bulletin 1893, pp. 361 to 370.)
Notes on the fisheries and fishery industries of Puget Sound. By James G. Swan. (Bulletin 1893, pp. 371 to 380.)
Report on a collection of fishes from the rivers of central and northern Mexico. By Albert J. Woolman. (Bulletin 1894, pp. 55 to 65.)
Report of investigations respecting the fishes of Arkansas conducted during 1891, 1892, and 1893, with a synopsis of previous explorations in the same State. By Seth Eugene Meek. (Bulletin 1894, pp. 67 to 94.)
Notes on the capture of Atlantic salmon at sea and in the coast waters of the Eastern States. By Hugh M. Smith. (Bulletin 1894, pp. 95 to 99.)

The completed volumes issued during the year were the Bulletin for the year 1891, and a report covering the years beginning July 1, 1889, and ending June 30, 1891.

The distribution of publications during the year consisted of 2,800

copies of the complete volumes of reports and bulletins, and 8,300 copies of the separate articles appearing in them.

Under the general title "Reports on an Exploration off the West Coasts of Mexico, Central and South America, and off the Galapagos Islands, in charge of Alexander Agassiz, by the U. S. Fish Commission steamer *Albatross*, during 1891, Lieut. Commander Z. L. Tanner, U. S. N., commanding," the following papers were published in the Bulletins of the Museum of Comparative Zoology, Cambridge, Mass.:

Report upon rocks collected from the Galapagos Islands. By George P. Merrill. (XVI, No. 13.)
Preliminary descriptions of new species of Crustacea. By Walter Faxon. (XXIV, No. 7.)
The Orthoptera of the Galapagos Islands. By Samuel H. Scudder. (XXV, No. 1.)
Compte-Rendu sur les Pantopodes. Par W. M. Schimkéwitsch. (XXV, No. 2.)
Report on the Turbellaria. By W. McM. Woodworth. (XXV, No. 4.)
Note Préliminaire sur les Alcyonaires. Par Théophile Studer. (XXV, No. 5.)
The Hydroids. By Samuel F. Clarke. (XXV, No. 6.)

There were also issued during the year in the "Proceedings of the United States National Museum," under the general title "Scientific results of explorations by the United States Fish Commission steamer *Albatross*," the following papers:

Report on the *Actiniæ* collected by the United States Fish Commission steamer *Albatross* during the winter of 1887–88. By J. Playfair McMurrich.
Descriptions of new genera and species of crabs from the west coast of North America and the Sandwich Islands. By Mary J. Rathbun.
Report on the mollusk-fauna of the Galapagos Islands, with descriptions of new species. By Robert E. C. Stearns.
Report on the pteropods and heteropods collected by the United States Fish Commission steamer *Albatross* during the voyage from Norfolk, Va., to San Francisco, Cal., 1887–88. By James I. Peck.
Catalogue of a collection of birds made in Alaska by Mr. C. H. Townsend during the cruise of the United States Fish Commission steamer *Albatross*, in the summer and autumn of 1888. By Robert Ridgway.
On *Cetomimidæ* and *Rondeletiidæ*, two new families of bathybial fishes from the northwestern Atlantic. By G. Brown Goode and Tarleton H. Bean.
A revision of the order *Heteromi*, deep-sea fishes, with a description of the new generic types *Macdonaldia* and *Lipogenys*. By G. Brown Goode and Tarleton H. Bean.
On *Harriotta*, a new type of chimæroid fish from the deeper waters of the northwestern Atlantic. By G. Brown Goode and Tarleton H. Bean.
Descriptions of new genera and species of crabs of the family *Lithodidæ*, with notes on the young of *Lithodes camtschaticus* and *Lithodes brevipes*. By James E. Benedict.
Report upon the crustacea of the order *Stomatopoda* collected by the steamer *Albatross* between 1885 and 1891, and other specimens in the United States National Museum. By Robert Payne Bigelow.

## COURTESIES RECEIVED AND EXTENDED.

The Treasury Department, through Mr. J. Stanley-Brown, furnished base-maps of the seal rookeries of the Pribilof Islands showing their condition in the years 1891 and 1892, and negatives of photographs of the rookeries taken during the latter year; also enlarged photographic reproductions of the charts of the same region made by Mr. Henry W. Elliott in 1890.

The United States Coast and Geodetic Survey supplied its charts as issued, and also met special requests for additional copies of charts needed for use in the inquiries conducted by the Commission. At the

request of the Fish Commission, Mr. Homer P. Ritter, assistant, was detailed to take charge of a survey of the oyster grounds of Mobile Bay and vicinity.

The General Land Office of the Interior Department furnished copies of maps of Montana, New Mexico, and Nevada.

The Post-Office Department supplied a full mounted set of post-route maps of the United States.

Acknowledgments are due Gen. Albert Ordway, commanding the District of Columbia militia, for the loan of tents and accessories for use at the Bryan Point Station of the Commission during the shad-hatching season.

From the health officer of the District of Columbia were received monthly returns of the receipts of fishery products at the Washington markets.

Acknowledgment is due to the Commercial Department of the London, England, Board of Trade for statistics of the fisheries of the coasts of England and Wales, and to the Fishery Board of Scotland, Edinburgh, for similar statistics of the fisheries of the coast of Scotland.

The Boston Fish Bureau, Boston, Mass., furnished daily reports of the receipts of fish at the Boston markets.

In accordance with the instructions of the President of April 9, 1894, the Commission's steamer *Albatross* was transferred to the Navy Department to assist in the patrol of Bering Sea and the North Pacific Ocean, for the enforcement of the regulations governing vessels engaged in fur-seal fishing provided for by the Paris Tribunal of Arbitration. In this duty she was employed till October 15, when she was returned to the Commission.

The United States Coast and Geodetic Survey was furnished with hydrographic data secured by the vessels and field parties of the Commission.

At the request of the Commissioners of the District of Columbia, the steam launch *Blue Wing* was placed at their disposal as a patrol boat pending repairs to the municipal harbor boat.

In compliance with the request of Mr. H. B. Vincent, president of the Ohio Fish and Game Commission, the United States Fish Commission operated the State hatchery at Sandusky during the season of the propagation of the pike-perch, commencing April 5, 1894. The aggregate of eggs placed in the hatchery was 54,800,000. The output of fry was 32,600,000, of which 13,700,000 were distributed in Kentucky waters, and 18,900,000 placed at the disposition of the Ohio Commission. The last shipment of fry was made May 10.

At the request of the governor of Virginia, the launch *Petrel* and crew were detailed in the work of surveying the natural oyster grounds of Virginia, under the direction of Mr. J. B. Baylor, assistant, United States Coast and Geodetic Survey.

## PROPAGATION AND DISTRIBUTION OF FOOD-FISHES.

The work accomplished during the year in the propagation of food-fishes is exhibited by the following summary of production:

*Summary of fish and eggs furnished by stations.*

| Source of supply. | Species. | Eggs. | Fry. | Adults and yearlings. |
|---|---|---|---|---|
| Craig Brook, Me | Atlantic salmon | 170,000 | | 233,398 |
| | Landlocked salmon | | 6,000 | 1,005 |
| | Brook trout | | | 7,330 |
| | Rainbow trout | | 500 | 471 |
| | Swiss Lake trout | | | 36 |
| | Lock Leven trout | | | 46 |
| | Von Behr trout | | | 18 |
| Green Lake, Me | Landlocked salmon | 79,000 | | 143,481 |
| | Sea salmon | | | 3,908 |
| | Brook trout | 46,000 | | 5,500 |
| | Lock Leven trout | | | 21,468 |
| | Von Behr trout | | | 36,803 |
| | Rainbow trout | | | 400 |
| | Lake trout | | 25,000 | |
| Gloucester, Mass | Cod | | 24,617,000 | |
| | Haddock | | 19,500 | |
| | Lobster | | 9,332,000 | |
| Woods Hole, Mass | Cod | | 1,254,000 | |
| | Flatfish | | 1,795,000 | |
| | Lobster | | 69,066,000 | |
| Delaware River (steamer *Fish Hawk*). | Shad | 1,500,000 | 5,768,000 | |
| Battery Island, Md | Shad | 5,634,000 | 22,645,000 | |
| | Yellow perch | | | 150 |
| Bryan Point, Md | Shad | 27,334,000 | | |
| Central Station, Washington, D. C. | Shad | | 21,082,000 | |
| | Whitefish | | 3,800,000 | |
| | Landlocked salmon | | 2,500 | |
| | Brook trout | | 19,500 | |
| | Rainbow trout | | 22,000 | |
| Fish Ponds, Washington, D. C. | Shad | | | 1,000,000 |
| | Carp | | | 51,802 |
| | Tench | | | 10,022 |
| | Golden tench | | | 431 |
| | Goldfish | | | 8,427 |
| | Golden ide | | | 1,947 |
| | Black bass | | | 12,330 |
| Wytheville, Va | Rainbow trout | 104,500 | 15,000 | 90,640 |
| | Rock bass | | | 20,750 |
| | Black bass | | | 40 |
| | Carp | | | 790 |
| | Goldfish | | | 2,649 |
| Put-in-Bay, Ohio | Whitefish | 6,000,000 | 21,710,000 | |
| | Pike perch | 5,000,000 | 177,700,000 | |
| | Lake herring | | 30,005,000 | |
| | Lake trout | | 121,000 | |
| | Yellow perch | | 70,000 | |
| Northville, Mich | Brook trout | 105,000 | 6,000 | 29,100 |
| | Von Behr trout | 100,000 | | 8,472 |
| | Loch Leven trout | 65,000 | 24,000 | 10,600 |
| | Lake trout | 1,100,000 | 102,000 | 19,593 |
| | Quinnat salmon | | 40,000 | |
| Alpena, Mich | Whitefish | 200,000 | 13,050,000 | |
| Duluth, Minn | Whitefish | | 10,100,000 | |
| | Lake trout | | 2,540,000 | |
| | Brook trout | | 10,000 | |
| | Pike perch | | 8,000,000 | |
| Quincy, Ill | Black bass | | | 13,642 |
| | Crappie | | | 8,542 |
| | Catfish | | | 16,597 |
| | Warmouth bass | | | 2,328 |
| | Sunfish | | | 219 |
| | Yellow perch | | | 262 |
| | Pike | | | 100 |
| | Rock bass | | | 30 |
| Neosho, Mo | Rainbow trout | 267,500 | 2,000 | 52,513 |
| | Catfish | | | 1,059 |
| | Black bass | | | 630 |
| | Rock bass | | | 4,710 |
| | Tench | | | 9,210 |
| | Carp | | | 2,275 |
| | Goldfish | | | 4,231 |
| | Golden ide | | | 18 |

*Summary of fish and eggs furnished by stations*—Continued.

| Source of supply. | Species. | Eggs. | Fry. | Adults and yearlings. |
|---|---|---|---|---|
| Leadville, Colo. | Brook trout | | 23,000 | 35,900 |
| | Loch Leven trout | | | 19,800 |
| | Black-spotted trout | | | 11,100 |
| | Rainbow trout | | 11,000 | 950 |
| | Von Behr trout | | | 1,450 |
| | Yellow-finned trout | | | 700 |
| Baird, Cal. | Quinnat salmon | 7,500,000 | 438,500 | |
| Fort Gaston, Cal. | Rainbow trout | | | 5,450 |
| | Steelhead trout | 50,000 | | |
| Korbel, Cal | Silver salmon | | 280,000 | |
| | Steelhead trout | 25,000 | 308,500 | |
| Clackamas, Oreg. | Quinnat salmon | | 213,000 | |

The details of the distribution of the foregoing product are given in the accompanying report of the assistant in charge of the division of fish-culture. Thirty-three species of fishes and one crustacean, the lobster, were distributed, the kinds and number of each being given in the following table:

*Summary of distribution.*

| Kind of fish. | Eggs. | Fry. | Adults and yearlings. | Total. |
|---|---|---|---|---|
| Spotted catfish | | | 16,556 | 16,556 |
| Catfish (common) | | | 1,059 | 1,059 |
| Carp | | | 47,757 | 47,757 |
| Tench | | | 17,820 | 17,820 |
| Goldfish | | | 13,391 | 13,391 |
| Golden ide | | | 1,780 | 1,780 |
| Golden tench | | | 272 | 272 |
| Shad | 3,324,000 | a 53,509,000 | 1,000,000 | 57,833,000 |
| Quinnat salmon | 7,500,000 | 690,500 | | 8,190,500 |
| Silver salmon | | 280,000 | | 280,000 |
| Atlantic salmon | 170,000 | | 235,306 | 405,306 |
| Landlocked salmon | 79,000 | 8,500 | 140,434 | 227,934 |
| Steelhead trout | 75,000 | 308,500 | | 383,500 |
| Loch Leven trout | 65,000 | 24,000 | 50,914 | 139,914 |
| Rainbow trout | 372,000 | 52,500 | 137,058 | 561,558 |
| Von Behr trout | 100,000 | | 45,774 | 145,774 |
| Black-spotted trout | | | 11,000 | 11,000 |
| Brook trout | 138,000 | 58,000 | 75,079 | 271,079 |
| Yellow-finned trout | | | 700 | 700 |
| Lake trout | 1,100,000 | 2,781,000 | 19,390 | 3,900,390 |
| Whitefish | 6,200,000 | 48,750,000 | | 54,950,000 |
| Lake herring | | 30,005,000 | | 30,005,000 |
| Pike perch | 5,000,000 | 181,700,000 | | 186,700,000 |
| Pike | | | 100 | 100 |
| Yellow perch | | 70,000 | 340 | 70,340 |
| Black bass | | | 22,783 | 22,783 |
| Rock bass | | | 18,981 | 18,981 |
| Warmouth bass | | | 2,161 | 2,161 |
| Crappie | | | 8,218 | 8,218 |
| Sunfish | | | 170 | 170 |
| Cod | | 25,871,000 | | 25,871,000 |
| Haddock | | 19,500 | | 19,500 |
| Flatfish | | 1,795,000 | | 1,795,000 |
| Lobster | | 78,398,000 | | 78,398,000 |
| Total | 24,123,000 | 424,320,500 | 1,867,043 | 450,310,543 |

a In addition to these, 2,109,000 were deposited for rearing in the fish ponds, Washington, D. C.

NOTE.—In addition to the foregoing there were furnished for distribution, but lost in transit, during the year: 684,000 shad fry, 7,000 lake-trout fry, 4,000,000 pike-perch fry, and the following adults and yearling fish; 41 spotted catfish, 7,110 carp, 1,412 tench, 1,916 goldfish, 1,990 Atlantic salmon, 4,052 landlocked salmon, 1,000 Loch Leven trout, 13,336 rainbow trout, 969 Von Behr trout, 100 black-spotted trout, 751 brook trout, 239 lake trout, 72 yellow perch, 3,859 black bass, 6,509 rock bass, 167 warmouth bass, 824 crappie, 49 sunfish, and 68 golden ide.

There were also collected from sloughs and deposited in the St. Francis River near Marked Tree, Ark., 8,500 fingerling crappie, and from the sloughs and deposited in the Illinois River near Meredosia, Ill., 21,100 white perch, 25,000 sunfish, 23,000 carp, 2,000 warmouth bass, 500 pike perch, 3,600 white bass, 1,000 black bass, 2,000 crappie, and 8,900 pike; but none of these figures are included in the above table.

## STATE FISH COMMISSIONS.

The policy of extending all possible aid to the fish commissions of the different States and Territories in the stocking of their respective waters was continued, and the aid thus given during the year is here shown:

| State or Territory. | Species. | Eggs. | Fish. |
|---|---|---|---|
| California | Quinnat salmon | 7,500,000 | |
| | Steelhead trout | 50,000 | |
| Colorado | Loch Leven trout | 20,000 | |
| Connecticut | Rainbow trout | | 475 |
| | Atlantic salmon | 25,000 | |
| | Von Behr trout | 20,000 | |
| | Lake trout | 100,000 | |
| Georgia | Whitefish | 200,000 | |
| | Carp | | 3,000 |
| | Goldfish | | 30 |
| | Golden ide | | 100 |
| Illinois | Rock bass | | 600 |
| | Catfish | | a 2,800 |
| | Black bass | | a 802 |
| | Rock bass | | a 30 |
| | Warmouth bass | | a 150 |
| Iowa | Crappie | | a 1,006 |
| | Spotted catfish | | 300 |
| | Tench | | 50 |
| | Goldfish | | 100 |
| Kansas | Black bass | | 100 |
| Maine | Goldfish | | 30 |
| Massachusetts | Rainbow trout | | 471 |
| Minnesota | Lake trout | 100,000 | |
| | Carp | | 2,500 |
| | Goldfish | | 50 |
| | Golden ide | | 25 |
| | Loch Leven trout | 20,000 | |
| | Rainbow trout | 42,000 | |
| | Von Behr trout | 20,000 | |
| | Brook trout | 20,000 | |
| Missouri | Lake trout | 100,000 | |
| | Goldfish | | 100 |
| | Golden ide | | 50 |
| Nebraska | Rainbow trout | 50,000 | |
| | Rainbow trout | 23,000 | |
| | Brook trout | 20,000 | |
| Nevada | Lake trout | 100,000 | |
| New Hampshire | Rainbow trout | 40,000 | |
| New York | Atlantic salmon | 25,000 | |
| | Carp | | 5,000 |
| | Shad | 2,000,000 | b 5,414,000 |
| | Atlantic salmon | 60,000 | |
| | Landlocked salmon | 30,000 | |
| | Lake trout | 300,000 | |
| | Whitefish | 6,000,000 | |
| Ohio | Pike perch | 5,000,000 | |
| Pennsylvania | Pike perch | | b 18,900,000 |
| Utah | Atlantic salmon | 60,000 | |
| Vermont | Lake trout | 100,000 | |
| | Landlocked salmon | | 1,000 |
| | Rainbow trout | 30,000 | |
| | Von Behr trout | 20,000 | |
| | Brook trout | 20,000 | |
| Wisconsin | Lake trout | 300,000 | |
| Wyoming | Goldfish | | 100 |
| | Rainbow trout | 45,000 | |
| | Von Behr trout | 15,000 | |

a Deposited by U. S. Fish Commission in waters designated by State commissioners. b Fry.

## FISH-CULTURAL AID EXTENDED TO FOREIGN COUNTRIES.

During the year eggs of fishes propagated by the Commission were furnished the following foreign countries:

*Canada.*—Mr. W. Greenough, Portneuf, was furnished with eggs of the rainbow trout.

*Mexico.*—Eggs of the Loch Leven trout and Von Behr trout were supplied to E. Chazari for the Mexican Government.

*United States of Colombia.*—At the request of Lieut. H. R. Lemly yearling golden tench and eggs of the landlocked salmon and brook trout were forwarded to the Government of the United States of Colombia.

*Belgium.*—Maj. W. Turner, of Bertrix, was supplied with eggs of the rainbow trout.

*France.*—Eggs of the rainbow trout were shipped to Mr. A. Geoffroy St. Hilaire and Mr. Raveret-Wattel for the Société Nationale d'Acclimatation at Paris.

*Scotland.*—Brook-trout eggs were sent to Mr. J. J. Armistead, Killywhan, Scotland.

*Switzerland.*—At the request of the Swiss Government eggs of the brook trout were shipped to Switzerland, and upon arrival were reported in very good condition.

*Japan.*—Eggs of the steelhead trout were forwarded to Japan through the Japanese consul at San Francisco, Cal.

## FREE TRANSPORTATION FURNISHED BY RAILROADS.

The limited appropriation made for the conduct of the fish-cultural work of the Commission would necessitate the distribution of the product of the different stations to neighboring waters, thereby preventing the introduction of desirable food-fishes in suitable waters distant from the source of supply, were it not for the generous aid extended by many of the railway companies of the country. Even at the very favorable rate granted by the roads demanding compensation for the transportation for the cars and messengers of the Commission, the value of the transportation furnished during the year would have aggregated a cost of over $13,000. In the following table is given the names of the railway companies extending this aid, and the amount of mileage respectively furnished:

*Table showing aid extended by railroads.*

| Name of railroad. | Cars. | Messengers. | Total. |
|---|---|---|---|
| Atchison, Topeka and Santa Fe | 1,278 | 183 | 1,461 |
| Baltimore and Ohio | 766 | ..... | 766 |
| Burlington, Cedar Rapids and Northern | 1,466 | ..... | 1,466 |
| Baltimore and Lehigh | ..... | 39 | 39 |
| Chesapeake and Ohio | 2,988 | 70 | 3,058 |
| Chesapeake, Ohio and Southwestern | 337 | ..... | 337 |
| Chicago and Great Western | ..... | 170 | 170 |
| Chicago and Northwestern | 1,163 | ..... | 1,163 |
| Chicago and West Michigan | 548 | ..... | 548 |
| Chicago, Burlington and Quincy | 6,540 | 264 | 6,804 |
| Chicago, Milwaukee and St. Paul | 1,028 | 191 | 1,219 |
| Chicago, St. Paul, Minneapolis and Omaha | 372 | ..... | 372 |
| Cleveland, Cincinnati, Chicago and St. Louis | 4,079 | 140 | 4,219 |
| Delaware and Hudson River | 533 | 294 | 827 |
| Denver and Rio Grande | 1,048 | 2,025 | 3,073 |
| Des Moines, Northern and Western | 34 | ..... | 34 |
| Detroit, Bay City and Alpena | 2,254 | ..... | 2,254 |
| Duluth and Iron Range | 12 | ..... | 12 |
| Duluth, South Shore and Atlantic | 168 | ..... | 168 |
| Flint and Pere Marquette | 3,588 | ..... | 3,588 |
| Fremont, Elkhorn and Missouri Valley | ..... | 18 | 18 |
| Fort Worth and Denver City | ..... | 678 | 678 |
| Grand Rapids and Indiana | 222 | 218 | 440 |
| Great Northern | 144 | ..... | 144 |
| Illinois Central | 619 | 17 | 636 |

*Table showing aid extended by railroads*—Continued.

| Name of railroad. | Cars. | Messengers. | Total. |
|---|---|---|---|
| International and Great Northern | 234 | ..... | 234 |
| Jacksonville Southeastern | 206 | ..... | 206 |
| Jacksonville, Tampa and Key West | 112 | ..... | 112 |
| Kansas City, Fort Scott and Memphis | 676 | 282 | 958 |
| Kansas City, Pittsburg and Gulf | 170 | ..... | 170 |
| Lake Erie and Western | 161 | ..... | 161 |
| Lake Harbor | 20 | ..... | 20 |
| Louisville and Nashville | 2,205 | 432 | 2,637 |
| Maine Central | ..... | 3 | 3 |
| Missouri, Kansas and Texas | 2,568 | ..... | 2,568 |
| Missouri Pacific | 1,444 | ..... | 1,444 |
| Michigan Central | 10,868 | 76 | 10,944 |
| Minneapolis, St. Paul and Sault Ste Marie | 322 | ..... | 322 |
| Mobile and Ohio | 126 | ..... | 126 |
| Northern Pacific | 3,312 | 2,020 | 5,332 |
| Quincy, Omaha and Kansas City | ..... | 108 | 108 |
| St. Louis and San Francisco | 2,142 | 353 | 2,495 |
| St. Louis, Iron Mountain and Southern | 544 | ..... | 544 |
| Texas and Pacific | 1,026 | 342 | 1,368 |
| Union Pacific | 5,038 | 909 | 5,947 |
| Wabash Railroad | 2,700 | 879 | 3,579 |
| Wabash, Chester and Western | 28 | ..... | 28 |
| West Virginia and Pittsburg | 208 | ..... | 208 |
| Wilmington and Northern | ..... | 82 | 82 |
| Wisconsin Central | 1,796 | ..... | 1,796 |
| Total | 65,093 | 9,793 | 74,886 |

## ADDITIONAL FISH-CULTURAL STATIONS.

On June 9, 1894, Hon. H. H. Bingham introduced in the House of Representatives the following resolution:

*Resolved*, That the United States Fish Commissioner be, and is hereby, directed to report to the House of Representatives the desirability of the Government establishing a fish-hatchery in the grounds of the Zoological Society, Philadelphia, on the Schuylkill River, in the city of Philadelphia, State of Pennsylvania.

A similar resolution was presented to the Senate on July 19, 1894, by Hon. M. S. Quay.

In replying to this resolution the Commissioner expressed an opinion adverse to the establishment of a station as proposed thereby, for the reason that it would be improper to locate Government works on property not freely open to the public, the Zoological Society charging an admission fee for entrance to its grounds. It was also ascertained that title to the site proposed for a station could not be vested in the United States, as required by law.

*Fish-hatchery at San Marcos, Tex.*—The release of the trustees under the trusts given to secure certain bonds issued by the San Marcos Water Company, mentioned in a previous report as required by the Attorney-General as necessary before the deed of said company conveying to the United States certain rights would vest a valid title to the same, were secured, and on September 27, 1893, the Attorney-General certified to their sufficiency to convey with the deed a proper transfer of the easements mentioned. Pending the erection of the dam across the San Marcos River, agreed to be built by the San Marcos Water Company and the citizens of San Marcos, settlement of the consideration to be paid was deferred. Payment for the tract of land purchased from Mr. W. D. Wood was made June 18, 1894.

*Fish-hatchery, New York.*—During July, 1893, a further investigation for a suitable site for the establishment of a fish-cultural station for the propagation of salmon as well as whitefish was made by Mr. Frank N. Clark, superintendent of the Northville, Mich., Station. The result of this examination demonstrated the impracticability of securing, within the limited territory specified in the appropriation act, a location such as was necessary for a station to be conducted on the plan originally contemplated. It was therefore decided to confine our attention to the increase of the principal commercial fishes of Lake Ontario—whitefish, lake trout, and the pike perch. On May 26, 1894, instructions were given the chief clerk and the engineer of the Commission, Mr. Gill and Mr. Reeves, to examine the eastern shore of Lake Ontario in New York for a location affording facilities for the propagation of these fishes. They recommended Cape Vincent, on the St. Lawrence River at the outlet of the lake, and secured options for the sale of two pieces of property affording the necessary requirements. One of these embraced a lot having a water front of about 115 feet on the river and extending about 200 feet to the main street of the village, and in near proximity to the railroad station, improved by a substantial stone building 60 feet by 40 feet, with a lean-to of 24 feet by 65 feet, and a large detached brick chimney tower. This building, which was formerly used as a grist mill, has walls between 2 and 3 feet thick, with their foundations on the solid rock, and is in close proximity to the river. It has three floors, a basement, and an attic, which afford ample facilities for hatcheries and office and sleeping accommodations. The option also provided in case of sale for the construction of a stone-crib wharf into the river in front of the building for the proper placing of the necessary water pipes for the supply of the hatcheries. The compensation to be paid was fixed at $3,500. The proposal has been accepted, and the necessary steps will be taken for the acquisition of the property.

*Tennessee.*—Under provision of an act approved August 5, 1892, authorizing an "investigation and report respecting the advisability of establishing a fish-hatching station at some suitable point in the State of Tennessee," investigations were made in that State during the September and October, 1893, and a report thereon submitted to Congress January 24, 1894 (Mis. Doc. No. 52, Fifty-third Congress, second session). The site appearing to offer the more favorable conditions for a station was one several miles distant from the town of Athens, McMinn County, though its distance from Athens, where the labor and supplies needed for the maintenance of a station must be obtained, would prove a serious drawback. It was recommended, however, that a final selection be deferred, should Congress direct the establishment of a station in Tennessee, till further comparisons of the sites mentioned in the report could be made. For the establishment of the station an item of $12,000 was submitted.

*Iowa, Nebraska, South Dakota, and Wyoming.*—Reference is made in the Commissioner's preceding report to the investigations in these States for the purpose of determining, as directed by Congress, the advisability of establishing in them fish-cultural stations. The results of these investigations were presented to Congress on January 24, 1894 (Mis. Doc. No. 53, Fifty-third Congress, second session). In this report the following conclusion was submitted:

> From a consideration of the foregoing results of the examinations in the States of Wyoming, South Dakota, Iowa, and Nebraska, I would recommend the establishment of but one station to supply the needs of South Dakota, Iowa, and Nebraska, Wyoming to be cared for by the station now being established at Bozeman, Mont. If a new station is authorized, either Manchester or Decorah, Iowa, should be selected. Which to recommend, however, I am not ready to say, final selection being dependent upon a careful consideration of the respective sites from an engineering standpoint, the certainty of their being secured by the Government, their cost, the expense of adapting the water supply, etc., questions which can not be determined in advance of the actual authorization of a station.

In case a station was authorized, an appropriation of $15,000 was recommended.

### PROTECTION OF FISH IN POTOMAC RIVER.

By act approved March 12, 1894, provisions of the act of March 2, 1885, entitled "An act to protect the fish in the Potomac River in the District of Columbia, and to provide a spawning ground for shad and herring in the said Potomac River," were continued for a period of ten years. Under this law, if properly enforced, reasonable hopes can be entertained for still more appreciable results from the Commission's efforts in stocking this river with shad.

### VISITS FROM OFFICIALS OF FOREIGN COUNTRIES.

During this year the offices were visited by a number of representatives of foreign countries, detailed by their governments to the World's Columbian Exposition, Chicago, for the purpose of studying the fisheries and fish cultural methods of the United States. Among these may be mentioned Dr. Henri de Varigny, delegate of the minister of commerce, Paris, France; Dr. Oscar Nordqvist, inspector of fisheries of Finland, Helsingfors; Dr. Nicolas Borodine, Uralsk, Russia; Dr. L. Wittmack, of Berlin, accompanied by Mr. Alfred Schillinger, of Munich, president of the fish-cultural department of the Bavarian State Fishery Association, in Sternberg, and Mr. Lewis Landau, of the Hungarian ministry of agriculture; Dr. Ernst Ehrenbaum, of the Royal Biological Station, Helgoland; Mr. Sakaye Sawatari, commissioner of the Japanese Fisheries Society, and Mr. J. J. Armistead, proprietor of the Solway fisheries, Dumfries, Scotland.

# REPORT ON THE PROPAGATION AND DISTRIBUTION OF FOOD-FISHES.

By TARLETON H. BEAN, *Assistant in Charge.*

The important features of the work of the division of fish culture at the numerous stations are shown in the abstracts of the annual reports of the superintendents. Certain experiments in the treatment of eggs and fish are grouped in a chapter of notes on the habits, diseases, fatalities, enemies, treatment, transportation, etc., of the species under observation.

The resources of the division were tested to their utmost by its duties in connection with the World's Columbian Exposition. It was called upon to provide and maintain a great aquarium of marine as well as fresh-water animals and plants, a hatchery for the eggs of shad, pike, perch, salmon, trout, and other fishes, together with a general exhibit of its methods and results, and, at the same time, to continue its usual work of hatching and distribution to meet the increasing demands of applicants in all parts of the United States.

The exhibit of the Fish Commission is made the subject of a separate report by its representative on the Government Board of Management and Control, Dr. Tarleton H. Bean. During his absence from Washington Mr. S. G. Worth performed the duties of acting assistant, serving from January 14, 1393, until February 20, 1894, when the assignment to World's Fair duty was completed.

Superintendent Page was detailed for special duty in the summer of 1893, to collect fishes from overflow ponds in the lowlands of St. Francis River, Arkansas, and has made a report upon the experimental work of the season.

The duties of the Commission at the World's Fair, combined with the regular work of distribution, entailed much additional labor upon the car and messenger service. The necessity of continuing the transportation of many kinds of fish during almost the entire year makes the natural difficulties of transportation very great.

A great burden was removed from the division near the close of 1893, when the Commissioner ordered the discontinuance of the general distribution of gold fish to individuals after the close of that season.

## STATION OPERATIONS.

The number of active stations was the same as during the last fiscal year. The World's Fair having been made a temporary base of operations, offset the closed landlocked salmon station on Grand Lake Stream, Maine. A new station, located at St. Johnsbury, Vt., was nearly completed at the time of closing this report. Mr. John W. Titcomb was appointed inspector of construction September 1, 1893, and superintendent March 1, 1894. This is intended as a hatching and rearing station for landlocked salmon and various kinds of trout. Its water supply is obtained from Sleeper River and from springs.

The following is a list of stations:

Craig Brook Station, Me.
Green Lake Station, Me.
Gloucester Station, Mass.
Woods Hole Station, Mass.
Delaware River Station (steamer *Fish Hawk*).
Battery Island Station, Md.
Bryan Point Station, Md.
Central Station, Washington, D. C.
Fish Ponds, Washington, D. C.
Wytheville Station, Va.
Put in Bay Station, Ohio.
Northville Station, Mich.
Alpena Station, Mich.
Duluth Station, Minn.
Quincy Station, Ill.
World's Fair Station, Chicago, Ill.
Neosho Station, Mo.
Leadville Station, Colo.
Baird Station, Cal.
Fort Gaston Station, Cal.
Clackamas Station, Oreg.

### Craig Brook Station, Maine (Charles G. Atkins, Superintendent).

The fish on hand at the station, July 1, 1893, were as follows:

| Species. | Hatched in the year— | | | | | | | Total. |
|---|---|---|---|---|---|---|---|---|
| | 1893. | 1892. | 1891. | 1890. | 1889. | 1888. | 1888 and 1889 mixed. | |
| Atlantic salmon | 257,775 | ..... | ..... | 34 | ..... | 33 | ..... | 257,842 |
| Atlantic salmon, domestic | 1,700 | 156 | ..... | ..... | ..... | ..... | ..... | 1,856 |
| Landlocked salmon | 6,764 | ..... | ..... | 29 | ..... | ..... | 26 | 6,819 |
| Brook trout | 9,013 | 14 | ..... | ..... | 28 | ..... | ..... | 9,055 |
| Rainbow trout | 1,012 | ..... | ..... | ..... | 13 | ..... | ..... | 1,025 |
| Loch Leven trout | ..... | ..... | ..... | 49 | ..... | ..... | ..... | 49 |
| Saibling | ..... | ..... | ..... | 1 | ..... | ..... | ..... | 1 |
| Swiss lake trout | ..... | ..... | ..... | 29 | ..... | ..... | ..... | 29 |
| Scotch sea trout | ..... | ..... | 63 | ..... | ..... | ..... | ..... | 63 |
| Von Behr trout | ..... | ..... | 47 | ..... | ..... | ..... | ..... | 47 |
| Whitefish | ..... | 1 | ..... | ..... | ..... | ..... | ..... | 1 |
| Total | 276,264 | 171 | 110 | 142 | 41 | 33 | 26 | 276,787 |

The Atlantic salmon were fed through the summer in troughs on chopped liver and other meat and on maggots. In November it was found that 234,367 of them had survived. Of these, 231,367 were liberated in local waters, 2,000 were transferred to other parties, and 1,000 were reserved for wintering. Of the fish wintered over, 867 were alive June 30, 1894.

Eggs of the Atlantic salmon were collected at the Penobscot Station in May and June, 1893, with the cooperation of the State of Maine. From 146 fish—51 males and 95 females—806,000 eggs were obtained. On March 1, 1894, after the ordinary losses and the rejection of the

unfertilized eggs, there remained 745,300 eggs, 435,000 of which were given to the United States Fish Commission and 310,300 to the Maine Commission. From the United States Fish Commission's share 170,000 eggs of the Atlantic salmon were shipped to the following parties in accordance with instructions:

| Date. | Consignee. | Number. |
|---|---|---|
| Jan. 30 | Fred Mather, Cold Spring Harbor, N. Y | 60,000 |
| 30 | J. P. Creveling, Allentown, Pa | 60,000 |
| Mar. 7 | D. C. McLine, Plymouth, N. H | 25,000 |
| 7 | R. E. Follett, Lime Rock, Conn | 25,000 |
| | Total | 170,000 |

There were reserved for hatching at the station 265,000. The number of fish actually hatched from these eggs was 264,612, and of these there were on hand June 30, 1894, 214,000. Of the 33 fish hatched in 1888 only 11 were left at the end of the year; and 31 of those hatched in 1890 were liberated in November, 1893.

The year began with two lots of domesticated salmon; 156 fish hatched in 1892, and 1,700 in 1893. The former were kept through the year in two troughs, and grew slowly, and fell off in numbers to 131; the latter were also kept in troughs, and 1,348 of them were left at the end of the year. Domesticated salmon eggs were obtained in October, 1893, from the Atlantic salmon that had been in confinement since 1888, to the number of 4,800 eggs; but the parent fish being of inferior quality, the 1,677 fish hatched from the eggs declined to 600 on June 30, 1894.

Indications of the presence of an epidemic were observed on April 23, and it continued to ravage the Atlantic salmon for several weeks, causing a loss of about 15,000. No other species was attacked, though the fry of some other kinds suffered seriously from a disease of a different character.

Of the 26 landlocked salmon hatched in 1888 and 1889 only 17 remained on June 30, 1894. The 29 hatched in 1890 were reduced to 20 in November, 1893, when they were liberated. The 6,764 hatched in 1893 received in September an addition of 1,500 fish of the same age from Green Lake; making a total of 8,264. Of these, 7,050 were transferred to other parties during the summer, and the remainder were liberated in the fall.

From the oldest lot of landlocked salmon there was taken in the fall a lot of spawn estimated at 8,500, from which were hatched 6,330 very weak fish, of which the last one died June 1, 1894.

The 9,013 brook trout on hand June 30, 1893, were fed until fall, when 2,825 were transferred to Green Lake Station and 4,476 liberated in Craig Pond. The 14 hatched in 1892 were kept until November 27, and then put in Craig Pond. Of the 28 hatched in 1889, a count on November 27 showed but 14 remaining, and these were placed in Craig Pond.

A few eggs were taken from brook trout in the fall of 1893:

| | |
|---|---|
| From fish of 1889 | 4,600 |
| From wild fish caught from time to time and held in confinement at station (taken at station) | 4,600 |
| Total | 9,200 |
| Received from Green Lake, February 20, 1894 | 10,000 |
| Total | 19,200 |

From these eggs 17,190 fish were hatched, of which 9,000 were on hand June 30, 1894.

The rainbow trout were fed in troughs during the summer. On September 21st, 500 were transferred to Green Lake, and November 15th, 471 were delivered to the agent of the Maine commissioners. Of the 13 fish hatched in 1889, only 6 remained at the end of the year.

The Loch Leven, Swiss Lake, and Von Behr trout on hand at the beginning of the year had become intermixed by dislocated partitions in the ponds, and, in accordance with instructions, were all liberated together in Heart Pond, 2 miles from the station.

Of the 63 Scotch sea trout on hand July 1, 1893, only 27 were left in November, by reason of mink having gained access to the pond. The fish spawned in the autumn of 1893, and yielded, November 2, 1893, about 6,000 eggs, from which 3,178 very weak fish were hatched, the last of which died June 11, 1894.

The fish have been fed during the year, as formerly, on chopped material derived from butcher's offal, and on maggots produced at the station. Considerable attention has been given to the production of natural food—live food in the station ponds—one man being kept nearly the entire time from April to July in the collection of material, its distribution in the ponds, observations on the pond temperatures, and the growth and multiplication of the entomostraca, etc., of which the collections mainly consisted.

The maximum and minimum temperatures of the air and water during the year were as follows:

| Month. | Air temperature. | | Water temperature. | |
|---|---|---|---|---|
| | Maximum. | Minimum. | Maximum. | Minimum. |
| 1893. | ° F | ° F | ° F | ° F |
| July | 90 | 56 | 68 | 56 |
| August | 92½ | 55 | 70 | 58 |
| September | 75 | 38 | 64 | 53 |
| October | 72 | 27 | 63 | 46 |
| November | 55 | 11 | 53 | 34 |
| December | 37½ | a 14 | 44 | 32 |
| 1894. | | | | |
| January | 40 | a 24 | 38 | 32 |
| February | 39 | a 22 | 37½ | 32 |
| March | 52 | 14 | 43 | 33 |
| April | 70 | 16 | 51½ | 38½ |
| May | 82 | 43 | 60 | 42 |
| June | 87½ | 50 | 71 | 52 |

a Below zero.

GREEN LAKE STATION, MAINE.

On July 1, 1893, the affairs of this station were temporarily put under the direction of the foreman, William H. Munson.

On July 5, Richard Dana reported at the station for the purpose of keeping the records and attending to the correspondence.

On August 2, 1893, in accordance with instructions from the Commissioner, E. M. Robinson took charge as acting superintendent and received a probationary appointment (under civil-service rules) as superintendent September 16, 1893.

Mr. Robinson reported the fish on hand at the station August 21, 1893, as follows:

| Kind. | Hatching of the year— | | |
|---|---|---|---|
| | 1893. | 1892. | 1891. |
| Landlocked salmon | 157,839 | 4,656 | 3,676 |
| Sea salmon | 3,420 | ..... | ..... |
| Loch Leven trout | 27,373 | 1,788 | ..... |
| Lake trout | 5,000 | ..... | ..... |
| Von Behr trout | 45,494 | 1,142 | ..... |
| Brook trout | 4,004 | ..... | ..... |
| Total | 243,130 | 7,586 | 3,676 |

One of the first subjects that received the attention of the superintendent was the collection of salmon and trout eggs in localities not too far removed from the station. A thorough reconnoissance was made of all the neighboring brooks, and Mann and Winkenpaugh brooks were selected as being the most suitable. In addition to the traps at those streams a net trap was put in at the outlet of Green Lake for the capture of landlocked salmon and the one at Great Brook was repaired.

During the season 133 landlocked salmon were taken. Of these, 90 were females and 43 males. The yield of eggs from the 90 females was 311,000, or an average of 3,477 to each fish. The first salmon was caught on September 26 at Mann Brook and the last on November 22 at Great Brook. After these fish were through spawning they were released in the lake.

On October 6 a trap was built at the head of Branch Pond, some 10 miles west of the hatchery; and on the 14th, after a heavy rain, 59 trout were taken. The season's catch of brook trout is as follows: Winkenpaugh Brook, 110; Great Brook, 14; Mann Brook, 1; total, 125. Of these 37 were males and 88 females. Eleven of the females were spent before being captured and only 15 of the males were found to be of any use.

The first eggs of the season were taken October 26; total for the season, 105,146.

During the season there were distributed from the station: Landlocked salmon, 143,481; sea salmon, 3,908; Loch Leven trout, 21,468; lake trout, 25,000; Von Behr trout, 36,803; brook trout, 5,500; rainbow trout, 400; total, 236,560.

Nearly all of these were planted in New England waters and principally in Maine.

Landlocked-salmon and brook-trout eggs were distributed from the station during the season, as follows:

| Date. | Consignee. | Variety. | Number. | Remarks. |
|---|---|---|---|---|
| 1894. | | | | |
| Jan. 23 | J. J. Armistead, Scotland | Brook trout | 20,000 | Received in good order. |
| 24 | W. H. Van Sickle, Bevans, N. J | do | 10,000 | Do. |
| 31 | Lieut. H. R. Lemly, South America | do | 3,000 | Did not sail; eggs opened at Central Station. |
| Feb. 10 | do | Landlocked salmon | 3,000 | Nothing heard from shipment. |
| 15 | W. Hamlin, Tuxedo Park Association, New York. | do | 3,000 | Received in good order. |
| 15 | R. C. Alexander, Adirondack League Club, New York. | do | 5,000 | Do. |
| 19 | Caleb Gilman, Calais, Me | do | 5,000 | Received in bad order. |
| 20 | C. G. Atkins, Craig Brook Station, Me. | Brook trout | 10,000 | Received in good order. |
| 20 | Edmund Hayes, president Wilmurt Club, Buffalo, N. Y. | Landlocked salmon | 5,000 | Do. |
| 20 | A. E. Adams, Boston, Mass | do | 5,000 | |
| 20 | W. L. Gilbert, Plymouth, Mass | do | 1,000 | Do. |
| 26 | Gardner Smith, Ragged Lake, N. Y | do | 5,000 | Do. |
| 26 | E. R. Hewett, Ringwood, N. J | do | 5,000 | |
| 26 | W. T. Haynes, Oakland, Me | do | 5,000 | Do. |
| 28 | Henry Studor, White Corners, N. Y | do | 5,000 | Do. |
| 28 | John G. Roberts, superintendent Saranac Inn Station, N. Y. | do | 30,000 | Do. |

The receipt of eggs at the station during the season was as follows:

| Date. | Consignor. | Variety. | Number. | Remarks. |
|---|---|---|---|---|
| 1894. | | | | |
| Jan. 19 | F. N. Clark, Northville, Mich | Von Behr trout | 25,000 | Fair condition. |
| 19 | do | Loch Leven trout | 20,000 | Do. |
| 20 | do | Lake trout | 50,000 | Good condition. |
| 23 | W. F. Page, Neosho, Mo | Rainbow trout | 50,000 | Bad condition. |
| Mar. 1 | J. J. Armistead, Killywhan Station, Scotland. | Loch Leven trout | 20,000 | All dead on arrival. |

Early in May the larva of the caddis fly was seen in the hatching troughs, and during the month 31,745 landlocked salmon fry were destroyed thereby. Other losses from the same cause were: Von Behr trout, 553; Loch Leven trout, 731; lake trout, 1,686.

The fry and other stock on hand for month ending June 30, 1894, at the station was as follows:

| Varieties. | Fry. | Hatching of— | | | Hatching of 1890 or older. |
|---|---|---|---|---|---|
| | | 1893. | 1892. | 1891. | |
| Landlocked salmon | 149,941 | ..... | 4,650 | 3,376 | 2 |
| Lake trout | 16,012 | ..... | ..... | ..... | ..... |
| Von Behr trout | 11,674 | ..... | 1,140 | ..... | ..... |
| Loch Leven trout | 15,678 | ..... | 1,788 | ..... | ..... |
| Brook trout | ..... | 263 | ..... | ..... | 90 |
| Total | 193,305 | 263 | 7,584 | 3,376 | 92 |

The temperatures during the year were as follows:

| Month. | Air. | | Water. | |
|---|---|---|---|---|
| | Max. | Min. | Max. | Min. |
| | ° F. | ° F. | ° F. | ° F. |
| July | 95 | 60 | 76 | 67 |
| August | 98 | 59 | 78 | 63 |
| September | 78 | 46 | 68 | 50 |
| October | 70 | 39 | 66 | 47 |
| November | 55 | 12 | 48 | 34 |
| December | 40 | *a* 8 | 38 | 33½ |
| January | 39 | *a* 28 | 34 | 32½ |
| February | 42 | *a* 25 | 33 | 32½ |
| March | 60 | 28 | 36 | 33 |
| April | 74 | 25 | 51½ | 34 |
| May | 82 | 42 | 63 | 47 |
| June | 88 | 52 | 77 | 56 |

*a* Below zero.

GLOUCESTER STATION, MASSACHUSETTS (A. C. ADAMS, MASTER SCHOONER GRAMPUS, IN CHARGE).

This station was in care of a custodian from July 1, being practically closed until the arrival of Mr. Adams on October 9, 1893, at which time the machinist and crew of the schooner *Grampus* were engaged in getting the station in order for the season's operations. Capt. A. C. Adams resigned his position as master of the *Grampus* in order to become fish-culturist and custodian of the Gloucester Station.

On November 16, instructions were received from the Commissioner to begin work, and on that date three men were sent to Kittery Point, Maine, to arrange for a supply of cod eggs. On the 18th of November 200,000 cod eggs were taken in Ipswich Bay, and 453,000 were received from Kittery Point on the 20th. These began to hatch December 1, with a mean water temperature of 42°. By the end of November 3,557,000 eggs were on hand.

The following table shows the number of cod eggs collected monthly during the season, and the number of fry hatched therefrom and liberated:

| Month. | Number of eggs collected. | Number of fry hatched and liberated. |
|---|---|---|
| November, 1893 | 3,557,000 | 1,574,000 |
| December, 1893 | 8,200,000 | 3,109,000 |
| January, 1894 | 16,421,000 | 5,697,000 |
| February, 1894 | 16,126,000 | 5,300,000 |
| March, 1894 | 18,513,000 | 8,053,000 |
| April, 1894 | 1,302,000 | 884,000 |
| May, 1894 | 656,000 | |

A snowstorm occurred on December 10, and by the 14th the temperature fell from 42° to 35°, retarding the hatching of all eggs taken previously. The water density also was from 24° to 24.5°, not enough to allow the eggs to float after a few days' development.

Shipments of cod eggs to the Woods Hole Station were as follows:

| Date. | Number. | Method. |
|---|---|---|
| February 10 | 1,110,000 | By messenger. |
| 10 | 413,000 | By express. |
| 13 | 1,159,000 | Do. |
| 15 | 695,000 | Do. |
| 21 | 450,000 | Do. |
| Total | 3,827,000 | |

On April 16, 18,000 haddock fry were planted, and 1,500 on May 14.

Both haddock and cod eggs were taken March 21, and on April 7 the two species hatched with a mean temperature of about 37° for the 17 hatching days.

The entire number of codfish eggs collected during the season was 64,775,000, and of these 24,617,000 were hatched and liberated.

The lobster work was begun May 3, when 20 egg lobsters were secured, from which 274,000 eggs were taken and placed in McDonald hatching jars. The whole number of egg lobsters obtained in May was 293, and these produced 3,757,000 eggs, of which 3,380,000 were hatched and planted in the outer harbor off Gloucester.

On May 18, Mr. Adams was detailed to work under the direction of Mr. Richard Rathbun, assistant in charge of the division of inquiry respecting food-fishes, and the lobster work was continued with Mr. W. P. Sauerhoff in charge.

The collections of egg lobsters in June amounted to 482, and yielded 6,530,000 eggs; from these, 5,953,000 young lobsters were liberated.

The whole number of egg lobsters purchased during the season to July 1 was 775; whole number of eggs taken from these, 10,287,000; whole number of lobsters hatched from these, 9,332,000; percentage hatched, 90.7.

WOODS HOLE STATION, MASSACHUSETTS (JOHN MAXWELL, SUPERINTENDENT).

The fish-cultural work covered a period of eight months—from November to the end of July.

*Codfish.*—Between February 9 and 20, 3,903,000 codfish eggs were received from Kittery, Me., from which 1,254,000 fry were produced and liberated in Vineyard Sound within twenty-four hours after hatching. The storage of brood cod was improved by placing live-boxes or cars in the salt-water reservoir in the basement of the hatchery building, where exhaust steam from the pumps could be used if necessary to heat the water in severe winter weather.

*Flatfish.*—Between February 13 and March 26, 17 adult flatfish were obtained by means of a fyke net set in Woods Hole Harbor. These yielded 2,227,000 eggs, which produced 1,795,000 fry; and the latter well deposited in Buzzards Bay and Vineyard Sound. Both the cod and flatfish were hatched in McDonald boxes and Chester jars, operated by tide motion.

*Lobster.*—The lobster-hatching season covered the months of April, May, and June. From 4,026 egg lobsters 97,635,000 eggs were obtained, but 14,500,000 of these were in bad condition when placed in the hatching apparatus, and were turned out in the harbor on the fourth day. Hatching began June 18 with a water temperature of 64½° F. From the 83,135,000 good eggs, 69,066,000 fry were produced and liberated in Vineyard Sound and Buzzards Bay from twelve to twenty-four hours after hatching. The experiment of keeping lobster eggs in process of hatching during the winter was again tried, with the following results:

| When stripped. | Number of lobsters. | Number of eggs produced. | Number of fry. | Number of days hatching. |
|---|---|---|---|---|
| December, 1893 | 38 | 361,000 | 225,000 | 146 |
| January, 1894 | 38 | 426,000 | 325,000 | 129 |
| February, 1894 | 9 | 121,800 | 95,500 | 106 |

The above shows that lobster eggs can be handled successfully during the winter, if the water temperature does not fall below 29° F.

A section of the basement under the hatchery was made into a reservoir by cementing, etc. In this reservoir 7 fish cars were erected with a capacity for storing 1,000 brood fish.

There were collected during the summer a large number of sea plants, shellfish, etc., for the World's Fair at Chicago.

The temperature of the water at the station during the hatching season was as follows:

| Month. | Max. | Min. | Month. | Max. | Min. |
|---|---|---|---|---|---|
| | ° F. | ° F. | | ° F. | ° F. |
| December, 1893 | 48 | 36 | April, 1894 | 47 | 39 |
| January, 1894 | 37 | 33 | May, 1894 | 59 | 48 |
| February, 1894 | 34 | 30 | June, 1894 | 67 | 58 |
| March, 1894 | 41 | 32 | | | |

DELAWARE RIVER SHAD-PROPAGATING STATION (LIEUT. ROBERT PLATT, U. S. N., IN CHARGE).

On May 8 the steamer *Fish Hawk* arrived off Gloucester City, N. J., to commence the season's work. The first eggs were obtained May 9 and the last June 7, during which time 9,651,000 eggs were taken from 395 fish. The number of fry produced was 5,768,000, and the number of eggs transferred 1,500,000. All were deposited in the Delaware River. The details of deposit are as follows:

| Date. | Number of fry or eggs. | Locality. |
|---|---|---|
| May 16, 1894 | 1,699,000 | Delaware Watergap, Pa. |
| 18, 1894 | 800,000 | Do. |
| 19, 1894 | 500,000 | Port Jervis, N. Y. |
| 19, 1894 | 142,000 | Gloucester, N. J. |
| 22, 1894 | 1,100,000 | Lambertville, N. J. |
| 28, 1894 | a 277,000 | Delaware Watergap, Pa. |
| | 709,000 | |
| June 5, 1894 | 400,000 | Callicoon, N. Y. |
| 8, 1894 | a 1,223,000 | Delaware Watergap, Pa. |
| | 418,000 | |

a Eggs.

The eggs were chiefly obtained, as in previous years, from Faunce's, Bennett's, and Howell's Cove fishing shores.

The water was muddy during the entire season.

The following table exhibits the take of eggs, temperatures, etc., during the season:

| Date. | Fish stripped. | | Number of eggs. | Noon temperatures. | |
|---|---|---|---|---|---|
| | Male. | Female. | | Air. | Water. |
| | | | | ° F. | ° F. |
| May 9 | 26 | 26 | 1,425,000 | 70 | 67 |
| 10 | 15 | 14 | 681,000 | 69 | 69 |
| 11 | 31 | 27 | 1,392,000 | 74 | 69 |
| 14 | 25 | 25 | 1,112,000 | 69 | 69 |
| 15 | 5 | 5 | 266,000 | 65 | 68 |
| 16 | 9 | 9 | 473,000 | 67 | 68 |
| 17 | 12 | 12 | 586,000 | 73 | 68 |
| 18 | 11 | 11 | 544,000 | 83 | 68 |
| 19 | 5 | 5 | 221,000 | 87 | 70 |
| 22 | 8 | 8 | 372,000 | 57 | 63 |
| 25 | 1 | 1 | 45,000 | 63 | 56 |
| 26 | 1 | 1 | 40,000 | 65 | 59 |
| 28 | 12 | 12 | 621,000 | 78 | 65 |
| 29 | 8 | 8 | 483,000 | 57 | 62 |
| June 4 | 12 | 12 | 442,000 | 82 | 62 |
| 5 | 10 | 10 | 469,000 | 62 | 61 |
| 6 | 4 | 4 | 238,000 | 50 | 61 |
| 7 | 5 | 5 | 241,000 | 61 | 60 |
| Total | 200 | 195 | 9,651,000 | | |

BATTERY ISLAND STATION, MARYLAND (W. DE C. RAVENEL, SUPERINTENDENT).

The station was opened April 1, and preparations commenced for the propagation of the shad. The collection of eggs began April 21, and continued to May 19. There were taken during that time 39,770,000 eggs, from which 22,695,000 fry were hatched, and of these 22,645,000 were distributed as follows:

| Place of deposit. | Number. | Place of deposit. | Number. |
|---|---|---|---|
| North East River, Maryland | 1,200,000 | Susquehanna River, Pennsylvania | 2,507,000 |
| Elk River, Maryland | 1,380,000 | Nanticoke River, Delaware | 450,000 |
| Bush River, Maryland | 630,000 | Brandywine River, Delaware | 1,330,000 |
| Wicomico River, Maryland | 345,000 | Delaware River, Delaware | 450,000 |
| Gunpowder River, Maryland | 450,000 | Carp Ponds, Washington, D. C. | 40,000 |
| Tuckahoe River, Maryland | 450,000 | Hudson River, New York | 5,414,000 |
| Chester River, Maryland | 450,000 | Delaware River, New York | 450,000 |
| Chesapeake Bay, Maryland | 2,976,000 | Connecticut River, Connecticut | 1,519,000 |
| Susquehanna River, Maryland | 1,104,000 | Palmer River, Rhode Island | 1,500,000 |

During the season eggs taken, numbering 5,634,000, were shipped as follows: To the New York Commission, for the Hudson River, 2,000,000; to the Palmer River, Providence, R. I., 1,669,000; to the Connecticut River, 1,610,000, and to Chesapeake Bay (Battery Station, Maryland), 355,000.

The water was generally clear.

The temperatures of air and water at noon during the season of 1894 were as follows:

| Date. | Air. | Water. | Date. | Air. | Water. |
|---|---|---|---|---|---|
| | °F. | °F. | | °F. | °F. |
| April 6 | 46 | 45 | April 30 | 61 | 61 |
| 7 | 47 | 45 | May 1 | 68 | 61 |
| 8 | 45 | 46 | 2 | 71 | 67 |
| 9 | 36 | 44 | 3 | 68 | 67 |
| 10 | 43 | 45 | 4 | 67 | 67 |
| 11 | 35 | 41 | 5 | 67 | 67 |
| 12 | 35 | 38 | 6 | 70 | 67 |
| 13 | 38 | 39 | 7 | 68 | 67 |
| 14 | 50 | 42 | 8 | 60 | 69 |
| 15 | 55 | 48 | 9 | 66 | 69 |
| 16 | 56 | 49 | 10 | 67 | 68 |
| 17 | 57 | 53 | 11 | 68 | 68 |
| 18 | 59 | 54 | 12 | 67 | 69 |
| 19 | 61 | 54 | 13 | 70 | 70 |
| 20 | 65 | 57 | 14 | 66 | 69 |
| 21 | 61 | 57 | 15 | 62 | 69 |
| 22 | 56 | 57 | 16 | 67 | 69 |
| 23 | 60 | 56 | 17 | 64 | 67 |
| 24 | 56 | 56 | 18 | 74 | 69 |
| 25 | 57 | 56 | 19 | 74 | 70 |
| 26 | 57 | 56 | 20 | 66 | 68 |
| 27 | 61 | 59 | 21 | 62 | 64 |
| 28 | 64 | 60 | 22 | 58 | 57 |
| 29 | 65 | 62 | | | |

On May 19, the last day on which eggs were taken, a severe storm set in which lasted three days, and caused the worst freshet that has occurred on the river since 1885, the island being under water for several hours on the 21st and 22d. This made the season the shortest that has ever been known on the Susquehanna, the station having been in operation only thirty-one days. After the freshet shad were caught in considerable numbers off Spesutia Island and in the vicinity of the station; but a careful examination failed to show a ripe shad between May 24 and June 3.

On April 25 one of the spawn-takers used a striped bass for fertilizing some 60,000 shad eggs, there being no male shad on hand, and on May 3 they were all hatched. When placed alongside of other shad fry hatched at the same time they seemed slightly different in color and action, and as it is claimed that the milt will not live exposed to the air more than a few minutes, it seems probable that the fry referred to are genuine hybrids.

Experiment was made in canning roes of shad and alewives for fish food for the rearing stations, but without success, the roes not having been sufficiently cooked or steamed. It is thought that the work in this line can be made a success if arrangements are made to do it early in April, when the herring or alewife first come in and when the roes are firm.

BRYAN POINT STATION, MARYLAND (S. G. WORTH, SUPERINTENDENT).

Until preparations for the shad season began, early in March, 1894, the property was in charge of a custodian. Mr. L. G. Harron, superintendent of the aquarium at Central Station, was sent to the station March 7, and on March 27 the launch *Blue Wing* was put in commis-

sion and assigned to the duty of carrying spawn-takers to fisheries lying between Bryan Point and Cockpit Point, at the lower entrance to Occoquan Bay.

The employees, with a few exceptions, were again housed in tents, furnished by Gen. Albert Ordway, commanding the militia of the District of Columbia, and the use of such quarters was found beneficial.

Seining operations with the Fish Commission seine began April 5.

Indurated fiber tubs with drop handles were substituted for the tin tanks formerly used for holding eggs in the boats and were found to possess many advantages. Being without joints and hoops, they do not fall to pieces or corrode, and they are good nonconductors of heat. The tubs are 17¾ inches in diameter and 8½ inches high, with tops of one-half inch white pine, to prevent splashing. Around the edge of the top is attached a rubber packing of suitable elasticity and in the center a 4-inch hole is cut to admit air.

The Fish Commission seine captured at Bryan Point 5,231 shad, of which 466 were skins, skips, or immature fish. The ripe fish yielded 4,350,000 eggs. Only a very small number of fish were hatched at the station. The total number of eggs obtained and the sources from whence derived are shown in the following statement:

| | |
|---|---|
| Chapman Point seine | 2,007,000 |
| Stony Point seine | 2,216,000 |
| Tulip Hill seine | 573,000 |
| Tent Landing seine | 235,000 |
| Freestone Point seine | 3,249,000 |
| Bryan Point seine | 4,350,000 |
| Gill nets | 19,763,000 |
| Total | 32,393,000 |

There were shipped to Central Station 32,254,000, which, on the day following their receipt in Washington, were measured and their number found to be 27,334,000, the loss in transportation being attributed chiefly to breakage of defective eggs. The eggs were packed in crates and delivered daily by the launch or small boat at Marshall Hall, whence they were taken in charge by Mr. F. H. Williams and carried to Washington on the Mount Vernon and Marshall Hall steamers. The season closed in early June, but shad continued to be abundant in the Potomac during June, July, and August, and some were observed in September. For the greater portion of that time eggs of apparently good quality could have been collected in large quantities.

CENTRAL STATION, WASHINGTON, D. C. (S. G. WORTH, SUPERINTENDENT).

From the beginning of the fiscal year until February 19, 1894, the superintendent performed the additional duties of acting assistant in charge of the division of fish culture during the detail of the assistant in connection with the World's Fair at Chicago. He was also a member of the examining board of the Civil Service Commission, and took the general oversight of the aquaria in the absence of the superintendent of aquaria.

The purchase and shipment of various supplies for other stations of the Commission were attended to by Mr. Worth, and numerous services were rendered for other departments of the Central office. The number of shipments of freight handled at the station was 618. The shad eggs collected at Bryan Point are hatched in Central Station, as well as eggs of trout, salmon, whitefish, pike-perch, etc., from distant stations of the Commission. This is the shipping-point also for the fish produced at the Fish Ponds in Washington, as well as for those hatched in the station.

A special carp-distribution pail, devised in October, 1893, has two small rings soldered midway between the ears of the handles. The openings in the rings and ears provide a ready means of fastening on the lids.

The cement used in repairing aquaria at the station is made according to the following formula: Putty, 4 pounds; litharge, 1 pound; red lead, 1 pound. The litharge and lead are kneaded into the putty. If the mixture should be too dry, linseed oil is added, drop by drop, until the desired consistency is secured. The cement may be darkened by asphaltum or lampblack. It requires several days to set.

For drilling glass, a file is fastened in a handle and the free end is ground on three faces with a $\frac{1}{8}$-inch bevel to a sharp point. "Bortine" or "glass-bore" is used as a lubricant in drilling.

In February, 1894, the office of the Commission was moved to the Atlantic Coast Line Building, corner of Sixth street and Pennsylvania avenue, and the first floor of the Central Station was used for storage during the repairs to the roof and upper floors. The work was completed and the office reinstated late in June.

In February, 1894, arrangements were made to discard the open water supply tank at the west end of the third-story hall. A safety valve was first connected with the iron piping supplying the hatching tables, and was found available as a temporary expedient during the hatching of some whitefish eggs. This was soon afterwards replaced by a 3-inch Watson water-pressure regulator, which proved entirely satisfactory. The regulator may be found useful at Alpena and other stations taking water by gravity.

In the spring of 1894, Superintendent Worth prepared 173 photographic prints from negatives of fishery and fish-culture subjects made for the World's Columbian Exposition, and these were sent to Dr. Ernst Ehrenbaum, Kgl. Biologische-Anstalt, Helgoland. Of similar illustrations, 36 were prepared and forwarded to Dr. Nicolas Borodine, Uralsk, Russia. Illustrations and explanations of the methods of the Commission in shad culture were also furnished to Mr. C. B. Hudson.

On June 27 the superintendent commenced an examination of the McDonald patent fishway at the Great Falls of the Potomac River to determine its condition and the number of fish ascending. A preliminary report was made, which was approved, and formed the basis of operations and expenditures.

The application of air for oxygenizing water in which living fishes

are kept has been a subject of experiment since the fall of 1888. References to this use of air will be found in the bulletin for 1890 and in the report for 1893. The first object of the experiments was to maintain fishes in salt-water aquaria without circulating the water. Rubber tubing, pricked with pinholes, to liberate air, was tried without satisfactory results. Section of dead grapevine, cornstalk pith, and twigs of various trees were substituted, with little improvement. Sponge, inserted in small openings in rubber tubes, also gave poor results.

Finally it was discovered, as detailed in the report for the preceding fiscal year, that twigs of the American linden or basswood furnish perfect liberators, and the difficult problem was solved. The liberator plugs are made from wilted or dead boughs of any size greater than ¼ inch in diameter. The bark is removed and the wood seasoned. It is then cut by a saw with very thin blade and fine teeth into sections ¼ inch to ½ inch long. The plugs are made from ¼ to ⅜ inch in diameter by forcing them through a round belt-lacing punch. The ends of the plugs may be smoothed with the finest sandpaper. The liberators continue useful from a few days to several weeks, according to the amount of grit entering the circulation. They were inserted in sections of ½-inch rubber tubing.

In January, 1894, a Bishop & Babcock air-compressor of large size was introduced to furnish air for the aquaria in Central Station through small iron pipes. It delivers air under pressure of from 5 to 8 pounds per square inch. The water or power cylinder is 4⅛ inches in diameter and 8½ inches long; the air cylinder, 5⅞ inches by 8½ inches. Strokes per minute, $6\frac{1}{10}$, delivering 1,405.13 cubic inches of air under a pressure of 7 pounds per square inch, a rate of 364.8 liquid gallons per hour, equivalent to the flow of salt water through the aquaria. At delivery points, ¼-inch brass jet cocks were inserted into the ⅜-inch conduit piping. To the jet cocks were attached sections of ½-inch rubber tubing, and air liberators were inserted in the free ends of the tubing.

The air circulation proved so successful in the aquaria as to lead to the addition of an air pump to the steam plant on car No. 3, in August, 1893, and the result was equally good. It has been demonstrated that as many fish can be transported in the same bulk of water by air circulation as with water circulation.

In December, 1893, a practical test was made of the practicability of hatching floating eggs by means of air circulation. Cod eggs and sea water were obtained from the Gloucester, Mass., Station, and two shipments of eggs out of eleven produced fry.

The eggs were placed in universal hatching jars and the jars were embedded about two-thirds of their height in a mixture of crushed ice and salt, the upper third being free and exposed to a strong light. The water temperature was kept uniformly at 38° F. Air was introduced at the bottom of each jar through a rubber tube provided with a liberator. It was believed that the experiment would have been more

satisfactory if pure sea water had been available to make a complete change of water every third day during the hatching process.

Advantages claimed for the air-circulation process are: (1) Thorough aeration, (2) active movement of the eggs, (3) light, (4) ability to keep eggs in sea water of proper density and at a uniform temperature, (5) economy of labor and apparatus, (6) increased comfort to hatchery employees, (7) economy and improved quality of water, (8) reduction of cost of pumping, (9) increased facility in removing dead eggs, (10) increased cleanliness and absence of wet floors, (11) economy of space in the hatching room, (12) improved facilities for observing the condition of eggs and fry. Hatching operations could be carried on in jars on the cars en route or on board ship.

Two lots of pike-perch eggs were received from Put-in-Bay Station May 4 and 5, 1894, with a loss of about 90 per cent. Those received May 5 were in a temperature of 62° F. They were allowed to rise to 62° and placed in water at 68°, when hatching commenced at once.

On December 28, 1893, Superintendent Seagle sent from Wytheville, Va., 10,000 rainbow-trout eggs of different ages for use by Prof. W. K. Brooks, of Johns Hopkins University, in his studies of the development of fins. The young cod hatched at Central Station were also shipped to Professor Brooks, together with three universal hatching jars, complete.

Central Station is credited with furnishing for distribution the following fry:

| Species. | Place where eggs were collected. | No. of fry distributed. |
|---|---|---|
| Shad | Bryan Point | 21,082,000 |
| Whitefish | Put-in-Bay | 3,800,000 |
| Landlocked salmon | Green Lake | 2,500 |
| Brook trout | Northville and Green Lake | 19,500 |
| Rainbow trout | Wytheville and Neosho | 22,000 |
| Pike perch | Put-in-Bay | 75,000 |
| Total | | 25,001,000 |

Of rainbow-trout eggs produced at Wytheville and Neosho 104,537 were reshipped to applicants in Baltimore, Md., Canada, Belgium, and France, as shown in the details of distribution. Of species forwarded from the Fish Ponds, World's Fair, Green Lake, Quincy, Wytheville, Neosho, Havre de Grace, and Put-in-Bay stations, 1,236,704 individuals were received and most of them were distributed.

### Aquaria, Central Station (L. G. Harron, Superintendent).

At the beginning of the fiscal year the superintendent was on detailed duty at the aquarium of the Fish Commission at the World's Columbian Exposition, and remained in that service until October 30, 1893. Preparations for restocking Central Station aquaria began November 5, and on November 12 a collecting trip was made to lower Chesapeake Bay. Fish had left the inlets and shallow bays owing to cold weather, and very few specimens could be collected.

In February, 1894, during repairs to the aquaria, the fish were transferred to the outside supply reservoir and air currents were introduced, but all of them died during spring and summer. The superintendent was detached for duty at Bryan Point until after the close of the fiscal year.

The water motor, introduced in May, 1893, to pump salt water into the storage tank, works satisfactorily and at much less cost than the gas engine previously used. A line of ⅜-inch iron pipe was extended from the air compressor to establish air circulation in the aquaria.

Goldfish spawned in May and the eggs were hatched in tubs of standing water; the fry were reared in small "balanced" aquaria. Eggs of the paradise fish were hatched and the fry reared in the same way. Common darters (*Boleosoma olmstedi*) spawned in May and the eggs were eaten by the adult fish. Among the marine species some of the mummichogs (*Fundulus*) spawned in June and a number of fry were produced, but they were devoured by the adults.

Adult grayling, brought from the World's Fair November 3, 1893, to the number of 44, were kept with the loss of only 4 until February 17, 1894, when they were transferred to the Wytheville, Va., Station in excellent condition. About 50 young brook trout, reared from fry exhibited at the World's Fair, were transferred to the aquaria at Central Station November 5, 1893, and held without loss until March 5, 1894, when they were from 5 to 6¼ inches in length. They were planted at Leesburg, Va. Some anemones from the Pacific Coast, exhibited four months in the aquarium at Chicago, were transferred to Washington November 5, 1893, and lived in salt water with air circulation until May, 1894, when they were killed by high temperature.

The mortality among marine species is merely nominal, and fresh-water fishes, with the exception of the *Salmonidæ*, which can not endure summer warmth, are successfully maintained.

FISH PONDS, WASHINGTON, D. C. (R. HESSEL, SUPERINTENDENT).

The following yearling fish were taken from the ponds in November, and distribution of them made through Central Station: Carp, 51,802; tench, 10,022; golden tench, 431; goldfish, 8,427; golden ides, 1,947; black bass, 12,330; shad, 1,000,000.

On the night of October 12 a strong wind blew up, which developed into a hurricane by morning, and forced the water from the bay into the Potomac. Toward evening, at high tide, the water rushed over the banks and flooded all the large ponds containing carp, black bass, and tench, and for eight hours the water was on a level with the base of the office building. The water thus became brackish, and about 1,000,000 yearling shad were swept into the Potomac somewhat earlier than originally intended.

*Ides.*—Early in March the old ides were transferred to the hatching ponds, where they began to spawn on April 20. Subsequently the frost killed over 20,000 eggs, and only about 40 young ides were saved.

*Black bass.*—Both kinds of the black bass were raised—the large-mouthed and the small-mouthed. On April 1 they were placed in their respective hatching ponds. The small-mouthed bass spawned April 23, and the large-mouthed one week later. On May 8 the first young bass of both species were seen. The large-mouthed variety soon increased to about 60,000, while the small-mouthed did not produce over 4,000 eggs. Soon after May 10, the young bass were placed in the north pond and the old ones retained in the hatching ponds. The bass were fed on live food, 500,000 tadpoles and 400,000 young carp being placed at their disposal.

With the arrival of the warm weather the natural consequences of the October flood could be seen. Grasses and other water plants, the seeds of which had been carried into the station by the high water, grew very rapidly into a dense mass of vegetation, which had to be removed over and over again to prevent their interfering with the growth of the young fish. There also appeared at the same time two kinds of *Notonecta* and *Nepa*, both insects being very injurious to young fish. Daily efforts were made to destroy them, but without success.

Notwithstanding the abundance of live food, the young large-mouthed black bass commenced to attack each other, thereby causing a decrease in the number of young fish; and how to remedy this is a problem yet to be solved.

*Carp.*—The leather and scale varieties were raised in the new pond, while the blue carp were placed in another pond. The carp in the new pond suffered from the insects above referred to.

*Tench.*—This species was hatched and raised in the south pond, and the golden tench in a smaller pond. Compared with former seasons, the young fish grew very fast.

*Pike perch.*—A number of transport cans full of this fish were transferred to the new south pond, but the fish all died on account of the too warm water, the pond being but one foot and a half deep.

The shad hybrids also died from the same cause.

WYTHEVILLE STATION, VIRGINIA (GEORGE A. SEAGLE, SUPERINTENDENT).

The product of this station during the season was as follows:

| Species. | Eggs. | Fry. | Yearlings. |
|---|---|---|---|
| Rainbow trout | 104,500 | 15,000 | 90,640 |
| Rock bass | ..... | ..... | 20,750 |
| Black bass | ..... | ..... | 40 |
| Carp | ..... | ..... | 700 |
| Goldfish | ..... | ..... | 2,649 |

Of the rainbow trout 250,000 eggs were collected from the brood stock at the station, 114,000 were received in January from the Neosho Station, and 10,000 from the Troutdale Fish Farm, Mammoth Spring, Ark., making in all 374,200 eggs. Of this number, 180,360 were hatched

at the station, 104,500 were shipped to Central Station for foreign shipments, and 80,040 died during incubation. From the native rainbow trout 10,000 eggs were shipped to the station from Hoopa Valley, California, on March 24, and arrived at Wytheville April 2; but as all the eggs hatched en route the shipment was a total loss.

From 135 black-spotted trout at the station there were collected 12,000 eggs, but owing to the lack of milt only 500 were saved. The propagation of this species has been tried at the station the past two seasons, but without success. The sexes do not mature together, the male having passed out of season when the female comes in.

About November 5 the rainbow trout commenced to spawn and ceased about February 20. Many of the older rainbows did not spawn this season from some unknown cause. The brood stock of rainbows consists of 5,400 fish, of which 1,000 are from 6 to 12 years old; 3,200 are 2 years old, and 1,200 are 1 year old. Very few of the 2-year fish produced eggs this season. Of rainbows, there were distributed this year 90,320 yearlings, 320 adults, and 15,000 fingerlings. Fish of a summer's growth were distributed as follows: Rock bass, 20,750; black bass, 40; carp, 790; goldfish, 2,649. The goldfish commenced spawning this year March 24, and the carp April 27.

From the rainbow-trout eggs hatched at the station the past season there are on hand, in good condition, 80,000 fingerlings. The bulk of these fish are being reared in the troughs where they were hatched.

The maximum and minimum temperatures of air and water during the months of November (twenty-six days), December, January, and February (twenty days), were as follows:

| | Temperature (air). | | |
|---|---|---|---|
| | Max. | Min. | Mean. |
| | ° F. | ° F. | ° F. |
| Twenty-six days in November | 60 | 13 | $40\frac{5}{8}$ |
| December | 58 | 12 | $30\frac{19}{31}$ |
| January | 58 | 12 | $30\frac{27}{31}$ |
| Twenty days in February | 58 | 12 | $37\frac{25}{29}$ |
| Water | 54 | 53 | $53\frac{55}{100}$ |

PUT-IN-BAY STATION, OHIO (J. J. STRANAHAN, SUPERINTENDENT).

The work of this station during the year was chiefly confined to the whitefish, pike perch, and lake herring. The egg-collecting season for whitefish and herring was one of the worst in the history of the commercial fisheries of Lake Erie. A very severe gale set in on November 12, which lasted, with the exception of November 16 and 20, to the close of the spawn-taking season, thereby greatly interfering with the collecting work.

*Whitefish.*—The first whitefish eggs were taken November 7, and the last November 29. The places and the number of eggs taken at each were: North Bass Island, 24,780,000; Middle Bass Island, 4,800,000;

Put-in-Bay Island, 5,190,000; Kelly Island, 2,880,000; East Sister Island, 1,260,000; Toledo, 140,000; total, 39,050,000.

*Herring.*—The first herring eggs were taken November 12, and the last November 26. From Put-in-Bay Island were received 31,000,000; from North Bass Island, 22,000,000; total, 53,000,000. Both kinds of eggs were, as a whole, of poor quality, owing to the difficulties under which they were obtained.

The work of penning live fish was a failure. There were penned only 82 fish, over one-half of which were males.

Only 45,000 lake trout eggs were collected during the season, and they were in such poor condition that but few of them hatched.

In the hatching, extensive and careful experiments were made with cone-shaped tubes as compared with the straight ones in general use. Eggs taken on the same day by the same person were mixed in a tub, and McDonald jars with open tops were fitted with the two styles of tubes and filled with these eggs. The percentage of loss was found to be much less with the cones than with the straight tubes. The percentage of loss after eye-specks were formed in the eggs was almost nothing with the cones, while it was considerable with the straight tubes. Like experiments were made with pike-perch eggs and with like results.

The cones were made at the station of tin, 6 inches long and 1 inch in diameter at the large end. Sections 6 inches long were cut from the lower end of the straight iron tubes, the cones centered and soldered on, after which all was coated with asphaltum.

*Pike perch.*—The season for collecting eggs of this species was very good, and 293,845,000 were obtained from the following grounds: North Bass Island, 80,580,000; Put-in-Bay Island, 61,030,000; Port Clinton, 100,725,000; Catawba Island, 3,400,000; East Sister Island, 21,760,000; Sandusky Bay, 26,350,000.

Of these, 248,965,000 were placed in the station, and 44,880,000 in the Sandusky station of the Ohio Fish Commission for the pike-perch season, the United States Commission having taken possession April 5.

On April 15, a series of experiments was commenced for the purpose of preventing the sticking together of adhesive eggs. Following the directions of Prof. Jacob Reighard, of Michigan, in 1 quart of dry corn-starch, dissolved in 5 gallons of water, was placed, after impregnation and 3 minutes interval, 1 gallon of pike-perch eggs. In another vessel was placed finely dissolved swamp muck in a solution of about the consistency of porridge, 2 quarts of this to 10 gallons of water, and in this were put 3 gallons of eggs. The spawn-taker making this experiment brought in 1 gallon of eggs in starch, and 2 gallons in muck. He reported that it was more work to keep the eggs free with the starch than under the former plan of constant stirring until the adhesive tendency disappears; as in the one case the eggs need attention only while being freed, while in the other they must be almost constantly

stirred until the station is reached. He reported that the muck entirely prevented adhesion, and gave no trouble whatever. After arriving at the station both lots were examined and then placed under running water as usual. The current carried over nearly all of the starch and a considerable portion of the muck. About twenty-four hours after being taken the two lots were separately removed from the kegs, passed through a screen with meshes large enough to admit of the passage of a single egg, when it was found that there were practically no lumps in either case. They were then put into a screen box with mesh fine enough to hold the eggs and all the muck was washed out, there being no starch remaining. Examination was made of both lots with the microscope, which showed minute particles of muck and starch adhering thickly all over the outer membrane of the eggs, thus preventing adhesion. Both lots showed a nearly equal percentage of good eggs, the muck eggs being slightly the better. In the starch solution 11 jars of eggs were taken; in the muck, 32. The muck was prepared by taking black muck from the shores of a pond near by, thoroughly mixing to a very thin solution with water, letting the vessel set about half a minute to settle out the coarser and heavier particles, then decanting off the water, holding the fine particles in solution, which was left to settle, when the nearly clear water was poured off, the muck being then rubbed through a fine wire screen, when it was ready for use.

An experiment was also made in hatching yellow-perch eggs. The eggs (73,000) were taken, April 27, from a fish weighing 9 ounces, and were at once impregnated, the milt of two small males being used. They were put in a McDonald jar and worked with a small amount of water, being thoroughly feathered twice a day or more. Eye-specks showed on the ninth day, and the fry hatched May 12. There was not 1 per cent of eggs in all which did not hatch.

Experiments were made in feeding the pike-perch fry to prevent cannibalism. One hundred thousand fry ten days old were placed in each of three kegs, each supplied with running water; one was entirely darkened; the fry in the second were freely fed on graham flour, and the third lot were left to themselves. The kegs were set up May 14. The darkened keg was opened on the 17th and again on the 19th, and but very few "doubles" were found—not over 1 per cent. The fry were light colored, and not as vigorous as those which had been in the light. On the 21st the keg was again opened, and a large percentage of the fry being dead, the experiment was abandoned and the live ones planted. There was a perceptibly greater mortality through cannibalism in the keg wherein the fry were not fed than in the one where they were, but it was considerable in the latter, although they seemed to eat the graham flour freely and remain healthy.

These experiments show that pike-perch fry can be held for two or three weeks for the purpose of facilitating shipment by providing ample tankage facilities, feeding often, and keeping the tanks moderately dark when the fry are not feeding.

Distribution and deposits of eggs and fry were made from the station, as follows:

Whitefish eggs to Central Station, Washington, D. C., 4,000,000; to Clayton, N. Y., State Fish Commission, 6,000,000.

Pike-perch eggs to Central Station, Washington, D. C., 3,700,000; to Constantia, N. Y., Fish Commission, 5,000,000; to Sandusky hatchery, 10,000,000.

Plants of fry were made in Lake Erie as follows: Whitefish, 21,710,000; herring, 30,005,000; pike perch, 132,000,000; lake trout, 121,000; yellow perch, 70,000.

Pike-perch fry delivered to United States Fish Commission (car No. 4), 24,300,000; to Ohio Fish Commission, 18,900,000; to John Fitzgerald (Winnow Point Club) at Put-in-Bay Station, for Mud Creek Bay, Ohio, 2,500,000.

NORTHVILLE STATION, MICHIGAN (F. N. CLARK, SUPERINTENDENT).

During the first half of the year there were completed two large ponds fed by pipe and race from the reservoir at the station, and twelve small rearing ponds were reconstructed. Drainpipes were introduced to all the remaining ponds, making it possible to draw each pond separately into the sewer.

The following table shows the number of each kind of fish on hand at the station July 29, 1893:

| Kind. | Hatching of the year. | | | |
|---|---|---|---|---|
| | 1893. | 1892. | 1891. | 1890, or previously. |
| Brook trout | 47,500 | 4,000 | 3,000 | 575 |
| Von Behr trout | 24,000 | 2,300 | ..... | 900 |
| Loch Leven trout | 37,700 | ..... | ..... | 1,700 |
| Black-spotted trout | ..... | 1,500 | 940 | ..... |
| Lake trout | 25,700 | ..... | ..... | ..... |
| Total | 134,900 | 7,800 | 1,240 | 7,175 |

There were not as many eggs collected this year from the parent fish at this station as in prior years, owing to the small number of breeders, a large portion of the stock fish having been shipped to the aquaria at the World's Fair.

*Brook trout.*—From 548 old fish (277 females and 271 males) 163,820 eggs were obtained, and from 3,106 yearlings (1,901 females and 1,205 males) 250,125 eggs, an average of 132 eggs to each fish. There were retained for hatching 228,945, and 185,000 eggs were shipped as follows: Troutdale Fish Farm, Mammoth Spring, Ark., 5,000; John G. Bailey, Rogers, Ark., 5,000; secretary of Hampshire Trout Club, Northampton, Mass., 10,000; Vermont Fish Commission, 20,000; Nebraska Fish Commission, 20,000; Minnesota Fish Commission, 20,000; A. P. Muzzey, New Richmond, Wis., 5,000; consul of Switzerland, at Havre, France, 20,000; Wytheville, Va., Station, 20,000; Duluth, Minn., Station, 20,000; Neosho, Mo., Station, 20,000; Central Station, Washington, D. C., 20,000.

Of yearlings, 29,100 were sent out, mostly to parties in Michigan, Pennsylvania, and New York. Six thousand fingerlings were shipped to persons in Michigan and Indiana.

When the brook-trout fry were 2 months old they began to die, and the loss continued as long as any of the fry were on hand, or until about July 1, 1894. It is thought that this loss was caused by the fact of the parent fish being diseased, a parasite attaching itself to their gills. About the beginning of March, when the disease was discovered, the fish were apparently clean, and from fifteen to thirty minutes after being attacked they would die. From early in March until in May over 3,000 of the parent fish, mostly from those 2 years old, died.

*Von Behr trout.*—Between October 31 and December 23 there were taken 235,000 eggs. Of these, 135,000 were distributed as follows: Troutdale Fish Farm Company, Mammoth Spring, Ark., 5,000; E. Chazari, City of Mexico, Mexico, 20,000; R. E. Follett, fish commissioner, Sheffield, Mass., 20,000; Minnesota Fish Commission, 20,000; Vermont Fish Commission, 20,000; Wyoming Fish Commission, 15,000; Green Lake Station, 25,000; Neosho Station, 10,000.

From the 24th of January to the 29th of March 14,972 fingerlings were distributed to parties in Michigan, Indiana, Ohio, Wisconsin, Iowa, and Kentucky.

*Loch Leven trout.*—Of this species 205,500 eggs were taken between October 30 and December 30. From these the following distributions were made: California Fish Commission, 20,000; Minnesota Fish Commission, 20,000; Green Lake, Me., Station, 20,000; Leadville, Colo., Station, 10,000; E. Chazari, inspector-general of pisciculture, City of Mexico, Mexico, 25,000.

Yearlings distributed, 10,600; fingerlings, 24,000.

*Lake trout.*—Eggs numbering 2,663,000 were received at the station during the season from Alpena, Mich., and 21,099 from the World's Fair on the 1st of November. Distributions of these eggs were made between January 17 and 19, as follows: Caledonia, N. Y., hatchery, 300,000; E. A. Brackett, fish commissioner, Winchester, Mass., 100,000; S. S. Watkins, superintendent Minnesota Fish Commission, St. Paul, 100,000; A. M. Musser, Salt Lake City, Utah, 100,000; C. C. Warren, fish commissioner, Roxbury, Vt., 300,000; Nebraska State Fish Commission, 100,000; R. E. Follett, fish commissioner, Sheffield, Mass., 100,000; Green Lake, Me., Station, 50,000; Put-in-Bay, Ohio, Station, 125,000; World's Fair, 54,000. Of this latter number, 21,099 were returned to the Northville Station November 1.

The number of fingerlings distributed between June 13 and 26 was 102,000: C. N. Clark, Cape Vincent, N. Y., 30,000; Lake Huron, off Sugar Island, 40,000; Lake Huron, off Alpena, 30,000; E. C. Dayton, Kalamazoo, Mich., 2,000.

Yearlings distributed, 19,423, to parties in New York, Pennsylvania, Ohio, Michigan, Indiana, and Montana. There were deposited in Lake Huron, near Alpena, Mich., 145 fish, 1, 2, and 3 years old.

*Black-spotted trout.*—The number of this species on hand April 1 was 927 of those coming 3 years, and 1,400 of those coming 2 years old. The 3-year-old fish were in excellent condition, but only 62,500 eggs were taken, and for some unknown reason these did not do well, as only about 20 per cent of very weak fry were produced, and nearly all of them died before they commenced to take food readily. Toward the close of the season nearly all the 2 and 3 year old fish died. This was caused by handling them while taking spawn during the very warm weather in May, and partially by the same disease which attacked the brook trout.

*Salmon.*—There were received from the World's Fair 40,000 Pacific Coast salmon eggs in very good condition, from which a good percentage hatched. After the sac was absorbed they were planted near Monroe, Mich., in the Rasin River, a tributary to Lake Erie. On April 30 there reached the station from Fort Gaston, Cal., 100,000 Pacific Coast salmon eggs, but on opening the package they were found to be all rotten.

Trout were forwarded from the Northville Station to the World's Fair, as follows:

Brook, 2 and 3 years old, 100; 1 and 2 years old, 100; yearlings, 300; fingerlings, 2,000.

Von Behr, 4 years old, 50; fingerlings, 2,000.

Loch Leven, 4 years old, 50; fingerlings, 2,000.

Black-spotted, 2 years old, 50.

Grayling, wild, 189.

Trout delivered to Michigan Fish Commission: Lake, 1 year old, 25; black-spotted, 1 year old, 25; 2 years old, 25; grayling, wild, 10.

On January 16, 20,000 rainbow-trout eggs were received from the Neosho Station, in fair condition. The loss in hatching these and up to the time of the absorption of the sac was 5,000. By the end of the year 8,000 more were lost, leaving 7,000 fingerlings on hand in good condition, which are held for distribution when a year old.

The following table shows the number of eggs, fry, and fish of each species on hand at the end of the year (June 30, 1894):

| Kind. | Eggs. | Fingerlings. | 1 year old. |
|---|---|---|---|
| Brook trout | 228,945 | | |
| Loch Leven trout | | | 1,500 |
| Lake trout | 1,388,000 | | |
| Von Behr trout | 100,000 | | |
| Rainbow trout | | 7,000 | |

ALPENA STATION, MICHIGAN (F. N. CLARK, SUPERINTENDENT).

The operations of this station during the season were, as in previous years, devoted to the collection of whitefish and lake-trout eggs. The work of securing these commenced about November 1, and continued during the month. The fishing was confined to fewer grounds than formerly, and the severe weather during the spawning seasons of these two species of fish interfered greatly with the work.

In September spawning outfits were sent to Thunder Bay and Middle Islands, and other arrangements were made for collecting shoal-trout eggs for the United States Fish Commission exhibit at the World's Fair, but very few eggs were collected during the month.

Early in October 96,000 shoal-trout eggs were received at the station, 54,000 of which were shipped by express to the World's Fair on the 6th, and 42,000 to the Northville Station by boat to Detroit on the 11th.

*Lake trout.*—During the latter part of October 368,000 eggs of the lake trout were received at the station, and 160,000 of these were shipped to Northville. During November 1,316,000 eggs were received, and these, with the 208,000 on hand at the end of October, were sent to Northville, and 1,000,000 were taken direct from Charlevoix to Northville. All the lake-trout eggs sent from Alpena to Northville were from fish taken in gill nets on the Big Reef in Lake Huron, near Alpena, and from reefs in Lake Michigan near Charlevoix, Mich.

*Whitefish.*—The first whitefish eggs, about 1,000,000, were received on the 9th of November; 19,010,000 were received during the month. The loss on these was 230,000. There were 6,590,000 eggs received in December; there being in all at the station at the close of the month, in fair condition, 24,320,000. Of these, a loss of 820,000 took place in January, leaving 23,500,000 on hand, January 31, in first-class condition.

On the 17th of February 10,000,000 whitefish eggs were sent to Duluth Station by car No. 1, and on the 24th of the same month 200,000 were shipped to R. E. Follet, fish commissioner, Sheffield, Mass. The loss on eggs during February was 250,000; leaving 13,050,000 on hand in first-class condition. There was no loss on the eggs on hand at the station during March.

The first fish hatched on the 6th of April and the last on the 30th.

Deposits of whitefish fry were made as follows:

| Date. | Points of deposit. | Number of fish. |
|---|---|---|
| Apr. 16 | Lake Huron, near East Tawas, Mich | 1,000,000 |
| 18 | Whitefish Lake, near Corinne, Mich | 2,000,000 |
| 24 | Lake Huron, north of Thunder Bay Island | 1,050,000 |
| 25 | Lake Huron, near Sturgeon Point | 1,000,000 |
| 26 | Lake Huron, near Miller Point | 1,000,000 |
| 27 | Lake Huron, Detour Passage | 1,500,000 |
| May 2 | Lake Michigan, near Manistique, Mich | 2,000,000 |
| 7 | Lake Michigan, near Charlevoix, Mich | 2,000,000 |
| 11 | Lake Michigan, Epaufette and Naubinway | 1,500,000 |
| | Total | 13,050,000 |

The maximum and minimum temperatures of the water at the station for the months given were as follows:

| Month. | Max. | Min. | Month. | Max. | Min. |
|---|---|---|---|---|---|
| | ° F. | ° F. | | ° F. | ° F. |
| November, 1893 | 40 | 33 | March, 1894 | 37 | 33 |
| December, 1893 | 33 | 33 | April, 1894 | 48 | 34 |
| January, 1894 | 33 | 32½ | May, 1893, to the 19th | 54 | 50 |
| February, 1894 | 34 | 33 | | | |

DULUTH STATION, MINNESOTA (S. P. WIRES, SUPERINTENDENT).

Dr. R. O. Sweeny, sr., tendered his resignation as superintendent to take effect July 31, 1893. The resignation was accepted. Mr. S. P. Wires, foreman of the station, was promoted to the position of superintendent.

The work at this station was confined during the year to the propagation of the whitefish, lake trout, brook trout, and pike perch.

*Whitefish.*—Between the 1st and 18th of November 750,000 eggs were collected: 500,000 from Siskowit Bay, Isle Royale, Mich., and 250,000 from Willey Island, vicinity of Bayfield, Wis.; and on February 22 10,000,000 eggs were received from Alpena Station. These 11,500,000 eggs produced 10,190,000 fry, which were deposited as follows: May 2, Raspberry Bay, Wisconsin, 2,000,000; May 2, Lake Superior, vicinity of Iron River, Wisconsin, 2,000,000; May 7, points between Duluth and Iron River, 2,000,000; May 11, Lake Superior, vicinity of Bayfield, 2,000,000; May 14, Lake Superior, vicinity of Isle Royale, 500,000; May 18, Siskowit Lake, Isle Royale, 1,000,000; May 19, Lake Superior, vicinity of Fish Island, Isle Royale, 490,000; May 19, vicinity of station, 200,000.

*Lake trout.*—The first lake-trout eggs of the season were collected at St. Ignace Island and Kings Bay, Ontario, September 25, and the last at Bayfield, Wis., November 17. Collections were made as follows:

| | |
|---|---|
| St. Ignace Island, Ontario | 973,400 |
| Kings Bay, Ontario | 729,650 |
| Fishermens Home, Isle Royale, Mich | 163,800 |
| Grand Portage, Minn | 437,300 |
| Fish Island and Rock Harbor, Isle Royale, Mich | 295,950 |
| Wright Island, Isle Royale, Mich | 180,000 |
| Washington Harbor, Isle Royale, Mich | 270,000 |
| Port Arthur, Ontario | 199,900 |
| Bayfield, Wis | 410,000 |
| Total | 3,660,000 |

From these were obtained 2,540,000 fry, which were planted in Lake Superior in many localities in May and June.

*Brook trout.*—On January 13th, 20,000 eggs were received from the Northville Station. There were lost of these, February, 1894, 1,000, mostly fry, and in March 9,000 fry. June 25, 10,000 fry were deposited in Washington River, Isle Royale, Mich.

*Pike perch.*—Between April 27 and 30, 23,000,000 eggs were collected at Pike River, Minn. In May there was a loss of 15,000,000 of these eggs. The 8,000,000 fry hatched were deposited at the following points: June 3, Pike Lake, St. Louis County, Minn., 2,500,000; June 4, Lake Vermilion, vicinity of Tower, Minn., 2,500,000; June 8, Lake Superior, vicinity of Sand Bay, Wis., 3,000,000.

The average temperature of the water was as follows: October, 44°; November, 35°; January, 34°; February, 34°; March, 33°; April, 32½°; May (from 33° on May 1 to 58° May 31); June, 65°.

QUINCY STATION, ILLINOIS (S. P. BARTLETT, SUPERINTENDENT).

As in former seasons, the work of this station was carried on from points along the Mississippi River above and below Quincy and from points on the Illinois River above and below Meredosia. The regular work of the station was delayed until the latter part of August, as the cars and equipments for the movement of the fish were used in the collection of fish for the aquarium at the World's Fair. Consequently, the collections were restricted to places not dried out by midsummer heat, or to rivers in which the water was not very low.

The fish distributed from the station were, in the main, much above the average size, and were in very good condition for transportation. They consisted principally of black bass, white bass, Warmouth bass, crappie, spotted catfish, pike, and sunfish. The following table shows the distribution work of the season:

| State. | Black bass. | Crappie. | Catfish. | Warmouth bass. | Sunfish. | Yellow perch. | White bass. | Wall-eyed pike. | Pike. | Bream. | Rock bass. | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Idaho | | | 100 | | | | | | | | | 100 |
| Illinois | 752 | 1,000 | 2,800 | 150 | | | | | | | 30 | 4,788 |
| Indiana | 385 | 2,725 | 375 | 650 | 20 | | | | | | | 4,105 |
| Iowa | 1,212 | 1,075 | 9,642 | 629 | 100 | 167 | | | | | | 12,825 |
| Kansas | 853 | 540 | 1,100 | 100 | | 20 | | | | | | 2,622 |
| Kentucky | 5,012 | 1,740 | 1,165 | 219 | | 75 | | | | 20 | | 8,231 |
| Massachusetts | 190 | | | 38 | | | | | | | | 228 |
| Missouri | 375 | 306 | 450 | 115 | | | | | | | | 1,246 |
| New York | 50 | 50 | 125 | | | | | | | | | 225 |
| Ohio | 2,275 | 15 | | | 50 | | | | | | | 2,340 |
| Oregon | 50 | | | | | | | | | | | 50 |
| Texas | 422 | 535 | 265 | 275 | | | | | | | | 1,497 |
| Utah | 50 | | | | | | | | | | | 50 |
| Virginia | 100 | 50 | 300 | | | | | | 100 | | | 550 |
| Washington | 550 | 18 | 100 | | | | | | | | | 668 |
| Wyoming | 600 | 25 | 25 | | | | | | | | | 650 |
| Central Station | 738 | 448 | 150 | 152 | 49 | | 9 | 61 | | | | 1,607 |
| Total | 13,564 | 8,542 | 16,597 | 2,328 | 219 | 262 | 9 | 61 | 100 | 20 | 30 | 41,732 |

In the distribution of these fish the four cars of the Commission were employed. The whole number of miles traveled was 16,498, transportation for 11,899 miles being given free by the railroads and 4,599 miles being paid for.

The residue of the fish taken from the ponds and lakes formed by the overflows of the Mississippi and Illinois rivers—those which had not been selected for distribution—was again returned to the nearest deep water. The kinds and numbers are as follows: White perch, 18,100; buffalo, 35,000; sunfish, 25,000; bullpout, 86,000; carp, 31,000; catfish, 109,000; warmouth bass, 3,900; pike perch, 500; white bass, 3,600; black bass, 1,000; crappie, 2,000; pike, 8,900; total, 324,000.

NEOSHO STATION, MISSOURI (WILLIAM F. PAGE, SUPERINTENDENT).

The operations of this station during the year were confined to the propagation of black bass, rock bass, carp, tench, golden ide, goldfish, spotted or channel catfish, brook trout, Von Behr trout, and rainbow trout.

A new railroad siding was projected to connect with the Kansas City, Pittsburg and Gulf Railroad at Neosho.

Owing to the ravages of crayfish, Mr. Page reports that the production of each pond has steadily decreased each season since its construction and no means have yet been found to destroy these pests. Another destructive agency is the boat fly (*Notonecta glauca*), by which 600 young goldfish were killed in about ten days.

*Black bass.*—About September 1 there were 2,000 of these fish at the station, but four months later, when distribution was about to be made, only 630 were shipped, the number being thus reduced by the fish eating each other, notwithstanding every effort was made to supply them liberally with both natural and artificial food.

On April 4, 20 old breeders were put in pond No. 10, and 23 2-year-old bass in pond No. 11, in which were 4 old breeders. April 21 these bass were found guarding newly made nests. By May 1 all the eggs in the earliest nests were hatched out, though new nests were seen up to June 10. June 1 the fish of the earliest hatch were 1¼ inches, and numbered from 8,000 to 15,000. On June 6 a heavy rainstorm destroyed most of them.

*Rock bass.*—Of this species 4,710 were distributed, mostly in Indian Territory, Texas, Arkansas, Missouri, Iowa, Kansas, and Nebraska.

*Carp.*—During the winter 2,275 yearling carp, ranging from one-quarter to one-half pound in weight, were shipped. It having been determined to discontinue the propagation of this species at this station, the breeders on hand were liberated, May 1, in Grand River, Indian Territory.

*Tench.*—The good results heretofore attained in the propagation of the tench were not realized this year, the total production being but 10,000, due, it is thought, to the depredations of crayfish. The number of yearling fish distributed was 9,210, to parties in Indian Territory, Texas, Missouri, and Arkansas.

*Golden ides.*—But 18 yearlings of this species were distributed during the season, and there is but one of two years old and one of four years on hand. These are employed as scavengers in the pond with the brood stock of rainbow trout.

*Goldfish.*—There were distributed 4,231 goldfish during the year. The production of this fish will hereafter be confined to a limited number of the finer specimens.

*Spotted or channel catfish.*—The fish of this variety which have been at the station for the past three years failed to spawn, and they all died during the winter, being attacked by fungus. There were distributed 1,059 yearlings.

*Brook trout.*—The 20,000 brook-trout eggs received from the Northville Station January 13, 1894, had every appearance of being in good condition when received, but twenty-four hours after unpacking 95 per cent of the eggs were dead. By February 11 all were dead. The cause of the loss is unknown.

*Von Behr trout.*—On January 19, 10,000 eggs were received from Northville. These produced 10,312 fry, which were placed in the outdoor pools.

*Rainbow trout.*—Of this variety there were distributed during the season 52,513 yearlings. This trout began to spawn December 12, and 787,339 eggs were produced, of which 604,923 (or about 75 per cent) were impregnated. Of those impregnated, 491,640 were shipped to other stations, and the remainder, 113,283, were retained for hatching and rearing. During the breeding season the loss of breeders from constant fighting incident to spawning amounted to 67 females and 103 males.

The temperatures of the waters in the various pools and ponds at the station during the year were as follows:

| Location. | Max. | Min. | Location. | Max. | Min. |
|---|---|---|---|---|---|
| | °F. | °F. | | °F. | °F. |
| Trout pools, A to F | 59 | 56 | Pond No. 7 | 70 | 59 |
| Trout pool; new, eastern | 62 | 56 | 8 | 72 | 32 |
| Pond No. 1 | 68 | 50 | 9 | 82 | 32 |
| 2 | 69 | 32 | 10 | 81 | 32 |
| 3 | 80 | 32 | 11 | 86 | 32 |
| 4 | 82 | 32 | 12 | 70 | 32 |
| 5 | 75 | 32 | 13 | 71 | 32 |
| 6 | 87 | 32 | 15 | 67 | 60 |

The air temperatures during the year were:

| 1893. | Max. | Min. | Mean. | 1894. | Max. | Min. | Mean. |
|---|---|---|---|---|---|---|---|
| | °F. | °F. | °F. | | °F. | °F. | °F. |
| July | 102 | 66 | 82.10 | January | 68 | —20 | 38.50 |
| August | 100 | 51 | 80.40 | February | 60 | — 1 | 35.60 |
| September | 96 | 42 | 77.40 | March | 80 | 14 | 54.50 |
| October | 87 | 28 | 60.70 | April | 90 | 31 | 64.95 |
| November | 70 | 10 | 44.70 | May | 92 | 43 | 72.90 |
| December | 66 | 11 | 42.60 | June | 103 | 52 | 84.40 |

LEADVILLE STATION, COLORADO (H. D. DEAN, SUPERINTENDENT).

In April, 1894, the United States acquired from John Law, Jennie Goodell Blow, and J. B. Grant their rights in the water of Rock Creek and their lakes and other property contiguous to the Government reservation, with exception of a prior right of De May to an amount not exceeding 500 gallons per minute from May to October, and an amount of water from Rock Creek not to exceed 1,000 gallons per minute for the Law Placer. The work at this station was, as in previous years, confined to the propagation of the trouts, the varieties handled being the brook, Loch Leven, black-spotted, rainbow, Von Behr, and yellow-finned.

*Brook trout.*—The first eggs were taken October 16; began hatching January 1, and feeding February 14. Between November 1 and 10 there were taken at Wellington Lake 789,200 eggs. Eye-spots showed in forty-four days; fish commenced hatching January 12 and completed January 30; 60 per cent hatched. The first lot began feeding April 5,

and the second March 16. Fully 75 per cent of the latter died from some unknown cause after hatching.

On November 4 there were taken at Uneva Lake 24,800 eggs from 5 females. These eggs began hatching January 29; 73 per cent hatched. They began feeding February 27, and on May 25 there were on hand 17,000 fish, or 68½ per cent. June 30, 8,500 were delivered to Searl & Lazenby, in accordance with agreement. There were taken from stock fish 448,400 eggs, 47 per cent of which hatched. The total number of eggs of this species taken was 1,262,400, of which 55½ per cent hatched. Between December 5, 1893, and June 11, 1894, there were distributed 23,000 fry and 35,900 yearlings, mostly to Colorado waters.

*Black-spotted trout.*—There were 74,800 eggs taken from stock fish, but they were very poor. It is thought that these fish can not be successfully kept in small ponds. From October 20 to December 6 there were 10,100 yearlings distributed to various parties for planting in Colorado waters, and 1,000 to Ernest Barthold, of Sheridan, S. Dak., for waters of that State.

*Rainbow trout.*—On January 18, there were received from Neosho 20,000 eggs. They were in very poor condition, however, and after hatching the fish were weak—would not take food—and on April 19 it was thought best to plant them, and 5,000 were deposited in Lower Evergreen Lake and 6,000 in Lake Creek. On November 12, 1893, 475 yearlings were furnished to W. R. Callicotte, of Denver, for his fish ponds, and December 5, 475 were given to Capt. G. L. Brown, Pine Ridge, S. Dak., which were deposited in Medicine Root Creek.

*Loch Leven trout.*—On January 21, there were received from Northville 11,200 eggs. After hatching, 80 per cent of them died. Between October 26 and December 18 there were distributed 19,800 yearlings in Colorado, Montana, New Mexico, South Dakota, and Wyoming.

*Yellow-finned trout.*—In December, the 2-year-old fish on hand began to die rapidly, and to save them the 700 that remained were planted in Lower Lake on December 13.

*Von Behr trout.*—In July, 450 yearlings were distributed in Colorado waters, and on December 24, 1,000 yearlings were deposited in Black Lake.

The mean air temperature for the year was 35¾°, and the mean water temperature 43⅔°. The highest air temperature was 72°, on July 2, 3, 4, 9, and on August 3. The lowest air temperature was on January 18, when it was 16° below zero.

The eggs, fry, and other stock on hand June 30, 1894, were as follows:

| Species. | Eggs. | Fry or fish hatched in calendar year— | | |
|---|---|---|---|---|
| | | 1894. | 1892. | 1891. |
| Brook trout | ..... | 145,000 | 3,445 | 1,123 |
| Rainbow trout | ..... | 500 | ..... | 26 |
| Loch Leven trout | ..... | 2,000 | 1,580 | 27 |
| Black-spotted trout | 5,000 | 13,500 | ..... | 424 |

BAIRD STATION, CALIFORNIA (LIVINGSTON STONE, SUPERINTENDENT).

The salmon rack across McCloud River having been built (in June) earlier this season than has been customary in recent years, accounts for the fact that there were more breeding salmon corralled at the station than there were last year, and a million more eggs were taken from the summer run of fish.

The regular fishing and spawn-collecting season for the summer run began August 22, when 104,000 eggs were taken. At the end of the month 840,000 eggs were in the hatching house. The season ended September 15, with a take of 2,069,200 eggs.

Fishing for the fall run of salmon began October 21 and continued till November 28, when a violent storm, lasting nine days, with a sudden rise in the river, tore out the rack and prevented further fishing for the season. During the fall run 6,019,150 eggs were obtained, making a total of 8,088,350, which was exceeded only in 1875 and 1878.

Five hundred thousand eggs were hatched at the station, and the fry distributed along the McCloud River; the remainder (7,500,000) were sent to the California State hatching station at Sisson, where they were hatched, and the young fish deposited in the Sacramento River.

On the 1st of September 50,000 eggs were sent to the World's Fair at Chicago, and were hatched there.

The highest temperatures of the air and water at 2 p. m. at the station during the year were as follows:

| 1893. | Air. | Water. | 1894. | Air. | Water. |
|---|---|---|---|---|---|
| | ° F. | ° F. | | ° F. | ° F. |
| July | 102 | 59 | January | 69 | 49 |
| August | 104 | 58 | February | 71 | 50 |
| September | 90 | 56 | March | 82 | 53 |
| October | 90 | 52 | April | 90 | 53 |
| November | 81 | 48 | May | 92 | 56 |
| December | 70 | 44 | June | a 90 | a 59 |

a Noon.

FORT GASTON STATION, CALIFORNIA (CAPT. WILLIAM E. DOUGHERTY, U. S. A., SUPERINTENDENT).

The station is situated on the Trinity River in the Hoopa Indian Reservation, the site being on the military reservation of Fort Gaston by permission of the War Department, afterwards confirmed by the Indian Bureau of the Interior Department. The Indian agent, Capt. W. E. Dougherty, discharges the duties of superintendent of the station.

The water supply for the hatchery is drawn from a ditch constructed by the Government for the supply of the reservation. The ponds are supplied from a small stream about one-fourth of a mile distant from the hatchery. The ponds contain steelhead salmon and eastern brook

trout. Silverside salmon are caught below a rack in the Trinity, and a few quinnat salmon also are taken there.

A tributary collecting station has been established on Bair's ranch upon Redwood Creek. The substation has a small hatchery and ponds for penning salmon. Probably a smaller proportion of quinnat salmon are found in Redwood Creek than in the Trinity. The run is short and occurs in the fall.

Another hatchery site was selected by Commissioner McDonald at Korbel on Mad River, where there is a large run of quinnat salmon, and where there is less interruption from net fishing. The site is about one-half mile above Korbel, at a point where a small tributary (Clear Creek) enters the river and furnishes ample water for the hatchery. A flume 150 yards long will suffice to convey the water, and a large building, formerly used by the Korbel Lumber Company, can be utilized for a hatchery and quarters for the employees at the cost of the lumber which it contains. The salmon can be stopped by a rack opposite the station.

There were collected during the season, from November to May, about 800,000 eggs of salmon, and about 460,000 of the steelhead, 15,000 of the Von Behr, and 3,000 of the rainbow.

During the fall a disease occurred among the trout which was not checked until it had destroyed a large number of each variety and nearly exterminated the Eastern brook trout.

In August and September 5,450 yearling rainbow trout were deposited in the waters of Trinity Mountain, Humboldt County.

In March and April 10,000 rainbow-trout eggs were shipped to the Wytheville, Va., Station; 100,000 eggs of the steelhead to the Northville, Mich., Station, and 50,000 eggs of the steelhead to the California State hatchery at Sisson.

There were remaining on hand at the station and substation on the 1st of July fry, as follows: Salmon, 560,000; steelhead, 332,000; eastern brook trout, about 40; Von Behr, 15,000; rainbow, 3,000; brood stock, about 600. The salmon and steelheads, when sufficiently grown, will be planted in waters adjacent to the station.

The season was very unfavorable for taking eggs on account of the continuous high water during the winter months.

The highest temperatures of the air and water at noon at the station for the months given were as follows:

| Month. | Air. | Water. | Month. | Air. | Water. |
|---|---|---|---|---|---|
| | ° F. | ° F. | | ° F. | ° F. |
| November, 1893 | 56 | 50 | March, 1894 | 57 | 48 |
| December, 1893 | 61 | 53 | April, 1894 | ..... | ..... |
| January, 1894 | 54 | 50 | May, 1894 | a 64 | a 58 |
| February, 1894 | 59 | 47 | June, 1894 | a 64 | a 60 |

CLACKAMAS STATION, OREGON (WALDO F. HUBBARD, SUPERINTENDENT).

The hatchery is located on the Clackamas River, 4 miles from its junction with the Willamette, about 12 miles from Portland and about 5 miles from the Willamette Falls at Oregon City. The station is reached by driving from Portland.

The salmon stripped at the station belong to the spring run of quinnat into the Columbia. They are intercepted by a rack, below which the fish are detained until they are ready to spawn. The success of the work depends upon the free passage of the salmon through the river below the rack, but this was interfered with by dams and numerous nets so that in the fall of 1893 the number of fish below the rack was very small in comparison with the number detained several years earlier.

About 4 miles below the hatchery and 1 mile from the mouth of the Clackamas is a sawmill dam about 7 feet high, with no adequate means for the ascent of the fish. The net fishing below the dam is of itself sufficient to prevent the salmon from ascending the stream and unless prohibited or greatly restricted the station may have to be abandoned.

On July 5 the building of a rack across the Clackamas River at the station for the purpose of preventing the salmon from going any farther up the stream was begun, and finished August 3. August 28 a trap for catching spawning salmon was built near the rack. Near the station is a deep pool in the river where the salmon collect until ready to spawn. Above this pool is a riffle where the rack and trap are situated, and the salmon that go there are taken in the trap. Below the pool is another riffle where some of the salmon spawn, and these are caught with a net.

On September 16 two ripe female salmon were taken, from which 7,000 eggs were obtained, and from that date to October 6 fishing was carried on daily. On account of the high water in the Clackamas during the season, the highest known for seventeen years, the work in the catching of adult fish was not as satisfactory as expected.

The whole number of eggs taken during the season was 277,000. Of these, 40,000 were sent, October 13, to the World's Fair at Chicago by one of the cars of the Commission and reached there with a loss of only 92. The eggs at the station began hatching November 1 and the fry liberated in the Clackamas December 25; between which date and January 26, 1894, 213,000 young fish were deposited in the Clackamas. About 10 per cent of the eggs at the station were lost in hatching.

On December 11, 1893, in accordance with instructions received from the Commissioner, the superintendent left the station to locate a site for a State hatchery at or near Knowles Creek, a tributary of the Siuslaw. A suitable location was found where a good supply of water can be taken by gravity into the hatching house. The building of the hatching house was let by contract, and work on it is now completed. Arrangements have been made to begin work there preparatory to taking salmon eggs the first part of July, 1894.

## DISTRIBUTION.

The fiscal year opened with the car and messenger service engaged in transporting fishes and other aquarium materials to the exhibit of the Commission at the World's Fair. In connection with the distribution of food-fishes of the Mississippi Valley, this work continued until November.

Fresh-water collections were brought from Wisconsin, Michigan, Lake Erie, Illinois, and Iowa, and marine species from Massachusetts, Florida, and the State of Washington. When the aquarium at the Exposition was dismantled the fishes were taken chiefly to Northville, Mich., Spirit Lake, Iowa, Champaign, Ill., and Washington, D. C.

The distribution of food-fishes from Quincy, Ill., began in August and was finished in December. Trout and salmon were taken from Green Lake in September and October; from Wytheville, November to March; Leadville, November and December; Neosho, December to March; Northville, January to March; and the fingerlings in June. The black bass reared in the Washington ponds were distributed in December and a few carp in January. Whitefish eggs were carried from Alpena to Duluth in February. Whitefish fry hatched at Central Station were taken to Lake Ontario in March, and fry of the same fish were distributed from Alpena in April and May. Pike-perch shipments were made in May, and shad were planted in May and June.

In accomplishing the above work car No. 1 was engaged 178 days; No. 2, 200 days; Nos. 3 and 4, each, 185 days. They made 129 trips, aggregating 105,529 miles, and carried 71,440,513 fish and eggs. In addition to the car travel, 40 detached messengers, during the distribution of the year, covered 60,228 miles.

A far greater bulk of distribution is carried on also from the various stations of the Commission to neighboring waters, especially cod and lobsters from Gloucester and Woods Hole, Mass. Eggs are forwarded by express to distant stations and to State commissions and foreign countries. Carp, goldfish, etc., are shipped from various centers to points more or less remote. The total distribution, amounting to more than 450,000,000, is set forth elsewhere in this report.

## CHANGES IN CARS.

An improvement in the water circulation on some of the cars was effected by substituting galvanized-iron pipes for the common pipes previously used. Steam-pipes were placed under the cars to circulate steam from the locomotive. Air-pumps were introduced and connected with the transportation tanks with good results; but the attempt to take in air through water from a small supply tank was unsatisfactory. An ice coil was laid on the bottom of the ice box in car No. 3, to reduce the temperature of the water by pumping cold air into it, but without success. Aërating syringes were furnished to the cars and messengers for use instead of dippers in carrying trout and other large fish, but they were found troublesome to keep safely in car work.

LOSSES DURING TRANSPORTATION.

The mortality among rainbow trout in transit was notably larger than with other species, and especially on journeys over thirty to thirty-five hours in length. The number lost was 13,366.

The results of work with food fishes of the Mississippi Valley were reduced by the necessity of maintaining the aquarium at the World's Fair.

NEW WORK.

The supply of black bass for distribution was much increased by collecting them from the reservoir at Celina, Ohio.

An experiment in carrying 1,000 yearling landlocked salmon from Green Lake to Vermont proved so encouraging that a full carload of 12,000 was afterwards taken, and although 3,000 of these were lost, it was demonstrated that the fish can be transported successfully. It was previously considered impossible to do so.

DIFFICULTIES IN TRANSPORTATION.

In shipping shad eggs on the cars to the South, trouble arose from the water foaming through sudden changes of temperature, causing some of the fry to hatch prematurely. In other shipments, when the water at destination was too warm, the fish hatched out weak, and when too cold, hatching was almost entirely prevented.

The details of the distribution of fishes and the scope of the distribution service for the year are shown in the appended table, pages 62 to 76.

COLLECTING FISH IN THE LOWLANDS OF ST. FRANCIS RIVER, ARKANSAS.

At the suggestion of Superintendent W. F. Page, arrangements were made in August, 1893, to collect food-fishes from overflow pools in northeastern Arkansas, just the same species as are obtained yearly at the Quincy, Ill., station. The Commission was greatly assisted by Mr. G. H. Nettleton, president of the Kansas City, Fort Scott and Memphis Railroad, along whose line the pools are located, and also by Mr. H. W. Diggins, division superintendent of the road.

Owing probably to the extremely high temperature of the water in the pools (called "borrow pits"), the results of the experiment were poor; but large collections might have been made if the work had been begun earlier in the year. Mr. Page's report follows herewith:

REPORT ON THE COLLECTION AND MOVEMENT OF NATIVE FISHES IN NORTHEAST ARKANSAS.

The annual inundation of the Sunk Lands of the St. Francis River basin creates a great number of small ponds along the line of the Kansas City, Fort Scott and Memphis Railroad by filling the "borrow pits." The overflow usually occurs in March, a little prior to the spring spawning of the fishes. The adult fish coming in with the high water find in these borrow pits excellent conditions for spawning. They go out with the falling waters, leaving behind their young in almost countless numbers. The droughts of August and September dry these pits, killing all the young fish in them. It was hoped that very many thousands of these young bass,

crappie, pickerel, and channel catfish might be seined from these pools and moved to the river currents before the droughts killed them.

Marked Tree, Ark., was selected as a base of operations because it presented the following points: (1) It is a station on the line of the Kansas City, Fort Scott and Memphis Railroad; (2) it has a night and day telegraph operator; (3) all trains stop there; (4) it has a railway water tank; (5) it has two side tracks aggregating over a mile; (6) on one side the St. Francis River is within 40 yards of the track, and on the other side Little River is as close; (7) the borrow pits extend 7 miles west of Marked Tree and about the same distance to the east. It was contemplated to seine the borrow pits, transfer the catch on hand cars to Marked Tree, and retain the fish in live-boxes until it was convenient to ship them.

The last week of July was spent in making preliminary arrangements for this work. On August 1 actual seining was commenced, with a force consisting of two seiners with one man to help in sorting and caring for the catch, two men to run the hand car, and one man at the live-boxes to equalize the difference in temperature of the water in the borrow pits and the river. The first day's seining resulted in about 4,500 fingerling crappie and bass transferred to the live boxes in apparent good order.

On the morning of August 2 an examination of the boxes showed that nearly all of the fishes caught the day before were dead. It was thought that this possibly had been produced by an overstrong current in the box, and a change in the position in the boxes was made so as to reduce the strength of the current. On this day we caught and removed to the boxes something over 5,000 fish. By evening the dying and suffering of those caught in the morning indicated clearly that the trouble was not solely due to current.

On the morning of August 3 the boxes had only about 300 fish (in bad order) to show for the 10,000 put in them in the past two days. To-day we fished the borrow pits near Oak Dornic, handling the fish in small lots and much more carefully. We secured about 5,000 fish, mostly crappie, and transferred them to the live-boxes.

August 4. This morning the condition of the boxes being unimproved, and all known methods of handling fish having been tried without avail, it was concluded to abandon for the present any attempt to store the fish. Seining was continued throughout the day, resulting in about 5,000 crappie and bass, which were planted directly in the St. Francis River. In the afternoon a telegram was sent to the Commissioner, stating that the fish alive twelve hours after capture were fungussed, and a recommendation made that the work be discontinued.

August 5. We seined the borrow pits until noon, capturing about 3,000 crappie, which we placed in the St. Francis River. At noon a telegram was received from the Commissioner, directing that the work be discontinued and that the equipment be transferred to Neosho Station.

It is the opinion that the failure to successfully handle these fish was due to the very high temperature of the water in which they were found, the water in many of the pits ranging from 95° to 98° F. The fish living in this water were so tender that the gentlest handling produced an abrasion which quickly resulted in a fungus growth. It is very doubtful if any of those planted in the St. Francis River will survive the handling.

It has been suggested that this work might successfully be prosecuted earlier in the season, before the water in the borrow pits has become so very hot as to render the fish too tender for handling. There is no doubt but that this might be done, but to a limited extent only, because the waters are already at a high temperature before they commence to fall, and until the recession occurs seining would be nearly impossible.

The inundation of the Sunk Lands usually occurs in the latter part of February or early in March. In the year 1893 it was later than for many years, not coming on until May. To this cause undoubtedly is to be ascribed the scarcity of young game fish in the borrow pits. The adults had spawned elsewhere before the overflow came in.

## FISH-CULTURAL NOTES.

The correspondence of the station superintendents furnishes many valuable records of observations and experiments which are not usually embodied in their annual reports. They may very properly be presented here, grouped under the names of the species to which they relate:

*Mackerel* (*Scomber scombrus*).—June 21, 1894, Mr. W. P. Sauerhoff found five small mackerel at Magnolia, Mass., containing ripe eggs, and obtained 116,000, the first taken this season.

*Pike perch* (*Stizostedion vitreum*).—Mr. Frank N. Clark wrote from Northville, Mich., March 30, 1894:

> In transferring pike-perch eggs from Detroit to the World's Fair last spring * * * the best success I obtained was in carrying the eggs in 10-gallon cans, putting from 12 to 16 quarts in a can, and frequently stirring the eggs and water to keep them from sticking together. If the eggs are to be held in jars * * * until the eyes show, I think you will meet with success in shipping them on flannel trays with a covering of damp moss on each tray, the top tray to contain nothing but fine ice, the whole to be surrounded with from 3 to 4 inches of sawdust; temperature from 55° to 60°. This is practically our mode of shipping eyed eggs during the winter.

Mr. J. J. Stranahan made the following report of an experiment with eggs and milt from dead fish:

> On April 23, 1894, I took 1 quart of eggs from dead pike perch, using milt from two dead males. Eggs came freely and looked fine. Milt flowed in a fluid stream, though very slightly thickened. The eggs were set up and worked in a jar in the usual way. Frequent examinations show that all are dead, and in 150 eggs counted and examined April 30 no life could be discovered. A curious feature in this case is that 95 per cent or more of the yolks are ruptured.

Mr. Stranahan weighed and counted a series at Put in-Bay, from which he puts the eggs at 170,000 to the quart. Mr. Bower uses the estimate of 150,000 to the quart. Mr. Stranahan says further:

> Eggs from different localities differ greatly in size. It seems to me that I can clearly see with the naked eye that the eggs of the Sandusky Bay pike perch (smallish, round, less compressed than lake fish, more fusiform, deep yellow instead of nearly white as in the lake fish), are perceptibly larger than those taken in the open lake. The pike perch from the bay, I feel sure, lives there, never entering the lake. It resembles very strongly those brought to Sandusky from the Lake of the Woods and those caught in inland waters belonging to the Mississippi system; also those from Saginaw Bay.

*Handling of pike-perch eggs at Put-in-Bay.*—April 15, 1894, Mr. Stranahan experimented with swamp muck for separating pike-perch eggs successfully. He screened the mud through fine wire cloth so that all was finer than the eggs. A pint of thick muck solution to a 12 gallon keg was sufficient. Afterwards he used a quart of muck of the consistency of sirup to a 15-gallon keg of water. An account of his experiments was published in the Transactions of the American Fisheries Society for 1894.[1]

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[1] The handling of adhesive eggs. J. J. Stranahan, Trans. Amer. Fish. Soc. 1894, 22-25.

*Pike and pike-perch hybrid (Esox lucius and Stizostedion vitreum.)*—Superintendent J. J. Stranahan, of the Put-in-Bay, Ohio, station made the following report, dated April 26, 1894, upon an experiment with the grass pike (*Esox lucius*):

Nineteen adult fish were captured, but none of them in spawning condition. We penned the best and although most of them kept well, having been caught in the net by the teeth, the females refused to yield their eggs and were finally released. On April 22, Mr. John Dischied, of North Bass Island, noticed a grass pike from which the eggs were running freely. He took a quantity, and not having a male, impregnated them with the milt of a pike perch. * * * I made my first examination of them April 26. They have gone too far to see the segmentation under the microscope, and I am in doubt whether any are alive. There are about 9½ eggs to a linear inch, 759 to a cubic inch, measured in water, or 43,832 to the fluid quart. The eggs are of about the same specific gravity as whitefish eggs, and work readily in the McDonald hatching jar, but have very thin membranes, easily ruptured between the fingers.

Under date of April 28, 1894, Mr. Stranahan forwarded the following additional notes:

The grass-pike eggs referred to in my letter of April 26 have been examined daily and now show the fish form past doubt. I examined 140 this morning under the microscope and found 40 with the fish formed, or about 28½ per cent. These were worked from the start in a McDonald jar. Those handled in a floating box show a fraction over 20 per cent alive, which leads me to believe that with careful working muskellunge can be hatched in jars. The developing embryo is unlike any other I have observed. It covers about one-third of the circumference of the egg and has on each side of the body not far behind the head what seems to be an oil drop, nearly equal to the body in diameter. The yolk has no distinct large oil drop, but numerous small ones, pretty evenly distributed over its surface, for which reason the embryo is as likely to be in one position as another, no two apparently assuming the same position. The embryo now covers about two-fifths of the circumference of the yolk. The egg is more opaque than any other I have examined, making its investigation difficult.

On May 4, Mr. Stranahan reported that the above eggs began hatching in small numbers. There were not enough to work well in the jar, the eggs attacked by fungus being hard to separate from the live ones. All the eggs in the floating boxes died and it was estimated that only 10 per cent of those in the jar would hatch. The eyes were not discerned until May 3, and then very faintly.

*Yellow perch (Perca americana).*—About the end of April, 1894, Mr. Stranahan took the eggs from a yellow perch weighing 9 ounces. He wrote:

The eggs came freely in a continuous tube and I used two males for impregnation. After swelling the mass was 73 inches long, the tube 3 inches wide (or 6 inches if flattened out). We find 13 eggs to the linear inch, or 73,000 in all. Impregnation was almost complete. Aside from the fragment used for counting, there do not appear to be 1 per cent of dead eggs.

On March 20, 1894, the eggs from a yellow perch were taken from one of the aquaria in Central Station and placed in a McDonald jar. They developed without perceptible loss (hatching began April 12), and on April 14 about one-tenth of them were out.

*Striped bass* (*Roccus lineatus*).—Twenty large striped bass, three or four of them in spawning condition, were taken near Edenton, N. C., in sturgeon nets, about April 18, 1894.

*Longjaw or blackfin whitefish* (*Argyrosomus nigripinnis* ?).—Mr. E. A. Tulian wrote Mr. F. N. Clark from Alpena, Mich., November 30, as follows:

I telegraphed Platts yesterday to find out when the longjaw would spawn and whether we could get any quantity of the eggs. I received an answer this morning saying: "We can get plenty of longjaw spawn now; trout run over." I answered him to collect all long-jaw spawn possible, with Clifford's help, until further orders.

Mr. Clark wrote the office that the longjaw is becoming a valuable food-fish, selling in the market for the same price as the common whitefish. While it was found easy to get eggs, there were no males and the experiment failed. It is supposed the males run later, but the season could not be prolonged, for lack of funds.

*Whitefish.*—Mr. S. P. Wires counted a liquid quart of whitefish eggs taken in Lake Superior and found 33,600 eggs.

Mr. F. N. Clark writes from Northville, Mich., March 28, 1894:

Eggs from fish caught in gill nets in Lake Michigan, near Manistique, show a measurement of 1,115 to the ounce, or 35,680 to the quart. These eggs were taken on December 9, 10, and 11, 1893. Eggs taken November 25, from fish caught in pound nets set in Lake Huron near Miller Point, show a measurement of 1,097 to the ounce, or 35,104 to the quart. Possibly, measuring eggs almost at the period of hatching is not a fair test.

*Brook trout.*—In taking eggs of brook trout at Greensboro Pond, Vermont, November 15, 1893, Mr. John W. Titcomb stripped 140 males and 70 females. This large proportion of males is observed also by anglers.

*Black-spotted trout.*—On February 24, 1894, Mr. Seagle collected about 1,000 eggs, but could not find a male in proper condition. Last season about 50,000 eggs were lost for want of milt. On March 7 Mr. Seagle took 2,500 eggs, but found no suitable male. On March 12 he obtained 2,000 eggs and secured one male in fair spawning condition. Some eggs of the black-spotted species have been fertilized at Wytheville with milt of the rainbow.

Superintendent Clark began taking eggs of black-spotted trout at Northville, Mich., April 30, 1894, but they were not very good. The females seemed to have a quantity of water that flowed with the eggs, and Mr. Clark feared the same trouble experienced with rainbow trout, in which the eggs became glassy. The superintendent thinks by introducing water direct from a cold spring better eggs and fish would be produced.

*Von Behr and Loch Leven trout.*—Mr. Frank N. Clark sent by express from Northville, Mich., 20,000 Von Behr trout eggs and 20,000 of the Loch Leven trout to Mexico. Although these were 8 days in transit and were consigned to a warm climate, they were received with a loss of only 60 of the former and 72 of the latter.

*Steelhead.*—A case containing 100,000 eggs of steelhead (*Salmo gairdneri*) was shipped in April from Fort Gaston Station to Northville,

Mich., but they were spoiled on the way because the temperature was not kept low enough.

*Landlocked salmon.*—On October 21, 1893, Mr. A. N. Cheney, of Glens Falls, N. Y., suggested to the Commissioner the advantages to be derived from planting landlocked salmon in Lake George, with the object of stocking that body of water as well as the larger Lake Champlain, into which it empties and in which the Commissioner desired to introduce that species. Mr. Cheney's letter pointed out the superior claims of Lake George as an experimental field, and his plan was considered worthy to be carried out.

*Packing trout eggs for transportation.*—Mr. W. F. Page, superintendent of the Neosho Station, is in favor of using cut sponge as a packing material, because of its cleanliness, the rapidity with which it can be worked, firmness and evenness of packing, and its economy in the long run. It can be dried out and used almost indefinitely. One pound of sponge will pack 15,000 rainbow-trout eggs. A pound of sponge, however, in Mr. Page's experience, requires the entire attention of one man for ten hours to properly pick up.

*Lobster.*—Capt. A. C. Adams was instructed to buy lobsters at a price not exceeding 10 cents each for large ones and 5 cents each for small ones, the lobsters to be liberated after removal of their eggs. Mr. W. P. Sauerhoff was assigned to the lobster work at Gloucester May 16, relieving Captain Adams, and on the 23d he reported 191 females which had furnished 2,473,000 eggs.

At Woods Hole Station arrangements were made in the spring of 1894 to buy egg-bearing female lobsters from lobster men at Cuttyhunk, Menemsha Bight, Nomans Land, and Woods Hole. About 3,300 pots are set in these localities. Off Nomans Land very large lobsters, from 3 to 10 pounds in weight, are taken and the largest yield 30,000 eggs. The pots are hauled twice a week and the average catch is about 2,400 pounds at a haul, two-thirds of which are egg-bearing females.

## FISH ENEMIES, DISEASES, AND FATALITIES.

*Otter.*—February 6, 1894, Mr. E. M. Robinson at Green Lake Station, reported the capture of an otter measuring 5 feet 6 inches, in two traps. He had eaten many trout before his capture. On February 24 the capture of another otter and one mink was reported.

*Larvæ of caddis and black flies.*[1]—In the spring of 1894 the superin-

[1] See also the following articles by the late Prof. C. V. Riley:
The death web of young trout. <Am. Ent. and Bot., Apr., 1870, v. 2, p. 174. Riley.
Supposed trout enemy. <Am. Ent. and Bot., Apr., 1870, v. 2, pp. 179–180. Riley.
The death web of young trout. <Amer. Ent. and Bot., May, 1870, v. 2, p. 211. Larvæ of a *Simulium*. Riley.
The death web of young trout. <Amer. Ent. and Bot., June, 1870, v. 2, pp. 227–228, figs. 143–144. Habits of *Simulium piscicidium*. Riley.
The so-called web worm of young trout. <Amer. Ent. and Bot., Dec., 1870, v. 2, pp. 366–367. Riley. Description of *Simulium piscicidium*, n. sp.
Remarks on *Simulium piscicidium*. <Trans. Acad. Sci. St. Louis, July, 1873, v. 3, p. 79 Proc. Nature and supposed ravages. Riley.
Carnivorous habits of caddis worms. <Amer. Ent., July, 1880 (v. 3), n. s., v. 1, p. 176. Riley.

tendent of the Green Lake Station reported the presence of the larvæ of two insects in the hatching troughs, and the destruction thereby of some newly-hatched landlocked salmon. Specimens were forwarded to the office of the Commission and were referred to the Department of Agriculture for identification. The following correspondence relates to the subject:

GREEN LAKE, ME., *May 7, 1894.*

I send by to-day's mail two specimens of water life which made its appearance in large numbers in our troughs just about the time the salmon were hatching or when the water reached 46° F. * * * The large specimens I would say were from five to six days old, while the small ones are not over two days old. The former are full grown. It seems they do not grow to any size, but their development is very rapid. * * * Any considerable number of them in a hatching trough in one night will spin the trough almost full of a very fine web; it is quite strong, too. They will sometimes spin a web around the neck of a fish and choke it to death; then they congregate in numbers and will eat the entire fish if left alone. They also attack the sac of the fish, and this is always fatal, as the sac soon bursts. They would not be able to harm the fish after they are ten days old, but should they come in numbers at the proper time they would destroy a good many fish if not kept out. I have no doubt this same insect will make excellent food for the fry a month later.

E. M. ROBINSON, *Superintendent.*

DEPARTMENT OF AGRICULTURE,
OFFICE OF ASSISTANT SECRETARY,
*Washington, D. C., May 19, 1894.*

SIR: I have the honor to acknowledge the receipt of your favor of May 12, transmitting vials containing larvæ received from the fish-cultural station at Green Lake, Me., and to report that they have been referred to the entomologist, who submits the following statement:

"The large larvæ sent by Colonel McDonald are predaceous in their habits. They belong to the species known as *Hydropsyche phalerata*, a form which is noted for the fact that it preys almost exclusively on the larvæ of the genus *Simulium*, known in different parts of the country as black flies, buffalo gnats, turkey gnats, etc. The smaller larvæ sent in a separate vial belong to the genus *Simulium;* the exact species can not be determined from the larva alone, but it is probably *decorum* or *invenustum*, and the adult is the common black fly of the Green Lake region, in all probability.

"The damage done by the larvæ of *Simulium* in fish hatcheries has been commented upon before. They feed upon aquatic vegetation in part, and in part upon minute infusoria, and the damage to the fish occurs through the spinning of their web through the water, as detailed by Mr. Robinson. The statement that the *Simulium* larvæ cluster upon the young fish after they are caught in the web, and feed upon them, may be doubted. It is very possible, however, that the *Hydropsyche* larvæ will feed upon very small fish captured in the net made by the *Simulium* larvæ. It is a very peculiar and interesting condition of affairs. The best article which has been published on the subject is entitled 'The death web of young trout,' and will be found in volume II of the American Entomologist and Botanist, pages 227–228 (June, 1870). Mr. Seth Green, the well-known pisciculturist of New York, was the first observer to call attention to this interesting habit of the *Simulium* larvæ. Mr. Robinson is perfectly correct in supposing that the young fry, when they are a little older, will feed upon the *Simulium* larvæ."

I have the honor to remain, respectfully, yours,

CHAS. W. DABNEY, Jr.,
*Assistant Secretary.*

Hon. M. MCDONALD,
*Commissioner Fish and Fisheries, Washington, D. C.*

GREEN LAKE, ME., *May 26, 1894.*

DEAR SIR: Your letter dated May 23, inclosing a copy of a report upon the larvæ sent, by the entomologist of the Agricultural Department, is at hand, and which I was glad to receive. I am not prepared to say positively whether the larvæ of the large caddis fly intentionally fed upon the fry, or whether the web spun was for the capture of the fry, but during a period of ten days they appeared in our supply and hatching troughs in large numbers, spinning them full of this fine web, which would naturally entangle a small per cent of the embryos. Clusters containing 25 or 30 of the large larvæ would be found all through the troughs, and invariably a fish would be found in the middle, in some cases almost entirely devoured; numbers would be seen moving to and fro, hither and thither; also quite a lot of them would adhere to the sides of the trough at water level. A single larva was noticed time and again to attach itself to the sac and sometimes to the head of the fish; the fish would swim around as if in severe pain for a moment or two, and would settle to the bottom dead or dying.

Of course, in one of our hatching troughs, where we were carrying from 10,000 to 12,000 fry, with as many thousand larvæ in it, it was natural to suppose that they were feeding upon them, which they surely did; it might not have been from preference but from necessity, as the troughs contained but very little else in the shape of food that could be seen with the unaided eye, though I am of opinion that they were feeding upon the sac of the embryo from preference, and I am sure that the sac of the young fry would make very delicate food. After the fish arrived at the age of 15 days, the larva was not able to entangle or capture them except in very rare cases, as the fish by this time had developed sufficient activity to free themselves. The larvæ of both the caddis and black fly have almost entirely disappeared. The fish is no longer the sufferer, but the fish-culturist, as the black fly is in all of his glory.

I am, very respectfully,

E. M. ROBINSON,
*Superintendent.*

DR. TARLETON H. BEAN,
*Assistant in Charge Division of Fish Culture,*
*U. S. Fish Commission, Washington, D. C.*

*Fungus and parasites.*—The parasite referred to in the following letter of Mr. Robinson was not identified, but similar attacks have been observed at other stations, and studies are now in progress looking toward the identification of the species and the elucidation of its life history, as well as the proper treatment of the fish affected.

GREEN LAKE, ME., *May 30, 1894.*

DEAR DR. BEAN: For the past month or twenty days the loss in our salmon fry began to be alarming, and at one time I feared the epidemic that caused so much destruction at the Craig Brook Station, and gave Mr. Atkins so much trouble, was upon us in its worst form. I first began to notice very fine fungus growth on the fins and near the gill covers; the little fish so affected would huddle together in the corners of the troughs and seemed to have no life about them, and in 24 or 36 hours would die. The next trouble discovered was a small parasite, not on any particular part of the body, but pretty generally distributed; these parasites looked to the unaided eye like very small warts, and showed white in the water. Whether the irritation of the parasite on the body of the fish causes the fungus I can't say, but am of the opinion it does.

As soon as the fungus and parasites were discovered I had salt used very freely; would have water cut off the troughs and drawn down to within 3 inches of the bottom; then made a strong brine by dissolving 1 quart of salt in a pail for each trough; this brine would be poured in, and at the same time be thoroughly mixed with the water and fish; all the little nooks and corners of the trough would

be washed out, and we would keep the brine on from 3 to 5 minutes. We feel by doing this we have checked the fungus and, in part, nipped the parasite; still, the parasite can be seen on a large number of the fish yet. The only remedy we know of is to keep cleaning and salting, and I am glad to say at this writing we can see a marked improvement in the fry. We are now salting every other day, and when a trough does not improve as we think it ought, we give it a quart every day. I send you by this mail two vials with labels inside that will show the parasite and fungus on the fins of the fry. Someone has said "the price of all fish is eternal vigilance," and I will add, in this locality, a free use of salt.

Very respectfully,

E. M. ROBINSON,
*Superintendent.*

Dr. TARLETON H. BEAN,
*Assistant in Charge Division of Fish-Culture,*
*U. S. Fish Commission, Washington, D C.*

*Epidemic among trout.*—April 21, 1894, Superintendent Clark reported an unusual loss of yearling and 2-year-old brook trout at the Northville, Mich., Station, which begun ten days before and was without visible cause. The fish were dying at the rate of from 40 to 100 a day in spite of the ample water flow and plenty of wholesome food. Trout in ponds below the dying fish did not seem to be affected, although the same water flowed through all.

Dr. R. R. Gurley was sent to Northville on April 23, and after investigation made a provisional report upon the epidemic. Arrangements were soon made also to isolate the diseased fish and to provide separate drainage for each pond. The epidemic abated considerably from the beginning of May. It involved the black-spotted as well as the brook trout.

*Black bass killed by thunder.*—On June 5, 1894, at the Neosho Station, Missouri, a very heavy storm of lightning and rain occurred about noon. Next morning thousands of young black bass were found dead on the bottom of a pond, mostly in water 3 feet deep. No signs of wounds or punctures were upon them and they were all in excellent condition in the morning of June 5. Some of the dead fish were examined by Dr. R. R. Gurley, assistant to the United States Fish Commission, who found no evident cause of death. He refers to an item in Rayer's Archiv de Med. Comp., Paris, 1843, pp. 253–254, in which it is stated:

> In times of storm fish, and particularly carp and perch, experience a very marked effect from the electricity. The fishermen assert that after a peal of thunder, in an étang or in a lake, fish have been seen to die in a few days.

*Fish struck by lightning.*—The Philadelphia *Public Ledger* stated that at Allentown, September 2, 1895, during a severe thunder storm lightning struck the water of one of the fish ponds of the State Fishery which contained 5-year-old California trout. The trout measured from 18 to 22 inches in length. Between 75 and 100 of the finest trout were paralyzed and many of them had their backs broken.

*Details of distribution, 1893–94.*

| Disposition. | Eggs. | Fry. | Adults and yearlings. |
|---|---|---|---|
| *Spotted catfish:* | | | |
| Applicant in District of Columbia | | | 10 |
| Boise River near Boise, Idaho | | | 100 |
| Kishwaukee River near Belvidere, Ill | | | 25 |
| Fox River near St. Charles, Ill | | | 1,916 |
| Elgin, Ill | | | 300 |
| Geneva, Ill | | | 25 |
| Applicants in Illinois | | | 534 |
| Pine Lake near Laporte, Ind | | | 150 |
| Applicants in Indiana | | | 225 |
| Iowa River near Lime Spring, Iowa | | | 100 |
| Chester, Iowa | | | 100 |
| Cedar River near Osage, Iowa | | | 100 |
| Lime Creek near Mason City, Iowa | | | 600 |
| Bishop Lake near Sheldon, Iowa | | | 300 |
| Twin Lakes near Rockwell City, Iowa | | | 2,800 |
| Des Moines River near Fort Dodge, Iowa | | | 300 |
| Storm Lake near Storm Lake, Iowa | | | 4,000 |
| Maquoketa River near Manchester, Iowa | | | 150 |
| Otter Creek near Oelwein, Iowa | | | 225 |
| Upper Iowa River near Decorah, Iowa | | | 275 |
| Cedar River near Cedar Rapids, Iowa | | | 292 |
| Iowa State Fish Commission ponds, Spirit Lake, Iowa | | | 300 |
| Applicants in Iowa | | | 100 |
| Kansas | | | 1,099 |
| Reservoir near Middlesboro, Ky | | | 50 |
| Tygart Creek near Olive Hill, Ky | | | 50 |
| Nolin Creek near Hodgensville, Ky | | | 150 |
| Clarkston Lake near Elizabethtown, Ky | | | 100 |
| Billys Creek near Elizabethtown, Ky | | | 75 |
| Blue Spring near Cecilian, Ky | | | 50 |
| Mud River near Russellville, Ky | | | 75 |
| Pond River near Bakersport, Ky | | | 75 |
| Drake Creek near Hortonville, Ky | | | 75 |
| Tradewater River near Dawson, Ky | | | 75 |
| Otter Creek near Cerulean Springs, Ky | | | 100 |
| Muddy Fork near Kuttawa, Ky | | | 75 |
| Applicants in Kentucky | | | 240 |
| Moreau River near Jefferson City, Mo | | | 100 |
| Applicants in Missouri | | | 350 |
| Johnson Creek near county line, N. Y | | | 50 |
| Mohawk River near Utica, N. Y | | | 75 |
| Applicants in Ohio | | | 25 |
| Texas | | | 265 |
| Virginia | | | 50 |
| Jackson River near Cedar Creek, Va | | | 300 |
| Applicants in Wyoming | | | 25 |
| Public lake near Montborne, Wash | | | 100 |
| *Catfish (common):* | | | |
| Herrealls Branch near Neosho, Mo | | | 1,050 |
| *Carp:* | | | |
| Applicants in Alabama | | | 575 |
| Arkansas | | | 611 |
| California | | | 18 |
| Colorado | | | 30 |
| Connecticut | | | 390 |
| Delaware | | | 60 |
| District of Columbia | | | 235 |
| Potomac River in District of Columbia | | | 1,757 |
| Applicants in Florida | | | 304 |
| Georgia State Fish Commission | | | 3,000 |
| Tallulah Creek, Tallulah Falls, Ga | | | 1,000 |
| Applicants in Georgia | | | 489 |
| Idaho | | | 60 |
| Illinois | | | 150 |
| Indiana | | | 90 |
| Indian Territory | | | 150 |
| Red River near Colbert, Ind. T | | | 390 |
| Grand River near Shawneetown, Ind. T | | | 35 |
| Applicants in Iowa | | | 340 |
| Kansas | | | 1,001 |
| Kentucky | | | 320 |
| Louisiana | | | 190 |
| Maine | | | 30 |
| Maryland | | | 610 |
| Massachusetts | | | 260 |
| Michigan | | | 780 |
| Minnesota | | | 1,000 |
| Minnesota State Fish Commission | | | 2,500 |
| Applicants in Mississippi | | | 806 |
| Missouri | | | 450 |
| Montana | | | 740 |
| Nebraska | | | 110 |

*Details of distribution, 1893–94*—Continued.

| Disposition. | Eggs. | Fry. | Adults and yearlings. |
|---|---|---|---|
| *Carp*—Continued. | | | |
| Applicants in New Hampshire | | | 160 |
| New Jersey | | | 280 |
| New Mexico | | | 484 |
| New York | | | 5,355 |
| New York State Fish Commission | | | 5,000 |
| Applicants in North Carolina | | | 1,218 |
| North Dakota | | | 186 |
| Ohio | | | 810 |
| Oklahoma | | | 510 |
| Oregon | | | 30 |
| Pennsylvania | | | 720 |
| Rhode Island | | | 7 |
| South Carolina | | | 304 |
| South Dakota | | | 1,910 |
| Tennessee | | | 1,990 |
| Doe River near Alleutown, Tenn | | | 384 |
| French Broad and Pigeon rivers in Jefferson County, Tenn | | | 384 |
| Holston River near Rutledge, Tenn | | | 193 |
| Strawberry, Tenn | | | 192 |
| Rogersville, Tenn | | | 384 |
| Tennessee River near Knoxville, Tenn | | | 770 |
| London, Tenn | | | 384 |
| Chucky Creek near Erwin, Tenn | | | 192 |
| Big Limestone Creek near Limestone, Tenn | | | 192 |
| Lick Creek near Mohawk, Tenn | | | 384 |
| Clinch River near Clinton, Tenn | | | 386 |
| Emory River near Harriman, Tenn | | | 193 |
| Obeys River near Lancing, Tenn | | | 193 |
| Red River near Cobert, Tex | | | 390 |
| Trinity River near Fort Worth, Tex | | | 390 |
| Applicants in Texas | | | 1,100 |
| Reed Creek near Wytheville, Va | | | 1,086 |
| Applicants in Virginia | | | 2,535 |
| Washington | | | 280 |
| West Virginia | | | 210 |
| Wisconsin | | | 30 |
| *Tench:* | | | |
| Applicants in Arkansas | | | 500 |
| Blue River near Armstrong, Ind. T | | | 600 |
| Applicants in Indian Territory | | | 500 |
| Iowa Fish Commission | | | 50 |
| Lime Creek near Mason City, Iowa | | | 50 |
| Bishop Lake near Sheldon, Iowa | | | 40 |
| Cedar River near Osage, Iowa | | | 25 |
| Applicants in Kansas | | | 100 |
| Appalachee River at crossing of Macon and Northern Railroad, in Georgia | | | 2,000 |
| Oconee River at crossing of Macon and Northern Railroad, in Georgia | | | 2,000 |
| Applicants in Maryland | | | 60 |
| Hickory Creek near Neosho, Mo | | | 1,200 |
| Applicants in Missouri | | | 1,015 |
| Applicants in New York | | | 4,000 |
| North Carolina | | | 150 |
| Ohio | | | 200 |
| Exalls Lake near Dallas, Tex | | | 1,000 |
| Canyon Lake near Cisco, Tex | | | 1,000 |
| Chesley tank near Cisco, Tex | | | 300 |
| Delmark tank near Cisco, Tex | | | 300 |
| Colorado River near Austin, Tex | | | 600 |
| San Marcos River near San Marcos, Tex | | | 1,200 |
| Applicants in Texas | | | 900 |
| *Goldfish:* | | | |
| Applicants in Alabama | | | 48 |
| Arkansas | | | 124 |
| Colorado | | | 24 |
| Connecticut | | | 30 |
| District of Columbia | | | 6,771 |
| Delaware | | | 48 |
| Florida | | | 50 |
| Florida Agricultural Department | | | 24 |
| Applicants in Georgia | | | 138 |
| Georgia Fish Commission | | | 30 |
| Applicants in Illinois | | | 310 |
| Indiana | | | 127 |
| Indian Territory | | | 24 |
| Iowa | | | 110 |
| Iowa Fish Commission | | | 100 |
| Applicants in Kansas | | | 162 |
| Kansas Fish Commission | | | 30 |
| Applicants in Kentucky | | | 84 |

*Details of distribution, 1893–94*—Continued.

| Disposition. | Eggs. | Fry. | Adults and yearlings. |
|---|---|---|---|
| *Goldfish*—Continued. | | | |
| Applicants in Louisiana | | | 419 |
| Maine | | | 14 |
| Maryland | | | 360 |
| Massachusetts | | | 74 |
| Michigan | | | 60 |
| Minnesota | | | 10 |
| Minnesota Fish Commission | | | 50 |
| Applicants in Mississippi | | | 66 |
| Missouri | | | 479 |
| Missouri Fish Commission | | | 100 |
| Applicants in Nebraska | | | 6 |
| New Jersey | | | 120 |
| New Mexico | | | 12 |
| New York | | | 224 |
| North Carolina | | | 227 |
| Ohio | | | 466 |
| Oklahoma | | | 12 |
| Pennsylvania | | | 838 |
| Rhode Island | | | 12 |
| South Carolina | | | 117 |
| Tennessee | | | 198 |
| Texas | | | 318 |
| Utah | | | 6 |
| Virginia | | | 797 |
| West Virginia | | | 72 |
| Wisconsin Fish Commission | | | 100 |
| *Golden ide:* | | | |
| Applicants in Arkansas | | | 100 |
| Colorado | | | 125 |
| District of Columbia | | | 91 |
| Florida | | | 50 |
| Georgia | | | 50 |
| Georgia Fish Commission | | | 100 |
| Applicants in Illinois | | | 37 |
| Indiana | | | 25 |
| Kansas | | | 8 |
| Administrator public buildings, New Orleans, La | | | 100 |
| Applicants in Maryland | | | 24 |
| Massachusetts | | | 24 |
| Minnesota Fish Commission | | | 25 |
| Missouri Fish Commission | | | 50 |
| Applicants in Missouri | | | 25 |
| New York | | | 275 |
| New Jersey | | | 15 |
| North Carolina | | | 100 |
| Ohio | | | 166 |
| Pennsylvania | | | 115 |
| Tennessee | | | 100 |
| Texas | | | 125 |
| Virginia | | | 50 |
| *Golden tench:* | | | |
| Applicants in District of Columbia | | | 50 |
| Illinois | | | 6 |
| Indiana | | | 12 |
| Iowa | | | 2 |
| Maryland | | | 24 |
| North Carolina | | | 86 |
| Pennsylvania | | | 18 |
| Tennessee | | | 42 |
| Virginia | | | 20 |
| United States of Columbia | | | 12 |
| *Shad:* | | | |
| Connecticut River near Warehouse Point, Conn | | 3,044,000 | |
| Potomac River near Georgetown, D. C | | 469,000 | |
| U. S. Fish Commission Fish Ponds, Washington, D. C | | a 2,109,000 | |
| Nanticoke River near Seaford, Del | | 450,000 | |
| Brandywine Creek near Wilmington, Del | | 1,330,000 | |
| St. Johns River near Palatka, Fla | | 2,250,000 | |
| Ogeechee River near Midville, Ga | | 500,000 | |
| Ocmulgee River near Macon, Ga | | 500,000 | |
| Savannah River near Augusta, Ga | | 1,417,000 | |
| Chesapeake Bay near Battery Island, Md | 355,000 | 2,976,000 | |
| Chester River near Chestertown, Md | | 420,000 | |
| Patuxent River near Laurel, Md | | 899,000 | |
| Patapsco River near Relay Station, Md | | 476,000 | |
| Susquehanna River near Port Deposit, Md | | 1,104,000 | |
| Bush River near Bush River Station, Md | | 630,000 | |
| North East River near North East, Md | | 1,200,000 | |
| Wicomico River near Salisbury, Md | | 345,000 | |
| Gunpowder River near Gunpowder Station, Md | | 450,000 | |

a Not to be included in summations.

*Details of distribution, 1893–94*—Continued.

| Disposition. | Eggs. | Fry. | Adults and yearlings. |
|---|---|---|---|
| *Shad*—Continued. | | | |
| Elk River near Elkton, Md | | 1,380,000 | |
| Potomac River near Washington Junction, Md | | 1,676,000 | |
| Tuckahoe Creek near Queen Anne, Md | | 450,000 | |
| Delaware River near Gloucester, N. J | | 142,000 | |
| Lambertville, N. J | | 1,100,000 | |
| Callicoon, N. Y | | 400,000 | |
| Port Jervis, N. Y | | 917,000 | |
| New York Fish Commission | 2,000,000 | 5,414,000 | |
| Pasquotank River near Elizabeth City, N. C | | 429,000 | |
| Lumber River near Lumberton, N. C | | 389,000 | |
| Neuse River near Newbern, N. C | | 403,000 | |
| Yadkin River near Salisbury, N. C | | 419,000 | |
| Susquehanna River near Columbia, Pa | | 870,000 | |
| Susquehanna River near Fites Eddy, Pa | | 757,000 | |
| Peach Bottom, Pa | | 850,000 | |
| Delaware River near Delaware Water Gap, Pa | 300,000 | 5,276,000 | |
| Palmer River near Providence, R. I | 669,000 | 2,350,000 | |
| Broad River near Columbia, S. C | | 1,000,000 | |
| Congaree River near Columbia, S. C | | 2,155,000 | |
| Catawba River near Catawba, S. C | | 900,000 | |
| Potomac River near Widewater, Va | | 457,000 | |
| Chappawansic Creek near Quantico, Va | | 1,407,000 | |
| Cedar River near Catletts, Va | | 482,000 | |
| Mattaponi River near Milford, Va | | 453,000 | |
| Stony Creek near Stony Creek, Va | | 433,000 | |
| Rapidan River near Rapidan, Va | | 448,000 | |
| Little River near Taylorsville, Va | | 451,000 | |
| Rappahannock River near Fredericksburg, Va | | 475,000 | |
| Occoquan River near Woodbridge, Va | | 907,000 | |
| Meherrin River near Belfield, Va | | 381,000 | |
| Tye River near Tye River Station, Va | | 463,000 | |
| Rockfish River near Rockfish, Va | | 459,000 | |
| Otter River near Evington, Va | | 447,000 | |
| Nansemond River near Suffolk, Va | | 509,000 | |
| *Quinnat salmon:* | | | |
| California Fish Commission | 7,500,000 | | |
| McCloud River near Baird, Cal | | 438,500 | |
| Raisin River in Monroe County, Mich | | 39,000 | |
| Clackamas River and Clear Creek near Clackamas, Oreg | | 213,000 | |
| *Silver salmon:* | | | |
| Mad River near Korbel, Cal | | 280,000 | |
| *Atlantic salmon:* | | | |
| New York Fish Commission | 60,000 | | |
| Pennsylvania Fish Commission | 60,000 | | |
| New Hampshire Fish Commission | 25,000 | | |
| Connecticut Fish Commission | 25,000 | | |
| Perts Stream, tributary to Toddy Pond in Hancock County, Me | | | 10,000 |
| Sucker Brook, tributary to Toddy Pond in Hancock County, Me | | | 8,000 |
| Luke Harriman's brook, tributary to Toddy Pond in Hancock County, Me | | | 9,200 |
| Trundy Brook, tributary to Toddy Pond in Hancock County, Me | | | 8,235 |
| Conary Brook, tributary to Toddy Pond in Hancock County, Me | | | 11,343 |
| Hatch brook, tributary to Toddy Pond in Hancock County, Me | | | 6,000 |
| Saunders Cove, tributary to Toddy Pond in Hancock County, Me | | | 5,900 |
| Robert Gray brook, tributary to Toddy Pond in Hancock County, Me | | | 6,191 |
| Toddy Pond in Hancock County, Me | | | 49,655 |
| Meadow brook, tributary to Alamoosook Lake in Hancock County, Me | | | 21,300 |
| Wardwell brook, tributary to Alamoosook Lake in Hancock County, Me | | | 14,625 |
| Gully brook, tributary to Alamoosook Lake in Hancock County, Me | | | 6,100 |
| Alamoosook Lake in Hancock County, Me | | | 32,089 |
| Heart Pond in Hancock County, Me | | | 9,899 |
| Hen Brook, tributary to Narramissic River in Hancock County, Me | | | 9,099 |
| Dead Brook, tributary to Narramissic River in Hancock County, Me | | | 18,662 |
| Little Dead Brook, tributary to Narramissic River in Hancock County, Me | | | 5,100 |
| Green Lake in Hancock County, Me | | | 3,908 |
| *Landlocked salmon:* | | | |
| Caleb Gilman, Calais, Me | 5,000 | | |
| W. T. Haynes, Oakland, Me | 5,000 | | |

*Details of distribution, 1893–94*—Continued.

| Disposition. | Eggs. | Fry. | Adults and yearlings. |
|---|---|---|---|
| *Landlocked salmon*—Continued. | | | |
| W. L. Gilbert, Plymouth, Mass | 1,000 | | |
| A. E. Adams, No. 115 State street, Boston, Mass | 5,000 | | |
| E. R. Hewett, Ringwood, N. J | 5,000 | | |
| Gardner Smaith, Ragged Lake, N. Y | 5,000 | | |
| Bisby Club, White Lake Corners, N. Y | 5,000 | | |
| New York Fish Commission | 30,000 | | |
| Wilmurt Club, Buffalo, N. Y | 5,000 | | |
| Adirondack League Club, Old Forge, N. Y | 5,000 | | |
| Tuxedo Park Association, Tuxedo, N. Y | 5,000 | | |
| Applicants in United States of Colombia | 3,000 | | |
| Monocacy River near Frederick Junction, Md | | 2,500 | |
| Applicants in Connecticut | | | 300 |
| Eagle Lake near Bar Harbor, Me | | | 5,000 |
| Fourth Pond near Bluehill, Me | | | 1,000 |
| Long Pond near South West Harbor, Me | | | 5,000 |
| Tributary of Duck Lake in Penobscot County, Me | | 6,000 | |
| Whites Pond near Penobscot, Me | | | 1,000 |
| Big Tunk Waters near Ellsworth, Me | | | 5,000 |
| Donnell Pond in Hancock County, Me | | | 10,000 |
| Great Pond near Waterville, Me | | | 1,000 |
| Parlin Pond in Somerset County, Me | | | 1,200 |
| Beech Hill Pond in Hancock County, Me | | | 2,500 |
| Giles Pond in Hancock County, Me | | | 5,000 |
| Great Pond in Hancock County, Me | | | 8,000 |
| Great Pond near Waterville, Me | | | 1,000 |
| Funk Pond in Washington County, Me | | | 1,489 |
| Brewer Pond near South Brewer, Me | | | 2,000 |
| Blunt Pond in Hancock County, Me | | | 2,000 |
| Green Lake in Hancock County, Me | | | 26,682 |
| Toddy Pond in Hancock County, Me | | | 6,585 |
| Long Pond in Hancock County, Me | | | 7,151 |
| Flanders Pond in Hancock County, Me | | | 2,665 |
| Rocky Pond No. 2 in Hancock County, Me | | | 5,000 |
| Phillips Pond in Hancock County, Me | | | 2,000 |
| Branch Pond near East Dedham, Me | | | 7,800 |
| China Lake near Waterville, Me | | | 1,500 |
| Cunieulocus Pond near Egypt, Me | | | 1,500 |
| Hatease Pond in Hancock County, Me | | | 3,000 |
| Mountany Pond in Hancock County, Me | | | 3,000 |
| Great Brook in Hancock County, Me | | | 6,000 |
| Simmons Pond near Ellsworth, Me | | | 1,000 |
| Fish River Lakes in Aroostook County, Me | | | 4,986 |
| Browns River, tributary of Lake Champlain near Waterbury, Vt | | | 2,269 |
| Indian Brook, tributary of Lake Champlain near Essex Junction, Vt | | | 2,269 |
| Winooski River, tributary of Lake Champlain near Essex Junction, Vt | | | 4,538 |
| Vermont Fish Commission | | | 1,000 |
| *Steelhead trout:* | | | |
| California Fish Commission | 50,000 | | |
| Government of Japan | 25,000 | | |
| North Fork of Mad River near Korbel, Cal | | 308,500 | |
| *Loch Leven trout:* | | | |
| California Fish Commission | 20,000 | | |
| Minnesota Fish Commission | 20,000 | | |
| Government of Mexico | 25,000 | | |
| Orchard Lake, Oakland County, Mich | | 10,000 | |
| Zukey Lake near Hamburg Junction, Mich | | 10,000 | |
| Cold Creek near Tawas City, Mich | | 4,000 | |
| Upper Clear Creek near Idaho Springs, Colo | | | 2,000 |
| South Platte River near Dome Rock, Colo | | | 2,500 |
| Estabrook, Colo | | | 500 |
| Frying Pan Creek near Thomasville, Colo | | | 1,500 |
| Ruedi, Colo | | | 1,000 |
| Eagle River near Berry's Branch, Colo | | | 2,000 |
| East River near Almont, Colo | | | 700 |
| Los Pinos River near Osier, Colo | | | 2,500 |
| Lake Creek near Idaho Springs, Colo | | | 500 |
| Lower Evergreen Lake near Leadville, Colo | | | 600 |
| Arkansas River near Boulevard, Colo | | | 500 |
| Applicants in Colorado | | | 200 |
| Oak Hill Lake near Butler, Ind | | | 800 |
| Clear Lake near South Bend, Ind | | | 500 |
| Hartman Lake near South Bend, Ind | | | 1,000 |
| Floods Pond in Hancock County, Me | | | 2,500 |
| Big Tunk Pond near Ellsworth, Me | | | 4,000 |
| Green Lake in Hancock County, Me | | | 11,668 |
| Simmons Pond near Ellsworth, Me | | | 500 |
| Branch Pond near East Dedham, Me | | | 2,000 |
| Heart Pond near East Orland, Me | | | 46 |
| Railroad Lake near Wingleton, Mich | | | 2,000 |

*Details of distribution, 1893–94*—Continued.

| Disposition. | Eggs. | Fry. | Adults and yearlings. |
|---|---|---|---|
| *Loch Leven trout*—Continued. | | | |
| Beitner Creek near Traverse City, Mich | | | 1,000 |
| Lake Mary Rowan near Jocko, Mont | | | 1,000 |
| Pecos River near Glorieta, N. Mex | | | 800 |
| Lake in Franklin Park, Columbus, Ohio | | | 300 |
| Deep Lake near Mount Pocono, Pa | | | 3,000 |
| False Bottom Creek near Deadwood, S. Dak | | | 900 |
| Applicants in South Dakota | | | 1,400 |
| Long Lake near Rice Lake, Wis | | | 1,000 |
| Cedar Lake near Rice Lake, Wis | | | 1,000 |
| La Prele Creek near Douglas, Wyo | | | 1,000 |
| *Rainbow trout:* | | | |
| Mammoth Springs Fish Co., Mammoth Springs, Ark | 12,000 | | |
| J. E. Bailey, Silver Springs, Benton County, Ark | 5,000 | | |
| Johns Hopkins University, Baltimore, Md | 2,500 | | |
| Missouri Fish Commission | 50,000 | | |
| Minnesota Fish Commission | 42,000 | | |
| Nebraska Fish Commission | 23,000 | | |
| Nevada Fish Commission | 40,000 | | |
| Vermont Fish Commission | 30,000 | | |
| J. E. Sherlock, Salt Lake City, Utah | 10,000 | | |
| F. A. Thole, New Castle, Wyo | 10,500 | | |
| Wyoming Fish Commission | 45,000 | | |
| W. P. Groenough, Portneuf, Quebec, Canada | 10,000 | | |
| Maj. W. Turner, Bertrix, Belgium | 25,000 | | |
| A. Geoffroy St. Hilaire, Paris, France | 57,000 | | |
| Raveret-Wattel, Fecamp, France | 10,000 | | |
| Evergreen Lake near Leadville, Colo | | 5,000 | |
| Lake Creek near Leadville, Colo | | 6,000 | |
| Green Lake in Hancock County, Me | | 500 | |
| Kephart stream near Glyndon, Md | | 9,500 | |
| Patapsco Falls near Glyndon, Md | | 9,500 | |
| Local streams near Alberton, Md | | 5,000 | |
| Crane Creek near Crane, Mo | | 2,000 | |
| Ocona Lufty River near Cherokee, N. C | | 5,000 | |
| Dry Run in Bath County, Va | | 4,500 | |
| Mill Creek in Bath County, Va | | 4,500 | |
| Applicants in Virginia | | 1,000 | |
| East Cahaba River near Birmingham, Ala | | | 500 |
| Applicants in Alabama | | | 475 |
| Spavina Creek near Nebo, Ark | | | 1,000 |
| Sugar Creek near Brightwater, Ark | | | 1,300 |
| Clear Fork of Illinois River near Johnson, Ark | | | 800 |
| Main Fork of White River near Durham, Ark | | | 600 |
| Delaney, Ark | | | 600 |
| St. Paul, Ark | | | 800 |
| West Fork, Ark | | | 1,000 |
| Winslow, Ark | | | 1,000 |
| Frog Gabou near Mountainburg, Ark | | | 700 |
| Frog Bayou near Lancaster, Ark | | | 600 |
| Lillie, Ark | | | 600 |
| Feazels Pond near Nashville, Ark | | | 500 |
| Applicants in Arkansas | | | 1,400 |
| Trinity Summit Lake near Trinity Summit, Cal | | | 5,400 |
| Colorado Fish Commission | | | 475 |
| Applicants in District of Columbia | | | 97 |
| Georgia | | | 200 |
| Clear River near Warren, Ill | | | 725 |
| Clear Lake near South Bend, Ind | | | 1,000 |
| Chamberlain Lake near South Bend, Ind | | | 500 |
| Applicants in Indiana | | | 200 |
| Jackson Creek near Cresco, Iowa | | | 700 |
| Clear Creek near Lansing, Iowa | | | 977 |
| Dourman Mill, Coulie Creek near McGregor, Iowa | | | 500 |
| Applicants in Iowa | | | 50 |
| Cow Creek near Baxter Station, Kans | | | 500 |
| Marmonton River near Fort Scott, Kans | | | 2,000 |
| Little Osage River near Fulton, Kans | | | 1,000 |
| Marais Des Cygnes River near Boicourt, Kans | | | 5,200 |
| Applicants in Kansas | | | 1,200 |
| Blue Spring near Cecilian, Ky | | | 200 |
| Lander Branch near Casky, Ky | | | 100 |
| Sinking Creek near Saulsberry, Ky | | | 750 |
| Applicants in Kentucky | | | 100 |
| Maine Fish Commission | | | 471 |
| Parlin Pond in Somerset County, Me | | | 300 |
| Almshouse Run near Hagerstown, Md | | | 52 |
| Lake Roland near Lutherville, Md | | | 312 |
| Beaver Run near Glyndon, Md | | | 100 |
| Local streams near Hagerstown, Md | | | 500 |
| Cronwell Creek near Timonium, Md | | | 1,000 |
| Big Pool near Hagerstown, Md | | | 1,000 |
| Minnehaha Creek near Glyndon, Md | | | 425 |

*Details of distribution, 1893–94*—Continued.

| Disposition. | Eggs. | Fry. | Adults and yearlings. |
|---|---|---|---|
| *Rainbow trout*—Continued. | | | |
| Egypt Branch near Brooklandville, Md | | | 425 |
| Applicants in Maryland | | | 250 |
| Kansas River near Kansas City, Mo | | | 100 |
| Indian Creek near Lanagan, Mo | | | 2,200 |
| Elk River near Rutledge, Mo | | | 2,200 |
| Shoal Creek near Neosho, Mo | | | 350 |
| Gasconade River near Arlington, Mo | | | 3,420 |
| Meramac River near Mosalle, Mo | | | 1,500 |
| Metcalf Spring near Steelville, Mo | | | 500 |
| Sugar Creek in McDonald County, Mo | | | 1,000 |
| Current River near Chicopee, Mo | | | 9,300 |
| Spring Pond near Ash Grove, Mo | | | 100 |
| Sylvan Lake near Ironton, Mo | | | 500 |
| Applicants in Missouri | | | 400 |
| Lake Creek near Rushville, Nebr | | | 400 |
| Worth Branch near Far Hills, N. J | | | 500 |
| Applicants in New Jersey | | | 150 |
| New York | | | 300 |
| Dods Lake near Babylon, N. Y | | | 600 |
| Jonathan Creek near Dellwood, N. C | | | 800 |
| Buck Creek near Marion, N. C | | | 1,500 |
| Linville River near Linville, N. C | | | 760 |
| Sugar Fork Run near Black Mountain, N. C | | | 800 |
| Long Branch near Black Mountain, N. C | | | 300 |
| Swananoa River near Black Mountain, N. C | | | 500 |
| Applicants in North Carolina | | | 200 |
| Ohio | | | 300 |
| Tributary of Gunpowder River near New Freedom, Pa | | | 500 |
| Deer Creek near New Freedom, Pa | | | 500 |
| Anderson Branch near Stewartstown, Pa | | | 500 |
| Loyalhanna Creek near Latrobe, Pa | | | 500 |
| Clover Creek near Altoona, Pa | | | 500 |
| Clear Creek near Johnstown, Pa | | | 800 |
| Trout Run near Bedford, Pa | | | 300 |
| Youghiogheny River near Ohiopyle, Pa | | | 500 |
| Elk Run near Ebensburg, Pa | | | 800 |
| Black Lick Creek near Ebensburg, Pa | | | 500 |
| Moore Run near Ebensburg, Pa | | | 500 |
| Long Run near Arnot, Pa | | | 800 |
| Bobs Run near Morris, Pa | | | 500 |
| Alder Run near Munsons, Pa | | | 800 |
| Little Montgomery Creek near Clearfield, Pa | | | 500 |
| Allegheny River near Coudersport, Pa | | | 700 |
| Freeman Run near Austin, Pa | | | 300 |
| Lick Run near Gaines, Pa | | | 1,000 |
| Cushing Creek near Coudersport, Pa | | | 600 |
| Local streams near Blossburg, Pa | | | 4,000 |
| Churchill Creek near Farmington, Pa | | | 800 |
| Clear Brook near Dubois, Pa | | | 200 |
| Falling Spring near Chambersburg, Pa | | | 500 |
| Trindle Run near Mechanicsburg, Pa | | | 800 |
| Hagerman Run near Williamsport, Pa | | | 600 |
| Local streams near Williamsport, Pa | | | 1,275 |
| Sugar Creek near Troy, Pa | | | 800 |
| Red Run Creek near Waynesboro, Pa | | | 500 |
| Glen Brook near Berwick, Pa | | | 300 |
| Harvey Lake near Nanticoke, Pa | | | 500 |
| Local streams near Stroudsburg, Pa | | | 4,000 |
| Pike Creek near Nanticoke, Pa | | | 300 |
| Roaring Brook near Scranton, Pa | | | 600 |
| Moss Hollow Creek near Hamilton, Pa | | | 300 |
| Spring River near Tobyhanna, Pa | | | 100 |
| Jerry Run near Lockhaven, Pa | | | 1,000 |
| Drury Run near Renovo, Pa | | | 600 |
| Deep Creek near Ashland, Pa | | | 500 |
| Quaker Pond near Shenandoah, Pa | | | 200 |
| Rock Run near St. Peters, Pa | | | 475 |
| Steens Run near Mortonville, Pa | | | 425 |
| Meadow Brook near Meadowbrook, Pa | | | 500 |
| Smyser Pond near York, Pa | | | 100 |
| Trout Run near York, Pa | | | 500 |
| Susquehanna River near Peach Bottom, Pa | | | 588 |
| Applicants in Pennsylvania | | | 1,590 |
| South Carolina | | | 100 |
| Indian Creek near Irwin, Tenn | | | 2,900 |
| Boon Creek near Irwin, Tenn | | | 100 |
| Knob Creek near Irwin, Tenn | | | 100 |
| Sinking Creek near Irwin, Tenn | | | 100 |
| Upper Doe River near Roan Mountain, Tenn | | | 1,150 |
| Cranberry Creek near Cranberry, Tenn | | | 1,112 |
| French Broad and Pigeon rivers in Jefferson County, Tenn | | | 1,000 |
| Doe River in Carter County, Tenn | | | 1,000 |

*Details of distribution, 1893-94*—Continued.

| Disposition. | Eggs. | Fry. | Adults and yearlings. |
|---|---|---|---|
| *Rainbow trout*—Continued. | | | |
| Spring Branch near Kimmins, Tenn | | | 200 |
| New River near Helenwood, Tenn | | | 250 |
| Little River near Knoxville, Tenn | | | 1,000 |
| Pigeon River in Knox County, Tenn | | | 500 |
| Tellico River in Knox County, Tenn | | | 500 |
| Applicants in Tennessee | | | 1,594 |
| Texas | | | 442 |
| Reed Creek near Wytheville, Va | | | 320 |
| Tyre River near Arrington, Va | | | 1,500 |
| Cowpasture River near Millboro, Va | | | 500 |
| Augusta Springs near Augusta Springs, Va | | | 500 |
| Barbers Creek near Craig City, Va | | | 500 |
| Spring Creek near Craig City, Va | | | 500 |
| Cowpasture River near Hot Springs, Va | | | 1,000 |
| Gordon Creek in Bath County, Va | | | 1,000 |
| Cedar Creek in Bath County, Va | | | 1,500 |
| Little Healing Creek in Bath County, Va | | | 1,500 |
| Walkers Creek near Pearisburg, Va | | | 500 |
| North Fork of Tye River in Nelson County, Va | | | 492 |
| Campbell County, Va | | | 500 |
| Clinch River near Tazewell County, Va | | | 600 |
| Wolf Creek in Tazewell County, Va | | | 1,000 |
| South Fork of Powell River in Wise County, Va | | | 1,000 |
| Powell River and branches near Bigstone Gap, Va | | | 500 |
| Beaver Dam Creek in Washington County, Va | | | 225 |
| Laurel Run in Rockbridge County, Va | | | 300 |
| Rappahannock River near Fredericksburg, Va | | | 200 |
| Spring Creek in Washington County, Va | | | 225 |
| Laurel River in Washington County, Va | | | 450 |
| Applicants in Virginia | | | 1,586 |
| Mound Spring Pond near Seymour, Wis | | | 300 |
| Wausaukee Fish and Game Club, Amberg, Wis | | | 2,000 |
| Gauley River in Fayette County, W. Va | | | 5,000 |
| Applicants in West Virginia | | | 895 |
| *Von Behr trout:* | | | |
| Troutdale fish farm, Mammoth Spring, Ark | 5,000 | | |
| Connecticut Fish Commission | 20,000 | | |
| Minnesota Fish Commission | 20,000 | | |
| Vermont Fish Commission | 20,000 | | |
| Wyoming Fish Commission | 15,000 | | |
| Government of Mexico | 20,000 | | |
| North Ten Mile Creek near Frisco, Colo | | | 450 |
| Black Lake in Summit County, Colo | | | 1,000 |
| Denslow Brook in Fairfield County, Conn | | | 310 |
| Trail Creek near Michigan City, Ind | | | 300 |
| Notre Dame Lake near South Bend, Ind | | | 200 |
| Applicants in Indiana | | | 500 |
| Hoover Spring near West Union, Iowa | | | 200 |
| Silver Springs near Waverly, Iowa | | | 200 |
| Spirit Lake near Spirit Lake, Iowa | | | 1,325 |
| Applicants in Iowa | | | 400 |
| Kentucky | | | 300 |
| Big Tunk Pond near Ellsworth, Me | | | 3,000 |
| Phillips Pond near Phillips Pond Station, Me | | | 2,000 |
| Rocky Pond in Hancock County, Me | | | 3,000 |
| Branch Pond near East Dedham, Me | | | 4,228 |
| Green Lake in Hancock County, Me | | | 3,000 |
| Pattens Pond in Hancock County, Me | | | 5,000 |
| Rogers Pond near Topham, Me | | | 400 |
| Heart Pond near Orland, Me | | | 18 |
| Lidensparker Pond near Waldoboro, Me | | | 1,500 |
| Fourth Pond in Hancock County, Me | | | 2,000 |
| One Mile River near Attleboro, Mass | | | 500 |
| Great Pond near Randolph, Mass | | | 800 |
| Almshouse Run near Hagerstown, Md | | | 118 |
| Pri Pond near Lawton, Mich | | | 300 |
| North Branch Tobacco River near Hatton, Mich | | | 2,000 |
| Centennial Mill and Pokagan Creek near Lagrange, Mich | | | 722 |
| Big Black Creek in Muskegon County, Mich | | | 500 |
| Big Bear Creek in Muskegon County, Mich | | | 400 |
| Little Bear Creek in Muskegon County, Mich | | | 100 |
| Pere Marquette River in Newaygo County, Mich | | | 1,000 |
| Little Manistee River in Newaygo County, Mich | | | 500 |
| Crooked Creek near Coldwater, Mich | | | 500 |
| Applicants in Michigan | | | 150 |
| Salt Peter Creek, near Rexville, N. Y | | | 200 |
| Local streams in Sullivan County, N. Y | | | 1,200 |
| Charlotte Creek near Oneonta, N. Y | | | 500 |
| Tawawa Lake near Sidney, Ohio | | | 500 |
| Applicants in Ohio | | | 268 |
| Columbia Creek near Troy, Pa | | | 300 |
| Lackawaxen River in Wayne County, Pa | | | 500 |

*Details of distribution, 1893-94*—Continued.

| Disposition. | Eggs. | Fry. | Adults and yearlings. |
|---|---|---|---|
| *Von Behr trout*—Continued. | | | |
| Applicants in Pennsylvania | | | 500 |
| Mill Brook near South Pomfret, Vt | | | 1,000 |
| Big Spring near Leesburg, Va | | | 85 |
| Gauley River in Fayette County, W. Va | | | 1,000 |
| Rush River near Baldwin, Wis | | | 300 |
| Middle Inlet near Amberg, Wis | | | 800 |
| North Branch near Farmington, Wis | | | 1,400 |
| Main Creek near Bangor, Wis | | | 300 |
| *Black-spotted trout:* | | | |
| Frying Pan Creek in Pitkin County, Colo | | | 1,200 |
| Eagle County, Colo | | | 1,300 |
| Upper Boulder Creek near Central City, Colo | | | 2,000 |
| Mammoth Creek near Central City, Colo | | | 2,000 |
| Lake Creek near Twin Lakes, Colo | | | 500 |
| Spring Brook near Carbondale, Colo | | | 500 |
| Tomichi Creek near Sargent, Colo | | | 1,800 |
| Rito Alto Creek near Moffat, Colo | | | 800 |
| Spring Creek near Sheridan, S. Dak | | | 900 |
| *Brook trout;* | | | |
| Troutdale Fish Farm, Mammoth Spring, Ark | 5,000 | | |
| John G. Bailey, Rogers, Ark | 5,000 | | |
| Hampshire Trout Club, Northampton, Mass | 10,000 | | |
| Minnesota Fish Commission | 20,000 | | |
| Nebraska Fish Commission | 20,000 | | |
| W. H. Vansickle, Bevans, N. J | 10,000 | | |
| Vermont Fish Commission | 20,000 | | |
| A. P. Muzz, New Richmond, Wis | 5,000 | | |
| Government of Switzerland | 20,000 | | |
| J. J. Armistead, Killywhan, Scotland | 20,000 | | |
| Lieut. H. R. Lemly, U. S. of Colombia, South America | 3,000 | | |
| Rock Creek in Lake County, Colo | | 3,000 | |
| Lake Creek in Lake County, Colo | | 2,500 | |
| Arkansas River near Arkansas Junction, Colo | | 2,500 | |
| Upper Lake in Lake County, Colo | | 15,000 | |
| Spring Brook near Laporte, Ind | | 2,000 | |
| Chamberlain Lake near South Bend, Ind | | 1,000 | |
| Almshouse Run near Hagerstown, Md | | 7,000 | |
| Creek near Dexter, Mich | | 2,000 | |
| Wells Creek near Schoolcraft, Mich | | 1,000 | |
| Washington River in Houghton County, Mich | | 10,000 | |
| North River near Staunton, Va | | 12,000 | |
| Arkansas River near Boulevard, Colo | | | 1,900 |
| Los Pinos Creek near Osier, Colo | | | 1,250 |
| Mill Creek near Idaho Springs, Colo | | | 2,000 |
| Fall River near Idaho Springs, Colo | | | 2,000 |
| South Platte River in Park County, Colo | | | 4,500 |
| South Boulder Creek near Central City, Colo | | | 2,000 |
| Jennie Lind Creek near Central City, Colo | | | 2,000 |
| Lake Creek in Lake County, Colo | | | 500 |
| Upper Twin Lakes in Lake County, Colo | | | 1,000 |
| Lower Evergreen Lake in Lake County, Colo | | | 2,000 |
| Lake Creek in Lake County, Colo | | | 500 |
| Crystal River near Carbondale, Colo | | | 500 |
| Tomichi Creek near Sargent, Colo | | | 400 |
| Gunnison, Colo | | | 2,500 |
| East River near Almont, Colo | | | 850 |
| Greenhorn River near Graneros, Colo | | | 500 |
| Roaring Fork River in Eagle County, Colorado | | | 1,000 |
| Applicants in Colorado | | | 800 |
| Hammonasset River near Madison, Conn | | | 700 |
| Whitlock Brook near South Norwalk, Conn | | | 240 |
| Jacks Brook in Litchfield County, Conn | | | 500 |
| Burr Oak Creek near Osage, Iowa | | | 200 |
| Craig Pond near East Orland, Me | | | 4,505 |
| Applicants in Maryland | | | 400 |
| Trout Brook near North Pembroke, Mass | | | 800 |
| Sweetwater Creek near Stearns, Mich | | | 500 |
| West Branch Donnaber Creek near Wingleton, Mich | | | 500 |
| Poquetts Creek in Lake County, Mich | | | 500 |
| Avery Creek near Cherry Valley, Mich | | | 1,000 |
| Spring Lake near Wingleton, Mich | | | 300 |
| Dannanber Creek near Wingleton, Mich | | | 500 |
| Mill Creek in Lake County, Mich | | | 800 |
| Baldwin Creek near Baldwin, Mich | | | 800 |
| Cedar Creek near Baldwin, Mich | | | 500 |
| Pickerel Creek near Baldwin, Mich | | | 800 |
| Sweetwater Creek near Branch, Mich | | | 500 |
| Sanborn Creek near Nirvana, Mich | | | 500 |
| Branch Pere Marquette River near Nirvana, Mich | | | 1,000 |
| Dock and Tom Creek near Lake Station, Mich | | | 800 |
| Chippewa River near Chippewa, Mich | | | 1,000 |
| South Branch Tobacco River near Clare, Mich | | | 2,000 |

*Details of distribution, 1893-94*—Continued.

| Disposition. | Eggs. | Fry. | Adults and yearlings. |
|---|---|---|---|
| *Brook trout*—Continued. | | | |
| Star Lake near Wingleton, Mich | | | 2,000 |
| Middle Branch of Tobacco River near Farwell, Mich | | | 800 |
| Willow Creek near Farwell, Mich | | | 1,000 |
| Indian Lake near Dowagiac, Mich | | | 300 |
| Keshy Brook near Milford, Mich | | | 100 |
| Glenwood Lake near Jefferson City, Mont | | | 500 |
| Buffalo and Travis creeks near Helena, Mont | | | 500 |
| Applicants in Montana | | | 500 |
| Nebraska | | | 250 |
| Merrimac River near Hudson, N. H | | | 400 |
| Pecos River near Las Vegas, N. Mex | | | 500 |
| Tesuque River near Santa Fe, N. Mex | | | 1,000 |
| Musconetcong River near Trenton, N. J | | | 900 |
| Applicants in New Jersey | | | 200 |
| Crum Creek near Congers, N. Y | | | 425 |
| Sauquoit Creek near Waterville, N. Y | | | 800 |
| Bridgewater Stream near Bridgewater, N. Y | | | 500 |
| Beaver Meadow Creek near Cutting, N. Y | | | 500 |
| Little Broken Straw Creek near Clymer, N. Y | | | 500 |
| Unadilla River near West Winfield, N. Y | | | 800 |
| Little Moose Lake near Wilmurt, N. Y | | | 1,000 |
| Oriskany Creek near Waterville, N. Y | | | 500 |
| Ragged Lake near Owls Head, N. Y | | | 990 |
| Harvey Creek near Nanticoke, Pa | | | 500 |
| Roaring Brook near Scranton, Pa | | | 500 |
| Walker Creek near Herrick Center, Pa | | | 200 |
| Corey Creek near Herrick Center, Pa | | | 200 |
| Price Creek near Herrick Center, Pa | | | 200 |
| Lee Creek near Herrick Center, Pa | | | 200 |
| McGonegal Creek near Herrick Center, Pa | | | 200 |
| Patterson Creek near Herrick Center, Pa | | | 200 |
| Tingley Creek near Herrick Center, Pa | | | 200 |
| Bowell Creek near Herrick Center, Pa | | | 200 |
| Brookings Creek near Herrick Center, Pa | | | 200 |
| Barnes Creek near Herrick Center, Pa | | | 200 |
| Dunns Creek near Herrick Center, Pa | | | 200 |
| Johnson Creek near Pleasant Mount, Pa | | | 200 |
| Applicants in Pennsylvania | | | 200 |
| Battle Creek near Hermosa, Pa | | | 500 |
| Dotham Pond near Hartford, Vt | | | 500 |
| Lake Witchel near North Pomfret, Vt | | | 600 |
| Ottaqueechy River near Sherburne, Vt | | | 1,000 |
| Lakota Lake near Woodstock, Vt | | | 500 |
| Big Spring near Leesburg, Va | | | 69 |
| Eighteen Mile Creek near Pratt, Wis | | | 800 |
| Kinnickinnick River near River Falls, Wis | | | 1,000 |
| Local stream near West Salem, Wis | | | 500 |
| Bear Creek near Rice Lake, Wis | | | 1,000 |
| Shoshone Creek in Yellowstone National Park, Wyo | | | 4,500 |
| *Yellow-finned trout:* | | | |
| Lower Evergreen Lake near Leadville, Colo | | | 700 |
| *Lake trout:* | | | |
| Connecticut Fish Commission | 100,000 | | |
| Massachusetts Fish Commission | 100,000 | | |
| Minnesota Fish Commission | 100,000 | | |
| Nebraska Fish Commission | 100,000 | | |
| New York Fish Commission | 300,000 | | |
| Utah Fish Commission | 100,000 | | |
| Vermont Fish Commission | 300,000 | | |
| Green Lake in Hancock County, Me | | 25,000 | |
| Pretty Lake near Kalamazoo, Mich | | 2,000 | |
| Lake Huron off North Point, Mich | | 29,000 | |
| Sugar Island, Mich | | 38,000 | |
| Lake Superior near Fishermans Home, Mich | | 100,000 | |
| Wright Island, Mich | | 100,000 | |
| Rock Harbor, Mich | | 100,000 | |
| Tobin Bay, Mich | | 100,000 | |
| Duncan Bay, Mich | | 100,000 | |
| Washington Harbor, Mich | | 200,000 | |
| Lester Park, Minn | | 40,000 | |
| Two Harbors, Minn | | 200,000 | |
| Beaver Bay, Minn | | 200,000 | |
| Grand Marcus, Minn | | 200,000 | |
| Poplar River, Minn | | 50,000 | |
| Grand Portage, Minn | | 400,000 | |
| Chicago Bay, Minn | | 100,000 | |
| French River, Minn | | 20,000 | |
| Fish Island, Minn | | 100,000 | |
| Eaglenest Lake near Ely, Minn | | 100,000 | |
| Burnside Lake near Ely, Minn | | 50,000 | |
| Trout Lake near Tower, Minn | | 77,000 | |
| Lake Ontario off Cape Vincent, N. Y | | 29,000 | |

*Details of distribution, 1893–94*—Continued.

| Disposition. | Eggs. | Fry. | Adults and yearlings. |
|---|---|---|---|
| *Lake trout*—Continued. | | | |
| Lake Erie on North Bass Island Reef, Ohio | | 79,000 | |
| Peach Point Reef, Ohio | | 42,000 | |
| Lake Superior near Bayfield, Wis | | 300,000 | |
| Hudson Lake near South Bend, Ind | | | 1,000 |
| Lake in Franklin Park, Columbus, Ohio | | | 300 |
| Lake Maxinkuckee near Marmont, Ind | | | 3,000 |
| Heart Pond near East Orland, Me | | | 19 |
| East Orland, Me | | | 17 |
| Lake Huron near Thunder Bay, Mich | | | 145 |
| off North Point, Mich | | | 6,823 |
| Star Lake in Saginaw, Mich | | | 2,000 |
| Bitter Root River near Hamilton, Mich | | | 780 |
| Ragged Lake near Owls Head, N. Y | | | 1,996 |
| Pundersons Lake near Burton, Ohio | | | 1,810 |
| Lake Winola near Falls, Pa | | | 1,000 |
| Beech Lake near Honesdale, Pa | | | 500 |
| *Whitefish:* | | | |
| Connecticut Fish Commission | 200,000 | | |
| New York Fish Commission | 6,000,000 | | |
| Lake Superior off Fish Island, Mich | | 990,000 | |
| Siskowit Lake, Isle Royal, Mich | | 1,000,000 | |
| Lake Michigan near Naubinway, Mich | | 750,000 | |
| Epoufette, Mich | | 750,000 | |
| Charlevoix, Mich | | 2,000,000 | |
| Manistique, Mich | | 2,000,000 | |
| Lake Huron near East Tawas, Mich | | 1,000,000 | |
| Detour Passage, Mich | | 1,500,000 | |
| Lake Huron off Miller Point, Mich | | 1,000,000 | |
| Sturgeon Point, Mich | | 1,000,000 | |
| Thunder Bay Island, Mich | | 1,050,000 | |
| Whitefish Lake in Mackinac County, Mich | | 2,000,000 | |
| Lake Superior near Duluth, Minn | | 200,000 | |
| Lake Ontario near Oswego, N. Y | | 1,900,000 | |
| Sackets Harbor, N. Y | | 1,900,000 | |
| Lake Erie on North Bass Island Reef, Ohio | | 4,340,000 | |
| Rattlesnake Island Reef, Ohio | | 4,420,000 | |
| Ballast Island Reef, Ohio | | 3,900,000 | |
| Green Island Reef, Ohio | | 2,600,000 | |
| Middle Bass Island Reef, Ohio | | 2,500,000 | |
| Peach Point Reef, Ohio | | 1,250,000 | |
| Starve Island Reef, Ohio | | 700,000 | |
| Kelly Island Reef, Ohio | | 1,000,000 | |
| Mouse Island Reef, Ohio | | 1,000,000 | |
| Lake Superior near Bayfield, Wis | | 4,000,000 | |
| Iron River, Wis | | 2,000,000 | |
| Raspberry Bay, Wis | | 2,000,000 | |
| Lake Erie on North Bass Island Reef, Ohio | | 5,450,000 | |
| Rattlesnake Island Reef, Ohio | | 7,230,000 | |
| Green Island Reef, Ohio | | 1,500,000 | |
| Middle Bass Island Reef, Ohio | | 1,600,000 | |
| Peach Point Reef, Ohio | | 3,125,000 | |
| Ballast Island Reef, Ohio | | 3,300,000 | |
| Starve Island Reef, Ohio | | 2,400,000 | |
| Kelley Reef, Ohio | | 3,400,000 | |
| Mouse Island Reef, Ohio | | 2,000,000 | |
| *Pike perch:* | | | |
| Long Lake near Albion, Ind | | 500,000 | |
| High Lake near Albion, Ind | | 500,000 | |
| Pretty Lake near Plymouth, Ind | | 1,000,000 | |
| Maxinkuckee Lake near Marmont, Ind | | 2,000,000 | |
| Twin Lakes near Plymouth, Ind | | 1,000,000 | |
| Lake of the Woods near Plymouth, Ind | | 1,000,000 | |
| Blue River near Milltown, Ind | | 200,000 | |
| Long Lake near Lagrange, Ind | | 500,000 | |
| Dallas Lake near Lagrange, Ind | | 500,000 | |
| Atwood Lake near Lagrange, Ind | | 500,000 | |
| Applicants in Indiana | | 200,000 | |
| Salt River near Shepherdsville, Ky | | 1,886,000 | |
| Green River near Bowling Green, Ky | | 1,667,000 | |
| Barren River near Munfordsville, Ky | | 1,647,000 | |
| Applicants in Kentucky | | 100,000 | |
| Pike Lake near Duluth, Minn | | 2,500,000 | |
| Lake Vermilion near Tower, Minn | | 2,500,000 | |
| Harper Lake near Center Village, N. Y | | 500,000 | |
| Owasco Lake near Auburn, N. Y | | 500,000 | |
| Cayuga Lake near Auburn, N. Y | | 500,000 | |
| New York State Fish Commission | 5,000,000 | | |
| Maumee Bay near Toledo, Ohio | | 13,600,000 | |
| Sandusky River near Fremont, Ohio | | 2,500,000 | |
| Sandusky Bay near Sandusky, Ohio | | 10,800,000 | |
| Lake Erie on Rattlesnake Island Reef, Ohio | | 8,400,000 | |
| Put-in-Bay Island Reef, Ohio | | 15,300,000 | |

*Details of distribution, 1893–94*—Continued.

| Disposition. | Eggs. | Fry. | Adults and yearlings. |
|---|---|---|---|
| *Pike perch*—Continued. | | | |
| Lake Erie on Port Clinton Reef, Ohio | | 13,200,000 | |
| Ballast Island Reef, Ohio | | 21,600,000 | |
| Middle Bass Island Reef, Ohio | | 26,700,000 | |
| Peach Point Reef, Ohio | | 15,000,000 | |
| North Bass Island Reef, Ohio | | 7,500,000 | |
| Ohio Fish Commission | | 18,000,000 | |
| Beech Lake near Honesdale, Pa | | 2,000,000 | |
| Chapman Lake near Jermyn, Pa | | 500,000 | |
| Heart Lake near Jermyn, Pa | | 500,000 | |
| Applicants in Pennsylvania | | 2,500,000 | |
| Lake Superior near Port Wing, Wis | | 3,000,000 | |
| *Pike:* | | | |
| Jackson River near Cedar Creek, Va | | | 100 |
| *Yellow perch:* | | | |
| Lake Erie on Put-in-Bay Island Reef, Ohio | | 70,000 | |
| Applicants in District of Columbia | | | 63 |
| Cedar River near Cedar Rapids, Iowa | | | 167 |
| Clark Creek near Skiddy, Kans | | | 20 |
| City reservoir, Winchester, Ky | | | 15 |
| Applicants in Kentucky | | | 25 |
| Pennsylvania | | | 50 |
| *Black bass:* | | | |
| Cahaba River near Selma, Ala | | | 100 |
| Applicants in Alabama | | | 240 |
| Arkansas | | | 100 |
| District of Columbia | | | 357 |
| East Lake near Atlanta, Ga | | | 200 |
| Applicants in Georgia | | | 367 |
| Fox River near St. Charles, Ill | | | 197 |
| Elgin, Ill | | | 150 |
| Geneva, Ill | | | 50 |
| Lake Sibley near Sibley, Ill | | | 22 |
| Kiswaukee River near Belvidere, Ill | | | 50 |
| Applicants in Illinois | | | 333 |
| Long Lake near Miller, Ind | | | 95 |
| Applicants in Indiana | | | 210 |
| Lime Creek near Mason City, Iowa | | | 50 |
| Bishop Lake near Sheldon, Iowa | | | 50 |
| Cedar River near Cedar Rapids, Iowa | | | 400 |
| Badger River near Fayette, Iowa | | | 25 |
| Upper Iowa River near Decorah, Iowa | | | 87 |
| Otter Creek near Oelwein, Iowa | | | 100 |
| Twin Lakes near Rockwell City, Iowa | | | 100 |
| Storm Lake near Storm Lake, Iowa | | | 100 |
| Maquoketa River near Manchester, Iowa | | | 75 |
| Iowa River near Lime Spring, Iowa | | | 50 |
| Iowa River near Chester, Iowa | | | 25 |
| Cedar River near Osage, Iowa | | | 25 |
| Iowa Fish Commission | | | 100 |
| Applicants in Iowa | | | 75 |
| Clark Creek near Skiddy, Kans | | | 50 |
| Lake View near Lawrence, Kans | | | 200 |
| Applicants in Kansas | | | 602 |
| Lake Reba near Richmond, Ky | | | 100 |
| Clark County Fishing Club, Winchester, Ky | | | 200 |
| Clear Creek near Shelbyville, Ky | | | 50 |
| City Reservoir, Winchester, Ky | | | 50 |
| Middleboro, Ky | | | 50 |
| Fleming Creek near Flemingsburg, Ky | | | 50 |
| Kinney Creek near Vanceburg, Ky | | | 50 |
| South Licking River near Cynthiana, Ky | | | 50 |
| Tygart Creek near Olive Hill, Ky | | | 100 |
| Nolin River near Hodgenville, Ky | | | 150 |
| Clarkston Lake near Elizabethtown, Ky | | | 100 |
| Billys Creek near Elizabethtown, Ky | | | 75 |
| Blue Spring near Cecilian, Ky | | | 50 |
| Big Clifty Creek near Clifty, Ky | | | 75 |
| Caney Creek near Spring Creek Station, Ky | | | 75 |
| Mud River near Russellville, Ky | | | 100 |
| Pond River near Bakersport, Ky | | | 75 |
| Tradewater River near Dawson, Ky | | | 50 |
| Lake Slough near Kuttawa, Ky | | | 200 |
| Little River near Cerulean Springs, Ky | | | 75 |
| Asylum Lake, Lakeland, Ky | | | 200 |
| South Park Lake near South Park, Ky | | | 50 |
| Harrods Creek, Ky | | | 200 |
| Rolling Fork, branch of Salt River, Ky | | | 450 |
| Green River near Hustonville, Ky | | | 300 |
| Dix River near Danville, Ky | | | 340 |
| Knob Lick Creek near Junction City, Ky | | | 150 |
| Crystal Lake near Covington, Ky | | | 75 |
| Applicants in Kentucky | | | 1,852 |

*Details of distribution, 1893–94*—Continued.

| Disposition. | Eggs. | Fry. | Adults and yearlings. |
|---|---|---|---|
| *Black bass*—Continued. | | | |
| Bayou Robert near Moreland, La | | | 230 |
| Applicants in Louisiana | | | 30 |
| St. Catherine Lake near Mount Hope, Md | | | 30 |
| Patapsco River near Glenn Falls, Md | | | 100 |
| Patuxent River near Laurel, Md | | | 100 |
| Applicants in Maryland | | | 100 |
| Dodgewell Pond near Attleboro, Mass | | | 30 |
| Hebron Pond near Attleboro, Mass | | | 30 |
| Applicants in Massachusetts | | | 130 |
| Magruder Lake near Canton, Miss | | | 100 |
| Applicants in Mississippi | | | 220 |
| Lake View near Nevada, Mo | | | 30 |
| Moreau Creek near Jefferson City, Mo | | | 300 |
| Applicants in Missouri | | | 25 |
| Ireland Mill Pond near Bridgeton, N. J | | | 100 |
| Crosswicks Creek near Crosswick, N. J | | | 100 |
| Applicants in New Jersey | | | 460 |
| Johnson Creek near County Line, N. Y | | | 50 |
| Lake Wiley near Charlotte, N. C | | | 100 |
| Broad River in Rutherford County, N. C | | | 100 |
| Pig Run near Rocky Mount, N. C | | | 100 |
| Union Mill Pond near Mebane, N. C | | | 100 |
| Pond on Sandy Creek near Henderson, N. C | | | 100 |
| Ten Mile Pond near Flat Rock, N. C | | | 50 |
| Yadkin River near Patterson, N. C | | | 100 |
| Applicants in North Carolina | | | 590 |
| Stone Lake near North Bend, Ohio | | | 125 |
| City reservoir near Bellevue, Ohio | | | 100 |
| Middle Fork of Little Beaver River near New Lisbon, Ohio | | | 100 |
| Bass Lake near Chardon, Ohio | | | 100 |
| Tinkers Creek near Bedford, Ohio | | | 75 |
| Cuyahoga River near Shalersville, Ohio | | | 75 |
| Lake tributary to Cuyahoga River near Shalersville, Ohio | | | 75 |
| Wills Creek near Coshocton, Ohio | | | 100 |
| Xenia Water Company Reservoir, Xenia, Ohio | | | 100 |
| Applicants in Ohio | | | 1,425 |
| Oregon | | | 50 |
| Beaver River near Beaver Falls, Pa | | | 200 |
| Local creek near Bedford, Pa | | | 100 |
| Simemahoning Creek near Winterburn, Pa | | | 300 |
| Lake near Yardley, Pa | | | 50 |
| Applicants in Pennsylvania | | | 130 |
| Seneca River near Seneca, S. C | | | 100 |
| Broad River near Alston, S. C | | | 30 |
| Ocall River near Parksville, Tenn | | | 100 |
| Lake Wildwood near Cleveland, Tenn | | | 100 |
| Clinch River near Clinton, Tenn | | | 386 |
| Emory River near Harriman, Tenn | | | 200 |
| Obed River near Lancing, Tenn | | | 100 |
| New River and tributaries near Helenwood, Tenn | | | 400 |
| Pigeon River near Knoxville, Tenn | | | 100 |
| Duck River near Wartrace, Tenn | | | 50 |
| Applicants in Tennessee | | | 170 |
| Mountney Lake near, Gainesville, Tex | | | 15 |
| Chesley Tank near Cisco, Tex | | | 50 |
| Palo Dowra Creek near Amarillo, Tex | | | 50 |
| Tulia Creek near Amarillo, Tex | | | 50 |
| Running Water Creek near Amarillo, Tex | | | 30 |
| Austin Rod and Gun Club, Austin, Tex | | | 100 |
| Applicants in Texas | | | 587 |
| Clinch River near Tazewell, Va | | | 200 |
| Rivanna River near Proffit, Va | | | 200 |
| Falling River and Seneca Creek near Lynchburg, Va | | | 100 |
| Jackson River near Cedar Creek, Va | | | 100 |
| Cowpasture River near Millboro, Va | | | 100 |
| Rappahannock River near Fredericksburg, Va | | | 199 |
| South Anne River near Ashland, Va | | | 100 |
| Applicants in Virginia | | | 480 |
| Shepherd Lake near Cheney, Wash | | | 50 |
| Clear Lake near Cheney, Wash | | | 50 |
| Lake near Hamilton, Wash | | | 150 |
| Lake Padden near Fairhaven, Wash | | | 125 |
| Applicants in Washington | | | 175 |
| Cheat River near Morgantown, W. Va | | | 149 |
| Gauley River near Camden on Gauley, W. Va | | | 1,000 |
| Applicants in West Virginia | | | 50 |
| Gibbon River in Yellowstone National Park, Wyo | | | 250 |
| *Rock bass:* | | | |
| Oxford Lake near Anniston, Ala | | | 100 |
| Applicants in Alabama | | | 150 |
| Arkansas | | | 1,100 |

*Details of distribution, 1893–94*—Continued.

| Disposition. | Eggs. | Fry. | Adults and yearlings. |
|---|---|---|---|
| *Rock bass*—Continued. | | | |
| Applicants in Delaware | | | 500 |
| Georgia | | | 725 |
| Georgia Fish Commission | | | 600 |
| Applicants in Illinois | | | 30 |
| Indian Territory | | | 1,000 |
| Kansas | | | 800 |
| Lake Reba near Richmond, Ky | | | 500 |
| Patuxent River near Laurel, Md | | | 1,000 |
| Applicants in Maryland | | | 200 |
| Missouri | | | 640 |
| Mississippi | | | 600 |
| Nebraska | | | 300 |
| North Carolina | | | 2,975 |
| Oklahoma | | | 100 |
| Pennsylvania | | | 490 |
| Allegheny River near Warren, Pa | | | 500 |
| Susquehanna River near Williamsport, Pa | | | 1,000 |
| Sinnemahoming River near Clearfield, Pa | | | 300 |
| Applicants in South Carolina | | | 930 |
| Tarra Blanco Creek near Amarillo, Tex | | | 200 |
| Applicants in Texas | | | 600 |
| State Capitol Ponds, Nashville, Tenn | | | 200 |
| Applicants in Virginia | | | 2,661 |
| Cove Creek near Wytheville, Va | | | 300 |
| Applicants in Tennessee | | | 600 |
| *Warmouth bass:* | | | |
| Applicants in Illinois | | | 100 |
| Fox River near St. Charles, Ill | | | 50 |
| Pine Lake near Laporte, Ind | | | 525 |
| Long Lake near Miller, Ind | | | 75 |
| Applicants in Indiana | | | 50 |
| Cedar River near Cedar Rapids, Iowa | | | 50 |
| Upper Iowa River near Decorah, Iowa | | | 104 |
| Otter Creek near Oelwein, Iowa | | | 150 |
| Twin Lakes near Rockwell City, Iowa | | | 100 |
| Storm Lake near Storm Lake, Iowa | | | 150 |
| Maquoketa River near Manchester, Iowa | | | 75 |
| Lake View near Lawrence, Kans | | | 100 |
| Mud River near Russellville, Ky | | | 75 |
| Lake Dlough near Kuttawa, Ky | | | 69 |
| Applicants in Kentucky | | | 75 |
| Patuxent River near Laurel, Md | | | 90 |
| Applicants in Massachusetts | | | 38 |
| Ohio | | | 50 |
| Texas | | | 235 |
| *Crappie:* | | | |
| Fox River near St. Charles, Ill | | | 217 |
| Elgin, Ill | | | 145 |
| Geneva, Ill | | | 40 |
| Lake Sibley near Sibley, Ill | | | 81 |
| Kishwaukee River near Belvidere, Ill | | | 40 |
| Applicants in Illinois | | | 483 |
| Pine Lake near Laporte, Ind | | | 2,350 |
| Applicants in Indiana | | | 375 |
| Storm Lake near Storm Lake, Iowa | | | 150 |
| Otter Creek near Oelwein, Iowa | | | 175 |
| Badger River near Fayette, Iowa | | | 50 |
| Upper Iowa River near Decorah, Iowa | | | 275 |
| Cedar River near Cedar Rapids, Iowa | | | 400 |
| Iowa River near Chester, Iowa | | | 25 |
| Lyons Creek near Junction City, Kans | | | 25 |
| Applicants in Kansas | | | 474 |
| Nolin River near Hodgenville, Ky | | | 150 |
| Clarkston Lake near Elizabethtown, Ky | | | 100 |
| Billys Creek near Elizabethtown, Ky | | | 75 |
| Big Clifty Creek near Clifty, Ky | | | 75 |
| Caney Creek near Spring Creek Station, Ky | | | 75 |
| Mud River near Russellville, Ky | | | 100 |
| Pond River near Bakersport, Ky | | | 75 |
| Drake Creek near Hortonville, Ky | | | 75 |
| Tradewater River near Dawson, Ky | | | 50 |
| Lake Dlough near Kuttawa, Ky | | | 250 |
| Muddy Fork near Kuttawa, Ky | | | 75 |
| Little River near Cerulean Springs, Ky | | | 75 |
| Otter Creek near Cerulean Springs, Ky | | | 100 |
| Reservoir near Winchester, Ky | | | 15 |
| Middleboro, Ky | | | 25 |
| Kinney Creek, near Vanceburg, Ky | | | 25 |
| South Licking near River Cynthiana, Ky | | | 25 |
| Applicants in Kentucky | | | 400 |
| Lake View near Nevada, Mo | | | 6 |
| Applicants in Missouri | | | 300 |

*Details of distribution, 1893–94*—Continued.

| Disposition. | Eggs. | Fry. | Adults and yearlings. |
|---|---|---|---|
| *Crappie*—Continued. | | | |
| Applicants in New York | | | 100 |
| Johnson Creek near county line, N. Y | | | 50 |
| Applicants in Ohio | | | 40 |
| Codorus Creek near Brodbecks, Pa | | | 17 |
| French Creek near Phœnixville, Pa | | | 50 |
| Moutney Lake near Gainesville, Tex | | | 20 |
| Applicants in Texas | | | 515 |
| Jackson River near Cedar Creek, Va | | | 50 |
| *Sunfish:* | | | |
| Lime Creek near Mason City, Iowa | | | 50 |
| Bishop Lake, Sheldon, Iowa | | | 50 |
| Pine Lake near Laporte, Ind | | | 20 |
| Applicants in Ohio | | | 50 |
| *Cod:* | | | |
| Vineyard Sound off the Massachusetts coast | | 1,254,000 | |
| Massachusetts Bay off Gloucester Harbor, Mass | | 24,617,000 | |
| *Haddock:* | | | |
| Massachusetts Bay off Gloucester Harbor, Mass | | 19,500 | |
| *Flatfish:* | | | |
| Vineyard Sound off the Massachusetts coast | | 1,795,000 | |
| *Lobster:* | | | |
| Vineyard Sound off the Massachusetts coast | | 69,066,000 | |
| Massachusetts Bay off Gloucester Harbor, Mass | | 9,332,000 | |
| Total | 24,123,000 | 424,320,500 | 1,867,043 |

*Résumé by States and Territories of the distribution and assignment of fish and fish eggs.*

| State or Territory. | Species. | Eggs. | Fry. | Adults and yearlings. |
|---|---|---|---|---|
| Alabama | Carp | | | 575 |
| | Goldfish | | | 48 |
| | Rainbow trout | | | 975 |
| | Black bass | | | 340 |
| | Rock bass | | | 250 |
| Arkansas | Carp | | | 611 |
| | Tench | | | 500 |
| | Goldfish | | | 124 |
| | Golden ide | | | 100 |
| | Rainbow trout | 17,000 | | 10,900 |
| | Von Behr trout | 5,000 | | |
| | Brook trout | 10,000 | | |
| | Black bass | | | 100 |
| | Rock bass | | | 1,100 |
| California | Carp | | | 18 |
| | Quinnat salmon | 7,500,000 | 438,500 | |
| | Silver salmon | | 280,000 | |
| | Steelhead trout | 50,000 | 308,500 | |
| | Loch Leven trout | 20,000 | | |
| | Rainbow trout | | | 5,400 |
| Colorado | Carp | | | 30 |
| | Goldfish | | | 24 |
| | Golden ide | | | 125 |
| | Loch Leven trout | | | 14,500 |
| | Rainbow trout | | 11,000 | 475 |
| | Von Behr trout | | | 1,450 |
| | Black-spotted trout | | | 10,100 |
| | Yellow-finned trout | | | 700 |
| | Brook trout | | 23,000 | 26,200 |
| Connecticut | Carp | | | 390 |
| | Goldfish | | | 30 |
| | Shad | | 3,044,000 | |
| | Atlantic salmon | 25,000 | | |
| | Landlocked salmon | | | 300 |
| | Von Behr trout | 20,000 | | 310 |
| | Brook trout | | | 1,440 |
| | Lake trout | 100,000 | | |
| | Whitefish | 200,000 | | |
| Delaware | Carp | | | 60 |
| | Goldfish | | | 48 |
| | Shad | | 1,780,000 | |
| | Rock bass | | | 500 |
| District of Columbia | Spotted catfish | | | 10 |
| | Carp | | | 1,992 |
| | Goldfish | | | 6,771 |

*Résumé of the distribution and assignment of fish and fish eggs*—Continued.

| State or Territory. | Species. | Eggs. | Fry. | Adults and yearlings. |
|---|---|---|---|---|
| District of Columbia | Golden ide | | | 91 |
| | Golden tench | | | 50 |
| | Shad | | 469,000 | 1,000,000 |
| | Rainbow trout | | | 97 |
| | Yellow perch | | | 63 |
| | Black bass | | | 357 |
| Florida | Carp | | | 364 |
| | Goldfish | | | 74 |
| | Golden ide | | | 50 |
| | Shad | | 2,250,000 | |
| Georgia | Carp | | | 4,489 |
| | Tench | | | 4,000 |
| | Goldfish | | | 168 |
| | Golden ide | | | 150 |
| | Shad | | 2,417,000 | |
| | Rainbow trout | | | 200 |
| | Black bass | | | 567 |
| | Rock bass | | | 1,325 |
| Idaho | Spotted catfish | | | 100 |
| | Carp | | | 60 |
| Illinois | Spotted catfish | | | 2,800 |
| | Carp | | | 150 |
| | Goldfish | | | 310 |
| | Golden ide | | | 37 |
| | Golden tench | | | 6 |
| | Rainbow trout | | | 725 |
| | Black bass | | | 802 |
| | Rock bass | | | 30 |
| | Warmouth bass | | | 150 |
| | Crappie | | | 1,006 |
| Indiana | Spotted catfish | | | 375 |
| | Carp | | | 90 |
| | Goldfish | | | 127 |
| | Golden tench | | | 12 |
| | Golden ide | | | 25 |
| | Loch Leven trout | | | 2,300 |
| | Rainbow trout | | | 1,700 |
| | Von Behr trout | | | 1,000 |
| | Brook trout | | 3,000 | |
| | Lake trout | | | 4,000 |
| | Pike perch | | 7,900,000 | |
| | Black bass | | | 335 |
| | Warmouth bass | | | 650 |
| | Crappie | | | 2,725 |
| | Sunfish | | | 20 |
| Indian Territory | Carp | | | 575 |
| | Tench | | | 1,100 |
| | Goldfish | | | 24 |
| | Rock bass | | | 1,000 |
| Iowa | Spotted catfish | | | 9,642 |
| | Carp | | | 340 |
| | Tench | | | 165 |
| | Goldfish | | | 210 |
| | Golden tench | | | 2 |
| | Rainbow trout | | | 2,227 |
| | Von Behr trout | | | 2,125 |
| | Brook trout | | | 200 |
| | Yellow perch | | | 167 |
| | Black bass | | | 1,262 |
| | Warmouth bass | | | 629 |
| | Crappie | | | 1,075 |
| | Sunfish | | | 100 |
| Kansas | Spotted catfish | | | 1,099 |
| | Carp | | | 1,001 |
| | Tench | | | 100 |
| | Goldfish | | | 192 |
| | Golden ide | | | 8 |
| | Rainbow trout | | | 9,900 |
| | Yellow perch | | | 20 |
| | Black bass | | | 852 |
| | Rock bass | | | 800 |
| | Warmouth bass | | | 100 |
| | Crappie | | | 499 |
| Kentucky | Spotted catfish | | | 1,190 |
| | Carp | | | 320 |
| | Goldfish | | | 84 |
| | Rainbow trout | | | 1,150 |
| | Von Behr trout | | | 300 |
| | Pike perch | | 6,200,000 | |
| | Yellow perch | | | 40 |
| | Black bass | | | 5,342 |
| | Rock bass | | | 500 |

*Résumé of the distribution and assignment of fish and fish eggs*—Continued.

| State or Territory. | Species. | Eggs. | Fry. | Adults and yearlings. |
|---|---|---|---|---|
| Kentucky | Warmouth bass | | | 219 |
| Louisiana | Crappie | | | 1,765 |
| | Carp | | | 190 |
| | Goldfish | | | 419 |
| | Golden ide | | | 100 |
| Maine | Black bass | | | 260 |
| | Carp | | | 30 |
| | Goldfish | | | 14 |
| | Atlantic salmon | | | 235,306 |
| | Landlocked salmon | 10,000 | 6,000 | 130,058 |
| | Loch Leven trout | | | 20,714 |
| | Rainbow trout | | 500 | 771 |
| | Von Behr trout | | | 24,146 |
| | Brook trout | | | 4,505 |
| | Lake trout | | 25,000 | 36 |
| Maryland | Carp | | | 610 |
| | Tench | | | 60 |
| | Goldfish | | | 360 |
| | Golden ide | | | 24 |
| | Golden tench | | | 24 |
| | Shad | 355,000 | 12,006,000 | |
| | Landlocked salmon | | 2,500 | |
| | Rainbow trout | 2,500 | 24,000 | 4,064 |
| | Von Behr trout | | | 118 |
| | Brook trout | | 7,000 | 400 |
| | Black bass | | | 330 |
| | Rock bass | | | 1,200 |
| | Warmouth bass | | | 90 |
| Massachusetts | Carp | | | 260 |
| | Goldfish | | | 74 |
| | Golden ide | | | 24 |
| | Landlocked salmon | 6,000 | | |
| | Von Behr trout | | | 1,300 |
| | Brook trout | 10,000 | | 800 |
| | Lake trout | 100,000 | | |
| | Black bass | | | 190 |
| | Warmouth bass | | | 38 |
| | Cod | | 25,871,000 | |
| | Haddock | | 19,500 | |
| | Flatfish | | 1,795,000 | |
| | Lobster | | 78,398,000 | |
| Michigan | Carp | | | 780 |
| | Goldfish | | | 60 |
| | Quinnat salmon | | 39,000 | |
| | Loch Leven trout | | 24,000 | 3,000 |
| | Von Behr trout | | | 6,172 |
| | Brook trout | | 13,000 | 16,200 |
| | Lake trout | | 769,500 | 8,968 |
| | Whitefish | | 15,040,000 | |
| Minnesota | Carp | | | 3,500 |
| | Goldfish | | | 60 |
| | Golden ide | | | 25 |
| | Loch Leven trout | 20,000 | | |
| | Rainbow trout | 42,000 | | |
| | Von Behr trout | 20,000 | | |
| | Brook trout | 20,000 | | |
| | Lake trout | 100,000 | 1,537,000 | |
| | Whitefish | | 200,000 | |
| | Pike perch | | 5,000,000 | |
| Mississippi | Carp | | | 806 |
| | Goldfish | | | 66 |
| | Black bass | | | 320 |
| | Rock bass | | | 600 |
| Missouri | Spotted catfish | | | 450 |
| | Catfish (common) | | | 1,059 |
| | Carp | | | 450 |
| | Tench | | | 2,245 |
| | Goldfish | | | 570 |
| | Golden ide | | | 75 |
| | Rainbow trout | 50,000 | 2,000 | 21,570 |
| | Black bass | | | 575 |
| | Rock bass | | | 640 |
| | Crappie | | | 306 |
| Montana | Carp | | | 740 |
| | Loch Leven trout | | | 1,000 |
| | Brook trout | | | 1,500 |
| | Lake trout | | | 780 |
| Nebraska | Carp | | | 110 |
| | Goldfish | | | 6 |
| | Rainbow trout | 23,000 | | 400 |
| | Brook trout | 20,000 | | 205 |
| | Lake trout | 100,000 | | |

*Résumé of the distribution and assignment of fish and fish eggs*—Continued.

| State or Territory. | Species. | Eggs. | Fry. | Adults and yearlings. |
|---|---|---|---|---|
| Nebraska | Rock bass | | | 300 |
| New Hampshire | Carp | | | 160 |
| | Atlantic salmon | 25,000 | | |
| | Brook trout | | | 400 |
| New Jersey | Carp | | | 280 |
| | Goldfish | | | 120 |
| | Golden ide | | | 15 |
| | Shad | | 1,242,000 | |
| | Landlocked salmon | 5,000 | | |
| | Rainbow trout | | | 650 |
| | Brook trout | 10,000 | | 1,100 |
| | Black bass | | | 660 |
| New Mexico | Carp | | | 484 |
| | Goldfish | | | 12 |
| | Loch Leven trout | | | 800 |
| | Brook trout | | | 1,500 |
| Nevada | Rainbow trout | 40,000 | | |
| New York | Spotted catfish | | | 125 |
| | Carp | | | 10,355 |
| | Tench | | | 4,000 |
| | Goldfish | | | 224 |
| | Golden ide | | | 275 |
| | Shad | 2,000,000 | 6,731,000 | |
| | Atlantic salmon | 60,000 | | |
| | Landlocked salmon | 55,000 | | |
| | Rainbow trout | | | 900 |
| | Von Behr trout | | | 1,000 |
| | Brook trout | | | 6,015 |
| | Lake trout | 300,000 | 29,000 | 1,906 |
| | Whitefish | 6,000,000 | 3,800,000 | |
| | Pike perch | 5,000,000 | 1,500,000 | |
| | Black bass | | | 50 |
| | Crappie | | | 150 |
| North Carolina | Carp | | | 1,218 |
| | Tench | | | 150 |
| | Goldfish | | | 227 |
| | Golden ide | | | 100 |
| | Golden tench | | | 86 |
| | Shad | | 1,640,000 | |
| | Rainbow trout | | 5,000 | 4,860 |
| | Rock bass | | | 2,975 |
| | Black bass | | | 1,240 |
| North Dakota | Carp | | | 186 |
| Ohio | Spotted catfish | | | 25 |
| | Carp | | | 810 |
| | Tench | | | 200 |
| | Goldfish | | | 466 |
| | Golden ide | | | 166 |
| | Loch Leven trout | | | 300 |
| | Rainbow trout | | | 300 |
| | Von Behr trout | | | 768 |
| | Lake trout | | 121,000 | 2,110 |
| | Whitefish | | 21,710,000 | |
| | Lake herring | | 30,005,000 | |
| | Pike perch | | 153,500,000 | |
| | Yellow perch | | 70,000 | |
| | Black bass | | | 2,275 |
| | Warmouth bass | | | 50 |
| | Crappie | | | 40 |
| | Sunfish | | | 50 |
| Oklahoma Territory | Carp | | | 510 |
| | Goldfish | | | 12 |
| | Rock bass | | | 100 |
| Oregon | Carp | | | 30 |
| | Quinnat salmon | | 213,000 | |
| | Black bass | | | 50 |
| Pennsylvania | Carp | | | 720 |
| | Goldfish | | | 838 |
| | Golden ide | | | 115 |
| | Golden tench | | | 18 |
| | Shad | 300,000 | 7,753,000 | |
| | Atlantic salmon | 60,000 | | |
| | Loch Leven trout | | | 3,000 |
| | Rainbow trout | | | 33,153 |
| | Von Behr trout | | | 1,300 |
| | Brook trout | | | 4,100 |
| | Lake trout | | | 1,500 |
| | Pike perch | | 5,500,000 | |
| | Yellow perch | | | 50 |
| | Black bass | | | 780 |
| | Rock bass | | | 2,200 |
| | Crappie | | | 67 |

*Résumé of the distribution and assignment of fish and fish eggs*—Continued.

| State or Territory. | Species. | Eggs. | Fry. | Adults and yearlings. |
|---|---|---|---|---|
| Rhode Island | Carp | | | 7 |
| | Goldfish | | | 12 |
| | Shad | 669,000 | 2,350,000 | |
| South Carolina | Carp | | | 304 |
| | Goldfish | | | 117 |
| | Shad | | 4,055,000 | |
| | Rainbow trout | | | 100 |
| | Black bass | | | 130 |
| | Rock bass | | | 900 |
| South Dakota | Carp | | | 1,910 |
| | Loch Leven trout | | | 2,300 |
| | Black-spotted trout | | | 900 |
| Tennessee | Carp | | | 6,221 |
| | Goldfish | | | 198 |
| | Golden ide | | | 100 |
| | Golden tench | | | 42 |
| | Rainbow trout | | | 11,506 |
| | Black bass | | | 1,606 |
| | Rock bass | | | 800 |
| Texas | Spotted catfish | | | 265 |
| | Carp | | | 1,880 |
| | Tench | | | 5,300 |
| | Goldfish | | | 318 |
| | Golden ide | | | 125 |
| | Rainbow trout | | | 442 |
| | Black bass | | | 882 |
| | Rock bass | | | 800 |
| | Warmouth bass | | | 235 |
| | Crappie | | | 535 |
| Utah | Goldfish | | | 6 |
| | Rainbow trout | 10,000 | | |
| | Lake trout | 100,000 | | |
| Vermont | Landlocked salmon | | | 10,076 |
| | Rainbow trout | 30,000 | | |
| | Von Behr trout | 20,000 | | 1,000 |
| | Brook trout | 20,000 | | 2,600 |
| | Lake trout | 300,000 | | |
| Virginia | Spotted catfish | | | 350 |
| | Carp | | | 3,621 |
| | Goldfish | | | 797 |
| | Golden ide | | | 50 |
| | Golden tench | | | 20 |
| | Shad | | 7,772,000 | |
| | Rainbow trout | | 10,000 | 16,398 |
| | Von Behr trout | | | 85 |
| | Brook trout | | 12,000 | 69 |
| | Pike | | | 100 |
| | Black bass | | | 1,479 |
| | Rock bass | | | 2,961 |
| | Crappie | | | 50 |
| Washington | Spotted catfish | | | 100 |
| | Carp | | | 280 |
| | Black bass | | | 550 |
| West Virginia | Carp | | | 210 |
| | Goldfish | | | 72 |
| | Rainbow trout | | | 5,895 |
| | Von Behr trout | | | 1,000 |
| | Black bass | | | 1,199 |
| Wisconsin | Carp | | | 30 |
| | Goldfish | | | 100 |
| | Loch Leven trout | | | 2,000 |
| | Rainbow trout | | | 2,300 |
| | Von Behr trout | | | 2,800 |
| | Brook trout | 5,000 | | 3,300 |
| | Lake trout | | 300,000 | |
| | Whitefish | | 8,000,000 | |
| | Pike perch | | 3,000,000 | |
| Wyoming | Spotted catfish | | | 25 |
| | Loch Leven trout | | | 1,000 |
| | Rainbow trout | 55,500 | | |
| | Von Behr trout | 15,000 | | |
| | Brook trout | | | 4,500 |
| | Black bass | | | 250 |
| Foreign countries | Golden tench | | | 12 |
| | Landlocked salmon | 3,000 | | |
| | Steelhead trout | 25,000 | | |
| | Loch Leven trout | 25,000 | | |
| | Rainbow trout | 102,000 | | |
| | Von Behr trout | 20,000 | | |
| | Brook trout | 43,000 | | |

# REPORT UPON THE INQUIRY RESPECTING FOOD-FISHES AND THE FISHING-GROUNDS.

By RICHARD RATHBUN, *Assistant in Charge.*

## FUR-SEAL INVESTIGATIONS.

In accordance with a provision of the sundry civil appropriation bill approved March 3, 1893, it was made incumbent upon the Fish Commissioner to continue, under the direction of the Secretary of the Treasury, the annual investigations relative to the conditions of seal life on the Pribilof Islands, which had then been carried on during three seasons; and the Commissioner was also charged with the conduct of further observations respecting the life-history and pelagic habits of the fur-seals. The first of the present series of inquiries on the Pribilof Islands was made during the summer of 1890 by Mr. Henry W. Elliott, a special agent of the Treasury Department, appointed under an act of Congress dated April 5 of that year, which provided for a thorough examination into the status of the fur-seal industry on the seal islands of Alaska, so as to make known its relative condition then as compared with 1872. A novel and important feature of Mr. Elliott's work was the construction of a series of maps showing the precise outlines of each of the breeding and hauling grounds. In 1891, and again in 1892, in connection with the preparation of the case of the United States for the Paris tribunal of arbitration, Mr. J. Stanley-Brown, also acting as a special Treasury agent, conducted corresponding observations, including the delineation of rookery areas occupied by seals, for the convenience of which purpose a set of base maps was prepared and lithographed. An innovation on the part of Mr. Stanley-Brown was the photographing of characteristic parts of each of the rookeries, in order to illustrate graphically the distribution and abundance of the seals upon them.

The summer of 1892 was the last preceding the meeting of the Paris tribunal, and the object in still further continuing the examinations was to provide for maintaining a record of all subsequent changes in the condition of the rookeries, especially under the operations of the Paris award, which had not, however, at that date been concluded. It was, therefore, made a part of the mission of the steamer *Albatross* to repeat the observations of Messrs. Elliott and Stanley-Brown, the naturalist of the steamer, Mr. C. H. Townsend, who had had considerable previous experience with the matter, being specially charged with the conduct of this work. He was stationed at the islands from July 11 to August 18, 1893, and was assisted in the photographic work by

Mr. N. B. Miller. The delineation of the rookeries and the taking of the photographs were all accomplished during the period when seal life was most abundantly represented on the islands—that is to say, when the rookeries had reached their maximum development for the season and before the females had begun their search for food. The views, 46 in number, were taken from the same positions as in 1892, and, so far as the weather permitted, at corresponding dates. The observations related mainly to the abundance of seals as compared with the previous season, the number of bachelor seals available for killing, the effects of long-distance drives and of culling, and the results to be expected from a continuance of pelagic sealing. In accordance with the law, the report of Mr. Townsend was transmitted to the Secretary of the Treasury.

The experience of the *Albatross* in previous years, as well as in 1893, has demonstrated that the pelagic habits of the seals can not be satisfactorily studied by means of so large a vessel, if by a steamer at all, about the only opportunities afforded for examining specimens being on the few occasions when a sealing schooner is boarded. To obviate this difficulty during the season of 1894, arrangements were made before the close of the fiscal year to have Mr. A. B. Alexander accompany one of the vessels actually engaged in pelagic sealing during the open period in the Bering Sea—that is to say, after August 1. The importance of such an undertaking will consist in the advantages to be gained from expert evidence in respect to several of the questions which have given rise to controversy, such as the proportions of each sex found at a distance from the islands, the breeding condition of the females there taken, the feeding habits of the seals, the character of their food, etc.

## OPERATIONS OF THE STEAMER ALBATROSS IN THE NORTH PACIFIC OCEAN AND BERING SEA.

During the summer of 1893 the steamer *Albatross*, Commander Z. L. Tanner, U. S. N., commanding, was attached to the sealing patrol fleet operating in the North Pacific Ocean and Bering Sea under the orders of the Secretary of the Navy. Her instructions also provided for the customary fishery investigations and for those relating to the pelagic habits of the fur-seal, as directed by Congress, which were to be carried on to the extent permitted by the requirements of this special detail. Through the cooperation of the senior naval officer in charge, a considerable amount of time was allotted to these inquiries, but they were necessarily restricted to that part of Bering Sea within the limits of possible pelagic sealing.

Leaving Port Townsend, Wash., on May 24, 1893, the *Albatross* followed along the course taken by the seal herds and the sealing fleet as far as Unalaska, whence she proceeded by way of Bering Sea and Amukta Pass to Adak Island, of the Aleutian chain, arriving at the latter place on July 1, the beginning of the fiscal year. The object of visiting Adak Island was to learn if one of its harbors, the Bay of Waterfalls, was being used as a rendezvous by pelagic sealers and

although no vessels were found there at the time, there were indications that it had been so utilized earlier in the season. After making an examination of the harbor, a line of soundings was carried southeasterly to latitude 50° 03′ N., longitude 174° 30′ W., in order to ascertain if the deep submarine trough occurring to the eastward and running approximately parallel with the trend of the Alaska Peninsula and Aleutian Islands extended to this point. A maximum depth of 4,002 fathoms was found in latitude 50° 28′ N., longitude 175° 10′ W., and only 2,802 fathoms at the end of the line, the depression being again crossed in 3,794 fathoms on the way back to Amukta Pass, thus demonstrating the existence of the trough in this vicinity. The beam trawl was used in Amukta Pass, whence a line of soundings was run to the Pribilof Islands, which were reached on July 10. Mr. C. H. Townsend, accompanied by Mr. N. B. Miller, was at once landed to begin upon the work of delineating and photographing the rookeries, as elsewhere explained, this task not being finally completed until August 18.

Until near the end of July the movements of the *Albatross* were governed chiefly by patrol duty and by the necessity of rendering incidental assistance in connection with the party on the islands, but some fishery and hydrographic inquiries were conducted, more especially to the northwestward of the Pribilofs. Before the close of the month, however, the investigations were taken up on a more comprehensive basis, and they were continued systematically until September 3, although patrol service remained a necessary adjunct of the work. The plan as carried out provided for regular series of observing stations along 13 lines equally distant from one another and radiating from a common center located midway between St. Paul and St. George islands. The length of each of these lines or radii was 225 miles, the area covered being, therefore, circular in shape and 450 miles in diameter; it extended a considerable distance beyond the border of the shallow platform to the south, east, and southeast of the islands, but the bulk of the work was done inside of the 100-fathom curve, which practically marks the outer limit of profitable fishing-grounds.

The inquiries comprised the customary examinations respecting the depth and temperature of the water; the character, condition, and richness of the bottom; the food-fishes of the region, their distribution, abundance, size, quality, etc., and the additional ones relating to the fur-seal. It was found to be impossible, however, to obtain satisfactory results in respect to the pelagic habits of the seal, which, quickly alarmed at the approach of any object, is especially distrustful of a steamer under way, and the most that could be accomplished was to record the positions of those noticed from the deck. Under the circumstances, therefore, it was not considered expedient for the ship to deviate from the regular courses laid out in connection with the fishery work, and the number of seals observed was undoubtedly much smaller than would have been the case had they been hunted for persistently. Seals were seen along 11 of the 13 radiating lines, the most distant

positions being from 180 to 200 miles from the Pribilof Islands in northeasterly, northwesterly, southwesterly, and southerly directions. With respect to their feeding-grounds in August, Commander Tanner makes the following remarks:

The 100-fathom curve from the one hundred and seventieth to the one hundred and seventy-fourth meridian is a favorite feeding-ground, where scattered seals were frequently observed from the decks of the vessel, a sure indication that it would have been a prolific hunting-ground had we hove to and sent out boats. Next to this region, the largest numbers were observed near the northern extremity of radial No. V, and it soon became evident that the August feeding-grounds were to the westward of the meridian of the Pribilof Islands. Earlier in the season they would doubtless have been found in greater numbers east of that meridian, where their food, composed largely of codfish, would still abound in the shoaler waters of eastern Bering Sea.

The restriction of the fishery work to a period of scarcely more than a month's duration made it necessary to so hasten its progress that the fishing trials could not, in most cases, be conducted with sufficient thoroughness to satisfactorily demonstrate the productiveness of the different grounds examined. Notwithstanding this fact, however, the results obtained have enabled Commander Tanner to reach certain conclusions which it is important to note in this connection. So far as known at present, Baird Bank and Slime Bank, in Bristol Bay, described in previous reports, afford the only profitable cod fishing in Bering Sea on a commercial basis, although this species has also been taken to a slight extent on the Kulukak Ground and is sufficiently abundant along the shores of the Aleutian Islands to supply the local demand. With respect to other parts of the sea, Commander Tanner makes the following statement:

Banks have been reported in various parts of Bering Sea, but we have no data at present that would justify a fisherman in visiting them as a commercial venture. A vessel can anchor anywhere inside of the 100-fathom line and by persistent fishing take enough to "fill the decks," to use a common expression, where a mess for all hands has been caught. The same may be done in calm, smooth weather, when the ship is lying dead in the water, yet the locality might be worthless commercially; and, in fact, such is the case over the greater portion of Bering Sea. The search for cod in paying quantities would be confined to spots where the bottom is free from mud, and a glance at the chart will show the prescribed areas where success would be probable.

First, a stretch of 60 miles or more will be observed ESE. (mag.) of St. George Island, in from 70 to 80 fathoms, coarse sand and gravel, and fine dark sand, near the 100-fathom curve. Another spot having favorable indications lies about 50 miles NE. by N. (mag.) from the island, in 40 fathoms, gray sand and rocky, and fine gray sand. A region of considerable area, having promising features, lies from 180 to 200 miles NE. (mag.) of St. Paul Island in from 20 to 30 fathoms, fine gray sand and shells. A spot about 42 miles N. by W. ½ W. (mag.) from northeast point of St. Paul Island has been reported as a bank, and has favorable indications, in about 40 fathoms, sand and gravel. There are other places between the above spot and Nunivak where a certain degree of success might be expected, although our examination did not develop a particularly rich fauna. There is also a region near the 100-fathom curve, in from 70 to 90 fathoms, fine gray sand and rocky bottom, lying from W. by S. to SW. by W. (mag.) of St. Paul Island, which promises well, although the depth is greater than fishermen are in the habit of resorting to in this region.

The report of the fishery expert, Mr. A. B. Alexander, gives the experience of this vessel in fishing with hand lines from the rail, but in considering the results it must be remembered that the vessel was always under way, frequently drifting rapidly before boisterous winds and heavy seas. The duration of trials never exceeded 20 minutes, and other work was frequently carried on when line fishing was impracticable; hence some of the most favorable localities escaped a fair trial with hook and line.

It is reasonable to suppose that the presence of cod varies with the seasons in the shoal waters of Bering Sea, as in other localities, and that they will be found in greater depths as summer approaches. The *Albatross* has never taken halibut in any considerable quantities in Bering Sea, and none of large size. The conditions under which trial lines have been used were particularly unfavorable for the capture of this slow-biting fish. Trawl lines set on favorable bottom near the 100-fathom line would be an interesting experiment, from which good results might be expected to follow.

Incidental to the specific objects of the cruise in Bering Sea, attention was also given, as heretofore, whenever the opportunity offered, to the requirements of navigation, in the direction of perfecting the information relative to harbors, coast lines, the passes between the islands, etc. In view of the dangers attending navigation in this region and the limited surveys hitherto made there, this work can not fail to be of great practical benefit, especially considering the number of vessels which now assemble in Bering Sea every season in connection with the fur-seal fishery. With respect to the principal harbor, located at the entrance to the sea, Commander Tanner summarizes his results as follows:

Great difficulty has frequently been experienced in making Unalaska in thick weather in the absence of soundings, and we have from time to time run lines from the 100-fathom curve to Unalaska Bay, which were supplemented after our departure from Unalaska by a line from Priest Rock, off Kalekhta Point, to the north head of Akutan, and thence to Akun, the route usually followed by steamers between Unimak Pass and Unalaska. These soundings, with others we have made in the vicinity of the Fox Islands, will, when plotted on a chart of large scale, greatly assist the navigator, inasmuch as it will make the lead available.

The work in Bering Sea terminated early in September, and on the 9th of that month the *Albatross* left Unalaska bound south. In accordance with the directions of the senior naval officer, a course was first laid along the south side of the Alaska Peninsula as far as Kadiak for the purpose of intercepting, if possible, certain vessels for violation of the hunting regulations. From off Cape Greville, Kadiak, soundings were made to the vicinity of Cape Edgecumbe, Baranof Island, with the object of investigating the circumstances connected with a reported discoloration of the water in the neighborhood of latitude 57° 16′ N., longitude 143° 11′ W., but only deep water and normal conditions were discovered along all parts of the line. Sitka was reached September 17, Port Townsend on the 24th, and the Mare Island navy-yard on the 30th. The control of the movements of the ship by the Navy Department was relinquished on October 16, but the work of repairing and refitting detained her at the navy-yard until the end of the calendar year.

As the appropriation would not permit continuous operations during the winter, the *Albatross* was ordered to San Diego, where a survey of the bay was considered desirable, and where the health of the crew

could best be assured. She reached that locality on January 4, 1894, and remained there until March 27, the examination of the bay being conducted by Mr. N. B. Miller, under the direction of Commander Tanner, and relating to its general fishery resources and its advantages for oyster cultivation. Returning to the Mare Island navy-yard the last of March, Mr. Townsend and Mr. Alexander were dispatched to the Puget Sound region to make inquiries respecting the character and conditions of the sea and salmon fisheries adjacent to the international boundary line in the interest of the joint investigation elsewhere described. On April 11 the ship was again placed under the orders of the Secretary of the Navy for detail to sealing patrol service during the season of 1895, and on April 19 she reached Port Townsend, the first rendezvous of the fleet. Nearly a month was spent in this region, such time as could be spared being given to cooperating with Messrs. Townsend and Alexander in the local inquiries above referred to.

Commander Tanner relinquished his command on May 1, being succeeded by Lieut. Commander F. J. Drake, U. S. N., and on May 17 the *Albatross* proceeded north in company with the flagship, the U. S. S. *Mohican*. The course was first to Unalaska, and thence to Attu Island, at the western end of the Aleutian chain, where Lieutenant Jacobs, United States Revenue Marine, was landed. Returning eastward, an outlook was maintained for the purpose of intercepting any sealing schooners which might approach from the westward with the intention of entering Bering Sea. Stops were made at the islands of Agattu, Kyska, and Atka, and the fishing-grounds in their vicinity were hastily examined. The latter part of June was occupied in patrol duty and in conducting observations relative to the distribution and pelagic habits of the fur-seal to the eastward and the southeastward of the Pribilof Islands, fishing trials being also made in the same connection. The instructions for 1895 contemplated the same combination of fishery and sealing work that had been carried on the previous season.

During the year the *Albatross* had been at sea 138 days, and had steamed 17,269 miles. The number of fishing and dredging stations occupied was 223, and of hydrographic stations 259. The civilian scientific staff consisted of Mr. C. H. Townsend, naturalist; Mr. A. B. Alexander, fishery expert; and Mr. N. B. Miller, laboratory assistant. Mention should also be made of Mr. H. C. Fassett, the captain's clerk, for his efficient services in preparing the charts illustrating the results of the investigations.

The retirement from active service with the Fish Commission, near the close of the fiscal year, of Commander Z. L. Tanner, U. S. N., has been the cause of deep regret, to which the writer ventures to give expression in this connection. Illness, following an attack of grip, made it imprudent for him to risk the exposure or assume the arduous duties attendant upon a northern cruise during the summer of 1894, and hence the action taken, at his own request. Commander Tanner was first assigned to duty with the Fish Commission as in charge of the tempo-

rary dredging steamer *Speedwell* in 1879, which led to his being selected by Professor Baird to supervise the planning and construction, first, of the steamer *Fish Hawk*, and, later, of the steamer *Albatross*, each of which he commanded in succession. The exceptional advantages afforded by these two vessels for marine investigations have, through his energetic and appreciative cooperation, been utilized to the greatest possible extent, the appliances for research have been developed and perfected to a degree not elsewhere approached, and the results accomplished in the lines both of fishery and of deep-sea exploration have greatly surpassed those by any other nation. After an experience of nine years on the Atlantic coast, during which his work extended from Newfoundland to South America, he was especially qualified to enter the comparatively unknown region of the North Pacific Ocean and Bering Sea, with which his name will ever remain associated as the earliest practical exponent of its fishing-grounds and fishery resources. Commander Tanner has in course of preparation an important paper descriptive of the methods of investigation employed on board the *Albatross* and of the history of their development.

## JOINT INVESTIGATION OF FISHERIES IN WATERS CONTIGUOUS TO CANADA AND THE UNITED STATES.

On December 6, 1892, an agreement was entered into between Great Britain and the United States for the investigation, by a joint commission of two experts, of the fisheries prosecuted in the territorial and contiguous waters of Canada and the United States, with the object of determining the regulations, practices, and restrictions proper to be adopted in concert for their preservation. The provisions of this agreement, the subjects and territory comprised within the scope of the inquiry, and the work accomplished to the end of the fiscal year 1892–93 were explained in the last annual report. At the close of that year the two representatives, Dr. William Wakeham on the part of Great Britain and Mr. Richard Rathbun on the part of the United States, were at Eastport, Me., having made a rapid reconnoissance of the mackerel fishery northward from New York City. Mr. R. Venning, of the department of marine and fisheries of Canada, accompanied Dr. Wakeham until July 8, and Dr. Hugh M. Smith, of the United States Fish Commission, acted in conjunction with Mr. Rathbun until July 21.

During a large part of July the Commission was engaged in investigating the mackerel in the Gulf of St. Lawrence, having the use for that purpose of the Canadian fishery cruiser *Acadia*, Capt. O. G. V. Spain commanding, by which means all the principal fishing centers were visited in rapid succession, the movements and spawning habits of the fish being studied, and many fishermen interrogated respecting the abundance of the species and condition of the fishery. Returning again to Eastport, Me., a temporary laboratory was established there to provide the means for studying the marine and especially the herring fisheries of Passamaquoddy Bay and adjacent waters. The *Fish Hawk* was detailed to the region to assist in the work, which was carried on

by Mr. H. F. Moore, of the University of Pennsylvania, and Mr. W. C. Kendall and Mr. B. L. Hardin, of the Fish Commission. This party continued its inquiries into November, making observations also respecting the fresh-water fishes in the upper St. Croix River.

By the end of July the members of the Commission had begun the examination of the St. Croix and St. John river basins, which are contiguous to Maine on the one side and to New Brunswick and Quebec on the other. Attention was first paid to the St. Croix River, including the main stream and its two branch systems, together with the interesting chain of lakes which constitute the most conspicuous features of the latter. An important part of this investigation was the survey, by the steamer *Fish Hawk*, under Lieut. Robert Platt, U. S. N., of the extensive beds of sawdust which encumber the upper tidal channel of the river from near the "Ledge" to the Calais–St. Stephen bridge.

The St. John River was next taken up, and all important places along its course were visited from the Bay of Fundy at its mouth to the St. Francis River in the upper part of the main valley. Examinations were also made of the Aroostook and Meduxnikeag rivers, the two most important western tributaries of the lower basin lying chiefly in the State of Maine and formerly resorted to by many salmon. This species is the principal one of international concern in both the St. John and St. Croix rivers, in which its numbers have been greatly reduced through the building of dams and the polluting and obstructing influences of factory refuse, although excessive fishing may also have been partly responsible for this result.

After completing the work on the Maine border Dr. Wakeham and Mr. Rathbun proceeded to the upper part of the St. Lawrence River, where they began the examination of the basin of the Great Lakes, their investigations extending westward along the northern sides of Lake Ontario and Lake Erie as far as the Detroit River, where the season's field work was completed about the middle of October.

During November sessions of the Commission were held at Gloucester, Mass., Portland and Eastport, Me., where the testimony of many mackerel and other fishermen was obtained and recorded stenographically. Dr. Hugh M. Smith was present at Gloucester and took part in the examinations.

In the spring of 1894 arrangements were completed for a thorough study, during the succeeding summer and fall, of the natural history of the fishes and the methods and statistics of the fisheries throughout the boundary waters of the chain of the Great Lakes and adjacent regions. The statistical inquiries were to be under the direction of Dr. Hugh M. Smith, the natural-history topics and the relations of the fishes to the different methods of capture employed being assigned to several parties, as follows: Lakes Ontario, Champlain, and Memphremagog, and the upper St. Lawrence River to B. W. Evermann and R. R. Gurley, of the Fish Commission, Barton A. Bean, of the National Museum, and R. H. Hinckley, of Bowdoin College; Lake Erie and Lake

St. Clair to H. F. Moore, B. L. Hardin, and Cloud. Rutter; Lake Huron to J. T. Scovell and D. C. Ridgely, of Indiana; Lake Superior and Lake of the Woods to A. J. Woolman, of Duluth, Minn. Work was begun on Lakes Ontario, Erie, and Huron early in June, Mr. Rathbun also spending some time with the party on Lake Erie during that month, and taking the field for the season just before the close of the fiscal year.

## OYSTER INQUIRIES.

### MOBILE BAY AND MISSISSIPPI SOUND, ALABAMA.

During February and March, 1894, a survey of the oyster beds of Mobile Bay and Mississippi Sound, Alabama, was made by Mr. Homer P. Ritter, assistant, United States Coast and Geodetic Survey, who had been specially detailed for that purpose, and who was assisted by Mr. W. F. Hill, of the Fish Commission, and Mate James A. Smith, U. S. N., of the steamer *Fish Hawk*. A small steamer, suitably equipped, belonging at Mobile, was employed for the use of the party. The limited time available for the inquiry prevented its being made as exhaustive as will eventually be desirable, but the work was executed in a methodical and thoroughly reliable manner, and, within the limits of the bay, is supposed to have been sufficiently comprehensive in scope to meet the present requirements of oyster fishermen of the region.

The principal object of the investigation, as stated in the instructions, was to determine the positions, outlines, characteristics, and richness of the different oyster beds, and the location and extent of all areas of bottom which appear to be suitable for oyster-planting, either in their natural condition or after preparation. During the period when the survey was in progress extensive freshets prevailed in the neighboring region, causing the bay to become nearly filled with fresh water, which extended far out into Mississippi Sound. The densities were therefore again observed by Mr. Ritter in the following December, when more normal conditions were found to exist. In his report,[1] which is accompanied by a large chart, showing graphically the results accomplished, Mr. Ritter states:

> The investigations were confined principally to the waters of Mobile Bay and the eastern end of Mississippi Sound. The location and extent of the natural oyster beds are shown, as is also the density of the water in the different parts of the bay, showing what it was during a heavy freshet and also after the succeeding protracted drought. The depth of water and nature of the bottom are also indicated wherever examined. * * * From the most reliable information we could gather, and which is borne out by our investigations, the northern limit for oyster growth in Mobile Bay is a line extending from Fowl River on the west to Great Point Clear on the east. The location of the oyster beds as shown on the chart indicates that in the bay the greater part of the natural oyster beds lies between the 6-foot and 12-foot curves. From all the information we could obtain the local impression seems to be that few if any oyster beds exist beyond the 12-foot curve.

[1] Report on a Reconnoissance of the Oyster Beds of Mobile Bay and Mississippi Sound, Alabama, by Homer P. Ritter, assistant, U. S. Coast and Geodetic Survey, Bull. U. S. Fish Com., xv, for 1895, pp. 325–339, pls. 56–63.

The total acreage of the reefs surveyed on the east side of the bay was less than 500 acres, but the oysters are generally large and of fine quality. The known reefs are few, of small size, and considerably depleted, owing doubtless to excessive fishing. Oyster planting is carried on to quite an extent in the southeastern part of this side of the bay, especially in and around the mouth of Bon Secours River and in Oyster Bay. The natural oyster-grounds are more extensive on the west side of the bay, the beds are larger, and at present are in a more flourishing condition. They seem to lie more in the pathway of the fresh waters coming from the large tributaries at the head of the bay, which may produce a more abundant supply of food, although at times these fresh waters may be a source of danger if too long continued. The total area of natural reefs surveyed on this side of the bay was 2,245 acres.

Only a few days could be given to the examination of Mississippi Sound, which for a distance of 15 miles east and west belongs within the State of Alabama, and detailed observations were, therefore, impossible. This territory merits further attention at an early date, its advantages for oyster cultivation suggesting the utility of a careful investigation. The water area embraced within the State, north of a line extending due west from the western end of Grant Pass, is roughly estimated at 35,000 acres, two-thirds of which has less than 6 feet of depth, and the remaining one-third averaging less than 9 feet. That much of that area may be considered suitable for oyster cultivation is borne out by the circumstances that oysters are growing in all parts of it. There may also be added to it no less than 10,000 acres of marsh, which if the occasion should demand might with a comparatively slight outlay for dredging be changed into canals or basins for oyster purposes. Little is known of the southern part of the sound, in which the water is of greater depth.

## BEAUFORT, N. C.

During the late spring and early summer of 1894 observations and experiments relating to the oyster were carried on at Beaufort, N. C., by Mr. C. P. Sigerfoos, of Johns Hopkins University, under the immediate direction of Dr. W. K. Brooks. The plan contemplated the utilization of a tract of tide-water marsh land on the Government reservation at Fort Macon, by the damming of one of the creeks flowing through it, in order to control the supply of water as desired and to test its nutrient value to the oyster. Unfortunately these arrangements could not be perfected, owing to the lateness of the season when the work began, but other experiments respecting the feeding of the species were conducted on a smaller scale and with significant results.

Although a complete report upon the investigation has not yet been submitted, it may be said that noteworthy progress was made in the attempt to rear oysters from the egg, a subject to which Dr. Brooks has given much attention, but not to the extent of entirely overcoming the difficulties previously existing in that respect. In connection with

all former experiments it had been impossible to discover any food suited to the larval oysters, or any means of renewing the water without losing the latter, owing to their small size, and they soon ceased to grow, dying of starvation. Mr. Sigerfoos was successful in devising a partially satisfactory method for replenishing the water and in finding that the young will feed voraciously upon a certain kind of alga after it has been finely powdered in a mortar. Under this treatment they grew rapidly for some time and large quantities were carried in good health past the stage where the former experiments met with failure, but after a while the remains of the powdered algæ, which were so minute that no way of getting rid of them could be found, caused the water to become vitiated with the inevitable result of destroying the larvæ. It is intended to continue these studies at a future time. A good series of the young attached oysters of all stages from one hour up to maturity were obtained and preserved for examination.

Mr. Sigerfoos also began upon a study of the shipworm (which is quite abundant in this region) from both a scientific and practical standpoint, securing material for a complete life-history of three species. It is expected that important results will be obtained, suggestive of more effective methods of protecting submerged timber against its inroads than are now recognized. A full report upon the subject is in course of preparation; a short preliminary paper on the development of the several forms observed has been published.[1]

## INQUIRIES RESPECTING THE MACKEREL, MENHADEN, ETC.

### MACKEREL.

The investigations respecting the habits and abundance of the mackerel and the fisheries to which this important species gives rise were continued again this year upon the same general plan as in 1893, but on a more elaborate scale and during a greater part of the season. The schooner *Grampus* and steamer *Fish Hawk* were both utilized in connection with this inquiry, and several land parties were employed to study the subject from the standpoint of the inshore fisheries along the entire coast covered by the range of the species. The information sought to be obtained from this series of observations was desired for the use of the Joint International Commission, as elsewhere explained, and the practical importance to the American fishermen of reaching a more complete and definite understanding of all the circumstances connected with the natural history of the mackerel, in relation to the several methods employed for their capture, has long been acknowledged.

Until this work was started by the Fish Commission a few years ago, most of the facts at hand were such as had been obtained incidentally, and it is only within a year or two that the matter has been taken hold of in the systematic and comprehensive manner which it deserves. The

[1] The Pholadidæ; note on the early stages of development. By C. P. Sigerfoos, Johns Hopkins University Circulars, XIV, No. 119, June, 1895, pp. 78, 79.

mackerel fishery has long been the subject of a vigorous controversy, both domestic and international. Each year the same phases are repeated; the fish first appear off our coast above Cape Hatteras, whence they spread rather rapidly toward the north and east as far as Labrador, giving rise to one of the most active and persistent fisheries of the world. Their abundance, within the scope of observation of the fishermen, varies from year to year, and at times the fluctuations are very great, periods of plenty of greater or less duration being followed by others of scant supply, bringing consternation to those whose fortunes are mainly linked with this species.

The improvement of methods for the capture of mackerel has kept pace with the steady development in other lines of industry until it would appear as though the limit of perfection had practically been reached. One of the most important questions of the day is whether, as some affirm, the modern devices are proving too destructive and are causing a depletion, in view of the lessened catch during several years past. To those who are at all acquainted with the history and character of the mackerel fishery, it will be evident that this question can not be answered offhand, and that the published observations respecting the natural history of the mackerel do not meet the requirements of a thorough consideration of the matter. To supply this desideratum so far as possible, has been the object of the inquiries now in progress.

These inquiries have been directed so as to cover at least the more essential features in the history of the mackerel during that part of each season when their presence along the coast becomes apparent through their surface distribution, the only period when they can be fished for. It has been attempted to trace their movements and all the principal circumstances connected therewith from the time of their first appearance in the spring until cold weather causes their return to winter quarters; to learn the extent and relations of the schools, the conditions which accelerate or retard their progress, and the factors which influence their swimming at different depths, whereby the great body of the fish may travel long distances unobserved; to settle definitely their spawning-places and seasons and their habits in that connection; to ascertain the effect upon the schools of the different fishing methods apart from the simple question of the quantity of fish so captured; and from the data thus secured, as well as from statistics of the catch, to determine, so far as possible, if the stock is being decimated and the causes which may be directly responsible therefor.

The schooner *Grampus* started south from Gloucester, Mass., on April 7, to repeat the customary examinations on the southern grounds during the early spring season, but heavy gales retarded her movements in the beginning, as well as interfered with the operations of the fishing vessels. Lewes, Del., was made the headquarters from April 20 to May 10, but the *Grampus* remained constantly with or in the neighborhood of the fleet, as the best means of keeping track of the schools of fish, making a careful series of physical observations at hourly

intervals, towing for mackerel food, and recording all facts obtainable from the fishing captains or by personal observations respecting the positions of the schools each day, their extent, movements, depth, the abundance, size, and condition of the fish, etc. From the extreme south the *Grampus* followed the main body of the fish to the region off New York, and thence proceeded eastward over Georges Bank to Cape Sable and the Nova Scotia coast. Here the mackerel were studied during their progress to the Gulf of St. Lawrence as far as Cape North, stops being made at Shelburne, Liverpool, Beaver Harbor, and North Sidney, in search of such information as could be gained from the local fisheries in the neighborhood of those places.

On June 13, the main part of the down run of mackerel having ended and the spring season closed on the cape shore, the *Grampus* left North Sidney and returned to Gloucester, first passing around the north side of Cape Breton and through the Gut of Canso, in quest of further data. Gloucester was reached on June 25, and the remainder of the month was spent in preparations for a summer cruise on the mackerel grounds in the Gulf of Maine. This work was in charge of Mr. E. E. Hahn, master of the *Grampus*, with Mr. W. C. Kendall as naturalist.

Mr. B. L. Hardin was stationed again this year at Fulton Market, New York City, from April 21 to the last of May, his observations being mainly supplemental to those conducted on board the schooner *Grampus* and directed chiefly toward completing the records bearing upon the early offshore fishery. Every fare landed by the purse-seiners from the southern grounds, as well as all specimens received from the shore fisheries tributary to New York, were inspected by Mr. Hardin, and everything that could be learned relating to their capture and conditions was fully noted. Convenient office and laboratory accommodations were supplied gratuitously by Hon. E. G. Blackford, through whom and the other prominent fish-dealers of the city, Mr. Hardin was afforded the fullest opportunity for the successful prosecution of his inquiries.

Mr. H. F. Moore, of the University of Pennsylvania, was detailed to the study of the shore fisheries from their southern limit at Virginia Beach, Va., to Rhode Island. His work was begun at the south at the commencement of the season, and was carried northward, all of the principal fishing centers being visited, the fishermen interrogated, specimens examined wherever possible, and blanks left to be filled in with daily records of the catch. In this manner a very complete account was secured of the shore relations of the mackerel during the period of their early movements, a subject which had not hitherto been given much attention.

Dr. W. E. Wolhaupter was given the section of coast from Rhode Island to the outer side of Cape Cod, including the important spawning and hooking grounds between Block Island and Nomans Land, and the extensive trap-net fisheries of Vineyard and Nantucket sounds.

The steamer *Fish Hawk* also assisted in the work here during a part of June. The region between Cape Cod and the Bay of Fundy, including the coast waters of Massachusetts, New Hampshire, and Maine, and the Gulf of Maine, was assigned to Capt. A. C. Adams, formerly in command of the schooner *Grampus*, and having a long experience in connection with the mackerel fishery. His inquiries were started at Provincetown on Cape Cod, about the middle of May, and were thence extended along the shores of Massachusetts Bay, Cape Ann, and the coast farther north to Portland, where he was joined by the steamer *Fish Hawk* and Dr. Wolhaupter in the latter part of June. By the close of the year the examination had been carried as far east as Boothbay Harbor.

MENHADEN.

From the 1st of March to early in May, 1894, the steamer *Fish Hawk*, Lieut. Robert Platt, U. S. N., commanding, was stationed in the lower Chesapeake Bay investigating the spawning and other habits of the menhaden and making observations respecting the natural history of the other economic fishes of the region, and the fisheries to which they give rise. Mr. W. C. Kendall was on duty as naturalist during the first part of the season, being succeeded later by Dr. W. E. Wolhaupter. The collecting work was carried on by means of seines, fyke nets, gill nets, and the beam trawl, and specimens were obtained from the fishermen wherever possible. In this manner much important information was secured relative to the life-history, distribution, seasons, food, spawning characteristics, etc., of several species. Physical observations relating more especially to the temperature and density of the water were also conducted at frequent intervals during the entire cruise.

The fact seems to have been quite conclusively established, through recent observations, that the menhaden resort to shallow, protected coastal waters, such as bays, inlets, and the lower parts of rivers and creeks, for spawning purposes, and that the young remain for a considerable length of time in the same or similar situations, but persistent investigations have failed to discover the mature fish in the act of breeding. A few specimens have been secured from time to time containing ripe eggs or ripe milt, but ripe individuals of both sexes have never yet been taken together, thus precluding the fertilization and hatching of the spawn artificially, whereby the conditions necessary to that process could positively be ascertained. The *Fish Hawk* was again unsuccessful in regard to the matter this spring, but many interesting observations on the young of different stages and on the adult fish were obtained, and from the evidence supplied by the fishermen and by the condition of the fish it was concluded that the spawning period in the Chesapeake Bay region occurs probably in February or March, or during parts of both of those months.

Mr. Vinal N. Edwards, of the Woods Hole Station, also gave much time during the spring of 1894 to the study of the menhaden question

in the region about Buzzards Bay, where that species is known to spawn abundantly, and where Mr. Edwards has conducted extensive inquiries on the subject during several years past.

## TILEFISH.

During a part of July and August, 1893, the schooner *Grampus* was employed, under the immediate direction of the Commissioner, in making fishing trials along the margin of the Gulf Stream slope off the coast of southern New England, New York, and New Jersey, for the purpose of determining the present range and abundance of the tilefish, in continuance of the examinations conducted during the past few years, as described in previous reports. A number of specimens, weighing from 7 to 20 pounds apiece, were obtained, and the reestablishment of the species seems to be assured, although it does not appear as yet to have been restored to its old-time abundance.

## TEMPERATURE OBSERVATIONS.

The Fish Commission has continued to receive, through the courtesy of the Light-House Board and the Southern Pacific Company, the daily records of water-temperature observations taken at many seacoast and inland stations, as follows:

*Temperature stations on the Atlantic Coast.*

Stations of the Light-House Board:

Coast of Maine: Petit Manan Island, Mount Desert Rock, Matinicus Rock, Seguin Island, Boon Island.

Coast of Massachusetts: Race Point, Pollock Rip light-ship, Great Round Shoal light-ship, Nantucket New South Shoal light-ship, Cross Rip light-ship, Vineyard Sound light-ship.

Coast of Rhode Island: Brenton Reef light-ship, Block Island southeast light.

Long Island Sound: Bartlett Reef light-ship, Stratford Shoal light-ship.

Coast of New Jersey: Absecon Inlet, Five Fathom Bank light-ship.

Delaware Bay: Fourteen Foot Bank light-ship.

Coast of Virginia: Winter Quarter Shoal light-ship.

Chesapeake Bay: Windmill Point, Stingray Point, York Spit.

Coast of North Carolina: Cape Lookout, Frying Pan Shoal light-ship.

Coast of South Carolina: Rattlesnake Shoal light-ship, Martins Industry Shoal light-ship.

Coast of Florida: Fowey Rocks, Carysfort Reef, Dry Tortugas.

*Temperature stations on the Pacific Slope.*

Stations of the Southern Pacific Company:

Sacramento River at Tehama and Yolo bridges and Kings Landing, California.

Feather River at Feather River Bridge, California.

American River at American River Bridge, California.

Mokelumne River at Lodi, Cal.

Tuolumne River at Modesto, Cal.

San Joaquin River at the upper and lower railroad crossings.

King River at Kingsburg, Cal.

Colorado River at Yuma, Ariz.

## WOODS HOLE LABORATORY.

The Woods Hole laboratory of the Commission was kept open, as usual, during the summer of 1893. A few investigators arrived there in June, but the largest attendance was during July and August. The laboratory was in charge of Mr. J. Percy Moore, instructor in biology in the University of Pennsylvania. The Commissioner was also present during the most of the season, aiding and advising in the direction of the work, and conducting experiments relative to fish-cultural subjects.

The others in attendance were as follows: Prof. Francis H. Herrick, of Adelbert College; Dr. William Patten, of Dartmouth College; Dr. Bashford Dean, of Columbia University; Dr. John A. Ryder and Mr. H. F. Moore, of the University of Pennsylvania; Dr. E. A. Andrews and Dr. George P. Dreyer, of Johns Hopkins University; Dr. H. V. Wilson, of the University of North Carolina; Dr. Charles B. Davenport, Mr. H. V. Neal, and Mr. Conkling, of Harvard University; Mr. James I. Peck, of Williams College; Prof. D. S. Kellicott, of the University of Ohio; Prof. R. C. Schiedt, of Franklin and Marshall College; Mr. John Y. Graham, of Princeton College; Mr. B. L. Hardin, of the Fish Commission; Miss Elizabeth Cooke, of the University of Chicago; Miss Ida Hyde, of Bryn Mawr College, and Miss M. H. Carter, of Boston.

Of these, Mr. J. Percy Moore, Professor Herrick, Mr. Peck, Dr. Dean, Mr. H. F. Moore, and Mr. Hardin were engaged upon investigations in the interest of the Fish Commission. The remainder were accorded the privilege of the laboratory for carrying on such special biological researches as they desired to undertake on their own account, in accordance with the custom which has prevailed since the establishment of the station by Professor Baird. The presence of such independent workers involves no extra expense upon the Government, and is fully justified both by the private subscriptions from scientific sources which rendered possible the purchase of the land on which the station is located, and by the benefits indirectly derived by the fishing industries from the results of all such inquiries.

The time of Mr. J. Percy Moore was given mainly to the study of the embryology and food of some of the more important market fishes. The station was not opened until after the close of the spawning season of both the menhaden and mackerel in this region, an examination of fresh specimens showing that the season had ended with the former about the middle of June, and with the latter perhaps a week later. From the study of alcohol specimens of menhaden, preserved from day to day by Mr. Edwards during the earlier part of the run, Mr. Moore is led to believe that in the case of that species the greatest spawning activity in the vicinity of Woods Hole occurs between May 15 and June 15, this conclusion agreeing essentially with the results of previous

observations by Mr. Edwards on the spawning conditions of the living fish. Inquiries were also made relative to the spawning of other species, to the age or size at which the menhaden, mackerel, and scup first begin to spawn, and to the anatomy of the adult menhaden, of which a number of drawings were made.

The fishes whose food was studied were the mackerel, cod, haddock, hake, scup, sea bass, weakfish, bluefish, and tilefish. Over 1,000 stomachs of the common mackerel (*Scomber scombrus*), besides a small number of the chub mackerel (*Scomber colias*), were examined. The majority were taken in the neighborhood of Woods Hole the latter part of June and during July and August, when the food was found to consist almost exclusively of surface amphipods, copepods, squids, and sand eels (*Ammodytes*), one or other of these forms or groups preponderating according to locality or time. The stomachs of over 200 individuals brought by the schooner *Grampus* from the coast of Nova Scotia, where they had been captured during the spawning season, furnished interesting results in respect to their habits at such times, as their contents consisted chiefly of bottom living animals, many of which were also discovered in the stomachs of cod and haddock taken in the same localities. Although copepods and appendicularia were abundant at the surface at the same time, as proved by the results of surface towings, these forms were detected in only two of the stomachs.

Mr. H. F. Moore and Mr. Hardin assisted in the study of the mackerel, but they remained at the station only a short time, being ordered to other parts of the coast on Fish Commission work.

Professor Herrick continued his researches on the natural history of the lobster, a work begun in 1889, in preparation for the writing of a complete monograph of the species, to include a discussion of all subjects relative to its structural features, life-history, habits, etc., which are important for consideration in connection with its protection and increase by legislative action and by propagation. The drawings for the report, which are being prepared by Professor Herrick himself, are not only noteworthy for their accurate representation of structural details, but they also exhibit a degree of finish and beauty of execution that will make them a popular object lesson in natural-history illustration.

During this season Professor Herrick also visited the principal lobster-fishing centers along the coast of Maine and Massachusetts for the purpose of extending the scope of his observations and of obtaining materials for study from additional localities. With the assistance of Mr. V. N. Edwards, inquiries were also continued at Woods Hole during the winter of 1893–94 and the following spring to determine the entire range of the breeding period of the lobster—that is to say, the time during which the extrusion of the eggs takes place—as well as other important questions respecting its winter habits. A number of lobster traps were kept set continuously, their contents being removed every

day and each lobster subjected to a detailed examination, all of the points on which information was desired being carefully noted and recorded.

The studies of Dr. Peck related chiefly to the food and feeding habits of the menhaden, which resort in considerable numbers to the region adjacent to Woods Hole, and his report[1] upon the work accomplished must be given a place in the front rank of biologic-economic contributions, both for the thoroughness with which the subject was treated and the uniqueness of the results. But few specimens of menhaden could be obtained at that season in the open waters, and the majority of those examined were from the smaller bays, brackish-water estuaries, and shallow lagoons. The material secured from those sources was quite sufficient to demonstrate the general character of the food, as well as some of its details, and to illustrate the mechanism by which it is taken. The food of the menhaden consists of the unicellular organisms, both vegetable and animal, which swarm in all surface waters, together with the smaller crustaceans and other free-swimming forms which congregate there.

The presence in a region of the brackish, even almost fresh, waters of broad shallow estuaries and inlets, connecting with the sea only by narrow channels, is very important as affecting the kind and abundance of the various microscopic organisms used by this fish as food. The streams tributary to them also bring down a wealth of fresh-water microorganisms of the most important nature, and salt-water forms are carried in with each tide, giving a new intensity to the struggle. These minute organisms furnish directly the food of the menhaden, not only within the limits of the brackish-water inlets and estuaries where the spawn is left to develop, but also wherever the fish is found in the more open coast waters. The whole food supply of this species is obtained by filtering out from the surface stratum of water the organic life there suspended. The observations of Dr. Peck related to the younger as well as to the adult stages of the fish. After discussing the different groups of organisms which were discovered among its food, he adds:

> Such being, then, the primitive character of the food supply of the menhaden, its economic relations are very important; it arrives first hand at a food supply which is the most stable, the most abundant and widely distributed of all foods, and yet so unavailable to the majority of other species. The wide distribution and vast extent of the schools of this fish testify to this fact, for no matter how many are aggregated together in a given area the food supply is adequate. At the same time the menhaden comes into no competition with the other food-fishes. * * * Not only, therefore, do the menhaden not compete with other fishes for food, but they themselves form an important factor in the food of other fishes, as has been so often observed in the bluefish, bonito, and squeteague; making available through their own life-history favorable conditions upon which the other economic fishes are borne and satisfied, bringing to them directly an elaboration of this primitive food supply here considered.

[1] On the Food of the Menhaden, by James I. Peck, Ph. D., Bull. U. S. Fish Com., XIII, for 1893, pp. 113–126, pls. 1–8.

Dr. Dean, who had carried on successful experiments during the spring respecting the artificial hatching of the sea sturgeon (*Acipenser sturio*) on the Delaware River, continued at Woods Hole the detailed study of the material collected and preserved at that time.

The subjects pursued by the independent investigators were mainly as follows: Dr. Andrews, the anatomy of certain annelids; Dr. Patten, the structure, physiology, and development of the horseshoe-crab; Dr. Schiedt, the anatomy and physiology of the oyster, an interesting conclusion based upon some of his experiments being that the presence of great quantities of minute algæ in the water is unfavorable to the life of oysters, the gills and palpi becoming so clogged as to interfere with the freedom of ciliary action, causing the animals practically to starve because of a superabundance of food; Professor Kellicott, the marine rotifera and infusoria; Dr. Ryder, the habits and life-history of a fresh-water polyp and the bathymetric relations and distribution of the foraminifera; Miss Carter, the micro-organisms affecting the alimentary canal of the mackerel and other fishes, a new field of study of probably great economic importance as well as scientific interest; Miss Hyde, the physiology and mechanism of the respiratory movements of the horseshoe-crab, and the ontogeny of several forms of jelly-fishes; Miss Cooke, the physical factors in the modification of the form and life phenomena of the lower animals; Mr. Graham, the development of the sea bass.

The season's work will result in the preparation for publication of at least 23 papers, all of scientific value and several of great economic importance.

Mr. Vinal N. Edwards, who has been attached to the station at Woods Hole since 1871, has continued his regular natural-history observations throughout the year, keeping a daily record respecting the presence, movements, etc., of the different fishes occurring in the region. In this connection the catches made by the local fishermen are closely examined and seines and other nets are constantly employed by him for this special purpose. Mr. Edwards has also conducted important investigations relative to the mackerel, menhaden, and lobster, as described elsewhere.

The season of 1894 was opened on June 4 by the arrival of Mr. J. Percy Moore, who was again designated to take charge of the laboratory, with instructions to begin upon a special study of the embryology and spawning habits of the common mackerel. Investigations relative to the natural history of the mackerel in connection with the fishery for that species off the southern coast of New England by Dr. Wolhaupter and Mr. Edwards were already in progress at this place, as elsewhere explained. Before the end of June the following additional investigators had also arrived: Mr. W. E. Castle, of Harvard University; Mr. Ulric Dahlgren, of Princeton College; and Mr. N. R. Harrington, of Williams College.

## INVESTIGATIONS OF INTERIOR WATERS.

### COLUMBIA RIVER BASIN.

The last annual report contains an account of investigations made during the fall of 1892, in accordance with two provisions of the act of Congress approved August 5, 1892, relative to (1) the character and extent of the obstructions to the ascent of salmon in the Clarke Fork of the Columbia River, and (2) the advisability of establishing a hatching station for salmon in the eastern part of the State of Washington. As this work was not completed at that time, it was taken up again during the summer of 1893 by Prof. B. W. Evermann, assisted by Drs. C. H. Gilbert, O. P. Jenkins, and W. W. Thoburn, of Stanford University, and by Mr. C. Rutter, of Long Pine, Nebr.

The primary objects of this inquiry were (1) to ascertain the location and character of all obstructions, natural and artificial, which seriously interfere with the movements of salmon and other important fishes in the principal streams of the Columbia River Basin; (2) to determine the past and present distribution of salmon throughout the basin, as indicating, in a measure, the extent of their depletion; (3) to locate definitely the spawning-grounds of the salmon and ascertain to what extent the species enters the different streams for spawning purposes; (4) to examine all available sites, especially in the State of Washington, with respect to their adaptation for salmon-hatching operations; and (5) to make a general study of the fish fauna of the basin.

In view of the wide extent of the Columbia drainage and the perplexing nature of many of the problems presented by the salmon question in that region, it was found to be impossible to cover the ground in one season as thoroughly as is desirable, or to arrive at more than tentative conclusions respecting the special points on which information is most urgently required. The waters examined were the Snake River at many points and 11 of its tributaries; the Pend d'Oreille River or Clarke Fork, from Albany Falls, Idaho, to the international boundary; the Upper Columbia at Kettle Falls, and the Colville and Spokane rivers; and the Lower Columbia River in numerous localities from Pasco, Wash., to its mouth.

The results of this investigation were embodied in a report to Congress by the Commissioner of Fisheries, under date of May 31, 1894, the same being supplemented by a detailed description by Professors Gilbert and Evermann, of the work accomplished during the seasons of 1892 and 1893.[1] According to the Commissioner:

> The area of distribution [of the salmon in the Columbia River Basin] is approximately 90,000 square miles. This immense tract is drained by innumerable streams of clear, cold water, into which the salmon enter for the purpose of spawning and

[1] The Salmon Fisheries of the Columbia River Basin, by Marshall McDonald, United States Commissioner of Fish and Fisheries; including a report upon investigations in the Columbia River Basin, with descriptions of four new species of fishes by Charles H. Gilbert and Barton W. Evermann. First issued August 27, 1894, as Senate Mis. Doc. No. 200, Fifty-third Congress, second session, and reprinted in Bull. U. S. Fish Com., XIV, for 1894, pp. 153–207, pls. 13–25.

up which they ascend till their progress is stopped by falls or other obstructions which they can not surmount. These waters furnish the feeding-grounds of the young salmon during their early life, which is spent in the fresh waters. Their migration seaward does not begin until they are at least a year old and have attained a length of from 8 to 10 inches. These streams are the nurseries of the great salmon fisheries of the Lower Columbia. From each goes out every year a colony more or less numerous, to swell the aggregate of young salmon necessary to repair the waste by natural casualty and by capture. The area of natural distribution has not as yet been very materially abridged. Certain streams, such as the Bruneau and the Boise, have been obstructed by dams near their mouths, but the vast extent of waters still accessible to salmon and affording suitable breeding and feeding grounds indicates that we must look to other causes to explain any ascertained deterioration in the salmon fisheries of the Columbia.

The investigations made by Professor Evermann and the parties under his direction establish conclusively the fact that there has been a very great reduction in the number of salmon frequenting the headwaters of the Columbia River and its tributaries. This decrease is more notable in the main river. * * * There is no reason to doubt—indeed, the fact is beyond question—that the number of salmon now reaching the headwaters of streams in the Columbia River Basin is insignificant in comparison with the number which some years ago annually visited and spawned in these waters. It is further apparent that this decrease is not to be attributed either to the contraction of the area accessible to them or to changed conditions in the waters which would deter the salmon from entering them. We must look to the great commercial fisheries prosecuted in the lower river for an explanation of this decrease, which portends inevitable disaster to these fisheries if the conditions which have brought it about are permitted to continue.

The principal recommendations of the Commissioner are as follows:

The initial step in attempting the restoration of the salmon fishery is to restrict and regulate the net fishing. The restriction that may be put in force with the least hardship to the fishermen is the shortening of the season of net fishing. The use of pounds, gill nets, traps, and seines in the lower river, from the Cascades to the mouth, should be limited strictly to the months of May, June, and July. The wheels should not be permitted to take salmon prior to the middle of May, so as to permit the salmon which have entered the river in April the opportunity to pass up to the headwaters. A further close season for wheels should be established from the 1st of August to the 10th of September, so as to provide for the uninterrupted spawning of the August run of salmon. There does not at present appear sufficient reason to prohibit the wheel fishing during the balance of September and during the month of October. Protection for the salmon which have thus been enabled to reach their spawning-grounds should be afforded by a close season during the months of September and October, covering the streams in Washington, Oregon, and Idaho, to which the salmon resort for breeding.

Should the policy above outlined be adopted by these States and the requisite measures to carry it into effect be enacted and enforced, it will be possible for the United States Fish Commission and the State commissions to greatly enlarge their fish-cultural operations and to prosecute them under much more satisfactory and economical conditions than at present. Until the States interested adopt measures to restrain net fishing, so as to permit a portion at least of the salmon entering the river to pass up to their spawning-grounds, it is not deemed wise or expedient to attempt to increase or extend the work of artificial propagation of the salmon.

The report of Gilbert and Evermann discusses the conditions found at each of the localities visited, the physical and natural-history features, the impediments to the movements of salmon, of which the principal ones are illustrated, and the advantages for fish-cultural operations presented by the waters in different parts of the basin. While good

sites for a hatching station occur in the Upper Columbia and on the Snake River and other tributaries, the investigations failed to show that spawning fish could be obtained in sufficient numbers in the neighborhood of any of those visited to make them suitable for that purpose. Their conclusions are as follows:

In summing up the facts brought out by these investigations it may be said, first, that the absence of salmon from the Pend Oreille River is not necessarily due to the presence of falls in that stream, but to other causes, chief among which is the excessive catching of salmon in the Lower Columbia; second, that while it is true that the salmon are shut out by falls and dams from a large area, especially in the Upper Snake River basin, and that these limitations are increasing as the streams become useful for irrigation and mining purposes, it is nevertheless certain that the decrease in the salmon has been even greater, and that the accessible waters suitable for spawning purposes are still more than ample to meet present needs; and, third, that the desirability of establishing another salmon hatchery at some point in the Columbia basin will depend largely upon the nature of the fishery legislation in the States of Washington, Oregon, and Idaho.

It must be understood, however, that our knowledge regarding the present abundance of salmon, their relative abundance as compared with former years, and the location and extent of their spawning-grounds, is of the most general kind. While valuable so far as it goes, the information which we now possess upon these important questions is chiefly useful in indicating the nature of the investigations which must be carried on for several seasons before a thorough understanding of the salmon question can be reached.

The study of the Columbia River was again taken up early in the season of 1894, by Professor Gilbert, who proceeded to Astoria on March 20. Three weeks were spent in the field at that time, chiefly at Astoria and on the fishing-grounds in the lower part of the river, in making observations on the runs of both the quinnat and blueback salmon, but the river was also ascended as far as Lewiston, Idaho, with stops at The Dalles, Riparia, and Starbuck. The work was resumed June 1 by Professor Gilbert, with three assistants from Stanford University, and its scope was extended to include a reconnoissance of the Klamath, Rogue, and Umpqua rivers, for the purpose of determining the relation of their faunas to that of the Sacramento on the south and the Willamette on the north. This inquiry was still in progress at the end of the fiscal year.

### IOWA, NEBRASKA, SOUTH DAKOTA, AND WYOMING.

The acts of Congress approved July 28 and August 5, 1892, directed that investigations be conducted respecting the advisability of establishing fish-hatching stations at suitable places in one or more of the States above named. This work was commenced in the fall of 1892 and was completed during the summer and fall of 1893, having been under the immediate direction of Prof. B. W. Evermann. The inquiries were twofold in nature, relating (1) to the physical and natural-history characteristics of the waters of the region, in order to determine their conditions as to the existing fish supply, as well as their suitability for stocking with species not indigenous to them and their requirements in that respect, and (2) to the advantages presented by different localities for fish-cultural operations.

A previous acquaintance with the general hydrographic features of the four States made it possible to restrict the investigations mainly to certain areas in each, outside of which it was evident that little information could be gained that would be of material advantage in reaching the desired results. Most attention was therefore given to the northeastern part of Iowa, the northern and central parts of Nebraska, the southeastern part of South Dakota, and the eastern part of Wyoming, including the Black Hills region in the two States last mentioned.

According to Professor Evermann's report,[1] there is no State west of the Mississippi which has a greater number of excellent fish streams than Iowa. Upon the first settlement of the country these numerous streams teemed with many of the most valuable river fishes, including both species of black bass, the wall-eyed pike, pickerel, white bass, fresh-water drum, channel cat, mud cat, and several species of suckers and sunfishes; while trout were abundant in the clear, cold streams in the northeast part of the State. Many of the streams are still well supplied with these species, and under proper regulations the rivers and lakes of Iowa can be made to yield annually an enormous amount of valuable and nutritious food-supply to the people of that State.

While the Platte and some other rivers of Nebraska are shallow and filled with shifting sands, there are many deep and important streams in which valued food and game fishes abound. The collections made show that this State is not inferior to neighboring States in the variety and abundance of its fish life. Among the food-fishes of most importance are the channel cat, mud cat, buffalo, several species of suckers, sturgeon, the large-mouthed black bass, the wall-eyed pike, and the sauger. In the small lakes in the northern part of the State and in some of the streams the large-mouthed black bass is abundant, and in some of the colder streams, particularly at Long Pine and Bazile Mills, trout were quite plentiful, the plants having been made by the Nebraska Fish Commission.

South Dakota does not differ greatly from Nebraska in its streams and the fishes which they contain. The larger streams in the eastern part of the State and the numerous lakes in the eastern and northeastern portions are well supplied with valuable food-fishes and the amount taken annually from these waters is of no small importance to the people of that State. The half of the State lying west of the Missouri River is but poorly supplied with permanent streams, and many of these are more or less alkaline, and in consequence not inhabited by many species of food-fishes. The numerous species of spiny-rayed fishes, among which are found nearly all of the better game fishes of the Mississippi Valley, are scarcely represented at all in the waters of this State west of the Missouri. The few species there which possess any food value are three species of catfish, a few suckers, and one or

[1] The Fishes of the Missouri River Basin, by Barton W. Evermann, ichthyologist of the U. S. Fish Commission, and Ulysses O. Cox, professor of biology in the Mankato, Minn., State Normal School. Report U. S. Fish Com. 1894, pp. 325–429.

two of the larger species of minnows. This is particularly true of the southwestern part of the State, in which occur the Mauvaises Terres or Bad Lands. The only region in the western half of the State which has really excellent streams is the Black Hills.

The Black Hills constitute a mountain island, with heavy pine forests and clear, cold streams, surrounded on all sides by plains with alkali soil, shallow, uncertain streams, and limited vegetation. All the streams of the Black Hills, unless contaminated by mining operations, are clear, pure, and cold, and well suited to trout, though trout do not occur in any of them naturally.

The streams of Wyoming belong to two very different types. Those of the northwestern and western parts of the State are, in many cases, excellent trout streams. The eastern and southern portions are not well supplied with permanent streams. Many of them dry up into isolated pools during the summer, and all are more or less alkaline. There are no trout in these streams, and other food-fishes are few in species and individuals. The only species in eastern Wyoming that are of any importance as food-fishes are three species of suckers, three of catfish, a few minnows, and the wall-eyed pike, which, however, is of rare occurrence. In Green River, in the southwestern part of the State, are found the large Cyprinoids, characteristic of the Colorado River Basin, and which are of some commercial importance.

The total number of fishes now known from the Missouri River Basin is 140; of these, 42 may be regarded as food-fishes of more or less importance. Some of these are game fishes, but it is the pond and river species whose cultivation will result in the greatest good to the Missouri River States.

The investigations bearing directly upon the selection of hatchery sites included the examination of more than 100 springs, at each of which the temperature, character, and volume of water were determined and the surrounding topographic features were considered with special reference to fish-cultural needs, such as the location of buildings, laying out of ponds, the supplying of water by gravity, railroad facilities, etc. In his report to Congress, transmitted on January 24, 1894,[1] the Commissioner recommended the establishment of only one station to supply the needs of Iowa, South Dakota, and Nebraska, the same to be devoted to the rearing of those species which are indigenous to the waters of the region, with some attention paid to trout, the cultivation of which should be a minor feature in the development of the station. Manchester, Iowa, was subsequently selected for the site as furnishing the best combination of facilities for that purpose. It was furthermore suggested that the station under construction at Bozeman, Mont., would be able to supply the requirements of the State of Wyoming.

Professor Evermann was assisted in this investigation by Prof. U. O. Cox, Mr. Cloudsley Rutter, and Prof. R. G. Gillum.

[1] Senate Mis. Doc. No. 53, Fifty-third Congress, second session.

### TENNESSEE.

In compliance with act of Congress approved August 5, 1892, providing "for investigation and report respecting the advisability of establishing a fish-hatching station at some suitable point in the State of Tennessee," the necessary inquiries to that end were conducted in September and October, 1893. The observations were limited to the eastern part of the State, as it was known that the conditions required for such a station as was contemplated were most likely to be found there. Many of the streams of that region are suitable for trout, but the majority are better adapted to the various species of pond and river fishes, and eastern Tennessee is especially noteworthy for its numerous large springs. More than 30 of the latter, together with their surroundings, chiefly in the vicinity of Greeneville, Cumberland Gap, Knoxville, Marysville, Athens, Cleveland, and Chattanooga, were examined with reference to their suitability for the purpose in question.

A careful study was also made of a number of streams in the same region with respect to their character and volume, the physical features of the adjacent country, and the abundance and distribution of their fishes, special attention being paid to the food and game species, of which there are a large number of varieties. The principal game fishes are the small-mouthed black bass, the "jack salmon" (*Stizostedion vitreum*), and the speckled trout, the first two occurring in the larger streams, the last in the small, colder ones that flow down the mountain slopes on the eastern boundary.

Only four of the springs examined were found to approximate the requirements of the proposed hatching station, two of these being in the neighborhood of Cleveland, one near Greeneville and one near Athens, the last offering the greatest natural advantages, but being somewhat distant from a railroad station and source of general supplies. A report upon the question of site was transmitted to Congress in January, 1894, and was printed as Senate Miscellaneous Document No. 52, of the Fifty-third Congress, second session. In this the Commissioner reserved his opinion respecting the choice of a location until additional inquiries could be made, but recommended action favorable to the establishment of a station. A general report upon the results of the investigation is in course of preparation. The examinations were conducted by Professor Evermann, assisted by Dr. R. R. Gurley, and by Dr. J. T. Scovell, of Terre Haute, Ind.

### OHIO, INDIANA, AND MICHIGAN.

During July and August, 1893, a detailed examination of the Maumee River basin, including its principal lakes and tributary streams, was made for this Commission by Prof. Philip H. Kirsch, fish commissioner of the State of Indiana, assisted by Mr. W. S. Blatchley, of Terre Haute, Ind., and Mr. Charles Beeson, of the Indiana University. This basin covers a considerable area in the northwestern part of Ohio, and

also extends over portions of Hillsdale and Lenawee counties, Mich., and of Steuben, Dekalb, Allen, and Adams counties, Ind., embracing in all a territory of about 7,500 square miles. The main river, formed by the confluence of the St. Joseph and St. Mary rivers, at Fort Wayne, Ind., flows in a general northeasterly direction a distance of 96 miles to Toledo, where it empties through Maumee Bay into Lake Erie, of which it is the most important side tributary. The water is rather clear in the main stream and its larger affluents, but more or less turbid in the smaller branches, owing to their clay channels; in all of the lakes visited it was remarkably clear and pure. Examinations were made in the Maumee River proper, in the neighborhood of Fort Wayne, Ind., and of Antwerp, Cecil, Defiance, Grand Rapids, Waterville, and Toledo, Ohio.

The other waters studied were the St. Joseph River and seven of its tributaries, including Fish Lake and Cedar Lake; St. Marys River, Gordon Creek, Lost Creek, Tiffin River, and Devils Lake; Auglaize River and four of its tributaries, and Beaver Creek.

This water system was found to be exceedingly rich in variety of fishes, the total number of species observed having been 87, more than is known from any other river basin of the same size. The list includes 8 species of catfishes, 9 of suckers, 25 of minnows (*Cyprinidæ*), 9 of sunfishes and basses, and 16 of perches. Over 30 species are of value for food, the most important of these being the two species of black bass, the grass pike, and the wall-eyed pike. Crayfishes and mussels are rather common in all parts of the basin; snails are plentiful, and shrimps were obtained in several streams.[1]

## INDIAN TERRITORY.

In May, 1894, Prof. S. E. Meek, of the Arkansas Industrial University, began an investigation of certain streams in the southeastern part of Indian Territory, along the line of the St. Louis and San Francisco Railroad between Fort Smith, Arkansas, and Arthur, Texas, this work being continued into the next fiscal year. Two of the most important rivers of that region are the Poteau and the Kimishi, both rising in the Ozark Mountains between the Arkansas and Red rivers, the former flowing north into the Arkansas, the latter south into the Red River. In the upper two-thirds of their courses they drain a mountainous sandstone region, their currents being swift and the bottom generally rocky. The Poteau River, below the town of the same name, occupies a deep and rather broad channel, with an occasional rocky shoal, the current being sluggish and causing it to partake somewhat of the nature of a lake. Examinations were made near the mouth of the river and in the vicinity of Poteau. The fishes of the Kimishi River were

[1] Report upon investigations in the Maumee River basin during the summer of 1893, by Philip H. Kirsch, commissioner of fisheries for the State of Indiana. Bull. U. S. Fish Com., XIV, 1894, pp. 315-337.

studied in the neighborhood of Kimishi and Goodland. Collections were also obtained from the Red River at Arthur, Tex.

These waters were found to be very rich in fish life, both as to species and individuals, the total number of species observed being 58, including the following important food varieties: Channel cat or white cat (*Ictalurus punctatus*), blue cat (*Leptops olivaris*), little green pickerel (*Lucius vermiculatus*), crappie (*Pomoxis annularis*), several species of sunfish, large-mouthed black bass (*Micropterus salmoides*), sauger (*Stizostedion canadense*), and fresh-water drum (*Aplodinotus grunniens*).[1]

MINNESOTA.

In the spring of 1894, the services of Prof. U. O. Cox, of Mankato, Minn., were secured to make a study of the small lakes in the neighborhood of Worthington, Nobles County, with special reference to the habits of the buffalo-fish which had been reported as running in exceedingly large numbers into the sloughs and other shallow waters about those lakes during their spawning season of 1893. The run did not occur, however, as anticipated, but observations were made on the fishes generally of the region, and a report upon the subject is in course of preparation.

THE GREAT LAKES.

*Lake Erie.*—During the summer of 1893, investigations were conducted along the south shore of Lake Erie, from Port Clinton, Ohio, eastward to and including Niagara River as far as the falls, by Mr. A. J. Woolman, of the Duluth High School, assisted by Mr. D. C. Ridgley, of Delphi, Ind., and Mr. E. M. Hasbrouck, of Washington, D. C. This work was carried on primarily for the purpose of securing information desired by the Joint International Commission, elsewhere referred to, and comprised the collecting of data relative to the commercial fisheries at the principal fishing centers, as well as the customary observations respecting the natural history of the fishes occurring along the lake shore and in the more important streams tributary thereto.

These inquiries were preliminary to more extensive investigations planned for the season of 1894, and which were taken up early in June by Mr. H. F. Moore, Mr. B. L. Hardin, and Mr. Rutter. During the balance of the fiscal year this party was engaged in a study of the fishes and the market fisheries in the region about Kelley Island and the Bass Islands, making personal examinations and also securing testimony from the fishermen concerning the methods, history, and conditions of their industry.

*Lake Huron.*—Corresponding inquiries on this lake were also begun in June, 1894, by Dr. J. T. Scovell, assisted by Mr. D. C. Ridgley. The work was commenced at the lower end of the lake and was carried thence northward.

[1] A list of fishes and mollusks collected in Arkansas and Indian Territory in 1894, by Seth Eugene Meek, Ph. D., associate professor of biology and geology in the Arkansas Industrial University. Bull. U. S. Fish Com., XV, 1895, pp. 341–349.

*Lake Ontario and St. Lawrence River.*—Coincident with the inquiries on Lake Erie and Lake Huron during the summer of 1894, investigations of a similar character were begun about the middle of June with respect to Lake Ontario and the upper or boundary part of the St. Lawrence River, by Professor Evermann, assisted by Mr. Barton A. Bean, of the United States National Museum.

During the same month Professor Evermann also made an examination of several springs located near together in the vicinity of Sterlingville, N. Y., which had been recommended as suited to the needs of the proposed hatching station recently authorized by Congress for the State of New York. The volume of water supplied, its character, temperature, etc., were determined, and observations were made relative to the adjacent stream known as Black Creek; but the distance of this place from Lake Ontario was found to be a serious objection to its selection for the purpose in view, especially as it was intended to utilize the station chiefly for the propagation of lake fishes.

## POLLUTIONS IN THE WABASH RIVER, INDIANA AND ILLINOIS.

In view of complaints made by the fishermen and other residents along the Wabash River at and below Terre Haute, Ind., the House of Representatives, by resolution dated April 30, 1894, requested the Fish Commission to investigate and report the extent of damage done to the food-fishes in the Wabash River by reason of the discharge into said river of the overflow and waste products of the oil wells located in the city of Terre Haute, and what steps, if any, are necessary to prevent further destruction of the fishes in that river by the polluting agencies referred to. The examinations required to ascertain the correctness of the statements relative to the conditions said to prevail in the region in question, the injury done to the fishes thereby, and the character and origin of the polluting influences, were made during the middle of May, by Prof. S. A. Forbes, director of the Illinois State Laboratory of Natural History, and indicated a state of affairs sufficiently serious to suggest and invite remedy.

Subsequently, the services of Mr. Arthur N. Talbot, professor of municipal and sanitary engineering in the University of Illinois, were secured to determine the amount of waste matter, deleterious to fishes, discharged into the river at Terre Haute, and the measures best adapted to disposing of it. The results of his observations were satisfactory in demonstrating that the waste products could readily be prevented from reaching the river without imposing any unreasonable or excessive charges upon the industrial enterprises which are responsible for their production. The reports of Professor Forbes and Professor Talbot were submitted to the House of Representatives on July 13, 1894.[1]

[1] House of Representatives Miscellaneous Document No. 196, Fifty-third Congress, second session.

Omitting the detailed statements based upon the testimony which he obtained, the report of Professor Forbes is as follows:

I have the honor to report, concerning the alleged injury to fishes in the Wabash River by overflow and waste from oil wells at Terre Haute, that in accordance with your instructions I went, May 15, to Marshall, in Clarke County, Ill., near the Wabash, spent May 16 and 17 along that river in and near the towns of Darwin, Old York, and Hutsonville, returned to Marshall on the evening of the 17th, and went thence to Terre Haute, where I remained until the forenoon of May 19, at which time other engagements compelled my return to Champaign.

I made personal observations of the condition of the river with reference to the contamination of its waters by coal oil or its waste products, and collected a mass of evidence concerning the pollution of the river at different times and under different circumstances, and likewise concerning the effect upon the fish. The time at my disposal was too short to permit a complete investigation, and I shall be obliged, consequently, to limit myself to a preliminary report.

As a general result of this investigation, I reached the conclusion that there can be no doubt of a considerable pollution of the river at Terre Haute by the oil wells and gas works connected with it, having the effect to injure fish for a distance of at least 40 miles down the river, and the consequent effect to diminish, and in some places practically suspend, the fishing industry, and to decrease or stop the sale of fish.

There are at Terre Haute three separate sources of pollution—the oil wells, the fuel-gas works, and the illuminating-gas works. In the absence of the general manager of the oil wells, who was out of the city during my visit, I was not able to get personal knowledge of the nature and amount of the objectionable materials which the waters of the Wabash may receive from these wells. I learned, however, from other reputable citizens—especially from the officers of the gas companies, so related to the oil business as to be thoroughly intelligent with reference to it—that there are three of these wells in the city now in operation. Their entire product, I am told, is used at the fuel-gas works, for the manufacture of gas distributed to the city, and at the works of a tool company, where the oil is used as a fuel.

The oil, after being pumped into large tanks, is steamed some time for the purpose of causing a separation of the water and other impurities, which settle to the bottom of the tank. This "B. S.," so called, is then drawn off into the sewers, and reaches the river by way of the main city sewer, a 5-foot brick sewer opening into the river at the foot of Eagle street. The present product of these wells, and the exact nature and amount of this contamination, I was not able to ascertain at the time. I was informed, however, by men who should be acquainted with the facts, that it is much greater than that from the gas works, and that occasional overflows of the wells have occurred, the oil then, of course, escaping into the river. Since my return to Champaign I have received a letter, in reply to inquiries addressed to Mr. S. M. Reynolds, the general manager of the Guarantee Oil and Gas Company, controlling these wells, in which he informs me that the entire product of the three wells is about 45 barrels per day, of which "not one-thousandth of 1 per cent finds its way into the waters of the Wabash." Further investigation will evidently be needed on this point. I may add that Mr. Reynolds volunteers the fullest information with regard to the situation and every opportunity to inspect the works personally.

The second source of contamination is the waste from the fuel-gas works, an establishment situated two blocks from the river and emptying the washings of the gas and other waste directly into the main brick sewer above described. I was shown this sewer connection, and saw also the liquid waste escaping. It is received in a large open tank, the surface of which is covered with a coating of slushy tar, while the water runs off, carrying an iridescent oily or tarry material in suspension. The stream of water, running at the time rapidly through the trough, was perhaps 8 or 9 inches across by an inch in depth. It is possible that there are other sewer

connections at this establishment or additional waste not seen by me. At the mouth of this sewer, which was nearly submerged by the water at the time of my visit, I found a continuous outpouring of oily and tarry materials into the river, which formed, at a distance of 50 feet below, a practically continuous film alongshore about 10 feet wide, with irregular patches extending farther out.

The wind at the time of my visit was blowing across the river from the west, with the effect to hold this floating film against the eastern bank. In an eddy just below the projecting mouth of the sewer was a triangular patch of black tar about half an inch thick and some 3 feet on each side. The amount of tar in the water here is shown by its accumulation in a thick layer at the water's edge, on the sides of barges, etc. A belt of this hard oil tar, three-fourths of an inch thick at its lower edge, had formed on the hull of a cabin boat, according to the owner's statement, within a month since it was cleaned away.

The third source of contamination is the illuminating-gas works, situated on the bank of the river at the foot of Swan street. In these gas works, according to the statement made to me independently by the superintendent of the works and by a workman whom I encountered there, the material principally used in making the gas is what is known as "naphtha oil," brought by rail from Whiting, Ind. From these gas works, I was told, only the washings of the gas escape into the river. These are received in an open iron tank, the overflow from which, as it runs rapidly down the bank, forms a rivulet about a foot wide and an inch deep. At this point a film similar to that from the fuel works was formed on the surface of the water, apparently containing, however, less tarry material. The current inshore is here slower than above, and the film was continuous for about 20 feet out from the bank at a distance of 50 feet below the point of entrance.

As we rowed across the river, about a quarter of a mile below these lowest gas works, small patches of this oily surface coating could be recognized halfway across the river, and the odor was strong for a considerable distance out. On the opposite side of the river there was neither appearance nor smell of this contamination of the surface. It would appear from information collected concerning the oil wells that this waste which I saw was derived entirely from the gas works, that from the wells coming off in quantities and at intervals only, as the tanks are emptied.

Going above the Eagle-street sewer, all appearance of pollution from these sources disappeared within a few rods, and, thence, as far upward as I went, I saw no signs of it on the water, and could get none of the characteristic odor from the driftwood or other water-soaked débris alongshore. The city waterworks are, in fact, situated on the river bank within the city limits above the mouth of this sewer, taking the water through an iron pipe which extends about a third of the way across the river; and here, as I was told by workmen in charge, no trouble is ever experienced with oil or tar or any similar substance. From this I judge that the fish occasionally taken above the town, which taste of oil, have recently come up from below, and that all important contamination of the river by these oil wastes is to be looked for at Terre Haute itself.

The time of my visit was said to be an unfavorable one for an estimate of the amount of pollution apparent at the towns below, since, although the river had begun to rise, it was coming up but slowly and was still below the medium stage. High-water mark is 28 feet, and the river stood at 8¾ by the gauge on the wagon bridge at Terre Haute. I was also repeatedly informed that the damage is much the worst in the spring, when the ice breaks up with the spring rise of the stream.

I saw, however, some slight but unmistakable evidence of present contamination as far down as Darwin, 23¾ miles below; and again, less evident, but still recognizable, at Old York and Hutsonville, the latter 48 miles by river from Terre Haute. At the place first mentioned I saw on the still water, at the mouth of a small creek opening into the river, a continuous film of an oily appearance, measuring probably 2 square rods, with flakes or patches of a thicker, blackish, tarry film, from mere specks to half an inch or more across. This was pointed out to me as the characteristic

evidence of pollution, and had, in fact, the same general appearance as the film above described at Terre Haute. The peculiar odor of this tarry material was easily obtained, in almost any eddy along the bank where fine drift had accumulated, by raking up a little of this from the bottom, and the same odor could occasionally be got from the bank by standing at the edge of such an eddy when the wind was blowing across it. It was universally said, however, by those with whom I talked, that at this time of year, and especially under conditions existing, these appearances were at their minimum.

I systematically questioned over 20 men at Terre Haute, Marshall, Darwin, Old York, and Hutsonville, examining them separately, and making full notes of their statements at the time. Although it was not possible for me to take sworn evidence, a comparison of these various statements with each other leaves no doubt of the substantial accuracy of most of them. They include reports from fishermen, business men, fish-dealers, and those who have bought and cooked damaged fish, as well as statements from the Fuel Gas Company, superintendent of the Gaslight Company, the city engineer of Terre Haute, and other prominent citizens. I may summarize the statements with respect to injuries to fish by saying that this whole mass of evidence, together with an indefinite amount of general conversation by others, was to the effect that the fishing industry along Wabash River has been practically destroyed at Terre Haute itself, and badly injured for at least 50 miles down the stream—beyond which my visit did not extend—by the presence in the water of oily and tarry waste, traceable to the oil wells and gas works, one or both, at Terre Haute.

Although three experienced fishermen gave some evidence that fish were killed in winter under the ice by accumulations of this waste, I was not fully satisfied that this was true. There can be no doubt at all, however, that they are largely rendered inedible, catfish and buffalo most frequently, but no species escaping wholly. The game fishes, the sheepshead, and the so-called pike perch are seemingly least liable to the injury. It is a curious fact, repeatedly stated to me, that the whole body of a fish may not be impregnated, but that the parts about the fins are most likely to be affected. The fact that catfishes are so much more susceptible in this particular than other species is explained by the fishermen, in part, by their naked skins. There is considerable reason to believe that fish which would otherwise pass upstream are kept below by this pollution, and as it unquestionably extends everywhere during seasons of overflow, it may easily have a serious effect upon the eggs and young. The contamination is, indeed, the most marked during the first two months of the season after the breaking of the ice, a time when fishing operations are most active, and coincident likewise, in part, with the spawning seasons of some important species. There is no doubt that the heavier portions of this waste settle in still water, and thus permeate the mud and drift accumulations on the bottom in a way to make it possible that they may have an injurious effect on the invertebrate animal life of the river, on which fish largely depend for food. Its accumulation in and beneath the ice in winter, testified to by several of my witnesses, should be taken into account in considering the importance of its effects.

It seems to me quite impossible to make a definite intelligent estimate of the ratio of damage or the amount of loss which this contamination of the river has caused. It has unquestionably compelled a considerable number of men to abandon fishing, and has reduced the income of others endeavoring to make a living by that business. Statistical information is, however, quite beyond my present reach, and I am equally unable to make any definite recommendations as to remedial measures. This last is evidently a question for an engineer rather than for a zoologist.

Respecting the fuel gas company, I beg to say that the president of the company, Mr. H. P. Townley, gave me every desired opportunity to examine their works, and assured me that they would be glad to do anything that we might indicate to correct any trouble due to their waste. The superintendent of the gaslight company, Mr. M. N. Diall, was also communicative, but seemed to attach but little importance to the waste from their works.

I trust that the foregoing will serve your purpose as a preliminary report and as a guide to further investigation if such is desired.

I send you herewith a copy of my notes of statements made by the various persons whom I examined systematically, together with bottles of the waste from the two gas works at Terre Haute and a small package of the tarry deposit from a barge in the river there. This barge had been cleaned off within a month, and a deposit of the thickness sent you had collected there since that time.

Following is the report of Professor Talbot:

In accordance with your instructions to make an investigation with respect to the amount of waste matter deleterious to fishes which empties into the Wabash River from the oil wells and gas works at Terre Haute, Ind., and to report upon the same with recommendations relative to the proper disposition of said refuse, I have the honor to report that I spent July 5 and 6 in Terre Haute, returning July 7, and that the amount and condition of the wastes at the oil wells, the fuel gas works, and the gaslight works are as follows:

*1. Oil wells.*—Only three wells produce oil. These are controlled by the Guarantee Oil and Gas Company. The oil is pumped into wooden tanks, where the process of steaming and subsidence separates the oil from the water and its impurities. The water is of limestone origin, and its impurities are much the same as those from the artesian wells in the locality. As much of these impurities as may properly be discharged into the sewer either settle in the river or at once mingle and diffuse with the water within a short distance of the mouth of the sewer, it is probable that their effect upon the fishes is comparatively small and not worth considering. It is the escaping oil and tarry matter which is to be avoided.

The product of two of the wells contains but little water. The third, however, discharges twenty times as much water as oil. At the time of my visit this third well, located near the Phœnix Foundry, was undergoing repairs, and the overflowing water and oil were flowing through an open ditch to the sewer, no effort being made to prevent the waste. While the flow of water may have been augmented somewhat by the increased amount of ground water due to the change of casing, the flow was probably less than during the process of pumping. I made weir measurements of the discharge, and calculate that the flow was at the rate of 0.0189 cubic feet per second, equal to about 12,200 gallons per 24 hours, or, say, 240 barrels in 24 hours. Of this I estimate that about 5 per cent is oil, perhaps 12 barrels per 24 hours.

Mr. Reynolds, the general manager of the Guarantee Oil and Gas Company, stated that this is the first time that repairs of this kind have been made to this well, and intimated that this is a very infrequent occurrence, adding that considerations of economy prevent the waste of oil.

The other wells were being pumped and the whole product was received in the tanks. There was visible evidence that there had been waste into the sewer, and testimony taken shows that not infrequently there is leakage and waste of a few barrels of oil, which is allowed to flow into the sewer. It was even stated that at times when it was inconvenient to tank the oil the whole flow of the wells passed into the sewer.

Of the amount of oil which escapes with the "B. S." at the time of the discharge of that waste I have no means of ascertaining. Judging from the means of separation and the care taken in the operation, there is considerably more than is necessary. The amount of this oil reaching the sewer probably would not usually be more than a barrel a day. There must, however, be times when the waste is considerably greater than this.

*2. Fuel-gas works.*—The second source of pollution is the works of the Citizens' Gas and Fuel Company, which uses oil in the manufacture of its gas. The overflow from the tar barrel and the washings from the "scrubber" are caught in a tank, from which, after the tar and oil are roughly separated by subsidence, the waste flows into the sewer. Owing to inadequate facilities for subsidence and to careless-

ness in operating, the quality of this waste is inexcusably bad, a large amount of oil and tar escaping with it.

By weir measurements the amount of waste discharged from the subsidence tank and escaping into the sewers was at the rate of 0.173 cubic feet per second, equal to 112,000 gallons per 24 hours, or about 2,150 barrels. It was impracticable to determine the amount of oil and tar contained in this, but the samples show that it must be at the rate of several barrels per day.

While these works are not now running during the night, it is probable that, except in the summer months, the total discharge for 24 hours is greater than indicated above.

*3. Illuminating-gas works.*—The discharge of waste from the works of the Terre Haute Gaslight Company is from a pipe on the bank of the river near the works. It is of much cleaner quality than the preceding. The discharge was at the rate of 43,000 gallons per 24 hours. Of this the oil did not amount to more than a few gallons a day. From what could be seen, I judge that little pollution comes from this source.

The discharge from the oil wells and the fuel gas works is into the city sewer, known as the canal sewer, which empties into the Wabash River at the foot of Eagle street. Samples taken from the sewer at three different points show a strong indication of oil, and even near the outlet, where sewage discharges down an incline with a velocity of 10 feet per second, at the rate of 2,000,000 gallons per day, the oil quickly comes to the top and floats along down the bank. The very marked coating of oil on the walls of the sewer shows that the discharge of oil must have continued for a considerable time and that it has been at different stages of the river.

It may be said that the total amount of oil discharged into the river is not large when compared with the oil received by other streams, and that the waste is not relatively as large as that from some oil wells and refineries. However, the refusal of the oil to diffuse with the water makes its presence, even when intermittent, very perceptible, and the results are far different than would be the case with diffusing liquids.

It is fortunate that this very principle of nondiffusion makes the separation of this refuse from the ordinary washings very easy, and hence the method of avoiding its discharge into the river is simple and inexpensive. The only process needed is that of separation by subsidence, carrying out more thoroughly and completely the method now used at both the oil wells and the fuel gas works.

The situation is such that no pumping or extra labor is necessary beyond the watching, the proper drawing off of oil and waste, and the occasional cleaning of the tanks. Contrary to what might be expected, there will be no necessity for expensive processes such as are used in sewage purification works.

The recommendations I would make relative to the disposition of the refuse are that the oil and tarry waste be not allowed to reach the sewer or the river, and that this waste be separated from the unobjectionable waste water by the process of subsidence in tanks. The difference in specific gravity is so marked that the separation of the water will not be difficult.

At the oil wells a tank at least 12 feet deep and 16 feet in diameter should be sunk in the ground to such a depth as to catch all overflow from the wells and all leakage from tanks and pipes and waste from loading. The inlet should be so made that the inflow will not agitate the liquid in the tank. A perforated partition will direct the proper distribution of the liquid. The outlet pipe should project well into the tank 3 or 4 feet above the bottom of the tank and be so perforated as to obtain an even draft from the liquid without causing any perceptible current in the tank. It should then be carried to the level of the inlet and connected with the discharge pipe. By this process the water will be carried away and the oil and heavier matter held in the tank. Care must be taken to draw off the oil and waste at the top as fast as it accumulates and to clean the bottom as often as necessary.

In drawing off the "R. S." from the steaming tank, sufficient time for the discharge must be given, that the flow through the separation tank will be

slow. Negligence in this matter and any overcharging of the tank will result in inefficiency. A second and smaller tank may be used if it is necessary to continue operations when this tank is being cleaned.

At the fuel-gas works a separation or subsidence tank, in addition to the one now in use, is very desirable. This may be similar to the one described for the oil wells. The depth should be 12 feet and the diameter 16 feet. It should be designed so that the inflow will be evenly and smoothly distributed, with partitions arranged so as to prevent currents, and with the outlet pipe placed 5 feet above the bottom and extending two-thirds the way across the tank and so perforated as to permit an even flow. The outlet pipe will discharge near the level of the inflow, and all the ordinary water and washings will flow off by gravity. The oil waste at the top and the tarry waste at the bottom may be emptied when necessary.

Some repairs and modifications of the tank now in use are desirable, and proper attention to its cleaning and operation will be necessary.

The expense of following out the recommendations made will not be great. Wooden tanks, partitions, and drains are suitable for the purpose. The waste products obtained will be of some commercial value, and at least will not be difficult to dispose of. The location is such that the tanks may receive and discharge the liquid without pumping.

To summarize my report, I may repeat:

(1) That oil waste escapes from the oil wells and from the fuel-gas works into the Wabash River in noticeable quantities, although the total amount is not large.

(2) That this waste may readily be separated from the waste water by inexpensive subsidence tanks.

I ship by American Express to-day a sample taken from the flow from the well of the Phœnix foundry; a sample of sewage from the canal sewer on Ninth street, near Sycamore, which receives the waste from the oil wells; a sample of sewage from the mouth of the sewer at the foot of Eagle street; a sample of the waste which passes into the sewer from the works of the Citizens' Fuel and Gas Company, and also a sample of the waste from the works of the Terre Haute Gaslight Company.

## DISEASES OF FISHES.

Dr. R. R. Gurley continued during the year his researches respecting the parasites and diseases of fishes. His paper on the Myxosporidia or protozoan parasites, which are the cause of considerable mortality among fishes, was finished early in the year, although assigned a place in the annual report for 1891–92, the publication of which was at that time not completed. Several cases of disease and mortality among the eggs and young fish at some of the hatching stations were made the subject of investigations, the most important being furnished by the station at Northville, Mich., where, during the spring of 1894, a very high death rate occurred among the yearling and two-year-old brook trout stored in the ponds at that place. Dr. Gurley was sent to the station and remained there several weeks, but despite the comprehensive scope of his inquiries the true cause of the difficulty failed to be discovered, or, at least, no effective remedy was found. The diseased fishes were infested to a greater or less extent with well-known parasites of two or more varieties, but it could not positively be said that they were the chief instrument of death, even if they were concerned in it at all.

# REPORT OF THE DIVISION OF STATISTICS AND METHODS OF THE FISHERIES.

By HUGH M. SMITH, *Assistant in Charge.*

The report of the division of statistics and methods of the fisheries for the fiscal year 1894 comprises an outline of the general statistical field investigations conducted by the regular corps of agents; an account of inquiries regarding special fisheries or in special regions; a notice of the published reports emanating from the division; suggestions for the work of the division, and notes on a number of miscellaneous matters connected with the division work.

The regular personnel of this division in 1894 consisted of 7 clerical assistants, 4 field agents, and 2 local agents. Two clerks and 1 local agent were at times assigned to duty as field agents. Mr. A. B. Alexander, fishery expert on the Fish Commission steamer *Albatross*, was temporarily detached from the vessel and given shore duty in this division. In a special inquiry several temporary field assistants were also employed for a short period. The appropriation for the field and other expenses was $5,400, of which $3,296 was expended in field inquiries and $541 for salaries of temporary employees, incidentals, etc., the unexpended balance being $1,563.

## GENERAL FIELD INVESTIGATIONS.

### THE MACKEREL FISHERY.

In the report of the division for 1893 announcement was made of the inauguration of a study of the New England mackerel fishery in May, 1893, in conjunction with a canvass of other fisheries of that region. Mention was also made of inquiries in the Middle Atlantic States regarding the catch of mackerel in pound nets. The work in New England was brought to a close by October, and resulted in the collection of more detailed statistical information for the mackerel fishery than the Commission had previously obtained. A synopsis of the scope of the statistical inquiries was given in last year's report.

In addition to the four regular field agents, the division had the services of Mr. E. F. Locke, who was detailed from the division of

fish-culture, and Mr. F. F. Dimick, local agent at Boston. The territory covered by the field force in the investigation was as follows: Mr. Ansley Hall canvassed the whole of Rhode Island and New Hampshire and that part of the Massachusetts coast lying between Newburyport and Barnstable, with the exception of Gloucester and vicinity; Mr. C. H. Stevenson, the whole of Connecticut and part of Maine coast between Round Pond, in Lincoln County, and Castine, including the islands in Penobscot Bay; Mr. W. A. Wilcox, part of Massachusetts south of Barnstable, including the Cape Cod peninsula and the islands off the southern coast; Mr. E. F. Locke, Gloucester, Rockport, and vicinity, Massachusetts, and the coast of Maine from Sullivan to Bluehill, including Mount Desert Island and other smaller islands adjacent thereto; Mr. F. F. Dimick, the eastern Maine coast from Gouldsboro to Lubec, inclusive; Mr. E. E. Race, the western part of Maine, from the State line to Round Pond and the region between Castine and Bluehill.

The number of persons engaged in the mackerel fishery of the New England States in 1892, the last of the three years covered by the agents' inquiries, was 5,893. Of this number, 2,406 were vessel fishermen, and 3,487 were shore or boat fishermen. These figures include all persons who fished especially for mackerel during any part of the year or in whose apparatus mackerel constituted a conspicuous part of the catch. Detailed information for each State is contained in the following table, in which data for the years 1890 and 1891 are added for comparison:

*Table showing by States the number of persons engaged in the New England mackerel fishery in 1890, 1891, and 1892.*

| States | Vessel fishermen. | | | Shore or boat fishermen. | | | Total. | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1890. | 1891. | 1892. | 1890. | 1891. | 1892. | 1890. | 1891. | 1892. |
| Maine | 374 | 482 | 418 | 2,429 | 2,603 | 2,387 | 2,803 | 3,085 | 2,805 |
| New Hampshire | 32 | 25 | 25 | 23 | 16 | 20 | 55 | 41 | 45 |
| Massachusetts | 1,440 | 1,722 | 1,876 | 948 | 969 | 1,006 | 2,388 | 2,691 | 2,882 |
| Rhode Island | 58 | 60 | 71 | 72 | 72 | 74 | 130 | 132 | 145 |
| Connecticut | ..... | 17 | 16 | ..... | ..... | ..... | ..... | 17 | 16 |
| Total | 1,904 | 2,306 | 2,406 | 3,472 | 3,660 | 3,487 | 5,376 | 5,966 | 5,893 |

The value of the fishing property connected with the mackerel fishery of the New England States in 1892 was $1,414,422. The vessels employed numbered 207, and were valued with their outfit at $789,358. The number of boats used in the shore fisheries was 2,906, with a value of $196,997. The apparatus consisted of 244 purse and other seines, valued at $127,775; 7,321 gill nets, worth $62,450; 361 pound nets and trap nets, having a value of $236,736; and 7,789 lines, with a value of $1,106. In the table which follows figures for each State are given, showing the details of the investment in the mackerel fishery in 1890, 1891, and 1892.

*Table showing by States the vessels, boats, and apparatus employed in the New England mackerel fishery in 1890, 1891, and 1892.*

| Items. | Maine. | | New Hampshire. | | Massachusetts. | |
|---|---|---|---|---|---|---|
| | No. | Value. | No. | Value. | No. | Value. |
| **1890.** | | | | | | |
| Vessels | 28 | $88,700 | 3 | $3,700 | 153 | $306,205 |
| Outfit | ..... | 38,900 | ..... | 1,950 | ..... | 97,641 |
| Tonnage | 1,608 | ..... | 90 | ..... | 6,305 | ..... |
| Boats | 1,972 | 105,219 | 43 | 1,620 | 778 | 79,622 |
| Apparatus, vessel fisheries: | | | | | | |
| Seines | 37 | 20,900 | 4 | 1,600 | 142 | 70,365 |
| Gill nets | 179 | 1,134 | 20 | 300 | 402 | 4,235 |
| Lines | ..... | ..... | ..... | ..... | 1,383 | 193 |
| Apparatus, boat fisheries: | | | | | | |
| Seines | 5 | 300 | ..... | ..... | 2 | 900 |
| Gill nets | 3,800 | 27,811 | 75 | 1,125 | 3,174 | 32,099 |
| Pound nets and weirs | 108 | 40,705 | ..... | ..... | 175 | 183,825 |
| Lines | 4,584 | 570 | 20 | 2 | 1,651 | 212 |
| Total | ..... | 324,239 | ..... | 10,297 | ..... | 775,297 |
| **1891.** | | | | | | |
| Vessels | 35 | 111,975 | 2 | 3,000 | 164 | 423,794 |
| Outfit | ..... | 48,000 | ..... | 1,285 | ..... | 125,819 |
| Tonnage | 2,079 | ..... | 75 | ..... | 7,728 | ..... |
| Boats | 2,156 | 112,287 | 36 | 1,525 | 799 | 80,992 |
| Apparatus, vessel fisheries: | | | | | | |
| Seines | 40 | 25,050 | 4 | 1,500 | 181 | 92,320 |
| Gill nets | 149 | 894 | ..... | ..... | 386 | 3,700 |
| Lines | ..... | ..... | ..... | ..... | 1,094 | 156 |
| Apparatus, boat fisheries: | | | | | | |
| Seines | 5 | 350 | ..... | ..... | 3 | 1,050 |
| Gill nets | 4,031 | 30,817 | 75 | 1,125 | 2,822 | 27,980 |
| Pound nets and weirs | 159 | 59,165 | ..... | ..... | 192 | 190,950 |
| Lines | 5,020 | 752 | 6 | 1 | 1,888 | 226 |
| Total | ..... | 389,290 | ..... | 8,436 | ..... | 946,987 |
| **1892.** | | | | | | |
| Vessels | 32 | 92,450 | 2 | 3,000 | 164 | 489,719 |
| Outfit | ..... | 41,210 | ..... | 1,385 | ..... | 137,972 |
| Tonnage | 1,758 | ..... | 75 | ..... | 8,657 | ..... |
| Boats | 2,005 | 109,576 | 34 | 1,580 | 830 | 80,041 |
| Apparatus, vessel fisheries: | | | | | | |
| Seines | 44 | 21,750 | 4 | 1,500 | 184 | 102,450 |
| Gill nets | 181 | 1,086 | ..... | ..... | 431 | 4,335 |
| Lines | ..... | ..... | ..... | ..... | 972 | 152 |
| Apparatus, boat fisheries: | | | | | | |
| Seines | 6 | 375 | 1 | 100 | 3 | 900 |
| Gill nets | 3,882 | 28,354 | 75 | 1,125 | 2,752 | 27,550 |
| Pound nets and weirs | 154 | 52,026 | ..... | ..... | 207 | 184,710 |
| Lines | 4,224 | 542 | ..... | ..... | 2,259 | 273 |
| Total | ..... | 347,369 | ..... | 8,690 | ..... | 1,028,102 |

| Items. | Rhode Island. | | Connecticut. | | Total. | |
|---|---|---|---|---|---|---|
| | No. | Value. | No. | Value. | No. | Value. |
| **1890.** | | | | | | |
| Vessels | 15 | $13,100 | ..... | ..... | 201 | $411,705 |
| Outfit | ..... | 1,236 | ..... | ..... | ..... | 139,727 |
| Tonnage | 158 | ..... | ..... | ..... | 8,161 | ..... |
| Boats | 36 | 5,300 | ..... | ..... | 2,829 | 191,761 |
| Apparatus, vessel fisheries: | | | | | | |
| Seines | ..... | ..... | ..... | ..... | 183 | 92,865 |
| Gill nets | ..... | ..... | ..... | ..... | 601 | 5,669 |
| Lines | 136 | 85 | ..... | ..... | 1,519 | 278 |
| Apparatus, boat fisheries: | | | | | | |
| Seines | ..... | ..... | ..... | ..... | 7 | 1,200 |
| Gill nets | ..... | ..... | ..... | ..... | 7,049 | 61,035 |
| Pound nets and weirs | ..... | ..... | ..... | ..... | 283 | 224,530 |
| Lines | 144 | 29 | ..... | ..... | 6,399 | 813 |
| Total | ..... | 19,750 | ..... | ..... | ..... | 1,129,583 |
| **1891.** | | | | | | |
| Vessels | 16 | 14,100 | 1 | $3,000 | 218 | 555,869 |
| Outfit | ..... | 1,336 | ..... | 1,300 | ..... | 177,740 |
| Tonnage | 173 | ..... | 71 | ..... | 10,126 | ..... |
| Boats | 36 | 5,300 | ..... | ..... | 3,027 | 200,104 |

*Table showing by States the vessels, boats, and apparatus employed in the New England mackerel fishery in 1890, 1891, and 1892*—Continued.

| Items. | Rhode Island. | | Connecticut. | | Total. | |
|---|---|---|---|---|---|---|
| | No. | Value. | No. | Value. | No. | Value. |
| 1891—continued. | | | | | | |
| Apparatus, vessel fisheries: | | | | | | |
| Seines | ..... | ..... | 2 | $700 | 236 | $119,570 |
| Gill nets | ..... | ..... | ..... | ..... | 535 | 4,594 |
| Lines | 152 | $86 | ..... | ..... | 1,246 | 242 |
| Apparatus, boat fisheries: | | | | | | |
| Seines | ..... | ..... | ..... | ..... | 8 | 1,400 |
| Gill nets | ..... | ..... | ..... | ..... | 6,928 | 59,922 |
| Pound nets and weirs | ..... | ..... | ..... | ..... | 351 | 250,115 |
| Lines | 144 | 29 | ..... | ..... | 7,058 | 1,008 |
| Total | ..... | 20,851 | ..... | 5,000 | ..... | 1,370,564 |
| 1892. | | | | | | |
| Vessels | 18 | 17,700 | 1 | 3,000 | 207 | 605,869 |
| Outfit | ..... | 1,622 | ..... | 1,300 | ..... | 183,489 |
| Tonnage | 203 | ..... | 71 | ..... | 10,764 | ..... |
| Boats | 37 | 5,800 | ..... | ..... | 2,906 | 196,997 |
| Apparatus, vessel fisheries: | | | | | | |
| Seines | ..... | ..... | 2 | 700 | 234 | 126,400 |
| Gill nets | ..... | ..... | ..... | ..... | 612 | 5,421 |
| Lines | 186 | 109 | ..... | ..... | 1,158 | 261 |
| Apparatus, boat fisheries: | | | | | | |
| Seines | ..... | ..... | ..... | ..... | 10 | 1,375 |
| Gill nets | ..... | ..... | ..... | ..... | 6,709 | 57,029 |
| Pound nets and weirs | ..... | ..... | ..... | ..... | 361 | 236,736 |
| Lines | 148 | 30 | ..... | ..... | 6,631 | 845 |
| Total | ..... | 25,261 | ..... | 5,000 | ..... | 1,414,422 |

The quantity of mackerel taken by New England fishermen in 1892 was 21,494,913 pounds, for which the fishermen received $1,062,460. The fish sold fresh amounted to 7,411,113 pounds, valued at $450,974; the remainder of the catch was pickled, making 9,389,200 pounds (or 46,946 barrels) of salt fish, with a market value of $611,486. The results of the fishery in each State, together with comparative figures for the two preceding years, are shown in the following table:

*Table showing by States the quantity and value of the New England mackerel catch in 1890, 1891, and 1892.*

| States. | Total quantity as taken from the water (pounds). | Quantity sold fresh. | | Quantity sold salted. | |
|---|---|---|---|---|---|
| | | Pounds. | Value. | Pounds. | Value. |
| 1890—Maine | 3,514,217 | 2,166,017 | $127,706 | 898,800 | $70,569 |
| New Hampshire | 107,800 | 74,800 | 6,140 | 22,000 | 1,578 |
| Massachusetts | 6,984,095 | 2,393,495 | 163,606 | 3,060,400 | 221,075 |
| Rhode Island | 339,175 | 88,375 | 7,652 | 167,200 | 13,509 |
| Connecticut | ..... | ..... | ..... | ..... | ..... |
| Total | 10,945,287 | 4,722,687 | 305,104 | 4,148,400 | 306,731 |
| 1891—Maine | 6,987,045 | 3,837,345 | 194,724 | 2,099,800 | 139,264 |
| New Hampshire | 68,460 | 10,560 | 522 | 38,600 | 2,187 |
| Massachusetts | 11,939,074 | 3,808,174 | 242,123 | 5,360,600 | 303,351 |
| Rhode Island | 274,475 | 93,275 | 8,176 | 120,800 | 9,583 |
| Connecticut | 93,300 | ..... | ..... | 62,200 | 3,408 |
| Total | 19,362,354 | 7,839,354 | 445,545 | 7,682,000 | 457,793 |
| 1892—Maine | 5,072,433 | 2,521,233 | 133,781 | 1,700,800 | 113,685 |
| New Hampshire | 59,000 | 15,500 | 1,420 | 29,000 | 2,525 |
| Massachusetts | 16,037,805 | 4,762,905 | 305,839 | 7,516,600 | 484,657 |
| Rhode Island | 226,975 | 111,475 | 9,934 | 77,000 | 5,802 |
| Connecticut | 98,700 | ..... | ..... | 65,800 | 4,817 |
| Total | 21,494,913 | 7,411,113 | 450,974 | 9,389,200 | 611,486 |

In the previous report mention was made of the intention of the office to obtain statistics showing, for the fresh and salt fish, respectively, the quantities and values of the mackerel of each size and grade recognized in commerce. No attempts had previously been made to secure complete information on this phase of the subject, the only data published bearing on it being the report of the inspection of salt mackerel in some of the New England States. By those who have favored the restriction of the mackerel fishery, much stress has been laid on the diminishing size of the mackerel caught, the point sought to be made being that the fishery is prosecuted so assiduously that the fish fail to attain maturity before they are caught. While the results of the efforts to secure complete figures on this point were not entirely satisfactory, owing to the general absence of records showing the sizes of the fish sold in a fresh condition, the information obtained is as accurate as the circumstances permit and undoubtedly differs but little from the actual results of the fishery.

The sizes of fresh mackerel recognized in the trade are extra large, large, medium, small, and tinkers; the grades of salt mackerel are No. 1 extra, No. 1, No. 2, No. 3 large, No. 3, No. 4. Several special grades are also recognized. These sizes and grades may be defined as follows, the measurements being made from tip of nose to fork of tail:

*Sizes and grades of fresh and salt mackerel recognized in the trade.*

| Fresh mackerel. | Designation. | Salt mackerel. | Designation. |
|---|---|---|---|
| Over 15 inches long | Extra large. | Best quality, over 15 inches long. | No. 1, large. |
| Over 13 inches and under 15 inches long. | Large. | Best quality, not less than 13 inches long. | No. 1. |
| Over 11 inches and under 13 inches long. | Medium. | Best quality, 11 inches long and under 13 inches. | No. 2. |
| Over 10 inches and under 11 inches long. | Small. | Second quality, not less than 13 inches. | No. 3, large. |
| Under 10 inches long | Tinkers. | Second quality, at least 10 and under 13 inches in length. | No. 3. |
| | | All under 10 inches in length. | No. 4. |

The data obtained in the recent canvass, combined with those secured in the previous investigation of this region, permit a comparison of the mackerel catch for a continuous period of six years ending in 1892. The figures are very instructive, in view of the importance of the fishery and the special attention it has of late received on account of the serious decline dating from 1886. When the yield of mackerel in 1880 is contrasted with that in each of the recent years, as is done in the following table, the full extent of the decrease is exhibited.

It appears from the table that in 1880 the quantity of mackerel sold fresh by the New England fishermen was 21,742,763 pounds, valued at $374,329, and the quantity salted was 50,226,800 pounds (or 251,134 barrels), valued at $1,442,917. During the six-year period covered by the figures presented, the fishery reached its lowest point in 1889, when the yield of fresh mackerel was only 3,074,441 pounds, worth $256,550, and of salt fish 5,286,967 pounds (or 26,435 barrels), having a value of $474,874; while the fishery was at its maximum in 1887, in which

year 7,356,046 pounds of fresh fish, valued at $373,070, were sold, and 18,716,580 pounds (or 93,583 barrels) of salt fish, worth $1,064,124, were packed.

The decrease in the mackerel catch, as compared with 1880, has been largely compensated for by the increase in the price. Thus, while the yield of fresh mackerel in 1892 was but little more than a third that in 1880, the value of the catch was one-fourth greater; and while the output of salt mackerel in 1892 was less than one-fifth that in 1880, the value of the salt fish was only about one-half less.

*Comparative table showing the quantities and values of fresh and salt mackerel taken by New England fishermen in 1880, 1887, 1888, 1889, 1890, 1891, and 1892.*

| Year. | Maine. | | | | New Hampshire. | | | |
|---|---|---|---|---|---|---|---|---|
| | Fresh. | | Salted. | | Fresh. | | Salted. | |
| | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. |
| 1880 | 4,352,455 | $135,249 | 18,228,000 | $524,055 | 368,000 | *a* $10,580 | 1,470,000 | $41,160 |
| 1887 | 1,011,814 | 54,809 | 3,023,000 | 159,784 | 144,377 | 8,849 | 49,600 | 2,728 |
| 1888 | 573,509 | 40,703 | 1,121,000 | 73,900 | 56,616 | 4,118 | 43,400 | 3,348 |
| 1889 | 417,441 | 36,074 | 562,100 | 51,904 | 21,860 | 2,010 | 24,600 | 2,359 |
| 1890 | 2,166,017 | 127,766 | 898,800 | 70,569 | 74,800 | 6,140 | 22,000 | 1,578 |
| 1891 | 3,837,345 | 194,724 | 2,099,800 | 139,264 | 10,560 | 522 | 36,600 | 2,187 |
| 1892 | 2,521,233 | 133,781 | 1,700,800 | 113,685 | 15,500 | 1,420 | 29,000 | 2,525 |

| Year. | Massachusetts. | | | | Rhode Island. | | | |
|---|---|---|---|---|---|---|---|---|
| | Fresh. | | Salted. | | Fresh. | | Salted. | |
| | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. |
| 1880 | 16,896,308 | $224,720 | 29,684,200 | $853,420 | 89,000 | *a* $2,670 | ..... | ..... |
| 1887 | 5,890,092 | 287,657 | 15,084,500 | 870,025 | 268,063 | 18,545 | 500,200 | $28,541 |
| 1888 | 4,755,925 | 268,800 | 8,920,050 | 659,520 | 237,100 | 20,007 | 303,800 | 23,624 |
| 1889 | 2,305,028 | 190,074 | 4,382,167 | 394,517 | 236,612 | 25,081 | 302,000 | 24,555 |
| 1890 | 2,303,495 | 163,666 | 3,060,400 | 221,075 | 88,375 | 7,652 | 167,200 | 13,509 |
| 1891 | 3,898,174 | 242,123 | 5,360,600 | 303,351 | 93,275 | 8,176 | 120,800 | 9,583 |
| 1892 | 4,762,905 | 305,839 | 7,516,600 | 484,657 | 111,475 | 9,934 | 77,000 | 5,802 |

| Year. | Connecticut. | | | | Total. | | | |
|---|---|---|---|---|---|---|---|---|
| | Fresh. | | Salted. | | Fresh. | | Salted. | |
| | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. |
| 1880 | 37,000 | *a* $1,110 | 844,600 | $24,282 | 21,742,763 | $374,329 | 50,226,800 | $1,442,917 |
| 1887 | 41,700 | 3,210 | 59,280 | 3,046 | 7,356,046 | 373,070 | 18,716,580 | 1,064,124 |
| 1888 | 28,160 | 2,276 | 24,500 | 2,100 | 5,651,310 | 335,904 | 10,412,750 | 762,492 |
| 1889 | 33,500 | 3,311 | 16,100 | 1,539 | 3,074,441 | 256,550 | 5,286,967 | 474,874 |
| 1890 | ..... | ..... | ..... | ..... | 4,722,687 | 305,164 | 4,148,400 | 306,731 |
| 1891 | ..... | ..... | 62,200 | 3,408 | 7,839,354 | 445,545 | 7,682,000 | 457,793 |
| 1892 | ..... | ..... | 65,800 | 4,817 | 7,411,113 | 450,974 | 9,389,200 | 611,486 |

*a* Approximate.

A feature of some interest disclosed by the foregoing figures is the relative proportion of mackerel sold fresh and salted in the years mentioned as compared with the conditions in 1880. The percentage of mackerel leaving the hands of the fishermen in a fresh condition in recent years was greater than in 1880, and the tendency toward the disposal of the fish in a fresh state appears to be increasing yearly. Thus, the percentage (by weight) of the total catch sold fresh was 28 in 1887, 35 in 1888, 37 in 1889, 53 in 1890, 51 in 1891, and 44 in 1892, while in 1880 it was only 30.

A consideration of the quantities of mackerel taken with each kind of apparatus shows the preponderating importance of the purse seine as a means of capture. Of the 47,946 barrels of salt mackerel landed in 1892, 42,650 barrels were caught with seines, and of the 7,411,113 pounds of fresh fish taken in the same year, 1,202,686 pounds were secured in seines. The largest quantities of the mackerel sold fresh are, however, obtained in pound nets, the catch in 1892 being 3,915,037 pounds.

In the following table detailed figures are given showing by States, for the years 1890, 1891, and 1892, the quantity and value of salt and fresh mackerel taken with the different appliances.

*Table showing by apparatus with which taken the quantity and value of the New England mackerel catch in 1890, 1891, and 1892.*

| Apparatus. | Maine. | | New Hampshire. | | Massachusetts. | |
|---|---|---|---|---|---|---|
| | Quantity. | Value. | Quantity. | Value. | Quantity. | Value. |
| 1890. | | | | | | |
| Salt fish: | | | | | | |
| Seines.....barrels.. | 3,993 | $64,311 | 80 | $1,103 | 13,560 | $192,825 |
| Gill nets.....do.... | 104 | 1,583 | 30 | 475 | 386 | 6,331 |
| Pound nets.....do.... | 231 | 2,340 | ..... | ..... | 29 | 415 |
| Lines.....do.... | 166 | 2,335 | ..... | ..... | 1,327 | 21,504 |
| Total..... | 4,494 | 70,569 | 110 | 1,578 | 15,302 | 221,075 |
| Fresh fish: | | | | | | |
| Seines.....pounds.. | 19,350 | 1,068 | 28,800 | 2,790 | 618,480 | 36,901 |
| Gill nets.....do.... | 815,148 | 48,572 | 28,000 | 1,950 | 499,007 | 40,586 |
| Pound nets.....do.... | 874,764 | 46,582 | ..... | ..... | 1,133,438 | 74,588 |
| Lines.....do.... | 456,755 | 31,544 | 18,000 | 1,400 | 142,370 | 11,531 |
| Total..... | 2,166,017 | 127,766 | 74,800 | 6,140 | 2,393,495 | 163,606 |
| 1891. | | | | | | |
| Salt fish: | | | | | | |
| Seines.....barrels.. | 8,647 | 113,325 | 193 | 2,187 | 25,456 | 283,143 |
| Gill nets.....do.... | 312 | 3,924 | ..... | ..... | 525 | 7,504 |
| Pound nets.....do.... | 1,233 | 17,288 | ..... | ..... | 83 | 1,788 |
| Lines.....do.... | 307 | 4,227 | ..... | ..... | 739 | 10,916 |
| Total..... | 10,499 | 139,264 | 193 | 2,187 | 26,803 | 303,351 |
| Fresh fish: | | | | | | |
| Seines.....pounds.. | 13,916 | 825 | 5,760 | 232 | 679,380 | 41,355 |
| Gill nets.....do.... | 1,049,485 | 56,281 | 3,000 | 210 | 521,807 | 42,526 |
| Pound nets.....do.... | 1,882,381 | 77,060 | ..... | ..... | 2,495,675 | 142,329 |
| Lines.....do.... | 891,563 | 60,558 | 1,800 | 80 | 201,312 | 15,913 |
| Total..... | 3,837,345 | 194,724 | 10,560 | 522 | 3,898,174 | 242,123 |
| 1892. | | | | | | |
| Salt fish: | | | | | | |
| Seines.....barrels.. | 7,539 | 102,546 | 145 | 2,525 | 34,637 | 440,016 |
| Gill nets.....do.... | 225 | 3,125 | ..... | ..... | 935 | 14,030 |
| Pound nets.....do.... | 137 | 1,499 | ..... | ..... | 1,107 | 17,560 |
| Lines.....do.... | 603 | 6,515 | ..... | ..... | 904 | 13,051 |
| Total..... | 8,504 | 113,685 | 145 | 2,525 | 37,583 | 484,657 |
| Fresh fish: | | | | | | |
| Seines.....pounds.. | 83,751 | 4,843 | 13,500 | 1,280 | 1,105,435 | 73,644 |
| Gill nets.....do.... | 806,510 | 45,703 | 2,000 | 140 | 607,787 | 47,449 |
| Pound nets.....do.... | 1,174,328 | 56,348 | ..... | ..... | 2,740,709 | 159,832 |
| Lines.....do.... | 456,644 | 26,887 | ..... | ..... | 308,974 | 24,914 |
| Total..... | 2,521,233 | 133,781 | 15,500 | 1,420 | 4,762,905 | 305,839 |

*Table showing by apparatus with which taken the quantity and value of the New England mackerel catch in 1890, 1891, and 1892*—Continued.

| Apparatus. | Rhode Island. | | Connecticut. | | Total. | |
|---|---|---|---|---|---|---|
| | Quantity. | Value. | Quantity. | Value. | Quantity. | Value. |
| 1890. | | | | | | |
| Salt fish: | | | | | | |
| Seines ..... barrels | ..... | ..... | ..... | ..... | 17,643 | $258,239 |
| Gill nets ..... do | ..... | ..... | ..... | ..... | 520 | 8,389 |
| Pound nets ..... do | ..... | ..... | ..... | ..... | 260 | 2,755 |
| Lines ..... do | 836 | $13,509 | ..... | ..... | 2,329 | 37,348 |
| Total ..... | 836 | 13,509 | ..... | ..... | 20,742 | 306,731 |
| Fresh fish: | | | | | | |
| Seines ..... pounds | ..... | ..... | ..... | ..... | 666,630 | 40,759 |
| Gill nets ..... do | ..... | ..... | ..... | ..... | 1,312,155 | 91,108 |
| Pound nets ..... do | ..... | ..... | ..... | ..... | 2,008,202 | 121,170 |
| Lines ..... do | 88,375 | 7,652 | ..... | ..... | 705,700 | 52,127 |
| Total ..... | 88,375 | 7,652 | ..... | ..... | 4,722,687 | 305,164 |
| 1891. | | | | | | |
| Salt fish: | | | | | | |
| Seines ..... barrels | ..... | ..... | 311 | $3,408 | 34,607 | 402,563 |
| Gill nets ..... do | ..... | ..... | ..... | ..... | 837 | 11,428 |
| Pound nets ..... do | ..... | ..... | ..... | ..... | 1,316 | 19,076 |
| Lines ..... do | 604 | 9,583 | ..... | ..... | 1,650 | 24,726 |
| Total ..... | 604 | 9,583 | 311 | 3,408 | 38,410 | 457,793 |
| Fresh fish: | | | | | | |
| Seines ..... pounds | ..... | ..... | ..... | ..... | 699,656 | 42,412 |
| Gill nets ..... do | ..... | ..... | ..... | ..... | 1,574,292 | 99,017 |
| Pound nets ..... do | ..... | ..... | ..... | ..... | 4,378,056 | 219,389 |
| Lines ..... do | 93,275 | 8,176 | ..... | ..... | 1,187,950 | 84,727 |
| Total ..... | 93,275 | 8,176 | ..... | ..... | 7,839,354 | 445,545 |
| 1892. | | | | | | |
| Salt fish: | | | | | | |
| Seines ..... barrels | ..... | ..... | 329 | 4,817 | 42,650 | 549,904 |
| Gill nets ..... do | ..... | ..... | ..... | ..... | 1,160 | 17,155 |
| Pound nets ..... do | ..... | ..... | ..... | ..... | 1,244 | 19,059 |
| Lines ..... do | 385 | 5,802 | ..... | ..... | 1,892 | 25,368 |
| Total ..... | 385 | 5,802 | 329 | 4,817 | 46,946 | 611,486 |
| Fresh fish: | | | | | | |
| Seines ..... pounds | ..... | ..... | ..... | ..... | 1,202,686 | 79,767 |
| Gill nets ..... do | ..... | ..... | ..... | ..... | 1,416,297 | 93,292 |
| Pound nets ..... do | ..... | ..... | ..... | ..... | 3,915,037 | 216,180 |
| Lines ..... do | 111,475 | 9,934 | ..... | ..... | 877,093 | 61,735 |
| Total ..... | 111,475 | 9,934 | ..... | ..... | 7,411,113 | 450,974 |

## THE NEW ENGLAND STATES.

In connection with the canvass of the mackerel fishery in the New England States, an investigation of certain other important fisheries of the region was undertaken, as mentioned in the last report of the division. Circumstances prevented a general canvass of the New England fisheries, and it was necessary to restrict the inquiries to those subjects having special interest. The branches considered were the fisheries for shad, alewives, herring, menhaden, salmon, smelt, lobsters, whales, oysters, clams, and scallops; the canning of sardines and lobsters; and the manufacture of menhaden oil and fertilizer. Complete data were obtained for all of these, the statistics relating to the calendar year 1892, and the descriptive matter indicating the principal changes in methods of fishing, abundance of fish and other products, and the general condition of the industry since the period covered by

the last field inquiries. Some brief descriptive notes on each of the foregoing branches will be presented, supplemented by general statistics.

*The shad fishery.*—While the shad is found along the entire New England coast, it is only in Maine and Connecticut that regular fishing for this fish is carried on; in all of the other States except New Hampshire, however, considerable quantities of shad are taken incidentally and add to the income of the fishermen. In Maine the shad ranks next to the smelt in value among the river fishes, and in Connecticut it is the most important anadromous species.

The principal part of the shad catch in Maine is taken in the Kennebec River and Casco Bay. In Connecticut, the Connecticut and Housatonic rivers yield most of the supply. The bulk of the shad credited to Massachusetts is obtained in pound nets in Barnstable County; larger or smaller quantities are, however, taken each year by mackerel vessels using purse seines. The shad caught in Rhode Island are mostly secured in pound nets set in Narragansett Bay.

The number of persons using apparatus set primarily for shad in the New England States in 1892 was 570; of these, 454 were in Maine and 116 in Connecticut; 177 fishermen used gill nets, 358 pound nets or weirs, and 35 seines; in Maine the gill-net fishermen numbered 96 and the pound-net fishermen 358. Shad fishing in Connecticut was carried on by 35 seine fishermen and 81 gill-net fishermen.

The apparatus employed especially for shad in Maine consisted of 365 gill nets, valued at $3,425, and 156 pound nets, valued at $13,280. In Connecticut, the shad apparatus comprised 12 seines, worth $675, and 46 gill nets, having a value of $2,312. The boats used in connection with the foregoing apparatus numbered 55, and were valued at $2,095.

The catch of shad in apparatus set especially for that fish was 939,110 pounds, valued at $34,948, of which quantity 850,150 pounds, worth $27,192, were taken in Maine, and 88,960 pounds, worth $7,756, in Connecticut. The yield of the different kinds of apparatus in each State was as follows: Pound nets, 669,450 pounds, $19,590 (all in Maine); seines, 17,252 pounds, $1,704 (all in Connecticut); gill nets, 180,700 pounds, $7,602, in Maine; 71,708 pounds, $6,052, in Connecticut. The catch of the regular shad fishermen was greatly augmented by the take of persons using apparatus set primarily for other fish. Thus, in Maine, pound nets took 17,420 pounds, valued at $789, and gill nets 1,400 pounds, $70; in Massachusetts, pound nets caught 48,382 pounds, $2,409; purse seines (operated from mackerel vessels) 79,300 pounds, $1,986; haul seines, 6,827 pounds, $410; in Rhode Island, pound nets secured 24,350 pounds, $776; in Connecticut, pound nets yielded 21,602 pounds, $1,679.

Considered in the aggregate, the New England shad fishery has declined since 1880. An analysis of the statistics shows that in Maine the catch has decidedly increased and that in Connecticut the decrease has been noticeable. In New Hampshire and Rhode Island there has also been a marked decline, while in Massachusetts the output in 1892

was about the same as in 1880. The total catch of shad in the New England States in 1880 was 2,117,392 pounds, having a value of $88,730. Of this quantity, 580,319 pounds were taken in Maine, 6,417 pounds in New Hampshire, 164,524 pounds in Massachusetts, 48,100 pounds in Rhode Island, and 1,318,032 pounds in Connecticut. The difference between the output in 1880 and 1892 was 979,001 pounds, valued at $45,663. In Maine the increase, amounting to 288,651 pounds, or about 50 per cent, was chiefly in the Kennebec River, and in Connecticut the decreased output, 1,207,470 pounds, or 92 per cent, was mostly in the Connecticut River.

The failure of the shad fishery of Connecticut River is one of the most noteworthy changes in the condition of the New England river fisheries in recent years. During the first half of the present century this was, next to the Potomac, doubtless the principal shad stream in the United States. The decline in the fishery dates from and may be definitely traced to the erection of a dam at Hadley Falls, Massachusetts, in 1848. A steady annual decrease in the catch was thereafter reported up to 1868, but as late as 1867 the output of the river was 628,500 shad. In 1869 and 1870 the effects of artificial propagation, first undertaken in 1867, were manifested and large numbers of people who had abandoned the fishery resumed operations; these carried on their business without regard for restrictions, and the supply again became exhausted and has since shown an almost unbroken annual decrease for twenty years, the decline being facilitated by overfishing, the interception of larger numbers of fish at or near the mouth of the river by means of nets, the pollution of the water by sewage and factory refuse, and the construction of jetties at the mouth of the river by which the migrating fish have been diverted to other streams.

The following table, compiled from the reports of the Connecticut and Massachusetts Fish Commissions, shows the number of shad taken in the Connecticut River in each of those States in a series of years. The figures for Massachusetts are fully as suggestive as those for Connecticut. The relatively large catch shown for that State in 1881 was due to a reduction from 5 inches to 2 inches in the size of the mesh permitted to be used in nets; this resulted in a greatly increased yield, consisting chiefly of small fish, and was immediately followed by an inordinately small catch.

*Statement of the number of shad taken in the Connecticut River during a series of years.*

| Years. | Connecticut. | Massachusetts. | Total. | Years. | Connecticut. | Massachusetts. | Total. |
|---|---|---|---|---|---|---|---|
| 1867 | 526,500 | 102,000 | 628,500 | 1884 | 150,045 | 1,593 | 151,638 |
| 1876 | ..... | 12,792 | 12,792 | 1885 | 190,300 | 1,718 | 192,018 |
| 1877 | ..... | 6,503 | 6,503 | 1886 | 117,950 | 577 | 118,527 |
| 1878 | ..... | 17,790 | 17,790 | 1887 | 80,350 | 850 | 81,200 |
| 1879 | 436,981 | 13,409 | 450,390 | 1888 | 68,450 | 824 | 69,274 |
| 1880 | 269,918 | 7,727 | 277,645 | 1889 | 42,325 | 796 | 43,121 |
| 1881 | 351,678 | 38,382 | 390,060 | 1890 | 34,318 | 58 | 34,376 |
| 1882 | 272,903 | 2,270 | 275,673 | 1891 | 20,503 | ..... | 20,503 |
| 1883 | 177,308 | 3,591 | 180,899 | 1892 | 18,376 | ..... | 18,376 |

*The alewife fishery.*—Among the river fishes of the New England States the alewives rank next to the smelt in importance, although in all the New England States except Maine and New Hampshire the alewife catch exceeds in value that of the smelt. The fishery is most extensive in Massachusetts, where nearly half the quantity and more than half the value of the yield are obtained. In Maine and Rhode Island the fishery is of similar extent, the former State having a somewhat larger catch and the latter a greater value.

Most of the alewife fishing is done in the rivers or the waters adjoining the river mouths. In Maine the principal alewife grounds are the Machias, Penobscot, Damariscotta, Kennebec, and Sheepscot rivers. In New Hampshire fishing is done in the Piscataqua River. The fishery in Massachusetts is most extensive in Cape Cod Bay, on Marthas Vineyard, and in the Bass, Essex, Rowley, Aganan, Taunton, Mattapoisett, and Acushnet rivers. The catch in Rhode Island is made in Narragansett Bay, and in Connecticut the Connecticut River is the only important fishing-ground.

In 1892 the number of persons in New England engaging in the capture of alewives was 571. Of these, 318 were in Massachusetts and 179 in Maine. The apparatus employed consisted of 112 seines, 203 gill nets, 60 pound nets and weirs, and 151 dip nets. These, with the 258 boats used, had a value of $17,686. The total catch of alewives amounted to 7,847,928 pounds, with a value of $100,364, of which 1,313,977 pounds, valued at $19,826, were incidentally taken in apparatus set primarily for other fish—salmon weirs in Maine and pound nets employed in general shore fishing in Massachusetts, Rhode Island, and Connecticut. The output in Massachusetts was over 3,650,000 pounds, for which the fishermen received $58,516. The principal part of the catch in Maine and New Hampshire was taken in weirs, in Massachusetts and Rhode Island seines took the largest quantities, while in Connecticut the most prominent apparatus was the gill net, which also took considerable quantities in Maine. More than one-third the aggregate yield was caught with seines, and almost as much with pound nets and weirs.

*The herring fishery.*—The taking of the sea herring is one of the most important fisheries of New England, because of its actual value and of the extensive industries dependent on it. The value of the herring fishery is exceeded only by that of such prominent fisheries as the whale, cod, mackerel, haddock, halibut, oyster, clam, and lobster; and, if the closely related business of canning and smoking herring is considered, the herring becomes more important than any other New England fishery product except cod.

The herring is taken chiefly in Maine and Massachusetts, although its range embraces the entire New England coast. By far the largest fishery is in Maine, where there are more herring fishermen, more capital invested in the fishery, and more fish taken than in all the other States combined. In Massachusetts, however, the fishery is important.

The bulk of the catch in Maine is consumed in the preparation of sardines and in smoking; while in Massachusetts more herring are used for bait in the line fisheries than for any other purpose.

In 1892 the number of persons engaged in fishing for herring in this region was 1,995; of these, 1,409 were in Maine. The capital invested in vessels, boats, and apparatus that were used in the capture of herring was $364,840; of this sum, $197,420 is to be credited to Maine, and $164,687 to Massachusetts. The aggregate catch of herring was 53,064,929 pounds of fresh fish; this was valued at $386,871 as it left the hands of the fishermen in a fresh, pickled, or smoked state.

Weirs, pound nets, gill nets, and seines take large quantities of herring, but brush weirs secure the major part of the catch. In Maine, these latter are to be credited with fully three-fourths of the herring yield, and in the entire region they took nearly three-fifths of the aggregate catch. Gill nets rank next to weirs and pounds in the quantity of their yield; they are especially important in Maine, where about seven-ninths of the herring thus secured are obtained. Seines take less than half the fish caught with gill nets, and are more prominent in Massachusetts than in Maine. On parts of the Massachusetts coast, the use of dip nets and torches in the capture of herring is rather a prominent feature of the fisheries, but in other States this primitive method is now of no importance.

Comparing the results of the herring fishery with previous years for which complete data are available, it appears that in 1892 the total output was nearly double that in 1880, and was considerably larger than in 1887, 1888, or 1889. In Maine the catch in 1892 was nearly twice that in 1880, and in Massachusetts the increase was comparatively almost as large. The yield in both Maine and Massachusetts in 1892 was larger than in any other year for which data are available. The following table shows, by States, the quantity and value of herring caught in each of the years named, the weights representing the fish as taken from the water:

*Table showing for a series of years the catch of herring in the New England States.*

| States. | 1880. | | 1887. | | 1888. | |
|---|---|---|---|---|---|---|
| | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. |
| Maine | 21,455,192 | $122,596 | 32,134,005 | $200,615 | 39,018,007 | $239,949 |
| New Hampshire | 108,750 | 932 | 225,500 | 1,793 | 358,200 | 3,060 |
| Massachusetts | 7,794,780 | 62,998 | 8,711,650 | 74,290 | 10,846,770 | 96,776 |
| Total | 29,358,722 | 186,526 | 41,071,155 | 276,098 | 50,222,977 | 339,785 |

| States. | 1889. | | 1892. | |
|---|---|---|---|---|
| | Pounds. | Value. | Pounds. | Value. |
| Maine | 30,056,999 | $239,571 | 40,814,164 | $274,397 |
| New Hampshire | 19,800 | 195 | 146,600 | 1,015 |
| Massachusetts | 10,434,103 | 90,762 | 12,103,465 | 110,829 |
| Total | 40,510,902 | 330,528 | 53,064,229 | 386,841 |

NOTE.—In Rhode Island in 1892, 700 pounds of herring were caught, having a value of $30.

In addition to the herring smoked at the sardine canneries in Maine, large quantities are so prepared by the fishermen of the eastern part of the State. In 1892, 10,495,143 pounds of fresh herring taken in American waters, chiefly with brush weirs, were consumed in the preparation of 5,997,225 pounds of smoked fish. These were placed on the market in 1,060,320 boxes, each holding about 5 pounds, and 27,825 boxes holding about 25 pounds each, the value of the smoked fish being $136,297. By far the largest quantities of herring are smoked by the fishermen of Eastport and Lubec, who also obtain many herring for smoking from weirs set in Canadian waters. The business is also important in the towns of Jonesport, Trescott, Cutler, Addison, and Machiasport. Between 1889, when the Fish Commission conducted an investigation of the Maine fisheries, and 1892, the year covered by the last canvass, this branch experienced a large increase, as shown by the following figures:

*Comparative statement of the quantities of herring smoked by Maine fishermen in 1889 and 1892.*

| Items. | 1889. | 1892. | Increase in 1892. | Percentage of increase. |
|---|---|---|---|---|
| Fresh herring utilized ..... pounds.. | 5,761,000 | 13,301,395 | 7,540,395 | 131 |
| Herring smoked: | | | | |
| Regular size ..... boxes.. | 626,400 | 1,460,320 | 833,920 | 133 |
| Value ..... | $98,031 | $162,156 | $64,125 | 65 |
| Bloaters ..... boxes.. | 6,400 | 34,825 | 28,425 | 444 |
| Value ..... | $5,008 | $23,741 | $18,733 | 374 |
| Total quantity as smoked ..... pounds.. | 3,292,000 | 8,172,225 | 4,880,225 | 150 |
| Total value ..... | $103,039 | $185,897 | $82,858 | 80 |

The present extent of the smoked-herring business as compared with the conditions ten years ago is one of the most noteworthy features of the Maine fisheries. This branch has steadily increased since the abrogation of the Washington treaty in 1885. It is not possible to present satisfactory comparative figures showing separately the fish smoked by fishermen and canners and the quantity coming from American and Canadian waters, but accurate statistics may be given showing for the years 1880, 1887, 1888, 1889, and 1892 the total extent of the smoked-herring business. This branch was somewhat less extensive in 1887 than in 1880, but since 1887 the business has steadily increased, and in 1892 had more than double the importance it had twelve years before.

*Comparative summary of the smoked-herring business of Maine in 1880, 1887, 1888, 1889, and 1892.*

| Year. | Fresh herring utilized (pounds). | Herring smoked. | | | | | |
|---|---|---|---|---|---|---|---|
| | | Regular size. | | Bloaters. | | Equivalent number of pounds as smoked. | Total value of smoked fish. |
| | | Boxes. | Value. | Boxes. | Value. | | |
| 1880 ..... | 6,138,942 | 318,915 | $63,783 | 51,700 | $36,190 | 4,434,111 | $99,973 |
| 1887 ..... | 5,984,098 | 588,297 | 88,506 | 19,120 | 11,982 | 3,419,485 | 100,488 |
| 1888 ..... | 7,630,761 | 755,077 | 124,705 | 23,402 | 15,449 | 4,360,435 | 140,154 |
| 1889 ..... | 8,908,243 | 919,880 | 143,061 | 19,641 | 15,369 | 5,090,425 | 159,330 |
| 1892 ..... | 17,765,466 | 1,781,214 | 198,670 | 49,825 | 33,366 | 10,151,695 | 232,036 |

*The salmon fishery.*—The taking of salmon is one of the most interesting of the New England river fisheries, although its economic importance is slight as compared with many other fisheries of that region. While straggling salmon are found in a number of the rivers, it is only in the Penobscot that the yield is sufficiently large to warrant notice, less than one-tenth the total annual output coming from other streams. Special fishing for salmon is prosecuted only in the St. Croix, Denny, and Penobscot rivers, the fish obtained in other waters being only an incidental element in the catch of nets set for shad, alewives, and other fish.

In 1892, the number of persons fishing specially for salmon in the Maine rivers was 198, of whom 174 were in the Penobscot. Of these, 29 used gill nets, 159 pound nets or weirs, and 10 lines. There were 20 gill nets employed, valued at $615; the pound nets and weirs were 211 in number, worth $14,450. The boats and shore and other property connected with the fishery had a value of $5,339. The aggregate catch was 98,322 pounds, for which the fishermen received $20,332. The quantity taken in the Penobscot River was 92,282 pounds (equivalent to 6,789 fish), valued at $19,124. The output of the St. Croix, Denny, and Kennebec rivers, respectively, was 2,560 pounds, with a value of $512; 1,200 pounds, $216; and 2,080 pounds, $460. In addition to the salmon catch shown, a few fish were taken in the Merrimac River and at several points on the Massachusetts coast. These, however, were generally released, in conformity with law. The gill-net catch amounted to only 3,650 pounds, valued at $745; that of lines was 560 pounds, with a value of $112, while the yield in pound nets was 94,112 pounds, worth $19,475. In Connecticut less than 200 pounds of salmon were taken in pound and gill nets set for shad, alewives, and other fish.

A small decrease (12,916 pounds, valued at $1,685) occurred in the New England salmon catch in 1892, as compared with 1880, although a comparison with intermediate years for which statistics are available shows a more pronounced decline. Thus, in 1887, the total yield was 186,067 pounds, valued at $36,736; in 1888, 205,679 pounds, valued at $41,635; and in 1889, 153,159 pounds, valued at $34,406, these figures being obtained in the official investigations of this division.

The principal decline in the New England salmon fishery considerably antedated 1880, however, and was coincident with the erection of dams or other barriers to the passage of fish. As early as the beginning of the century the rivers of Maine began to experience a decline, and one by one the numerous streams to which the salmon had been accustomed to resort ceased to support the fish, until only the Penobscot remains. Prior to 1798, salmon were very abundant in the Connecticut River; in that year a 16-foot dam was placed entirely across the river about 100 miles above its mouth, and from that time the fish began to decrease. By 1810 the salmon had almost disappeared, and during the succeeding sixty years the fish was practically unknown in this river.

There seems little reason to doubt that the preservation of the salmon run in the Penobscot River has been due entirely to artificial propagation, which began about 1871 and has continued to the present time.

The known results of the attempts to acclimatize salmon in new streams warrants the belief that but for cultivation salmon would have long since been exterminated on the east coast of the United States. The plants of salmon fry in New England waters by the national and State fish commissions aggregated about 20,000,000 to 1892.

The suggestive history of salmon propagation in the Connecticut may here be outlined. The first planting of fry in this river, consisting of 2,000, was made in 1869. A second lot of 30,000 was planted in 1870. In 1873 150,000 were planted in the tributaries of the river, and in 1874 another lot of 1,189,000 was introduced. In 1875 the plantings consisted of 500,000, and in 1876 300,000. Results were soon seen. In 1872 a 7¾-pound female, a 10-pound female, and a 1-pound grilse, apparently the results of the plantings in 1869, were taken. In 1874 and 1875 smolts were observed in large numbers in this stream, and several were caught in the Farmington River, the principal tributary of the Connecticut. At least three or four salmon were caught in 1876, while in 1877 the catch amounted to about a dozen. The best results, however, were observed in 1878, four years after the largest deposits had been made. During that season the catch amounted to probably 500 marketable fish, the average weight of which was reported as about 12 pounds, some of them weighing 20 pounds. The catch in 1879 is reported as having been somewhat less than in 1878, but the average weight was greater, most of those taken exceeding 18 pounds. Because of certain difficulties, relatively few fry have been planted in the Connecticut River since 1879, and since that year the catch has been very small, only a few stragglers being reported each year. In 1882 four were reported, two of which weighed 23 and 25 pounds, respectively, the other two about 15 pounds each. In 1884 two were captured. In 1887 the catch was unusually large, about twenty being reported. In 1892 three, weighing 35 pounds, were caught in gill nets set below Chester, in the township of Saybrook, and six others, weighing 78 pounds, were taken in pound nets on either side of the mouth of the river.

*The smelt fishery.*—While the catching of smelt is not of great importance in comparison with other branches of the New England fisheries, this fishery has some interesting features and in parts of Maine is of considerable extent. The fish enter the fresh waters of all the coast States of the region, but only in Maine are they sufficiently abundant to constitute a prominent river fish; there they are more valuable than salmon, shad, alewives, or any other anadromous species.

Smelt fishing is carried on along the entire coast of Maine, but is most extensive in the Machias, Westongus, Penobscot, Bagaduce, Damariscotta, Sheepscot, Kennebec, and Saco rivers, in Penobscot Bay, Muscongus Sound, Casco Bay, and in small streams in York County. In Massachusetts regular smelt fishing is confined to the Merrimac River. The smelt catch in Rhode Island is obtained in the Pawcatuck River. The Thames and Mystic rivers are the principal smelt streams in Connecticut.

The smelt fishery in 1892 gave employment to over 2,000 persons, of whom more than 1,900 were in Maine. These used, as apparatus of capture, 161 seines, 305 bag nets, 62 traps and weirs, and 3,858 lines, which, with 408 boats, had a value of $32,406, of which over $29,000 represented the investment in Maine. The quantity of smelts taken was 1,697,768 pounds, for which the fishermen received $123,963, the catch in Maine being 1,616,758 pounds, valued at $115,913. The product of the fishery in 1892 was greater than in any other year for which data are available. Thus, in 1880, the New England catch was 966,641 pounds, worth $51,313; in 1887, 1,316,350 pounds, $96,467; in 1888, 1,397,450 pounds, $103,584; in 1889, 1,209,385 pounds, $84,912. More than half the aggregate catch in 1892 was obtained with seines, after which, in point of output, came lines and bag nets.

The increase in recent years over 1880 has been chiefly due to the employment of more fishermen and the use of more apparatus. Thus, in Maine the smelt fishermen in 1880 numbered only 992 against 1,913 in 1892, and the number of smelt seines (the most prominent apparatus now used) increased from 4 to 152.

*The lobster fishery.*—This fishery has of late attracted much attention on account of the serious decrease in the output in the principal lobster-producing States, and special attention was given to it in the field inquiries. The lobster is generally distributed in the coastal waters of the New England States, and in each its capture constitutes an important industry. It is more valuable in Maine than in all the other States combined, and is the principal fishery product of the State.

This fishery in 1892 gave employment to 3,673 persons directly engaged in fishing. Of these, 2,628 were in Maine, 26 in New Hampshire, 616 in Massachusetts, 145 in Rhode Island, and 258 in Connecticut. The vessels employed in catching lobsters numbered 55, and were valued, with their outfit, at $63,590. They were provided with 6,457 pots, having a value of $11,124, and carried 151 fishermen. Seven of the vessels belonged in Maine, 2 in Massachusetts, 12 in Rhode Island, and 34 in Connecticut. The number of boats used was 3,925, valued at $323,290; 2,888 were in Maine, 29 in New Hampshire, 739 in Massachusetts, 86 in Rhode Island, and 183 in Connecticut. The pots or traps employed in the boat fishery numbered 190,617, valued at $206,118, of which 152,121 are to be credited to Maine, 1,393 to New Hampshire, 25,872 to Massachusetts, 5,121 to Rhode Island, and 6,110 to Connecticut. The live-cars and other accessory property connected with this fishery had a value of $55,709, of which $30,746 belonged in Maine and $18,573 in Massachusetts. The quantity and value of the lobster catch in 1892 were as follows: Maine, 17,642,677 pounds, $663,043; New Hampshire, 196,350 pounds, $11,790; Massachusetts, 3,182,270 pounds, $205,638; Rhode Island, 774,100 pounds, $53,762; Connecticut, 1,614,530 pounds, $101,358; a total of 23,409,927 pounds and $1,035,591.

A comparison of the extent of the New England lobster fishery in 1880 and 1892 shows that in the aggregate there has been an advance

in practically every item. In 1880 the number of lobster fishermen was 2,759, divided as follows among the States: Maine 1,843, New Hampshire 44, Massachusetts 595, Rhode Island 129, Connecticut 148. The increase in 1892 was therefore 914, or 33 per cent; the largest advances were in Maine and Connecticut.

The increase in the investment has been very marked in every State; it rose from $263,963 in 1880 to $659,831 in 1892, the gain being 150 per cent. The number of boats and vessels used advanced from 2,438, valued at $150,537, in 1880, to 3,980, worth $386,880, in 1892; in Maine the increase in this item was from 1,797 to 2,895, and in Massachusetts from 446 to 741. The lobster pots or traps employed in 1880 numbered 140,083, valued at $217,242, the increase in 1892 being 43,009, or 31 per cent.

The output of the New England lobster fishery in 1880 was 19,946,733 pounds, valued at $477,484; the catch in 1892 was 3,463,194 pounds larger and $558,107 more valuable, an increase of 17 per cent in quantity and 117 per cent in value.

The increased valuation per pound in 1892 as compared with 1880 indicates the condition of the fishery and suggests the actual decline which is not disclosed by the bare figures for the catch. The following table, showing the percentage of increase or decrease in the quantity and value of the yield in the two years named, strikingly illustrates this point. In Maine, while the output increased 23.95 per cent, the value of the catch to the fishermen increased 146.72 per cent. In Massachusetts there was a decrease in the quantity of 26.26 per cent, but an increase in the value of 23.42 per cent. Similar noteworthy differences appear for the other States.

*Comparison of the New England lobster catch in 1880 and 1892.*

| States. | 1880. | | 1892. | | Increase (+) or decrease (—). | | Percentage of increase or decrease. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. |
| Maine | 14,234,182 | $268,739 | 17,642,677 | $663,043 | +3,408,495 | +$394,304 | + 23.95 | +146.72 |
| New Hampshire | 250,000 | 7,500 | 196,350 | 11,790 | — 53,650 | + 4,290 | — 21.46 | + 55.73 |
| Massachusetts | 4,315,416 | 158,229 | 3,182,270 | 205,638 | —1,133,146 | + 47,409 | — 26.26 | + 23.42 |
| Rhode Island | 423,250 | 15,871 | 774,100 | 53,762 | + 350,850 | + 37,891 | + 82.89 | +238.74 |
| Connecticut | 723,885 | 27,145 | 1,614,530 | 101,358 | + 890,645 | + 74,213 | +123.04 | +273.39 |
| Total | 19,946,733 | 477,484 | 23,409,927 | 1,035,591 | +3,463,194 | + 558,107 | + 17.36 | +116.88 |

An additional evidence of the decline in this fishery is the diminished average catch per man. In 1880 the Maine lobster fishermen took, on an average, during the season 7,723 pounds of lobsters; in 1892 they caught 6,713 pounds. The change in this State has been especially marked since 1889, in which year the average catch per man was 12,019 pounds. The average yield in Massachusetts was 7,253 pounds in 1880 and 5,165 pounds in 1892. In Rhode Island there has been an advance in this respect from an average of 3,281 pounds per man in 1880 to 5,338 pounds in 1892. A similar increase has occurred in Connecticut, the average being 4,884 pounds in 1880 and 6,258 pounds in 1892. It

will be seen, however, that the increase has been due to the use of larger numbers of traps per man. Considering the entire region, the average catch per man was 7,229 pounds in 1880 and 6,374 pounds in 1892.

Further indication of a diminished supply of lobsters is seen in the smaller average catch per trap. In 1880 the average quantity of lobsters taken in the New England States was 142 pounds per trap; in 1889 it was 180 pounds, and in 1892 it was 119 pounds. The figures for Maine are 136 pounds per trap in 1880 and 115 pounds in 1892. In 1889, when the lobster fishery reached its height, it was 195 pounds, against 193 in 1888 and 200 in 1887. In Massachusetts the average catch per pot declined from 149 pounds in 1880 to 121 pounds in 1892. The decrease was most marked in Rhode Island and Connecticut. In the former the average was 194 pounds in 1880 and 122 pounds in 1892, while in Connecticut the average for 1880 was 349 pounds and for 1892 only 149 pounds.

The following comparative table shows the New England lobster catch in the five years for which figures are available, and gives a clear idea of the fluctuations which have characterized the fishery in each State:

| States. | 1880. | | 1887. | | 1888. | |
|---|---|---|---|---|---|---|
| | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. |
| Maine | 14,234,182 | $268,739 | 22,916,642 | $512,044 | 21,694,731 | $515,880 |
| New Hampshire | 250,000 | 7,500 | 142,824 | 6,268 | 136,350 | 6,256 |
| Massachusetts | 4,315,416 | 158,229 | 3,511,075 | 156,204 | 3,743,475 | 172,936 |
| Rhode Island | 423,250 | 15,871 | 570,039 | 27,128 | 588,500 | 28,047 |
| Connecticut | 723,885 | 27,145 | 1,487,020 | 82,594 | 1,477,226 | 85,723 |
| Total | 19,946,733 | 477,484 | 28,627,600 | 784,238 | 27,640,282 | 808,842 |

| States. | 1889. | | 1892. | |
|---|---|---|---|---|
| | Pounds. | Value. | Pounds. | Value. |
| Maine | 25,001,351 | $574,165 | 17,642,677 | $663,043 |
| New Hampshire | 137,175 | 6,415 | 196,350 | 11,790 |
| Massachusetts | 3,353,787 | 148,492 | 3,182,270 | 205,638 |
| Rhode Island | 456,000 | 21,565 | 774,100 | 53,762 |
| Connecticut | 1,501,290 | 83,099 | 1,614,530 | 101,358 |
| Total | 30,449,603 | 833,736 | 23,409,927 | 1,035,591 |

*The whale fishery.*—The whale fishery continues to be one of the most important branches of the New England fisheries, although its importance is much less than formerly, owing to the scarcity of whales, the withdrawal of vessels from the business, and the transfer of interests to the Pacific Coast, where the conditions for carrying on the fishery are better. New Bedford, which in 1880 had 123 vessels engaged in whaling, in 1892 had a fleet of only 41 vessels, 17 of which made their headquarters at San Francisco. The other 11 vessels, comprising the New England whaling fleet in the latter year, hailed from Provincetown, Boston, Edgartown, and New London. The value of the vessels and their outfits was $700,700, and the tonnage of the fleet was 9,537.60 net. The crews numbered 1,409. The following table shows the rigs represented and the grounds resorted to by the vessels of each port.

The yield of the whale fishery consisted of 211,235 gallons of whale

oil valued at $88,712, 440,159 gallons of sperm oil valued at $294,931, 120,150 pounds of bone valued at $585,347 and 20 pounds of ambergris valued at $5,277. The aggregate value of the fishery products was $974,267, of which $656,072 represented the results of the fishery carried on by New Bedford vessels rendezvousing at San Francisco and fishing in the North Pacific and Arctic oceans; their catch was made up of whale oil worth $67,778, sperm oil worth $37,044, and whalebone worth $551,250. The aggregate gross stocks of the vessels fishing from the different ports are shown in the summary.

*Summary of the New England whaling fleet in 1892.*

| Hailing ports. | Number of vessels of each rig. | | | | | | Number of vessels on each fishing-ground. | | | | | Gross value of catch. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Steamers. | Barks. | Ships. | Brigs. | Schooners. | Total. | North Pacific and Arctic oceans. | Atlantic Ocean. | Okhotsk Sea. | Hudson Bay. | Total. | |
| New Bedford: | | | | | | | | | | | | |
| At New Bedford | .... | 11 | 1 | .... | 12 | 24 | ..... | 23 | .... | 1 | 24 | $226,360 |
| At San Francisco | 2 | 14 | .... | 1 | .... | 17 | 14 | 1 | 2 | .... | 17 | 656,072 |
| Provincetown | .... | .... | .... | 1 | 7 | 8 | ..... | 8 | .... | .... | 8 | 80,140 |
| Edgartown | .... | .... | .... | .... | 1 | 1 | ..... | 1 | .... | .... | 1 | 6,332 |
| Boston | .... | .... | .... | 1 | .... | 1 | ..... | 1 | .... | .... | 1 | 4,040 |
| New London | .... | .... | .... | .... | 1 | 1 | ..... | 1 | .... | .... | 1 | 1,323 |
| Total | 2 | 25 | 1 | 3 | 21 | 52 | 14 | 35 | 2 | 1 | 52 | 974,267 |

*The oyster fishery.*—With the exception of the cod, the oyster was the most valuable product of the New England fisheries in 1892. Although absent from the waters of Maine and New Hampshire, and taken in only limited quantities in Massachusetts, the extent of the fishery in Rhode Island and Connecticut is sufficient to give the oyster a position in advance of such important products as haddock, halibut, herring, mackerel, lobsters, and whales.

The New England oyster industry in 1892 gave direct employment to 1,741 persons, of whom 1,152 were fishermen and 589 were shoresmen, 714 of the former and 561 of the latter being in Connecticut. The aggregate investment in the industry was $471,931, exclusive of the oyster-grounds. Of this amount over $400,000 is to be credited to Connecticut. $370,000 represented vessels and their outfit, $89,000 boats, and $12,000 dredges and tongs. The yield of the oyster fishery consisted of 1,175,182 bushels of market oysters, valued at $1,201,782; 1,004,245 bushels of seed oysters, valued at $567,347; and 230,661 bushels of shells, used for planting purposes, valued at $8,263.

The most interesting and suggestive feature of the oyster industry of this section is the complete dependence for the supply on grounds under private ownership or control. During the period between 1880 and 1892 great changes occurred in the methods of the oyster fishery. In 1880 the exhaustion of the natural oyster-grounds had resulted in a decrease in the fishery, the average size of the oysters was smaller than before, and a still further decline in the industry was unavoidable

under the conditions prevailing. The output of the fishery in that year was only 435,650 bushels, a quantity insignificant when compared with the yield which subsequent experience has shown to be possible in these waters. The most noteworthy change in the condition of the industry occurred in Connecticut, which has been the scene of the most extensive and remunerative oyster-culture in the world. The entire history of the oyster industry in that State, as well as in the other States of the section, has demonstrated the futility of depending on natural oyster-grounds for the supply and the possibility of bringing barren areas of sea bottom, hitherto regarded as useless, under profitable cultivation. The Connecticut system has attracted much attention and has been adopted by other States. For a detailed account of the methods and conditions which have contributed to the development of the oyster industry of Connecticut, recourse should be had to the State reports and to papers[1] published by this Commission.

In addition to the value of fishing property (vessels, boats, apparatus) employed in the Connecticut oyster fishery, there are very important investments represented by the private oyster-grounds, the crop on the beds, and the shore property and cash capital required by the large operators for the proper conduct of the business. In 1892 the market value of the oyster-grounds was $1,283,650; the oysters planted on the grounds had an estimated value of $2,118,600; the value of the wharfs, buildings, etc., connected with the industry was $361,270, and the cash capital was $370,000.

According to the official State records, the available area for oyster fishing and planting in Connecticut is 93,601 acres. The division of this area into private and public grounds is shown in the following table, in which the areas over which the State and towns respectively exercise jurisdiction are separately indicated:

| Grounds. | Public. | Private. |
|---|---|---|
| | *Acres.* | *Acres.* |
| State | 5,809 | 67,905 |
| Town | 13,482 | 6,405 |
| Total | 19,291 | 74,310 |

The public beds in 1892 yielded less than a bushel of market oysters and less than 11 bushels of seed oysters to the acre. The private beds, on the other hand, produced on an average 13 bushels of market oysters and 10 bushels of seed oysters per acre, if the entire grounds be considered, but if, as is proper, only the part actually utilized in 1892 be regarded (about 18,225 acres), then the average production per acre was 53 bushels of market oysters and 41 bushels of seed oysters. The average value per acre of the oysters taken from the public or natural beds was under $4, while the yield of the cultivated grounds had an average value of about $75 per acre.

[1] See especially "Notes on the oyster industry of Connecticut," by J. W. Collins (Bulletin U. S. Fish Commission 1889), and "The methods of deep-water oyster culture," by Henry C. Rowe (Bulletin U. S. Fish Commission 1893).

Following is a table showing the quantity and value of the market and seed oysters taken from public and private grounds in 1892:

| Grounds. | Bushels. | Value. |
|---|---|---|
| Private grounds: | | |
| Market oysters | 972,074 | $878,560 |
| Seed oysters | 752,460 | 474,340 |
| Total | 1,724,534 | 1,352,900 |
| Public grounds: | | |
| Market oysters | 13,720 | 10,125 |
| Seed oysters | 201,920 | 63,224 |
| Total | 215,640 | 73,349 |
| Grand total | 1,940,174 | 1,426,249 |

The business of planting seed oysters and of placing various kinds of shells on the oyster-grounds for the purpose of furnishing a suitable place for the attachment of the oyster spat is very extensive. The use of crushed stone and gravel for the latter purpose is also resorted to in some parts of the State. The quantity and value of the seed, shells, and stone deposited on the grounds in 1892 are given in the following table; 106,500 bushels of the seed sown, valued at $62,260, represented small oysters brought from the South.

| Items. | Quantity. | Value. |
|---|---|---|
| Seed oysters ..... bushels | 288,700 | $122,670 |
| Shells ..... do | 1,666,450 | 125,416 |
| Crushed stone and gravel ..... tons | 26,745 | 21,435 |
| Total | | 269,521 |

The most northern locality on the New England coast where any form of oyster-culture is practiced is in the mouth of Parker River, at Newburyport, Mass., where 12 acres are under cultivation. In 1892 1,500 bushels of oysters, costing $1 per bushel, were planted. When taken up they amounted to 1,800 bushels, which were sold at retail in Newburyport for $2,700. Mr. Hall, field agent, reports as follows on the oyster business at this place:

This is not a natural oyster region. The business is very small, and there is no prospect that it will ever increase. The oysters are planted in April and taken up during the following summer and fall. The bottom is hard mud. Sea cabbage (an alga) grows on portions of the beds. The oystermen believe it is beneficial to the oysters. The seed oysters, which come from Barnstable Bay, are large when planted. After lying on the beds one season they open 1 gallon to the bushel. No seed oysters are produced on the beds, and those brought from Barnstable Bay cost too much to render competition practicable on the part of the producers at Newburyport, as market oysters can be obtained in Boston from Virginia, Maryland, Rhode Island, and elsewhere more cheaply than they can be raised at Newburyport.

On the southern part of the Massachusetts coast, the principal places where the oyster fishery is carried on are Barnstable Bay and Wellfleet Bay, on the northern side of the Cape Cod Peninsula; Oyster Pond and Oyster Pond River, at Chatham, on the east side of the cape; Cotuit Harbor and Lewis Bay, arms of Vineyard Sound, which washes

the southern shores of the peninsula; Red Brook Harbor, Bourne Neck, Buttermilk Bay, Onset Bay, Wareham River, Sippican Harbor, and Westport River, all tributaries of Buzzards Bay; and Taunton River, which enters Narragansett Bay. The oysters in these localities are taken from natural grounds having an area of about 1,100 acres and from cultivated beds with an area of about 3,125 acres. The principal natural grounds are in Taunton River and the most extensive cultivated beds are in Onset Bay and Wareham River.

The inquiries of the office showed that about 1,500 acres in Onset Bay and its arms and 800 acres in Wareham River were utilized for oyster-culture by 47 planters. Some of the planters do only a small business, while others are quite extensively engaged. Some years the set is very good, that in 1893 being the best in many years. It is reported that fully half the yearly output represents native growth. In 1892, 7,041 bushels of market oysters, valued at $14,082, were taken; 10,600 bushels of seed oysters from Connecticut and Rhode Island and 10,000 bushels of shells, costing $7,160, were planted on the grounds in the same year. The seed from Rhode Island remains planted one year and is then returned to Providence River to mature. This is done chiefly to escape the ravages of starfish in Rhode Island waters while the oysters are young, starfish being uncommon in Onset Bay and Wareham River and doing no damage. The borer, however, is quite destructive, and the periwinkle is also injurious.

Mr. W. A. Wilcox, field agent, has submitted the following notes on the oyster industry of Taunton River:

Taunton River has more acres in natural oyster beds than any other ground in the State. The natural oyster beds are estimated to cover 1,000 acres of ground; they extend on either side of the river in an almost continuous bed from the mouth at Fall River up as far as Dighton. The oyster beds are owned by the towns bordering on the river, the town right extending from the shore to the middle of the stream. Each town leases its oyster privileges to one person, who has the exclusive right to take oysters from grounds within the respective towns between September 1 and June 1. The leases are sold at public or private sale, and are good for one year or a term of years. During 1892 the town licenses for that year were as follows: Fall River, $152; Somerset, $710; Dighton, $275; Berkeley, $1,500; Freestone, $1,000 (two leases). The town of Freestone sells one privilege for Taunton River and one for Asonet River. The latter is a small stream tributary to Taunton River; natural oyster beds are found from its mouth for a distance of 2¼ miles upstream.

In past years the Taunton River oysters were highly esteemed and considered equal to any in the State, but since about 1883, when extensive copper works were established at Taunton, the oysters, from some unknown cause, have taken on a greenish-yellow color and an astringent coppery flavor. As a consequence, they are not now considered wholesome and are not placed on the market or used locally, and the beds are now only valuable for the seed oysters produced. Of late years about 25,000 bushels of seed oysters have been taken annually from Taunton and Asonet rivers and transplanted in Providence River, where they lose their undesirable color and flavor, becoming equal to any oysters taken from Providence River, which is noted for its fine stock. The seed are taken up during April and May, when about 50 rowboats, with one man each, are at work on the beds. The men tong the oysters, taking on an average about 25 bushels daily, for which service they receive 10 to 20 cents a bushel.

Of late years oysters are reported to be growing scarce, which is not surprising, as there has been no good set for a number of years, and the beds are allowed no chance to recuperate.

The oyster output of Rhode Island is at present obtained almost wholly from private cultivated grounds. These have an area of about 700 acres. In 1892 there were taken from these beds 156,080 bushels of marketable oysters, valued at $239,941. As the oysters remain on the beds for about three years, on an average, and as about one-third of the ground gives up these oysters annually, it appears that the average production of marketable oysters to the acre is 670 bushels, valued at $1,020. The natural oyster beds of the State have become practically unproductive of marketable oysters. In 1892 only 2,000 bushels, valued at $2,075, were taken off the natural grounds. In addition to these, 14,865 bushels of small oysters, worth $5,783, were obtained, which were used for planting purposes.

A striking illustration of the utility of a rational system of water culture applied to mollusks is seen by comparing the oyster with other shellfish the beds of which are not subject to private ownership except on an exceedingly small scale. The susceptibility of the soft clam, the quahog, and the scallop to cultivation is perhaps as pronounced as that of the oyster, and the comparison is therefore fair. While the average quantities of soft clams, of quahogs, and of scallops taken for market in the New England States in 1892 were, respectively, 227 bushels, 154 bushels, and 176 bushels per man, the average quantity of oysters was 1,892 bushels per man. The incomes of the fishermen from the sale of these products indicate a similar disparity, being $125 per man for soft clams, $168 per man for quahogs, $141 per man for scallops, and $1,536 per man for oysters.

*The clam fishery.*—Clams are among the most valuable fishery resources of the New England States, and their collection constitutes one of the most extensive and important branches of the fisheries. Throughout this region the soft clam or long clam (*Mya arenaria*) is found abundantly; but it is only along the southern part of the coast that the quahog or round clam (*Mercenaria mercenaria*) occurs. The former is the more abundant and important species, considering the yield in the aggregate; it is especially prominent in Maine and Massachusetts. The quahog is most important in southern Massachusetts.

The number of persons engaged in clamming is larger than in any other fishery under consideration, with the exception of the lobster. Over 3,300 persons in 1892 took clams for a livelihood during some part of the year. In Maine there were more than 1,900 clam fishermen and in Massachusetts over 800. Owing to the inexpensive outfit required for clamming and the comparative ease with which the clams are taken, this fishery is of great assistance to the poorer classes in the fishing communities; and it is a saying along parts of the Maine coast that "the clam beds keep many people off the town." The semiprofessional nature of the fishery in Maine may be judged from the circum-

stance that the average value of the clams taken in 1892 was only $80 per man.

The New England clam catch in 1892 was 759,402 bushels, valued at $462,889. The yield of soft clams was 667,509 bushels, valued at $362,477, and that of quahogs 91,893 bushels, with a market value of $100,412. The production of each species by States is given in the following table:

| Production of soft clams and quahogs. | States. | Bushels. | Value. |
|---|---|---|---|
| Soft clams | Maine | 416,806 | $157,431 |
| | New Hampshire | 1,050 | 975 |
| | Massachusetts | 191,923 | 133,529 |
| | Rhode Island | 33,950 | 45,222 |
| | Connecticut | 23,780 | 25,320 |
| | Total | 667,509 | 362,477 |
| Quahogs | Maine | | |
| | New Hampshire | | |
| | Massachusetts | 54,823 | 61,801 |
| | Rhode Island | 19,950 | 20,275 |
| | Connecticut | 17,120 | 18,336 |
| | Total | 91,893 | 100,412 |
| Total | Maine | 416,806 | 157,431 |
| | New Hampshire | 1,050 | 975 |
| | Massachusetts | 246,746 | 195,330 |
| | Rhode Island | 53,900 | 65,497 |
| | Connecticut | 40,900 | 43,656 |
| | Total | 759,402 | 462,889 |

In Maine a large part of the clams taken are salted, to be used as bait in the line fisheries for cod and other ground fish. The salted clams are placed in barrels holding about 12 bushels of shucked clams. In 1892, 75,269 bushels were thus utilized in the preparation of 5,938 barrels of clam bait, for which the fishermen received $27,044. Notwithstanding the increase in the clam production in 1892 as compared with 1880, the quantity of clams salted for bait was much greater in 1880, being 178,164 bushels, from which were prepared 12,726 barrels of pickled clams, valued at $63,630.

Between 1880 and 1892 the output of soft clams fluctuated considerably; in Maine, Massachusetts, and Rhode Island, the yield in 1889 was larger than in any other year for which complete data are available, the aggregate catch being double that in 1880. The season of 1892 was unusually poor in both Maine and Massachusetts; the catch was but little more than in 1880, and the total production of the region was hardly 100,000 bushels more than in 1880. The years 1887 and 1888 also had a larger output than 1880 and 1892.

The yield of quahogs in 1892 was perhaps the largest known up to that time. Massachusetts experienced a noteworthy advance, which counterbalanced the decline in Rhode Island and Connecticut. The abundance of this mollusk, however, seems to have been singularly uniform, as judged by the aggregate catch, the smallest production, in 1889, being only 25 per cent less than the largest in 1892.

Following is a comparative exhibition of the results of the clam fishery in each State during all the years for which figures are at hand:

*Comparative statement of the yield of clams in the New England States during a series of years.*

| | Soft clams. | | Quahogs. | | Total. | |
|---|---|---|---|---|---|---|
| | Bushels. | Value. | Bushels. | Value. | Bushels. | Value. |
| Maine: | | | | | | |
| 1880 | 318,383 | $101,808 | | | 318,383 | $101,808 |
| 1887 | 608,780 | 228,490 | | | 608,780 | 228,490 |
| 1888 | 600,675 | 227,665 | | | 600,675 | 227,665 |
| 1889 | 595,105 | 200,761 | | | 595,105 | 200,761 |
| 1892 | 416,806 | 157,431 | | | 416,806 | 157,431 |
| New Hampshire: | | | | | | |
| 1880 | 17,960 | 8,980 | | | 17,960 | 8,980 |
| 1887 | 280 | 140 | | | 280 | 140 |
| 1888 | 300 | 150 | | | 300 | 150 |
| 1889 | 300 | 150 | | | 300 | 150 |
| 1892 | 1,050 | 975 | | | 1,050 | 975 |
| Massachusetts: | | | | | | |
| 1880 | 158,626 | 76,195 | 11,050 | $5,525 | 169,676 | 81,720 |
| 1887 | 230,659 | 121,202 | 35,540 | 21,363 | 266,199 | 142,565 |
| 1888 | 243,777 | 127,838 | 26,165 | 14,822 | 269,942 | 142,660 |
| 1889 | 240,831 | 137,711 | 16,913 | 12,549 | 257,744 | 150,260 |
| 1892 | 191,923 | 133,529 | 54,823 | 61,801 | 246,746 | 195,330 |
| Rhode Island: | | | | | | |
| 1880 | 53,960 | 48,564 | 42,000 | 35,000 | 95,960 | 83,564 |
| 1887 | 25,825 | 25,030 | 19,215 | 15,699 | 45,040 | 40,729 |
| 1888 | 30,825 | 30,030 | 33,029 | 28,075 | 63,854 | 58,105 |
| 1889 | 33,375 | 32,475 | 29,650 | 25,600 | 63,025 | 58,075 |
| 1892 | 33,950 | 45,222 | 19,950 | 20,275 | 53,900 | 65,497 |
| Connecticut: | | | | | | |
| 1880 | 75,000 | 38,000 | 49,250 | 29,475 | 124,250 | 67,475 |
| 1887 | 26,735 | 25,370 | 18,887 | 18,677 | 45,622 | 44,047 |
| 1888 | 26,575 | 24,270 | 18,907 | 18,729 | 45,482 | 42,999 |
| 1889 | 26,360 | 24,900 | 21,362 | 21,114 | 47,722 | 46,014 |
| 1892 | 23,780 | 25,320 | 17,120 | 18,336 | 40,900 | 43,656 |
| Total: | | | | | | |
| 1880 | 623,929 | 273,547 | 102,300 | 70,000 | 726,229 | 343,547 |
| 1887 | 892,279 | 400,232 | 73,642 | 55,739 | 965,921 | 455,971 |
| 1888 | 902,152 | 409,953 | 78,101 | 61,626 | 980,253 | 471,579 |
| 1889 | 895,971 | 395,997 | 67,925 | 59,263 | 903,896 | 455,260 |
| 1892 | 667,509 | 362,477 | 91,893 | 100,412 | 759,402 | 462,889 |

The question of artificially raising clams has received but little consideration; the following note of Mr. Ansley Hall, field agent, on the inception of clam-culture at Essex, Mass., will therefore prove of interest:

I found quite an interesting feature in connection with the clam fisheries at Essex, Mass., in the shape of clam-culture. In 1888 an act was passed by the legislature authorizing the selectmen of the town to stake off in lots of 1 acre or less each of the flats along the Essex River and let them to persons desiring to plant clams, for a rental of $2 per acre or lot for five years and an additional fee of 50 cents. Thus far 37½ acres have been taken up and seeded with clams. Small clams are dug on the natural beds and planted on these hitherto unproductive flats. Mr. J. Bennett Fuller states that about 500 bushels are required to plant an acre properly. During the first two years (1889 and 1890) the people were slow to avail themselves of the privilege of planting, for fear that after they had spent their time and labor they would not be able to secure protection from trespassers. But in 1891 and 1892 lots were obtained and planted. The principal difficulty encountered has been the loss of the clams by the sand washing over them, the bottom in some localities being soft and shifting. In 1892 there were 25 acres that were quite productive, about one-third of the entire catch of the section being obtained from them. The catch from these lots is not definitely known, but is estimated at about 2,500 barrels.

The cultivated clams possess some advantage over the natural growth from the fact that they are more uniform in size and are as large as the best of the natural

clams. They bring $1.75 per barrel, while the natural clams sell for $1.50 per barrel. This is the price received by the catchers. One acre of these clams is considered to be worth $1,000 if well seeded and favorably located so as not to be in danger of being submerged with sand. This valuation would be too high for an average, since all the acres are not equally well seeded and located. The clammers are generally impressed that the industry can be extensively and profitably developed, and their only fear is that they will not be able to secure lots permanently. The greater part of the land available for this purpose is covered by the deeds of people owning farms along the river and the consent of the land-owners has to be obtained before lots can be taken up. It seems probable, however, that the business will continue to progress unless checked by complications that may arise relative to the occupancy of the grounds.

*The scallop fishery.*—The taking of scallops is recognized as a commercial fishery only in Maine, Massachusetts, and Rhode Island. In the first-named State, where the fishery is of least importance, the scallop taken differs from that obtained in the other States and is known as the giant scallop or smooth scallop (*Pecten magellanicus*). It attains a very large size, but is found only in circumscribed limits and is not especially abundant in the accessible localities. The common scallop (*Pecten irradians*) ranges from southern Massachusetts to Connecticut, and is very abundant in parts of Massachusetts and Rhode Island.

The principal grounds resorted to by the Maine scallop fishermen in 1892 were the eastern side of Mount Desert Island, the region between Deer Isle and Castine, and the Sheepscot River. In Massachusetts the scallop-grounds are in Nantucket Sound and Buzzards Bay. Scallops are generally distributed in the waters of Rhode Island, the largest catch, however, being obtained in Greenwich Bay, a tributary of Narragansett Bay, in Kent County.

In 1892 the scallop fishery was engaged in by 55 vessel fishermen, 838 boat fishermen, and 80 shoresmen, 973 persons in all. Of the fishermen, 142 were in Maine, 509 in Massachusetts, and 242 in Rhode Island. The aggregate investment in the industry was $102,397, of which $11,535 represented the value of 24 vessels, $81,970 the value of 626 boats, and $8,892 the value of the apparatus used. Of the aggregate sum $63,592 was invested in Massachusetts. The quantity of scallops taken for market in Maine was 19,374 bushels, having a value of $9,455; in Massachusetts, 84,154 bushels, valued at $75,637, and in Rhode Island, 52,690 bushels, valued at $38,998. In Connecticut, where there is no regular scallop fishery, 440 bushels of scallops, worth $330, were taken by clam fishermen.

The New England scallop output in 1892 was 231 per cent larger and the value of the catch was 905 per cent greater than in 1880. The very interesting and unusual feature shown by the statistics of a greatly augmented yield, attended by an even greater increase in the selling price, is to be accounted for by the fact that the mollusks have steadily risen in popular favor as a food product. In 1880 the yield of scallops in Massachusetts was only 7,568 bushels, having a value of $3,514, and in Rhode Island was 35,600 bushels, valued at $8,900. No

fishery was at that time prosecuted in Maine. The output of giant scallops in this State has decreased since 1887, the first year for which statistics were obtained. Thus, in that year 35,204 bushels were taken, valued at $13,994; in 1888, 29,578 bushels, worth $11,278, and in 1889, when the fishery probably reached its height, 45,368 bushels, valued at $18,647.

*The menhaden industry.*—In 1892 seven menhaden factories were in operation in the New England States; four of these were in Connecticut, two in Rhode Island, and one in Massachusetts. In previous years several firms were engaged in the menhaden industry in Maine. The business was much less extensive than during a number of previous years. The details of this branch are brought out in the following table, which shows an investment of over $588,000 in factories, vessels, etc., a catch of 21,450,500 pounds of menhaden (equivalent to about 35,750,835 fish), and resulting manufactured products with a value of $134,144. In Rhode Island the 1,120,400 pounds of other fish besides menhaden reported as being utilized in the industry consisted chiefly of sea-robins and sculpins.

*Table showing by States the extent of the menhaden industry in the New England States in 1892.*

| Items. | Massachusetts. | Rhode Island. | Connecticut. | Total. |
|---|---|---|---|---|
| Number of factories in operation | 1 | 2 | 4 | 7 |
| Value of factories | $8,000 | $215,500 | $66,800 | $282,300 |
| Amount of cash capital | $1,000 | $42,000 | $22,500 | $65,500 |
| Number of shoresmen employed | 6 | 70 | 70 | 146 |
| Number of fishermen employed | 22 | 161 | 86 | 269 |
| Number of steam vessels employed | 1 | 8 | 4 | 13 |
| Net tonnage | 69.46 | 627.32 | 343.72 | 696.78 |
| Value | $12,000 | $126,000 | $49,000 | $187,000 |
| Value of outfit and apparatus | $2,493 | $34,731 | $16,100 | $53,324 |
| Pounds of menhaden handled | 60,000 | 10,355,600 | 11,034,900 | 21,450,500 |
| Value to fishermen | $300 | $38,904 | $34,087 | $73,291 |
| Pounds of other fish handled | ..... | 1,120,400 | ..... | 1,120,400 |
| Value to fishermen | ..... | $1,400 | ..... | $1,400 |
| Number of gallons of oil made | 1,100 | 136,540 | 175,006 | 312,646 |
| Value as sold | $394 | $37,001 | $49,826 | $87,221 |
| Number of tons of scrap prepared | 12 | 1,758 | 1,635 | 3,405 |
| Value as sold | $144 | $21,919 | $24,860 | $46,923 |

*The canning industry.*—The business of canning herring, mackerel, lobsters, and clams is very extensive in Maine, where it supports important fisheries. The canning of herring as sardines is the most prominent branch of this nature, and the extent of the herring fishery is in a large part due to the canneries. Fifty-eight separate establishments were operated in 1892; of these, 37 canned only sardines; 3, sardines and lobsters; 2, sardines, plain herring, lobsters, and clams; 2, sardines, lobsters, and clams; 1, lobsters only; 5, clams only; 2, herring and clams; 2, sardines and clams; 2, lobsters and clams, and 2, lobsters, clams, and herring. In Massachusetts, where the conditions appear favorable for fish canning, only 5 such establishments were in operation. At these mackerel and herring were canned.

The value of the property devoted to the canning industry in Maine in 1892 was $439,210; an additional cash capital of $549,700 was required

to conduct the business. The cannery employees numbered 5,020. Over 63,000,000 pounds of raw products, for which the fishermen received $399,749, were consumed in canning. The value of the prepared products was $2,486,247.

In Maine most of the canneries are located in the eastern part of the State, in Washington County, where there were 39 in 1892. The prominent centers of the canning industry in that county are Eastport and Lubec; the former has for many years been the chief sardine center of the country, and in 1892 had 15 canneries, most of them of large size, while Lubec had 13 such establishments in 1892, and in 1893 had an increase which gave it a greater number than Eastport. The other places in this county in which canneries were located are Robbinston 2, Perry 1, West Pembroke 1, Cutler 1, Machiasport 1, Jonesboro 1, Jonesport 2, Millbridge 2. In Hancock County there were 9 canning houses, situated as follows: Prospect Harbor 1, Greens Landing 2, Oceanville 1, Brooklin 1, Hancock 1, Southwest Harbor 1, Bass Harbor 1, West Tremont 1. Knox County had 1 cannery at St. George. The 4 canneries in Lincoln County were at Pemaquid, South Bristol, Boothbay Harbor, and Round Pond. In Cumberland County were 5 canneries, as follows: Portland 2, Pine Point 2, West Scarboro 1.

The 50 establishments in Maine engaged in the preparation of sardines and plain canned herring utilized over 57,000,000 pounds of fresh herring, for which the fishermen were paid $253,848. A conspicuous part of the raw material consumed by the factories in Eastport and Lubec came from Canadian waters and is not shown in the figures for the herring fishery elsewhere given. From the foregoing there were prepared 568,853 cases (equivalent to 48,460,110 cans) of sardines, 14,883 cases (or 548,496 cans) of plain herring, 828 barrels of Russian sardines, 2,048 barrels of pickled herring, and 335,894 boxes of smoked fish, the whole having a value of $2,081,994. The most important of the numerous grades of canned herring are the small fish packed in oil in quarter-pound cans and generally known to the trade as "quarter oils." Of these, 396,428 cases of 100 cans each were prepared, for which $1,455,245 was received, an average price of $3.67 per case, or 3⅔ cents per can. Next in point of importance are the sardines in mustard in three-quarter pound cans. Of these, 149,020 cases of 50 cans each were canned, the market value of which was $435,863, or $2.92 per case. Other rather important grades of sardines are "half-oils," "three-quarter spices," and "quarter-mustards."

The 11 lobster canneries operated in Maine in 1892 were located in four counties, 5 being in Washington, 3 in Lincoln, 2 in Hancock, and 1 in Knox. The quantity of fresh lobsters utilized was 5,326,322 pounds, for which the canneries paid $78,720; from these, 25,732 cases of 1-pound and 2-pound cans were prepared, for which the canneries received $195,953.

At many of the sardine canneries in Washington County, Me., the smoking of herring constitutes an important branch. The herring so

utilized are mostly surplus fish or fish too large for canning. The business is most extensive in Eastport and Lubec, a large part of the fish coming from Canadian waters, as is the case with the sardine fish. The quantity of herring utilized for smoking at the sardine canneries was about 3,465,000 pounds. The prepared product consisted of 320,894 regular-sized boxes and 15,000 boxes of bloaters, the weight of the smoked fish being 1,979,470 pounds, and the value $46,139.

The canning of soft clams, in the form of clam chowder, plain clams, and clam juice, is carried on at 17 establishments on the Maine coast—1 in Washington County, 6 in Hancock County, 4 in Lincoln County, 5 in Cumberland County, and 1 in Knox County.

In the following table the details of the canning industry of Maine are given:

*Table showing the extent of the canning industry of Maine in 1892.*

| Items. | No. | Value. | Items. | No. | Value. |
|---|---|---|---|---|---|
| Establishments | 58 | $388,200 | *Manufactured products*—continued. | | |
| Cash capital | | 549,700 | Plain herring: | | |
| Employees | 5,020 | | One pound.....cases.. | 7,971 | $22,894 |
| Vessels and boats | 106 | 51,010 | Two pound.....do.... | 6,912 | 17,268 |
| Total | | 988,910 | Pickled herring.....barrels.. | 2,048 | 9,179 |
| *Raw products utilized.* | | | Russian sardines.....do.... | 828 | 4,153 |
| | | | Smoked herring: | | |
| Herring.....pounds.. | 57,061,320 | 253,848 | Regulars.....boxes.. | 320,894 | 36,514 |
| Mackerel.....do.... | 51,760 | 1,339 | Bloaters.....do.... | 15,000 | 9,025 |
| Lobsters.....do.... | 5,326,322 | 78,720 | Lobsters: | | |
| Clams.....bushels.. | 195,914 | 65,842 | One pound.....cases.. | 25,603 | 195,114 |
| | | | Two pound.....do.... | 129 | 839 |
| Total | | 399,749 | Clams: | | |
| *Manufactured products.* | | | One pound.....do.... | 34,146 | 108,933 |
| | | | Two pound.....do.... | 23,313 | 49,658 |
| Sardines, in oil: | | | Clam chowder: | | |
| Quarters.....cases.. | 396,428 | 1,455,245 | One pound.....do.... | 675 | 2,294 |
| Halves.....do.... | 6,614 | 31,870 | Three pound.....do.... | 6,341 | 19,631 |
| Sardines, in mustard: | | | Clam juice.....do.... | 1,151 | 4,604 |
| Quarters.....do.... | 5,031 | 21,582 | Total | | 2,466,107 |
| Three-quarters.....do.... | 149,020 | 435,863 | | | |
| Sardines, in spices: | | | *Secondary products.* | | |
| Quarters.....do.... | 543 | 2,145 | | | |
| Three-quarters.....do.... | 5,705 | 18,011 | Oil.....gallons.. | 14,140 | 3,160 |
| Two pound.....do.... | 730 | 1,643 | Pomace.....tons.. | 1,506 | 14,632 |
| Three pound.....do.... | 1,042 | 3,126 | Refuse | | 2,348 |
| Odd sizes.....do.... | 2,000 | 7,500 | Total | | 20,140 |
| "Brook trout" (herring): | | | | | |
| One pound.....cases.. | 278 | 1,090 | Total of manufactured and secondary products | | 2,486,247 |
| Two pound.....do.... | 1,462 | 4,286 | | | |
| Mackerel: | | | | | |
| One pound.....do.... | 708 | 3,040 | | | |

*Statistical recapitulation.*—In the following series of tables the extent of the foregoing fisheries is shown by States. The statements relate (1) to the number of persons engaged in each branch, (2) to the vessels, boats, and apparatus employed in each fishery, and (3) to the quantity and value of the catch in each form of apparatus. In the tables of persons engaged and of boats, vessels, and apparatus used, the full extent of each branch is shown, regardless of the duplications of persons and appliances employed in two or more fisheries.

In a statistical paper printed in the Bulletin of the Fish Commission for 1893, use was made of the advance returns for the New England

fisheries, the data desired for the paper in question being hastily compiled from field agents' notes. In the final compilation of the figures certain revisions were necessary, which make the information heretofore published differ in some particulars from the actual results of the field investigation as correctly given in the present report.

*Table showing the number of persons engaged in certain fisheries of the New England States in 1892.*

| Fisheries. | Maine. | New Hampshire. | Massachusetts. | Rhode Island. | Connecticut. | Total. |
|---|---|---|---|---|---|---|
| Alewife | 179 | 9 | 318 | 51 | 14 | 571 |
| Herring | 1,409 | 17 | 569 | | | 1,995 |
| Menhaden | | | | 161 | 217 | 378 |
| Salmon | 198 | | | | | 198 |
| Shad | 454 | | | | 116 | 570 |
| Smelt | 1,913 | 47 | 25 | 13 | 19 | 2,017 |
| Lobster | 2,628 | 26 | 616 | 145 | 258 | 3,673 |
| Clam | 1,940 | 14 | 843 | 228 | 339 | 3,364 |
| Oyster | | | 251 | 187 | 714 | 1,152 |
| Scallop | 142 | | 509 | 242 | | 893 |
| Whale | | | 1,396 | | 13 | 1,409 |

*Table showing by States the vessels, boats, and apparatus employed in the capture of certain products of the fisheries of the New England States in 1892.*

| Fisheries and apparatus. | Maine. | | New Hampshire. | | Massachusetts. | | Rhode Island. | | Connecticut. | | Total. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | Value. | No. | Value. | No. | Value. | No. | Value. | No. | Value. | No. | Value. |
| Alewife: | | | | | | | | | | | | |
| Boats | 115 | $3,605 | 7 | $110 | 100 | $1,730 | 29 | $580 | 7 | $155 | 258 | $6,180 |
| Pound nets, trap nets, and weirs | 38 | 2,630 | 6 | 300 | 5 | 86 | 11 | 660 | | | 60 | 3,676 |
| Seines | | | 1 | 150 | 91 | 4,470 | 20 | 720 | | | 112 | 5,340 |
| Gill nets | 178 | 950 | | | | | | | 25 | 1,250 | 203 | 2,200 |
| Dip nets | 75 | 150 | | | 76 | 140 | | | | | 151 | 290 |
| Total | | 7,335 | | 560 | | 6,426 | | 1,960 | | 1,405 | | 17,686 |
| Herring: | | | | | | | | | | | | |
| Vessels | 32 | 27,450 | | | 11 | 4,802 | | | | | 43 | 32,252 |
| Tonnage | 673.30 | | | | 112.78 | | | | | | 786.17 | |
| Outfit | | 5,650 | | | | 951 | | | | | | 6,601 |
| Boats | 1,169 | 57,907 | 37 | 1,536 | 404 | 30,054 | | | | | 1,610 | 89,497 |
| Pound nets, trap nets, and weirs | 213 | 64,616 | | | 97 | 118,745 | | | | | 310 | 183,361 |
| Seines | 20 | 6,125 | | | 8 | 2,150 | | | | | 28 | 8,275 |
| Gill nets | 4,380 | 35,671 | 84 | 1,197 | 707 | 7,773 | | | | | 5,171 | 44,641 |
| Dip nets | 1 | 1 | | | 57 | 212 | | | | | 58 | 213 |
| Total | | 197,420 | | 2,733 | | 164,687 | | | | | | 364,840 |
| Menhaden: | | | | | | | | | | | | |
| Vessels | | | | | | | 8 | 126,000 | 6 | 67,500 | 14 | 193,500 |
| Tonnage | | | | | | | 627.32 | | 483.14 | | 1,110.46 | |
| Outfit | | | | | | | | 19,331 | | 13,900 | | 33,231 |
| Boats | | | | | | | | | 88 | 8,295 | 88 | 8,295 |
| Pound nets, trap nets, and weirs | | | | | | | | | 75 | 22,470 | 75 | 22,470 |
| Seines | | | | | | | 15 | 13,400 | 13 | 9,640 | 28 | 23,040 |
| Total | | | | | | | | 158,731 | | 121,805 | | 280,536 |
| Salmon: | | | | | | | | | | | | |
| Boats | 210 | 4,272 | | | | | | | | | 210 | 4,272 |
| Pound nets, trap nets, and weirs | 211 | 14,445 | | | | | | | | | 211 | 14,445 |
| Gill nets | 20 | 615 | | | | | | | | | 20 | 615 |
| Lines | | 8 | | | | | | | | | | 8 |
| Total | | 19,340 | | | | | | | | | | 19,340 |

*Table showing by States the vessels, boats, and apparatus employed in the capture of certain products of the fisheries of the New England States in 1893*—Continued.

| Fisheries and apparatus. | Maine. | | New Hampshire. | | Massachusetts. | | Rhode Island. | | Connecticut. | | Total. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | Value. | No. | Value. | No. | Value. | No. | Value. | No. | Value. | No. | Value. |
| Shad: | | | | | | | | | | | | |
| Boats | 297 | $6,640 | | | | | | | 55 | $2,095 | 352 | $8,735 |
| Pound nets, trap nets, and weirs | 156 | 13,280 | | | | | | | | | 156 | 13,280 |
| Seines | | | | | | | | | 12 | 675 | 12 | 675 |
| Gill nets | 365 | 3,425 | | | | | | | 46 | 2,312 | 411 | 5,737 |
| Total | | 23,345 | | | | | | | | 5,082 | | 28,427 |
| Smelt: | | | | | | | | | | | | |
| Boats | 390 | 9,895 | | | | | 6 | $175 | 12 | 195 | 408 | 10,265 |
| Pound nets, trap nets, and weirs | 50 | 1,680 | | | | | 12 | 1,350 | | | 62 | 3,030 |
| Seines | 152 | 7,970 | | | | | 1 | 175 | 8 | 560 | 161 | 8,705 |
| Bag nets | 255 | 9,810 | 50 | $200 | | | | | | | 305 | 10,010 |
| Lines | | 383 | | 5 | | $8 | | | | | | 396 |
| Total | | 29,738 | | 205 | | 8 | | 1,700 | | 755 | | 32,406 |
| Lobster: | | | | | | | | | | | | |
| Vessels | 7 | 6,070 | | | 2 | 1,350 | 12 | 7,000 | 34 | 31,400 | 55 | 45,820 |
| Tonnage | 77.11 | | | | 17.77 | | 84.43 | | 322.17 | | 501.48 | |
| Outfit | | 980 | | | | 360 | | 1,565 | | 14,865 | | 17,770 |
| Boats | 2,888 | 242,629 | 29 | 594 | 739 | 47,162 | 86 | 15,320 | 183 | 17,585 | 3,925 | 323,290 |
| Pots | 153,043 | 143,709 | 1,393 | 2,786 | 26,102 | 38,479 | 6,341 | 10,090 | 10,105 | 22,178 | 197,074 | 217,242 |
| Total | | 393,388 | | 3,380 | | 87,351 | | 33,975 | | 86,028 | | 604,122 |
| Clam: | | | | | | | | | | | | |
| Vessels | | | | | 1 | 1,000 | 2 | 1,100 | | | 3 | 2,100 |
| Tonnage | | | | | 7.89 | | 16.48 | | | | 24.37 | |
| Outfit | | | | | | 20 | | 265 | | | | 285 |
| Boats | 1,548 | 27,506 | 14 | 180 | 663 | 16,000 | 183 | 4,860 | 172 | 5,290 | 2,580 | 53,836 |
| Hoes, rakes, etc | | 1,894 | | 11 | | 2,605 | | 833 | | 463 | | 5,806 |
| Total | | 29,400 | | 191 | | 19,625 | | 7,058 | | 5,753 | | 62,027 |
| Oyster: | | | | | | | | | | | | |
| Vessels | | | | | 1 | 2,000 | 6 | 18,100 | 123 | 304,140 | 130 | 324,240 |
| Tonnage | | | | | 17.87 | | 79.90 | | 2,488.44 | | 2,580.21 | |
| Outfit | | | | | | 2,100 | | 3,322 | | 40,540 | | 45,962 |
| Boats | | | | | 369 | 22,440 | 189 | 14,430 | 543 | 52,413 | 1,101 | 89,284 |
| Dredges | | | | | 158 | 912 | 62 | 2,415 | 240 | 3,198 | 460 | 6,525 |
| Tongs | | | | | 275 | 1,457 | 294 | 2,214 | 509 | 2,249 | 1,078 | 5,920 |
| Total | | | | | | 28,909 | | 40,482 | | 402,540 | | 471,931 |
| Scallop: | | | | | | | | | | | | |
| Vessels | 2 | 400 | | | 19 | 8,800 | 3 | 1,400 | | | 24 | 10,600 |
| Tonnage | 33.60 | | | | 130.27 | | 17.58 | | | | 181.45 | |
| Outfit | | 170 | | | | 700 | | 65 | | | | 935 |
| Boats | 64 | 3,610 | | | 322 | 49,370 | 240 | 28,990 | | | 626 | 81,970 |
| Dredges and rakes | 105 | 504 | | | 1,236 | 4,722 | 874 | 3,066 | | | 2,215 | 8,892 |
| Total | | 4,684 | | | | 63,592 | | 34,121 | | | | 102,397 |
| Whale: | | | | | | | | | | | | |
| Vessels | | | | | 51 | 364,600 | | | 1 | 4,000 | 52 | 368,600 |
| Tonnage | | | | | 9,410.27 | | | | 127.33 | | 9,537.60 | |
| Outfit and apparatus | | | | | | 329,100 | | | | 3,000 | | 332,100 |
| Total | | | | | | 693,700 | | | | 7,000 | | 700,700 |

*Table showing by States and apparatus with which caught the quantities and values of certain products taken in the fisheries of the New England States in 1892.*

| Species and apparatus. | Maine. | | New Hampshire. | | Massachusetts. | |
|---|---|---|---|---|---|---|
| | Quantity. | Value. | Quantity. | Value. | Quantity. | Value. |
| Alewives: | | | | | | |
| Pound nets, trap nets, and weirs.....pounds.. | 1,411,350 | $13,302 | 45,000 | $690 | 720,025 | $10,850 |
| Gill nets.....do.... | 583,150 | 3,877 | | | | |
| Seines.....do.... | | | 5,000 | 80 | 1,853,200 | 32,812 |
| Dip nets.....do.... | 282,000 | 1,875 | | | 1,077,650 | 14,854 |
| Total..... | 2,276,500 | 19,054 | 50,000 | 770 | 3,650,875 | 58,516 |
| Herring: | | | | | | |
| Pound nets, trap nets, and weirs.....pounds.. | 32,072,214 | 224,250 | | | 6,247,315 | 60,164 |
| Gill nets.....do.... | 6,905,700 | 42,396 | 140,000 | 1,500 | 1,915,900 | 14,639 |
| Seines.....do.... | 1,832,250 | 7,738 | 6,600 | 115 | 2,323,600 | 20,593 |
| Dip nets.....do.... | 4,000 | 13 | | | 1,616,650 | 15,433 |
| Total..... | 40,814,164 | 274,397 | 146,600 | 1,615 | 12,103,465 | 110,829 |
| Menhaden: | | | | | | |
| Pound nets, trap nets, and weirs.....pounds.. | | | | | 185,010 | 3,036 |
| Gill nets.....do.... | 83,140 | 532 | 4,000 | 40 | | |
| Seines.....do.... | | | | | 65,000 | 722 |
| Total..... | 83,140 | 532 | 4,000 | 40 | 250,010 | 3,758 |
| Salmon: | | | | | | |
| Pound nets, trap nets, and weirs.....pounds.. | 94,112 | 19,475 | | | | |
| Gill nets.....do.... | 3,650 | 745 | | | | |
| Lines.....do.... | 560 | 112 | | | | |
| Total..... | 98,322 | 20,332 | | | | |
| Shad: | | | | | | |
| Pound nets, trap nets, and weirs.....pounds.. | 686,870 | 20,379 | | | 48,382 | 2,409 |
| Gill nets.....do.... | 182,100 | 7,672 | | | | |
| Seines.....do.... | | | | | 86,127 | 2,396 |
| Total..... | 868,970 | 28,051 | | | 134,509 | 4,805 |
| Smelt: | | | | | | |
| Pound nets, trap nets, and weirs.....pounds.. | 72,870 | 6,215 | | | | |
| Seines.....do.... | 839,478 | 54,363 | | | | |
| Bag nets.....do.... | 301,050 | 25,159 | 16,500 | 1,650 | | |
| Lines.....do.... | 403,360 | 30,176 | 14,500 | 1,450 | 3,000 | 600 |
| Total..... | 1,616,758 | 115,913 | 31,000 | 3,100 | 3,000 | 600 |
| Lobsters: | | | | | | |
| Pots.....pounds.. | 17,642,677 | 663,043 | 196,350 | 11,790 | 3,182,270 | 205,638 |
| Clams: | | | | | | |
| Rakes, hoes, etc...bushels.. | 416,806 | 157,431 | 1,050 | 975 | 246,746 | 195,330 |
| Oysters, market: | | | | | | |
| Dredges and tongs....do.... | | | | | 29,807 | 59,638 |
| Oysters, seed: | | | | | | |
| Dredges and tongs....do.... | | | | | 35,000 | 24,000 |
| Total..... | | | | | 64,807 | 83,638 |
| Scallops: | | | | | | |
| Dredges and rakes.bushels.. | 19,374 | 9,455 | | | 84,154 | 75,637 |
| Whale: | | | | | | |
| Oil, whale.....gallons.. | | | | | 208,085 | 87,389 |
| Oil, sperm.....do.... | | | | | 440,159 | 294,931 |
| Bone.....pounds.. | | | | | 120,150 | 585,347 |
| Ambergris.....do.... | | | | | 20 | 5,277 |
| Total..... | | | | | | 972,944 |
| Total value special fisheries..... | | 1,288,208 | | 18,290 | | 1,711,695 |

*Table showing by States and apparatus with which caught the quantities and values of certain products taken in the fisheries of the New England States in 1892*—Continued.

| Species and apparatus. | Rhode Island. | | Connecticut. | | Total. | |
|---|---|---|---|---|---|---|
| | Quantity. | Value. | Quantity. | Value. | Quantity. | Value. |
| **Alewives:** | | | | | | |
| Pound nets, trap nets, and weirs.....pounds.. | 487,468 | $8,126 | 79,360 | $683 | 2,743,203 | $33,651 |
| Gill nets.....do.... | | | 601,600 | 3,125 | 1,184,750 | 7,002 |
| Seines.....do.... | 702,125 | 10,090 | | | 2,560,325 | 42,982 |
| Dip nets.....do.... | | | | | 1,359,650 | 16,729 |
| Total ..... | 1,189,593 | 18,216 | 680,960 | 3,808 | 7,847,928 | 100,364 |
| **Herring:** | | | | | | |
| Pound nets, trap nets, and weirs.....pounds.. | 700 | 30 | | | 38,320,229 | 284,444 |
| Gill nets.....do.... | | | | | 8,961,600 | 58,535 |
| Seines.....do ... | | | | | 4,162,450 | 28,446 |
| Dip nets.....do.... | | | | | 1,620,650 | 15,446 |
| Total ..... | 700 | 30 | | | 53,064,929 | 386,871 |
| **Menhaden:** | | | | | | |
| Pound nets, trap nets, and weirs.....pounds.. | 34,000 | 57 | 2,515,200 | 7,332 | 2,734,210 | 10,425 |
| Gill nets.....do.... | | | | | 87,140 | 572 |
| Seines.....do.... | 10,726,600 | 40,725 | 20,432,280 | 63,548 | 31,223,880 | 104,995 |
| Total ..... | 10,760,600 | 40,782 | 22,947,480 | 70,880 | 34,045,230 | 115,992 |
| **Salmon:** | | | | | | |
| Pound nets, trap nets, and weirs.....pounds.. | | | 78 | 45 | 94,190 | 19,520 |
| Gill nets.....do.... | | | 35 | 24 | 3,685 | 769 |
| Lines.....do.... | | | | | 560 | 112 |
| Total ..... | | | 113 | 69 | 98,435 | 20,401 |
| **Shad:** | | | | | | |
| Pound nets, trap nets, and weirs.....pounds.. | 24,350 | 776 | 21,602 | 1,679 | 781,204 | 25,243 |
| Gill nets.....do.... | | | 71,708 | 6,052 | 253,808 | 13,724 |
| Seines.....do.... | | | 17,252 | 1,704 | 103,379 | 4,100 |
| Total ..... | 24,350 | 776 | 110,562 | 9,435 | 1,138,391 | 43,067 |
| **Smelt:** | | | | | | |
| Pound nets, trap nets, and weirs.....pounds.. | 18,740 | 1,720 | | | 91,610 | 7,935 |
| Seines.....do.... | 19,460 | 1,840 | 8,810 | 790 | 867,748 | 56,993 |
| Bag nets.....do.... | | | | | 317,550 | 26,809 |
| Lines.....do.... | | | | | 420,860 | 32,226 |
| Total ..... | 38,200 | 3,560 | 8,810 | 790 | 1,697,768 | 123,963 |
| **Lobsters:** | | | | | | |
| Pots.....pounds.. | 774,100 | 53,762 | 1,614,530 | 101,358 | 23,409,927 | 1,035,591 |
| **Clams:** | | | | | | |
| Rakes, hoes, etc...bushels.. | 53,000 | 65,497 | 40,900 | 43,656 | 759,402 | 462,889 |
| **Oysters, market:** | | | | | | |
| Dredges and tongs....do.... | 159,581 | 253,459 | 985,794 | 888,685 | 1,175,182 | 1,201,782 |
| **Oysters, seed:** | | | | | | |
| Dredges and tongs....do.... | 14,865 | 5,783 | 954,380 | 537,564 | 1,004,245 | 567,347 |
| **Oyster shells:** | | | | | | |
| Dredges and tongs....do.... | 40,661 | 2,033 | 190,000 | 6,230 | 230,661 | 8,263 |
| Total ..... | 215,107 | 261,275 | 2,130,174 | 1,432,479 | 2,410,088 | 1,777,392 |
| **Scallops:** | | | | | | |
| Dredges and rakes.bushels.. | 52,690 | 38,998 | 440 | 330 | 156,618 | 124,420 |
| **Whale:** | | | | | | |
| Oil, whale .....gallons.. | | | 3,150 | 1,323 | 211,235 | 88,712 |
| Oil, sperm.....do.... | | | | | 440,159 | 294,931 |
| Bone .....pounds.. | | | | | 120,150 | 585,347 |
| Ambergris .....do.... | | | | | 20 | 5,277 |
| Total ..... | | | | 1,323 | | 974,267 |
| Total value special fisheries..... | | 482,896 | | 1,664,128 | | 5,165,217 |

### THE GREAT LAKES.

In connection with the consideration of the fish and fisheries of the basin of the Great Lakes by the international commission appointed by the United States and Canada to investigate the fisheries of the contiguous waters of the two countries, a canvass of the commercial fisheries of the United States waters of these lakes was begun by this division in May, 1894, and by the close of the fiscal year had progressed satisfactorily. The inquiry related to the statistics and methods of the industry, the abundance of the economic fishes, and the changes occurring since the last investigation. The United States Fish Commission conducted a complete canvass of the Great Lakes in 1891, the results of which are published in the annual report for 1892; but recent marked and rapid changes in certain important phases of the industry made another inquiry at this time desirable in order to arrive at a proper knowledge of the extent and methods of the fisheries.

## SPECIAL INQUIRIES.

### PACIFIC COAST FISHERIES.

In November, 1893, Mr. A. B. Alexander, fishery expert on the *Albatross*, was detached from that vessel and assigned to temporary field duty in this division. He was ordered to make a study of those fishes which have been artificially introduced into the waters of the Pacific States and become the object of fisheries. Supplementary instructions were subsequently issued covering a canvass of the whale fishery and salmon-canning industry. Mr. Alexander had previously been engaged in similar inquiries for this division, and his familiarity with the fisheries of the region made his services valuable. The inquiry began November 7, and was continued until about February 10. Work was begun in the vicinity of San Francisco, extended as far south as Monterey Bay, and later carried on at Portland, Astoria, and other places on the northern part of the west coast.

The fishes to which attention was specially directed were shad, striped bass, black bass, catfish, eel, and carp. The inquiry was addressed to the methods, apparatus, history, and statistics of the fisheries, to the wholesale trade, and to such phases of the natural history as may have a bearing on the practical aspects of the subject. Statistical data relating to the calendar year 1893 were obtained. The data collected for the whale fishery consisted of the statistics for the year 1893 for the San Francisco fleet and for the New Bedford vessels rendezvousing at the former port. The salmon investigation covered all phases of the packing industry in California, Oregon, Washington, and Alaska. While it was not feasible to visit all streams on which salmon canneries were located, nor to personally study the salmon-packing in Alaska, complete information was obtainable for the more remotely located canneries at the headquarters of the firms located in San Francisco and Portland.

The notes submitted by Mr. Alexander on the shad and striped bass are reserved for incorporation in a special report now in course of preparation, in which the entire subject of fish acclimatization in the Pacific States is considered. His statistics of the whale fishery and salmon-canning industry have been embodied in a general report on the fisheries of the Pacific States, prepared by Mr. W. A. Wilcox. An outline of the results of his work is here given.

The shad is increasing in numbers yearly, and is now one of the cheapest fish on the coast. Comparatively few years ago only the wealthy could afford to buy shad; now it is within the reach of everyone. Only a small part of the supply is taken, and few fish are obtained in nets set especially for them. With proper apparatus, the catch could doubtless be increased to ten times more than it is at present.

During the year 1893 the fish was very numerous in the Sacramento and San Joaquin rivers and in the San Francisco Bay region, which is the center of its abundance, and was very low in price. About the middle of November it was selling at 2 cents a pound in the city markets, and about the first of the month the fish sold as low as 4 and 5 cents apiece. Mr. Alexander found the crab fishermen were using shad for bait, a circumstance forcibly illustrating the fish's abundance and cheapness.

In Monterey Bay, the southern limit of distribution of the fish, it is more abundant on the north side, near Soquel and Santa Cruz, than on the south side, in the vicinity of Monterey. Only six shad were taken at Monterey in 1893, while on the other side of the bay the catch was much larger, although small as compared with that in other waters.

In the Columbia River the shad is very rapidly increasing in numbers. Each season shows a decided increase over the preceding one. The physical conditions appear to be quite as favorable to the shad as those found in the Sacramento and San Joaquin rivers. Only an inconspicuous part of the run is taken, and the entire quantity marketed is obtained incidentally in traps and seines operated for salmon.

The striped bass, like the shad, has steadily increased in numbers, and like the shad it attains its greatest abundance in San Francisco Bay and its tributaries. In the lower courses of the Sacramento and San Joaquin rivers it is very numerous and it may there be taken at all seasons. It is, however, much less numerous than the shad and holds a higher place in popular estimation as a food-fish. At the present rate of increase, it would appear that in a few years the supply will so far exceed the demand that the price of the fish will be reduced almost to that of the shad.

Monterey Bay marks the southern limit of the range of the striped bass as it does of the shad. The bass is so uncommon in the bay that it may almost be regarded as a straggler. At Monterey only two or three have ever been taken. At Santa Cruz only one was taken in 1893; this weighed 15 pounds. At Capitola bass were first taken in 1893; 25, weighing 260 pounds, were obtained in a drag seine.

This fish has not as yet distributed itself along the more northern parts of the Pacific Coast. It is not known from the Columbia River, and there are no records of its capture at any place in either Oregon or Washington.

An interesting fact disclosed by Mr. Alexander's inquiries is that the striped bass feed largely on carp, which are very numerous in the rivers frequented by the bass, and are by many persons considered of little value. If further inquiries show that carp constitute an important part of the food supply of the bass, they will doubtless rise in popular favor. On November 22, of 9 bass opened in the San Francisco markets 6 contained carp, and Mr. Alexander is convinced that 7 bass in every 10 will be found to contain carp.

Black bass are well distributed in numerous rivers, lakes, and reservoirs in California, but are not taken in commercial fishing. The fish have readily become accustomed to their new environments and are rapidly increasing.

Carp and catfish are very abundant in the Sacramento and San Joaquin and Columbia rivers, and are also found in other waters of the west coast. They do not rank high as food-fish, but considerable quantities are taken and sold in the San Francisco, Sacramento, and Portland markets. The catfish have failed to attain the average size reached by the fish in their natural habitat, but the carp are as large as those found anywhere in the country.

Diligent inquiry was made by Mr. Alexander as to the possible existence of lobsters on the Pacific Coast as a result of the attempts to acclimatize them made by the United States Commission of Fish and Fisheries. Several reports of the capture of the eastern lobster had from time to time been circulated since the experimental plans were made, and in the summer of 1893 accounts of the taking of other reputed lobsters in the vicinity of Monterey were published. Mr. Alexander reported as follows on this subject:

Reports are frequently circulated that lobsters have been taken by the fishermen of Monterey, but each time the investigation which has followed has proved the story false. Those not familiar with the lobster easily mistake the fresh-water crayfish for that animal. During the past season a report was circulated through the press of this coast that several small Eastern lobsters had been caught at Monterey, and to add strength to the story it was stated that samples had been sent to the Fish Commission for identification, and word had been sent back that the samples received were the genuine Eastern lobster. Such reports are very misleading, and have caused considerable inquiry to be made concerning the lobsters planted on the coast in 1888.

The writer has had occasion to interview the fishermen of Monterey several times during the past four years, but has never been able to find a man who was certain he had caught a lobster. Prof. Charles H. Gilbert saw the specimens that were taken this summer, and states that they were fresh-water crayfish.

That several of the lobsters planted at Monterey have been caught, there is little doubt. Captain Nichols, of the United States Navy, says that several years ago he ate a lobster which was purchased at a market in Oakland; being an Eastern man, and having taken an interest in the fisheries all his life, it is to be presumed that he is correct in what he says. The white fishermen say they have never been guilty of saving what they supposed to be lobsters, but are of the opinion that the Chinese

have caught and sold many specimens, but of this there is no direct proof. From what can be learned it would seem that the lobsters planted here were either caught before they had time to increase, or the character of the bottom and general surroundings was not suited to them for propagating.

No traces of the lobsters planted off Trinidad, Cal., have ever been found. The fishermen of that locality have made diligent search for them with such appliances as they had, but to no purpose. Captain Nichols, in charge of the Light-House Board of California, has had lobster pots made and set on and near the spots where they were planted. This kind of apparatus has also met with negative results.

In view of the fact that nearly five years have passed since the planting was made, it is very probable that the water and general surroundings of this locality are not conducive to their growth. A few lobsters planted off the coast washed by so vast an ocean as the Pacific can not be considered a fair test; 302 lobsters, the number planted, would naturally in a few days become more or less scattered, and the sexes widely separated and perhaps never get together again.

It is frequently stated that a lobster ought to live in a water where crayfish are found. This can hardly be expected, for crayfish are never found as far north as Monterey Bay, which proves conclusively that they require warmer water than a lobster, and in all probability they would not live off the New England coast.

The geographical position, temperature of water, and general character of the bottom in many parts of Alaska are, in the opinion of the writer, much better suited to the requirements of the lobster than that part of the coast lying below or south of Cape Flattery. The whole archipelago of southeastern Alaska contains many places where the lobster would be more likely to live and multiply than any other place on the Pacific Coast.

The temperature and other environments of this region correspond more closely to the home of the lobster on the Atlantic Coast. It is quite evident that lobsters require a change in temperature of water far greater than they would find off the Pacific Coast below 50° N. latitude, from the fact that they are only found in latitudes where the water undergoes such a change.

The coast of southeastern Alaska is cut up into hundreds of islands both large and small, forming numerous bays, channels, and estuaries very similar to the coast of Maine and some parts of Nova Scotia and Newfoundland. From Massachusetts to the Gulf of St. Lawrence is where the lobster abounds in greatest numbers, and in this region the water in summer is comparatively warm and in winter extremely cold, elements perfectly congenial to this crustacean. In Alaska the water annually undergoes, to a much less degree, the change which takes place in the latitudes above mentioned. All things considered, no great mistake would be made in planting lobsters in the waters of southeastern Alaska. The harbor of Sitka would be an excellent place to try the experiment; also at Hooniah. There are many localities equally as good above Prince of Wales Island, viz: Howkan, Nichols Bay, and Shakan; or at Loring, Revillagigedo Island, and several more points farther up the Behm Canal.

The canvass of the whale fishery carried on from San Francisco by San Francisco and New Bedford vessels disclosed a fleet of 49 vessels in 1893. In comparatively recent years San Francisco has attained leading importance as a whaling center. The scarcity of whales in the Atlantic Ocean and the relative abundance of the valuable bowhead whales in the North Pacific and Arctic oceans have led to the transfer of a number of New Bedford vessels, which, with the local fleet, have made San Francisco the principal rendezvous for whaling vessels in the United States.

The fleet consisted of 35 vessels belonging in San Francisco and 14 others owned in New Bedford. The tonnage of the combined fleet was 13,910 net tons, and the value was $1,702,360. Thirteen of the vessels

were propelled by steam. Detailed figures showing the number and tonnage of vessels of each rig, etc., are given in the following table:

| Vessels. | San Francisco fleet. | | New Bedford fleet. | | Total. | |
|---|---|---|---|---|---|---|
| | No. | Tonnage. | No. | Tonnage. | No. | Tonnage. |
| Steam barks | 9 | 3,188.66 | 2 | 763.73 | 11 | 3,952.39 |
| Steam brigs | 1 | 164.78 | | | 1 | 164.78 |
| Steam barkentine | 1 | 281.42 | | | 1 | 281.42 |
| Barks | a15 | 4,573.25 | 10 | 3,358.57 | 25 | 7,931.82 |
| Brigs | 4 | 779.87 | 1 | | 5 | 779.87 |
| Ship | | | 1 | 328.55 | 1 | 328.55 |
| Schooners | b5 | 471.57 | | | 5 | 471.57 |
| Total | 35 | 9,459.55 | 14 | 4,450.85 | 49 | 13,910.40 |
| Value | | $656,000 | | $241,000 | | 897,000 |
| Value of outfit | | 595,360 | | 210,000 | | 805,360 |

a Includes one vessel of 307.24 tons burned at sea while bound for the Arctic Ocean.
b Includes one vessel of 141.25 tons engaged in trading for bone and ivory with the natives in the Arctic Ocean.

The persons employed on the whaling vessels with headquarters at San Francisco numbered 1,767; 1,214 of these were on the local fleet and 553 on the New Bedford vessels. The 13 steamers carried 520 persons, an average of 40 to a vessel, while the 36 sailing vessels had 1,247 men, an average of about 35, as shown in the following table:

| Rigs. | San Francisco fleet. | New Bedford fleet. | Total. |
|---|---|---|---|
| Steam barks | 373 | 86 | 459 |
| Steam brigs | 24 | | 24 |
| Steam barkentine | 37 | | 37 |
| Barks | 590 | 402 | 992 |
| Brigs | 108 | 27 | 135 |
| Ship | | 38 | 38 |
| Schooners | 82 | | 82 |
| Total | 1,214 | 553 | 1,767 |

In 1893 337 whales were taken by the San Francisco whaling fleet; of these, 288 were obtained by San Francisco vessels and 49 by New Bedford vessels. The catch comprised 278 bowhead whales, 45 sperm whales, 13 right whales, and 1 humpback whale; these yielded 225,951 gallons of oil and 417,266 pounds of bone, worth $1,136,657. Figures showing the results of the fishery by San Francisco and New Bedford vessels are separately given in the following statement:

*Table showing the number of whales taken and products obtained by the fleet rendezvousing at San Francisco in 1893.*

| Whales taken. | San Francisco vessels. | New Bedford vessels. | Total. | Products. | San Francisco vessels. | New Bedford vessels. | Total. |
|---|---|---|---|---|---|---|---|
| Sperm | 40 | 5 | 45 | Sperm oil..galls. | 31,400 | 5,700 | 37,100 |
| Right | 5 | 8 | 13 | Whale oil....do... | 117,441 | 71,410 | 188,851 |
| Bowhead | 243 | 35 | 278 | Whalebone..lbs.. | 368,966 | 48,300 | 417,266 |
| Humpback | | 1 | 1 | Ivory.....do... | | | |
| Total | 288 | 49 | 337 | Value | $956,249 | $180,408 | $1,136,657 |

NOTE.—In addition to the products given, 1,350 pounds of bone and 2,000 pounds of ivory, valued at $3,700, were landed by a vessel that traded with the natives.

The classification of the whaling fleet by fishing-grounds and the number of whales of each species taken on the different grounds are given in the following table. The importance of the North Pacific and Arctic oceans will be readily seen from the figures presented. More than nine-tenths (293) of the whales captured were taken on those grounds, and of these fully 280 were obtained in the Arctic Ocean.

*Table showing by fishing-grounds the number of whales taken by the vessels rendezvousing at San Francisco in 1893.*

| Fishing-grounds. | San Francisco fleet. | | | | | | New Bedford fleet. | | | | | | Total. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. of vessels. | Number of whales. | | | | | No. of vessels. | Number of whales. | | | | | No. of vessels. | Number of whales. | | | | |
| | | Sperm. | Right. | Bowhead. | Humpback. | Total. | | Sperm. | Right. | Bowhead. | Humpback. | Total. | | Sperm. | Right. | Bowhead. | Humpback. | Total. |
| North Pacific and Arctic oceans | a33 | .... | 5 | 243 | .... | 248 | 13 | 4 | 5 | 35 | 1 | 45 | 46 | 4 | 10 | 278 | 1 | 293 |
| Okhotsk Sea | 1 | 3 | .... | .... | .... | 3 | 1 | 1 | 3 | .... | .... | 4 | 2 | 4 | 3 | .... | .... | 7 |
| South Pacific and Indian oceans | 1 | 37 | .... | .... | .... | 37 | .... | .... | .... | .... | .... | .... | 1 | 37 | .... | .... | .... | 37 |
| Total | 35 | 40 | 5 | 243 | .... | 288 | 14 | 5 | 8 | 35 | 1 | 49 | 49 | 45 | 13 | 278 | 1 | 337 |

a Includes one vessel burned on the way to the fishing-grounds and one vessel engaged in trading for bone and ivory.

The season in the Arctic was remarkably successful. One vessel took 48 bowhead whales; these yielded 72,000 pounds of bone, valued at $180,000. Five other vessels secured, respectively, 45, 38, 30, 26, and 20 whales and stocked over $100,000 each ($163,750 to $104,298).

The practice of remaining in the Arctic during the winter in order to be early on the grounds is becoming more prevalent, and 7 steamers and 3 sailing vessels wintered near the mouth of the Mackenzie River in 1893.

In May, 1894, the writer made a brief visit to the Pacific Coast for the purpose of studying the apparatus and methods of the fisheries. He was instructed by the Commissioner to make observations on the condition of the salmon industry, the sturgeon fishery, and other prominent branches, and to give special attention to those fishes which have been artificially introduced into the waters of the Pacific States, namely, the shad, the striped bass, the catfish, and the carp.

The inquiry began in San Francisco, Cal., May 24 and was terminated at Portland, Oreg., June 25. The short time available restricted the inquiry to the fisheries of greatest extent and interest and to the localities affording the best opportunities to see the greatest variety of fishery products and methods. The results of the inquiry will be incorporated in a special report and need only be outlined at this time.

The time spent in San Francisco and vicinity was chiefly devoted to the consideration of the market fishery for salt-water products; to the salmon, shad, striped bass, sturgeon, and other fisheries in the lower

courses of the Sacramento and San Joaquin rivers and in San Francisco, San Pablo, and Suisun bays, and to the San Francisco fish trade. Some valuable data relating to the acclimatized fishes were obtained from the records of the wholesale dealers. Through the courtesy of the California Fish Commission several days were passed in the Sacramento-San Joaquin delta, where are located the principal spawning-grounds of the shad and striped bass and important fishing-grounds for them, salmon, and other species.

A short visit was made to San Pedro, in Los Angeles County, for the purpose of investigating the sardine fishing and canning at that place. While the sardine (*Clupea sagax*) is found along the whole length of the west coast, it appears that it is only in the southern part of its range that it occurs in sufficient abundance and with enough regularity to permit the prosecution of a successful business. A sardine cannery was established at San Pedro in 1893. This is the only cannery of the kind now on the Pacific Coast, although for a number of years prior thereto sardine canning had been done at San Francisco. Sardines of suitable size are quite abundant, and the prospects seem very favorable. In connection with the capture and utilization of sardines, a scombroid fish (*Trachurus picturatus*), locally called Spanish mackerel, is taken and canned.

At Astoria and Portland attention was given to the important fisheries for salmon and sturgeon and to the canning industry. The prevalence of unprecedentedly high water prevented a visit to the interesting wheel and other fisheries of the Upper Columbia River. Some very suggestive detailed statistics regarding the present and past condition of the salmon industry were secured at Astoria. A canvass among canners and others interested in the fishing industry and deeply concerned in the preservation of the salmon showed that while all looked to extensive artificial propagation as affording the most certain relief, practically all favored the establishing of a close time throughout April or August, or both.

### INQUIRY REGARDING WHITING.

In the summer of 1893 an inquiry regarding the edible qualities of the whiting (*Merlucius bilinearis*) was made. This fish is a member of the cod family, and occurs in great abundance on the New England coast. It reaches an average length of about 20 inches. It is known as whiting, silver hake, and Old England hake. Attention has from time to time been drawn to the probable economic value of the fish, in the publications of the Commission. In a report on the fisheries of the New England States, printed in the Fish Commission Bulletin for 1890, the following reference to this fish was made:

Although the whiting, as it comes from the water, is one of the best flavored and most nutritious of our food-fishes, the difficulty of keeping it fresh and in good condition when iced has militated against its utilization to a large extent for market purposes. Often great quantities are taken in pound nets and floating traps, but

generally these fish have to be turned out of the nets, only to reenter perhaps on the next tide. Some effort has been made to market at least a portion of the catch, and it is to be hoped that a method will be discovered for utilizing quantities of this species. In view of its abundance and cheapness it seems pertinent to suggest the possibility of its profitable utilization by canning or smoking. Its delicate flavor should make it an excellent article of food when canned, or, if lightly salted and prepared like kippered herring and finnan haddies, a demand might be created which would consume great quantities of what is now essentially a waste product.

While small quantities are utilized in a fresh condition or for salting, in most places the whiting is regarded as having no market value, and fully nine-tenths of the quantities taken are discarded. It is especially abundant in the region of Cape Cod, Massachusetts, where it is taken in large numbers each year in pound nets set for mackerel and other fish. When this section was visited June 1–12, 1893, there was an exceedingly large body of whiting in Cape Cod Bay and the pound nets were filled with them; one net at Provincetown on June 9 contained 300 barrels, and some nets had been dismantled so that the trouble of having to turn the fish out might be obviated.

The abundance of the whiting at that time and its nonutilization prompted an inquiry into its possible food value and economic importance. According to the statements of the weir fishermen, there are often 400 to 500 barrels of whiting in some nets at one time, and in a single week as many as 2,000 barrels will be taken. Many of the fish must be caught a number of times, for as long as the school remains they continue to enter the traps. An estimated annual catch of 100,000 barrels would probably be below the actual figures.

The run of whiting in Cape Cod Bay usually begins in the latter part of May and continues about two weeks. The fish are in a spawning condition at this time. There is also another well-marked run in the fall. Scattering fish are taken throughout the pound-net season. The fish thus obtained are usually from 18 to 24 inches long and weigh about 2 pounds, although many smaller fish are taken.

It may be said that practically no use is made in the Cape Cod region of the whiting in a fresh state. A few are at times shipped to New York where they bring the same price as haddock, and to Boston where there is little market for them; small numbers are used for lobster bait. The opinion is unanimous as to the excellent food qualities of the whiting in a perfectly fresh condition. The flesh is very sweet and palatable, and the fish is generally regarded as equal to cod, haddock, and hake, and, by some, preferred to those fish. The fish is by some persons considered too soft to bear shipment well, with the present methods of preservation; others, however, say that when properly iced it keeps as well as any other fish. Objection is made to its use fresh as bait in the line fisheries on account of its softness.

In this region the whiting is generally regarded as a nuisance. Its advent interferes with the run of better fish, such as mackerel and herring, and no large catches of the latter are made while the whiting

remain. A great many are killed in emptying the nets, and the dead bodies often thickly cover the shores and bottom. They are also destructive to the nets, owing to slime which accumulates on the twine when large numbers of fish are crowded into the pounds.

Small quantities of salted whiting have been prepared for sale at Provincetown and other places on Cape Cod, although most of the fish thus preserved have been for home consumption. Mr. Henry T. Lewis, of Provincetown, pickled 80 barrels of whiting in 1892 and sent them to Cayenne, South America, on a whaler, where they sold for $7 per barrel. In 1893 it was his intention to prepare several hundred barrels for the West Indian or South American trade.

When split and pickled the fish keep well, retain a good color, and will bear shipment to the tropics. When dry-cured, however, they become very hard, turn yellowish, owing to the oil they contain, and lose their market value.

Mr. Morgan, of South Truro, a fish-canner of much experience, states that the experiments made in canning whiting have shown that the fish is not well suited to that method of preservation; the flesh is flaky and breaks up in the canning process.

The possibility of utilizing whiting for salting was suggested, and it seemed probable that in Central and South America a market might be created for this cheap fish. It was, therefore, determined to secure an expression of opinion from a number of dealers and to have some samples of salted whiting prepared for a distribution with a view to test their edible qualities. Mr. W. A. Wilcox, agent of the Commission, who was then in the Cape Cod region, was instructed to make arrangements for the preparation of the fish, and Capt. Atkins Hughes, of North Truro, was engaged to select and cure them. It was intended to have them prepared in a number of different ways—as pickled, kench-cured, and smoked—but it was found feasible to have only the pickled fish prepared. Through some misunderstanding, the fish intended for pickling were not eviscerated and split in the best manner, and the samples presented a less inviting appearance than might otherwise have been the case. Several hundred pounds were distributed in Gloucester and Boston by agents of the office, and at the same time the following letter, in which the objects of the inquiry were explained, was addressed to the principal firms by the Commissioner:

The United States Fish Commission is desirous of securing an expression of your opinion as to the economic value of the fish known on the New England coast as the whiting, silver hake, or Old England hake. As you are doubtless aware, it occurs abundantly on our shores, and is taken in large quantities in traps and pound nets. Owing to real or supposed difficulties in shipping it to market in a fresh condition and the low price which it commands, only small quantities are utilized for food purposes, and in many places it is regarded as a nuisance. It has occurred to me that the financial condition of many of our fishermen might be materially improved if means could be devised to utilize the whiting, either in a fresh or prepared state; and it is with a view to secure the benefit of your experience and advice in this matter that this communication is addressed to you.

I am aware that efforts have long ago been made to introduce this fish into commerce and give it a permanent place in our fish trade; that prior to the expiration of the reciprocity treaty there was a limited trade in salt whiting with the British Provinces, and that small consignments of this fish have in recent years been sent to Brazil, the West Indies, and other places; but there has probably never been a better opportunity to make profitable use of this waste product than is now afforded by the reciprocity relations established between the United States and various other countries.

The Commission has recently had prepared at North Truro, Mass., a quantity of pickled whiting with a view to submit them to the principal dealers in Boston, Gloucester, and elsewhere and have their edible and commercial qualities determined. It is the intention to continue the inquiries and to ascertain the value of the fish for smoking, canning, etc. Within a short time an assistant of this office will wait upon you and present to you samples of the fish. Permit me to ask that you will kindly examine them and favor me with a written statement of your views.

The principal points on which your opinion is desired are the following:

(1) The commercial importance of whiting prepared like the samples.

(2) The food value of the whiting in a dry-salted and pickled state as compared with (1) cod, (2) hake, and (3) haddock.

(3) The commercial value of dry-salted and pickled whiting in the United States and Canada, and the possibility of renewing a market for it in the latter country.

(4) The commercial value of dry-salted and pickled whiting in the West Indies, Brazil, and other South American countries, and the possibility of establishing with them a remunerative trade.

(5) The food and economic value of smoked whiting; its comparison with smoked herring.

(6) The feasibility of preparing boneless whiting to supply a demand for cheap boneless fish.

Of the large number of responses received and variety of opinions expressed, the following, chiefly from leading firms of Boston and Gloucester, will be sufficient to illustrate the different views entertained regarding the special points referred to in the circular letter:

[Leonard A. Treat, wholesale fish-dealer, Boston.]

The rank of whiting, either in a dry-salted or pickled state, as compared with cod, hake, and haddock, would be about fourth. There would be no difficulty in renewing a market in Canada for whiting, and also for hake, haddock, and cod, if it were not for the tremendous duty on all our goods going into Canada. Give us reciprocity with Canada and there will be no question about a market for whiting and a great many other of our fish products. Smoked whiting would take its place in economic and food value alongside of smoked haddock and hake; it would be better than hake, perhaps not quite as popular as haddock. It is entirely feasible to market boneless whiting. It has been done and is being done whenever the whiting is put on the market at a lower price than hake. If whiting can be cured and marketed at a competing price with hake, it will find a place at once in the various markets of this country. As the years would roll around it would become more and more popular as its value became known, and ultimately would, in our opinion, rank fully up with cusk and haddock, if not equal to medium cod. This fish has but to be known to be appreciated. What might be done with the fish abroad is, in our opinion, an unknown quantity, a mere conjecture, as the value of our reciprocity relations with the various countries to the south of us has not been of such magnitude as to give it a passing notice. The truth of the matter is that it costs us so much to produce our goods here in this country, as compared with Canada, that notwithstanding the apparent advantage of our reciprocity relations with Brazil, etc., Canada and Newfoundland still hold the trade. Reciprocity in fish has not, so far as we know, materialized to the financial benefit of our salt-fish trade.

[Frederick F. Dimick, secretary Boston Fish Bureau.]

I have had a few of the silver hake which you sent me cooked and placed on my table. I found them very good eating, tasting very much like salt codfish. They were prepared for the table in the same way salt codfish usually are. There is a taste to them, however, that one who eats much codfish easily discovers, but I confess that I could hardly tell the difference.

[John Pew & Son, outfitters and wholesale fish-dealers, Gloucester.]

We have carefully considered your inquiry in regard to the whiting, or Old England hake, as we call them. They are quite common in the market as cheap fresh fish, but without any demand otherwise. In regard to their value for general trade as cured fish, we have doubts of their being handled with any success in any direction. They are of a long, slender, soft nature, very expensive to handle as far as labor is concerned. Fresh, they equal the hake in most ways of cooking and to some minds are as desirable as the haddock or cusk, but do not compare with the cod. Dried, and salted especially, they would be so thin and unattractive that they could not be sold for a price that they really would cost after the labor and expenses were put upon them. Efforts have been made years ago to handle them in different directions, but without success. The common hake, which is of a better substance, being harder, are much preferred to the whiting in quality and are much cheaper to handle. The common hake has a large liver, valuable sound, and considerable pea [spawn], all of which are of commercial worth. The cost of the common hake dressed and salted, after crediting the value of livers, etc., is much less than the whiting. We would answer your specific inquiries, therefore, as follows:

The commercial importance of the whiting as prepared in your sample, namely, in pickle, would be very small, indeed, and it is doubtful if any considerable market could be obtained for them. We do not think a market could be found in either the United States or Canada at a remunerative price. The whiting being of such a soft nature we think it would be impossible to process them in any way, either by smoking or canning, as it would leave a soft substance of very small value, for which it would be hard to secure a market. They are not very fat and would not smoke, as do the herring, and keep for transportation, though lightly smoked for immediate consumption they are very good, but even then without much commercial value. We have made no attempts at skinning or boning them, but think as the skin is quite tough and the flesh very soft the flesh would be torn and its worth proved very slight.

[Oscar Andrews, with Benjamin Low, wholesale salt-fish dealer, Gloucester.]

You have asked my opinion as to the introduction of whiting to the trade of this country for export. I was one of the partners of the house of Andrews & Co., who were in the shipping business in this city from 1878 until 1888. We did quite a business in Canada from 1881 until the expiration of the treaty in 1885. In 1882 we introduced the whiting to that trade and sold several hundred barrels pickled. They seemed to give perfect satisfaction in every case. At any rate, the parties who first took hold of them ordered again and again. We prepared them in exactly the same way as codfish, splitting and salting them in precisely the same way. The second year we split them on the backs, as we do mackerel, and it made trouble for the reason that they hurt near the bone. This was our own fault; we should have let good enough alone. We did not try to introduce these fish to the trade of the United States in 1882, as Canada took all that we prepared, and we could really have sold many more than we did there if we had salted more down while the school was on our coast. I think there is a party in this city who has been canning them for several years. There are no better eating fish than whiting. Every person who has ever eaten one of them broiled will agree with me on this point. They would make a very nice smoked fish, and would really be far superior to finnan haddie, but unfortunately they are a summer fish and would soon spoil if shipped any distance. As dried fish they would be a failure, for, owing to having a little fat in the flesh, they rust very quickly. I should say on the whole that whiting shipped fresh, packed in

ice, canned, or packed in barrels or small packages as pickled fish, would prove to be of great commercial importance.

[Lyon, Dupuy & Co., wholesale salt-fish dealers, Boston].

In regard to the value of whiting, we would say that our business with fish being confined entirely to the export trade to the West Indies, we can best give you our idea of the whiting as regards its value for shipping to such tropical and semi-tropical countries. The fish fit to ship to such countries must be able to withstand a certain amount of hot weather, and we consider the whiting as being too soft to successfully do this, and much inferior to codfish in this respect. We consider that codfish would be so much preferred that no difference in price would cause whiting to be used in our trade. The meat of the whiting is so soft, watery, and tender that the skin can not be removed, and they are therefore useless as boneless fish. On account of these qualities people do not like the fish and will not buy them and dealers will not handle them. Therefore, their food value as compared with cod, haddock, etc., is not so great, especially as the latter are caught in sufficient quantities.

[Capt. Atkins Hughes, weir fisherman, North Truro, Mass.]

As a food-fish, fresh, there is no ground fish that is better, in my opinion. As the weir men give them to anyone who comes for them, there are a good many eaten in this place and Provincetown. At some places on the Massachusetts coast, the fish-dealers protested so much against this practice of the weir men, on the ground that it injured their business, that the fishermen had to abandon their generosity. I mention this to show that the whiting are good fish and would be more generally used if the common people could get them. Their keeping qualities fresh are as good as any fish we ship away in ice. In 1893 not more than 200 or 300 barrels of whiting were utilized in the Cape Cod region, about 100 barrels being salted at Provincetown and the remainder shipped to the New York market. A good many whiting are now taken to Boston and sold to peddlers, but the regular dealers do not handle them.

[James G. Tarr & Bro., wholesale fish-dealers, Gloucester.]

We are able to state from practical experience that the whiting is only fit for use fresh or pickled for immediate consumption. We split and salted 3,000 pounds in 1891, carried them in salt pickle three months, and found upon examination they had shrunk in weight nearly one-half, and were turned a yellowish straw color on their faces. We soaked, dried, and smoked the lot, and when cured they were worthless, being like cardboard, dry and shriveled up, worthless for food. In cans they do a little better, but there is so much water in the fish that contents of cans get mushy, and we do not consider it profitable to use them.

[H. E. Woodward & Co., wholesale fish-dealers, Boston.]

The silver hake or whiting in our judgment can only be used when split and salted exactly as hake are. In that state could be exported same as hake, and might also be dressed for cheap boneless fish. We think of no other way of utilizing it.

## THE FRESH-WATER PEARL FISHERIES.

In December, 1893, negotiations were opened with Mr. George F. Kunz, the well-known gem expert, with a view to have him make a thorough investigation of the fresh-water pearl fisheries of the United States and prepare a report on the subject for the Commission.

While the taking of fresh-water pearls is not a branch of the fisheries which possesses great importance because of the number of persons finding employment or the capital invested therein, the industry possesses much interest and the value of the output is in the aggregate large. The absence of even an approximately complete account of the

extent, methods, and other features of this fishery, and the opportunity of having the subject investigated by one so well informed as Mr. Kunz and at a purely nominal expense, were taken into consideration.

Mr. Kunz was already in possession of a large amount of important unpublished material which he had been gathering for many years. This was freely placed at the disposal of the Commission and served as a valuable basis for the future inquiries. Mr. Kunz also had access to the extensive records of Messrs. Tiffany & Co., the well-known New York jewelers, with whom he is associated.

In order to bring the matter up to date and secure uniformity in the information obtained, a circular form was prepared for Mr. Kunz's use, and sent out by him to all persons who had within recent years engaged in the pearl fishery or in buying and selling the pearls. The topics sought to be brought out by the schedule were as follows:

*The pearl-bearing mussels:*
Nature of stream in which found; kind of bottom; character of water.
Geological character of the district as to rock, soil, etc.
General abundance of mussels.
Size, shape, and position of the mussel beds.
Local names of mussels.
Habits of mussels.
Enemies and fatalities to which mussels are exposed; nature and extent of destruction by muskrats, hogs, freshets, etc.
Size, shape, and color of mussels.
Species of mussels in which pearls are most common.
Proportion of mussels in which pearls occur.
Sizes, or other peculiarities, of shells in which pearls are found.

*The pearls:*
Nature and origin of pearls.
Position in mussel.
Size, shape, and color of pearls.
Relative value of pearls in different sizes, shapes, and colors.
Markets for pearls.
Prices for pearls.

*The fishery:*
Method of taking the mussels.
Description of apparatus used in taking mussels and in opening the shells.
Methods of extracting the pearls.
Treatment of pearls when found.
Utilization of mussels after extraction of pearls or after opening.
Principal occupations of mussel fishermen.
Statistics of fishery in 1893: Fishermen, boats, apparatus, pearls.
Statistics, complete or partial, for previous years.
Period when pearl fishing was of greatest importance in district.
History of origin and growth of fishery.
Exhaustion of mussel beds; causes, rapidity.
Do exhausted beds become replenished, and in what time?
Is State protection of beds desirable or necessary?

The inquiries were begun in February, 1894, and by the close of the fiscal year, when they were still in progress, much interesting and useful data had been secured. The completion of the inquiry is expected during the next fiscal year.

## THE MENHADEN FISHERY.

In the report of the division for 1892 reference was made to the desirability of undertaking a special inquiry regarding one of the controversial points that had arisen in the menhaden fishery, namely, the extent to which other fish besides menhaden are taken in the seines.

The plan proposed contemplated the assignment of agents to menhaden vessels fishing from various points on the coast, and the recording of the detailed results of each seine-haul during the season.

By the opening of the fishing season, in May, 1894, arrangements had been perfected for conducting an inquiry in accordance with the plan suggested in the report cited. The limited force available for this work, owing to the prosecution of extensive field inquiries in the Great Lakes, necessitated a curtailment of the original plan to the extent of making continuous observations on only two menhaden vessels. A number of menhaden firms consented to the use of their vessels, when the purposes of the investigation were made known. The offers accepted were those of Messrs. Luce Brothers, of Niantic, Conn., and Mr. A. J. Morse, of Hoffman's Wharf, Va., the former tendering the use of the steamer *Arizona*, of 103 tons; the latter the steamer *J. W. Hawkins*, of 125 tons. Mr. C. E. Latimer, a former employee of the Commission, was appointed to duty on the *Arizona*, and Mr. E. F. Locke, field agent, was assigned to the *J. W. Hawkins*. Owing to sickness, Mr. Latimer's services were discontinued shortly after he entered on the work, and Mr. W. P. Hay, teacher of zoology in the Washington High School, took his place.

Up to the end of the fiscal year the inquiry had progressed satisfactorily, and the indications were that by the close of the season more detailed and reliable information than had ever before been collected on this subject would be in the possession of the Commission.

## SALMON IN COAST WATERS AND AT SEA.

A paper entitled "Notes on the capture of Atlantic salmon at sea and in the coast waters of the Eastern States" was issued in pamphlet form in May, 1894. The purpose of the article was to record some of the results of salmon culture, as evidenced by the capture of salmon in places remote from the rivers in which fry had been deposited; to solicit information from offshore and coast fishermen concerning the taking of salmon in their nets, and "to bring to their attention the opportunity they will thus have of increasing the knowledge of the movements of the salmon, of aiding in the determination of the results of fish-cultural operations, and of ultimately, if not immediately, benefiting themselves by supplying information that will conduce to the most effective application of artificial methods."

An edition of 500 copies of the article was printed. The paper was sent to persons engaged in the mackerel, menhaden, and other ocean fisheries, and to the operators of pound nets, traps, and other shore apparatus in the New England and Middle States, accompanied by a circular letter from the Commissioner directing attention to that part of the paper in which information was solicited.

Already numerous replies have been received recording the occurrence of salmon on various parts of the coast, and it is expected that in the next two or three years much valuable material will be obtained in this way.

## INQUIRIES AT BOSTON AND GLOUCESTER, MASS.

The nature of the services performed by the local agents of the Commission at Boston and Gloucester has been fully explained and the importance of these inquiries has been referred to in previous reports of the division. At nominal salaries, Mr. F. F. Dimick, at Boston, and Capt. S. J. Martin, at Gloucester, have continued to render efficient service and to procure accurate data showing the operations of a large part of the New England fishing fleet.

The following table, based on Mr. Dimick's returns, shows that in the calendar year 1893 67,595,289 pounds of fish, having a value to the fishermen of $1,595,902, were landed at Boston by American fishing vessels, in addition to which considerable quantities of lobsters, clams, and other products were received. More than half the aggregate weight of the fish landed represented haddock; of this species, over 31,229,000 pounds, valued at $658,000, were brought in. Of cod, the next important fish, over 16,000,000 pounds, worth $451,000, were taken. The receipts of hake were 11,590,000 pounds, having a value of over $133,000. Georges Bank was the principal fishing-ground resorted to by vessels landing their fares at Boston; this famous bank yielded over 17,000,000 pounds of the fish shown in the table. The South Channel grounds are credited with over 13,600,000 pounds. Other important banks were Cashes, Jeffreys Ledge, Middle, La Have, and Western. Detailed figures for the different species and grounds are given in the table.

*Summary by fishing-grounds of certain fishery products landed at Boston, Mass., in 1893 by American fishing vessels.*

| Fishing-grounds. | No. of trips from each ground. | Cod. | | Cusk. | | Haddock. | |
|---|---|---|---|---|---|---|---|
| | | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. |
| East of 66° W. longitude: | | | | | | | |
| La Have Bank | 101 | 1,368,000 | $36,989 | 539,500 | $7,658 | 1,125,700 | $22,550 |
| Western Bank | 68 | 823,300 | 21,194 | 195,000 | 3,233 | 212,400 | 3,819 |
| Cape Shore | 47 | 507,500 | 14,820 | 163,700 | 2,448 | 341,400 | 8,818 |
| Gulf of St. Lawrence | 2 | | | | | | |
| West of 66° W. longitude: | | | | | | | |
| Browns Bank | 46 | 543,000 | 13,198 | 150,500 | 2,225 | 904,000 | 14,511 |
| Georges Bank | 547 | 4,221,700 | 122,145 | 598,200 | 8,615 | 10,524,300 | 230,647 |
| Cashes Bank | 189 | 1,117,600 | 31,639 | 1,524,400 | 22,533 | 1,283,600 | 24,616 |
| Clark Bank | 6 | 52,000 | 1,285 | 10,000 | 200 | 72,000 | 1,735 |
| Fippenies Bank | 14 | 48,400 | 1,663 | 23,500 | 299 | 82,000 | 1,718 |
| Tillies Bank | 7 | 12,500 | 399 | | | 35,000 | 800 |
| Ipswich Bay | 72 | 222,800 | 6,633 | 1,000 | 13 | 286,500 | 7,184 |
| Jeffreys Ledge | 492 | 773,900 | 22,460 | 212,750 | 2,958 | 2,390,300 | 52,626 |
| Middle Bank | 548 | 764,600 | 22,703 | 149,100 | 1,903 | 2,554,850 | 58,897 |
| Off Highland Light | 215 | 653,800 | 17,048 | 118,000 | 1,605 | 1,258,800 | 25,555 |
| Off Chatham | 81 | 172,000 | 4,690 | 6,000 | 113 | 707,700 | 14,158 |
| South Channel | 538 | 3,278,900 | 87,807 | 393,300 | 6,159 | 7,308,700 | 145,263 |
| Nantucket Shoals | 74 | 683,000 | 20,296 | 3,400 | 43 | 461,900 | 7,579 |
| Shore, general | 779 | 841,290 | 26,240 | 149,300 | 2,398 | 1,080,200 | 37,732 |
| Total | 3,826 | 16,075,290 | 451,209 | 4,237,650 | 62,403 | 31,229,350 | 658,208 |

*Summary by fishing-grounds of certain fishery products landed at Boston, Mass., in 1893 by American fishing vessels*—Continued.

| Fishing-grounds. | Hake. | | Halibut. | | Pollock. | |
|---|---|---|---|---|---|---|
| | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. |
| East of 66° W. longitude: | | | | | | |
| La Have Bank | 780,000 | $8,539 | 151,100 | $14,808 | 128,800 | $1,791 |
| Western Bank | 301,500 | 3,315 | 747,500 | 75,065 | 30,500 | 481 |
| Cape Shore | 230,100 | 2,856 | 30,650 | 2,489 | 30,800 | 521 |
| West of 66° W. longitude: | | | | | | |
| Browns Bank | 107,000 | 1,153 | 71,600 | 8,411 | 13,000 | 287 |
| Georges Bank | 1,272,100 | 14,845 | 202,910 | 20,593 | 64,100 | 978 |
| Cashes Bank | 2,302,400 | 27,890 | 13,040 | 1,309 | 47,000 | 690 |
| Clark Bank | 39,500 | 555 | 3,500 | 270 | ..... | ..... |
| Fippenies Bank | 67,000 | 860 | 6,500 | 598 | 3,800 | 54 |
| Tillies Bank | 17,500 | 168 | ..... | ..... | 1,000 | 15 |
| Ipswich Bay | 21,700 | 247 | 400 | 40 | 1,000 | 10 |
| Jeffreys Ledge | 1,449,100 | 15,531 | 3,200 | 304 | 231,650 | 2,948 |
| Middle Bank | 1,142,000 | 13,491 | 6,435 | 593 | 65,950 | 900 |
| Off Highland Light | 566,900 | 6,627 | 11,385 | 1,151 | 20,000 | 283 |
| Off Chatham | 94,900 | 931 | 2,182 | 218 | 4,200 | 56 |
| South Channel | 2,464,700 | 27,782 | 113,450 | 11,995 | 84,900 | 1,065 |
| Nantucket Shoals | 38,700 | 482 | 400 | 57 | 22,500 | 349 |
| Shore, general | 695,300 | 8,599 | 10,200 | 1,111 | 138,500 | 1,635 |
| Total | 11,590,400 | 133,871 | 1,374,452 | 139,012 | 889,200 | 12,063 |

| Fishing-grounds. | Mackerel. | | | | Other fish. | | Total. | |
|---|---|---|---|---|---|---|---|---|
| | Fresh. | | Salted. | | | | | |
| | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. |
| East of 66° W. longitude: | | | | | | | | |
| La Have Bank | ..... | ..... | ..... | ..... | ..... | ..... | 4,093,100 | $92,335 |
| Western Bank | ..... | ..... | ..... | ..... | 225 | $14 | 2,310,425 | 107,121 |
| Cape Shore | ..... | ..... | 316,400 | $17,207 | ..... | ..... | 1,620,550 | 49,159 |
| Gulf of St. Lawrence | ..... | ..... | 65,000 | 4,788 | ..... | ..... | 65,000 | 4,788 |
| West of 66° W. longitude: | | | | | | | | |
| Browns Bank | ..... | ..... | ..... | ..... | 3,000 | 135 | 1,783,700 | 39,920 |
| Georges Bank | ..... | ..... | ..... | ..... | 156,825 | 10,275 | 17,040,135 | 408,098 |
| Cashes Bank | 10,500 | $635 | ..... | ..... | ..... | ..... | 6,208,540 | 109,312 |
| Clark Bank | ..... | ..... | ..... | ..... | ..... | ..... | 177,000 | 4,045 |
| Fippenies Bank | ..... | ..... | ..... | ..... | ..... | ..... | 231,200 | 5,192 |
| Tillies Bank | ..... | ..... | ..... | ..... | ..... | ..... | 66,000 | 1,382 |
| Ipswich Bay | ..... | ..... | ..... | ..... | ..... | ..... | 533,400 | 14,127 |
| Jeffreys Ledge | ..... | ..... | ..... | ..... | 5,105 | 305 | 5,066,005 | 97,132 |
| Middle Bank | ..... | ..... | ..... | ..... | 9,725 | 367 | 4,692,660 | 98,854 |
| Off Highland Light | ..... | ..... | ..... | ..... | 4,000 | 142 | 2,633,785 | 52,411 |
| Off Chatham | 22,700 | 1,636 | ..... | ..... | 64,450 | 1,076 | 1,074,132 | 22,878 |
| South Channel | ..... | ..... | ..... | ..... | 16,100 | 768 | 13,660,050 | 280,839 |
| Nantucket Shoals | ..... | ..... | ..... | ..... | ..... | ..... | 1,209,900 | 28,806 |
| Shore, general | 470,100 | 36,981 | 696,100 | 47,371 | 358,717 | 17,436 | 5,039,707 | 179,503 |
| Total | 503,300 | 39,252 | 1,077,500 | 69,366 | 618,147 | 30,518 | 67,595,289 | 1,595,902 |

The receipts of fish at Gloucester in 1893, landed from American fishing vessels, consisted of 29,478,000 pounds of fresh and 45,322,000 pounds of salt fish, valued at $2,503,000. Over 38,500,000 pounds, or more than half the total receipts, consisted of fresh and salt cod, the salt cod amounting to about 34,000,000 pounds. The value of the cod at first hands was $1,145,000. The next important fish was halibut, of which 8,418,000 pounds, worth $656,000, were landed. Hake were taken in about the same quantities as halibut, but their value was much less; 8,400,000 pounds, valued at $59,000, are shown in the statistics. Of mackerel, 7,715,420 pounds, with a value of $503,887, were received. The most prominent fishing-grounds visited by the Gloucester vessels are the Grand Banks; here over 19,000,000 pounds of fish, having a value of $572,000, were caught. Georges Bank yielded more than 14,100,000 pounds, valued at $492,000. The details are shown in the following table, compiled from statistics furnished during the year by Capt. S. J. Martin.

*Summary by fishing-grounds of certain fishery products landed at Gloucester, Mass., in 1893, by American fishing vessels.*

| Fishing-grounds. | No. of trips from each ground. | Cod. | | | | Cusk. | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Fresh. | | Salted. | | Fresh. | | Salted. | |
| | | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. |
| East of 66° W. longitude: | | | | | | | | | |
| La Have Bank | 92 | 431,000 | $8,367 | 571,770 | $20,522 | 350,000 | $5,004 | ..... | ..... |
| Western Bank | 73 | 30,000 | 550 | 493,200 | 14,510 | 12,000 | 198 | ..... | ..... |
| Quereau Bank | 163 | 2,000 | 80 | 433,260 | 11,778 | ..... | ..... | 7,000 | $158 |
| Misaine Bank | 1 | ..... | ..... | 32,000 | 1,040 | ..... | ..... | ..... | ..... |
| St. Peters Bank | 7 | ..... | ..... | 26,000 | 734 | ..... | ..... | ..... | ..... |
| Green Bank | 2 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Grand Bank | 148 | ..... | ..... | 18,021,275 | 491,934 | ..... | ..... | ..... | ..... |
| Canso Bank | 9 | ..... | ..... | 864,940 | 24,209 | ..... | ..... | ..... | ..... |
| Cape Shore | 100 | ..... | ..... | 1,083,350 | 35,097 | 45,000 | 720 | 31,600 | 576 |
| Gulf of St. Lawrence | 35 | ..... | ..... | 909,330 | 26,405 | ..... | ..... | ..... | ..... |
| Iceland and Greenland | 11 | ..... | ..... | 156,000 | 4,935 | ..... | ..... | ..... | ..... |
| Off Newfoundland | 4 | ..... | ..... | 15,000 | 475 | ..... | ..... | ..... | ..... |
| Total | 645 | 463,000 | 8,997 | 22,606,125 | 631,639 | 407,000 | 5,922 | 38,600 | 734 |
| West of 66° W. longitude: | | | | | | | | | |
| Browns Bank | 25 | 234,000 | 4,488 | 181,800 | 5,418 | 112,500 | 1,618 | 4,000 | 70 |
| German Bank | 1 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Georges Bank | 672 | 1,090,360 | 24,484 | 10,213,472 | 372,924 | 369,600 | 5,567 | 82,000 | 1,892 |
| Clarks Bank | 1 | 3,000 | 60 | ..... | ..... | 35,000 | 578 | ..... | ..... |
| Cashes Bank | 287 | 1,612,200 | 30,583 | ..... | ..... | 3,653,900 | 56,083 | ..... | ..... |
| Fippenies Bank | 1 | ..... | ..... | ..... | ..... | 2,000 | 27 | ..... | ..... |
| Middle Bank | 23 | 8,950 | 207 | ..... | ..... | 47,500 | 723 | ..... | ..... |
| Platts Bank | 3 | ..... | ..... | 30,000 | 810 | ..... | ..... | 21,000 | 448 |
| Jeffreys Ledge | 43 | 40,000 | 924 | ..... | ..... | 94,000 | 1,460 | ..... | ..... |
| Off Chatham | 9 | 4,000 | 72 | ..... | ..... | ..... | ..... | ..... | ..... |
| South Channel | 18 | 36,000 | 580 | ..... | ..... | 119,000 | 1,789 | ..... | ..... |
| Nantucket Shoals | 45 | ..... | ..... | 1,270,000 | 40,209 | 24,000 | 360 | ..... | ..... |
| Shore, general | 1,415 | 686,007 | 21,350 | 72,000 | 2,056 | 7,620 | 96 | 28,000 | 630 |
| Total | 2,543 | 3,715,417 | 82,748 | 11,767,272 | 421,417 | 4,465,120 | 68,301 | 135,000 | 3,040 |
| Grand total | 3,118 | 4,178,417 | 91,745 | 34,373,397 | 1,053,056 | 4,872,120 | 74,223 | 173,600 | 3,774 |

| Fishing-grounds. | Haddock. | | | | Hake. | | | |
|---|---|---|---|---|---|---|---|---|
| | Fresh. | | Salted. | | Fresh. | | Salted. | |
| | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. |
| East of 66° W. longitude: | | | | | | | | |
| La Have Bank | 271,000 | $2,586 | ..... | ..... | 655,000 | $4,563 | ..... | ..... |
| Western Bank | ..... | ..... | ..... | ..... | 40,000 | 310 | ..... | ..... |
| Cape Shore | 5,000 | 45 | 13,000 | $163 | ..... | ..... | 38,300 | $367 |
| Iceland and Greenland | ..... | ..... | ..... | ..... | ..... | ..... | 14,500 | 182 |
| Total | 276,000 | 2,631 | 13,000 | 163 | 695,000 | 4,873 | 47,500 | 549 |
| West of 66° W. longitude: | | | | | | | | |
| Browns Bank | 247,000 | 2,218 | ..... | ..... | 88,000 | 612 | 3,000 | 38 |
| German Bank | ..... | ..... | ..... | ..... | 30,000 | 255 | ..... | ..... |
| Georges Bank | 1,235,500 | 12,395 | 9,000 | 100 | 403,080 | 3,001 | 2,000 | 20 |
| Clarks Bank | ..... | ..... | ..... | ..... | 5,000 | 35 | ..... | ..... |
| Cashes Bank | 633,350 | 5,851 | ..... | ..... | 6,216,500 | 42,254 | ..... | ..... |
| Fippenies Bank | ..... | ..... | ..... | ..... | 8,000 | 68 | ..... | ..... |
| Middle Bank | 10,700 | 237 | ..... | ..... | 113,000 | 844 | ..... | ..... |
| Platts Bank | ..... | ..... | 8,000 | 101 | ..... | ..... | 33,000 | 388 |
| Jeffreys Ledge | 12,000 | 552 | ..... | ..... | 187,000 | 1,597 | ..... | ..... |
| Off Chatham | 18,000 | 162 | ..... | ..... | 4,000 | 20 | ..... | ..... |
| South Channel | 61,000 | 526 | ..... | ..... | 204,500 | 1,495 | ..... | ..... |
| Nantucket Shoals | 8,000 | 72 | ..... | ..... | 18,000 | 98 | ..... | ..... |
| Shore, general | 133,880 | 2,098 | 14,000 | 186 | 190,520 | 1,280 | 152,500 | 1,745 |
| Total | 2,359,430 | 24,111 | 31,000 | 387 | 7,468,200 | 51,559 | 190,500 | 2,191 |
| Grand total | 2,635,430 | 26,742 | 44,000 | 550 | 8,163,200 | 56,432 | 238,000 | 2,740 |

*Summary by fishing-grounds of certain fishery products landed at Gloucester*—Continued.

| Fishing-grounds. | Halibut. | | | | Mackerel. | | | |
|---|---|---|---|---|---|---|---|---|
| | Fresh. | | Salted. | | Fresh. | | Salted. | |
| | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. |
| East of 66° W. longitude: | | | | | | | | |
| La Have Bank | 705,935 | $56,197 | | | | | | |
| Western Bank | 1,251,844 | 95,008 | 2,700 | $162 | | | | |
| Quereau Bank | 2,532,720 | 222,060 | 2,000 | 100 | | | | |
| Misaine | 63,000 | 2,655 | | | | | | |
| St. Peters Bank | 197,980 | 14,131 | | | | | | |
| Green Bank | 48,400 | 4,542 | | | | | | |
| Grand Bank | 874,225 | 72,132 | 145,680 | 8,525 | | | | |
| Canso Bank | | | 2,540 | 152 | | | | |
| Cape Shore | 11,000 | 822 | 2,880 | 173 | | | 2,823,000 | $153,825 |
| Gulf of St. Lawrence | | | | | | | 750,400 | 53,108 |
| Iceland and Greenland | | | 1,673,200 | 98,078 | | | | |
| Off Newfoundland | 122,250 | 7,257 | | | | | | |
| Total | 5,807,354 | 474,804 | 1,829,000 | 107,190 | | | 3,573,400 | 206,933 |
| West of 66° W. longitude: | | | | | | | | |
| Browns Bank | 8,900 | 548 | | | | | | |
| Georges Bank | 753,025 | 72,218 | | | | | | |
| Cashes Bank | 12,600 | 783 | | | | | | |
| Middle Bank | 3,520 | 340 | | | | | 91,200 | 7,402 |
| Jeffreys Ledge | 160 | 16 | | | | | | |
| Off Chatham | | | | | | | 44,000 | 2,445 |
| Nantucket Shoals | 3,900 | 347 | | | | | | |
| Shore, general | | | | | 48,420 | $3,205 | 3,958,400 | 283,902 |
| Total | 782,105 | 74,252 | | | 48,420 | 3,205 | 4,093,600 | 293,749 |
| Grand total | 6,589,459 | 549,056 | 1,829,000 | 107,190 | 48,420 | 3,205 | 7,667,000 | 500,682 |

| Fishing-grounds. | Pollock. | | | | Other fish. | | | |
|---|---|---|---|---|---|---|---|---|
| | Fresh. | | Salted. | | Fresh. | | Salted. | |
| | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. |
| East of 66° W. longitude: | | | | | | | | |
| La Have Bank | | | | | 3,000 | $360 | | |
| Iceland and Greenland | | | | | | | 2,200 | $132 |
| Total | | | | | 3,000 | 360 | 2,200 | 132 |
| West of 66° W. longitude: | | | | | | | | |
| Browns Bank | 3,000 | $21 | | | | | | |
| Georges Bank | | | 3,000 | $30 | 1,000 | 120 | | |
| Jeffreys Ledge | 161,300 | 1,222 | | | | | | |
| Off Chatham | | | 158,000 | 2,688 | | | | |
| South Channel | 2,000 | 15 | | | | | | |
| Shore, general | 2,398,126 | 17,593 | | | 422,490 | 2,975 | 834,400 | 9,394 |
| Total | 2,564,426 | 18,851 | 161,000 | 2,718 | 423,490 | 3,095 | 834,400 | 9,394 |
| Grand total | 2,564,426 | 18,851 | 161,000 | 2,718 | 427,090 | 3,455 | 836,600 | 9,526 |

*Summary by fishing-grounds of certain fishery products landed at Gloucester*—Continued.

| Fishing-grounds. | All fish. | | | | | |
|---|---|---|---|---|---|---|
| | Fresh. | | Salted. | | Total. | |
| | Pounds. | Value. | Pounds. | Value. | Pounds. | Value. |
| East of 66° W. longitude: | | | | | | |
| La Have Bank | 2,416,535 | $77,077 | 571,770 | $20,522 | 2,988,305 | $97,599 |
| Western Bank | 1,333,844 | 96,066 | 495,900 | 14,672 | 1,829,744 | 110,738 |
| Quereau Bank | 2,534,720 | 222,140 | 442,260 | 12,036 | 2,976,980 | 234,176 |
| Misaine Bank | 63,000 | 2,055 | 32,000 | 1,040 | 95,000 | 3,695 |
| St. Peters Bank | 197,980 | 14,131 | 26,000 | 734 | 223,980 | 14,865 |
| Green Bank | 48,400 | 4,542 | ..... | ..... | 48,400 | 4,542 |
| Grand Bank | 874,225 | 72,132 | 18,166,955 | 500,459 | 19,041,180 | 572,591 |
| Canso Bank | ..... | ..... | 867,480 | 24,361 | 867,480 | 24,361 |
| Cape Shore | 61,000 | 1,587 | 3,986,830 | 190,201 | 4,047,830 | 191,788 |
| Gulf of St. Lawrence | ..... | ..... | 1,659,730 | 79,513 | 1,659,730 | 79,513 |
| Iceland and Greenland | ..... | ..... | 1,845,900 | 103,327 | 1,845,900 | 103,327 |
| Off Newfoundland | 122,250 | 7,257 | 15,000 | 475 | 137,250 | 7,732 |
| Total | 7,651,954 | 497,587 | 28,109,825 | 947,340 | 35,761,779 | 1,444,927 |
| West of 66° W. longitude: | | | | | | |
| Browns Bank | 693,400 | 9,505 | 188,800 | 5,526 | 882,200 | 15,031 |
| German Bank | 30,000 | 255 | ..... | ..... | 30,000 | 255 |
| Georges Bank | 3,853,165 | 117,785 | 10,309,472 | 374,966 | 14,162,637 | 492,751 |
| Clarks Bank | 43,000 | 673 | ..... | ..... | 43,000 | 673 |
| Cashes Bank | 12,128,550 | 135,554 | ..... | ..... | 12,128,550 | 135,554 |
| Fippenies Bank | 10,000 | 95 | ..... | ..... | 10,000 | 95 |
| Middle Bank | 183,670 | 2,351 | 91,200 | 7,402 | 274,870 | 9,753 |
| Platts Bank | ..... | ..... | 92,000 | 1,747 | 92,000 | 1,747 |
| Jeffreys Ledge | 495,360 | 5,771 | ..... | ..... | 495,360 | 5,771 |
| Off Chatham | 26,000 | 254 | 202,000 | 5,133 | 228,000 | 5,387 |
| South Channel | 422,500 | 4,405 | ..... | ..... | 422,500 | 4,405 |
| Nantucket Shoals | 53,900 | 877 | 1,270,000 | 40,209 | 1,323,900 | 41,086 |
| Shore, general | 3,887,063 | 48,597 | 5,059,300 | 297,913 | 8,946,363 | 346,510 |
| Total | 21,826,608 | 326,122 | 17,212,772 | 732,896 | 39,039,380 | 1,059,018 |
| Grand total | 29,478,562 | 823,709 | 45,322,597 | 1,680,236 | 74,801,159 | 2,503,945 |

It is intended to prepare in a short time a special discussion on the condition of the vessel fisheries of Massachusetts based on reports of the local agents at Boston and Gloucester. Material is at hand showing, for a series of years (1889 to 1894), the yield of different kinds of fish on each of the important banks resorted to by the vessels landing their fares in those cities, which, as has previously been stated, receive fully seven-eighths of the offshore vessel catch of New England.

## REPORTS, SPECIAL PAPERS, ETC.

The published reports relating to commercial fisheries, issued from this division during the year, dealt chiefly with special subjects connected with the fisheries. A number of general reports, however, dealing with the fisheries of important geographical sections, were in course of preparation or of printing, and will be shortly published.

Among special data prepared by the division for use outside of the regular reports were statistical tables showing the extent of the fisheries of Maryland, for the Maryland Fish Commission, and printed in its report for 1893; information regarding the American mackerel fishery, for the Scotch Fishery Board, through the British embassy; a large series of detailed tables relating to the salmon industry of the Columbia River, for the use of the United States Fish Commissioner in a report to Congress on the condition of the industry.

A list of the articles issued, with a brief notice of their character, is as follows:

Report on the coast fisheries of Texas. (Report, 1889-1891, pp. 373-420, pls. 12-27.)

This report is based on field inquiries conducted in 1891, and is supplementary to the notice of the Texas fisheries contained in the report on the fisheries of the Gulf States, published in the Bulletin for 1891. The principal fisheries of the coast are first fully discussed, and then the fisheries are reviewed by geographical divisions. The paper is accompanied by 15 plates of the principal food-fishes of the coast waters of the State.

The oyster industry of Maryland. (Bulletin, 1892, pp. 203-297, pls. LVI-LXXI.)

The economic aspects of the oyster interests of the State having the most valuable oyster industry are considered in this paper. A history of the Maryland oyster-fishery from the earliest times is given, with an account of the legislation enacted for its regulation, the oyster-grounds, the methods pursued in oystering, oyster-culture, the oyster-police and the oyster-revenue services, the transporting, packing, and marketing trades, and detailed statistics of the industry. Fifteen plates showing fishing vessels, boats, appliances, and methods, and a colored chart indicating the position of the oyster beds, accompany the report.

The use of the proof sheets of this report was tendered the Maryland Bureau of Industrial Statistics, and the entire paper was printed in the report of that bureau for 1893.

The fyke nets and fyke-net fisheries of the United States, with notes on the fyke nets of other countries. (Bulletin, 1892, pp. 299-355, pls. LXXII-XCI.)

This article embodies the results of an original study of this group of fishing apparatus which had been in progress for several years. The fyke is one of the most generally used nets in the United States, and is also found in nearly every other country having important commercial fisheries. The paper defines the fyke net, gives the names by which it is known, explains the principle of its action, classifies and describes the different types, contains a geographical and statistical review of the fyke-net fisheries of the United States, and concludes with notes on the fyke net in other countries. In the fyke-net fisheries of the coast and lake States, 2,300 persons are shown to have been engaged, 25,700 nets used, and over 12,000,000 pounds of fish taken, the value of the catch being over $300,000. Illustrations of 40 types of fyke nets employed in the United States and other countries are given.

Economic and natural-history notes on fishes of the northern coast of New Jersey. (Bulletin, 1892, pp. 365-380.)

The commercial fisheries of the northern part of the New Jersey coast are of great importance, and angling from the shore and from boats is also very extensively carried on during the summer months.

The paper represents the personal observations of the writer during parts of four years, and is chiefly based on a study of the pound-net fisheries. Pound nets of this section are more prominent than any other nets, and are the principal objects of the opposition to net fishing which exists on this coast. The article consists of a general review of the history and extent of the pound-net fishery, and of notes on the abundance, movements, and commercial value of the principal food-fishes of the region. About 50 species are separately mentioned, and for all the most important ones detailed figures are given showing the monthly catch in 1891 and 1892 at a pound-net fishery in Monmouth County.

Notes on the capture of Atlantic salmon at sea and in the coast waters of the Eastern States. (Bulletin, 1894, pp. 95–99, pls. 3 and 4.)

Some instances of the occurrence of Atlantic salmon off the coasts of Maine, Massachusetts, New Jersey, and Delaware are given in this paper. The taking of salmon at places remote from the mouths of rivers and off States having no salmon streams is of considerable interest to naturalists and fish-culturists, in view of the information afforded as to the oceanic migrations of this fish and owing to the efforts being made to introduce it into new waters. Reference is elsewhere made to this paper and to a special inquiry of which it served as a basis.

## MISCELLANEOUS MATTERS, NOTES ON FISHERIES, ETC.

### FISHERIES EXHIBIT AT THE WORLD'S COLUMBIAN EXPOSITION.

Opportunity was afforded the writer to inspect the exhibits of foreign countries in the fisheries section of the World's Columbian Exposition. A special study of the apparatus there displayed was made. Some of the notes and sketches taken were incorporated in the paper elsewhere referred to on the fyke nets and fyke-net fisheries of the United States and other countries. The foreign fishery exhibits which were especially noteworthy for their completeness or for special features were those of Canada, Norway, Russia, New South Wales, and Japan. These contained many objects offering valuable suggestions to the fishery interests of the United States as to apparatus, methods, preparation, and utilization of products, etc. The descriptive catalogues and reports issued by the Governments of Japan and New South Wales relating to the fishery exhibits and to the fisheries and fishery resources of those countries deserve mention.

Among the States whose official exhibits were worthy of special note were North Carolina, Wisconsin, Pennsylvania, California, Oregon, and Washington. Some of the foremost fishing States were, unfortunately, either entirely unrepresented in the fisheries building or were represented only by a few individual dealers or manufacturers.

### THE WORLD'S FISHERY CONGRESS.

This congress, one of a series of international gatherings under the auspices of the World's Columbian Exposition, convened at Chicago October 16–19, 1893. As chairman of the section devoted to the con-

sideration of the commercial fisheries, the writer entered into correspondence with persons in this country and abroad with a view to secure their cooperation and attendance. He also delivered an address on the condition of the American fisheries at the opening of the section, presented papers on the southern spring mackerel fishery and the statistics of the United States fisheries; compiled a report on the fisheries of Japan, based on the official catalogue of the Japanese exhibit, and abstracted and arranged a paper on improvements suggested for the British fisheries.

Following is a list of papers relating to the economic aspects of the fisheries which are printed as a part of the proceedings of the congress as contained in the Bulletin of the Fish Commission for 1893:

Fish nets: Some account of their construction and the application of their various forms in the American fisheries. By C. H. Augur.
The sea and coast fisheries. By Daniel T. Church.
Notes on the Irish mackerel fisheries. By W. S. Green.
The fisheries of Canada. By L. Z. Joncas.
The fishing industry of Lake Erie, past and present. By C. M. Keyes.
The exhibit of pearls at the World's Columbian Exposition. By George F. Kunz.
Foul fish and filth fevers. By J. Lawrence-Hamilton.
Reforms and improvements suggested for the fisheries of Great Britain and Ireland. By J. Lawrence-Hamilton. (Abstracted and arranged by Hugh M. Smith.)
Fishing in British Guiana. By J. J. Quelch.
Remarks on the maintenance and improvement of the American fisheries. By Hugh M. Smith.
Statistics of the fisheries of the United States. By Hugh M. Smith.
The fisheries of Japan. Compiled by Hugh M. Smith.
Our ocean fisheries, and the effect of legislation upon the fisheries. By J. M. K. Southwick.
The decrease of fish in American waters, and some of the causes. By A. M. Spangler.
The past and future of the fur-seal. By J. Stanley-Brown.
Notes on the fisheries and fishery industries of Puget Sound. By James G. Swan.
The fisheries of the Virginia coast. By J. T. Wilkins.

## INTERNATIONAL FISHERY COMMISSION.

In July, 1893, the writer accompanied Mr. Richard Rathbun, the United States representative on the International Fishery Commission, to points in New Brunswick, Nova Scotia, and Quebec. In addition to the special inquiries of the commission, an opportunity was afforded by personal observation to acquire a knowledge of the methods of taking and curing fish at some of the most important fishing stations in the provinces named. In November the writer accompanied the commission to Gloucester, where several weeks were spent in interviewing the mackerel fishermen.

## MARKET VALUE OF THE CARP.

Notwithstanding the carp has for many years been abundantly distributed over a large part of the United States, and extensively cultivated for home consumption, it is only recently that the fish has had sufficient abundance in public waters to warrant the prosecution of a special fishery or to give the fish a conspicuous position in the fish markets of the country. Of late, however, large quantities of carp

have been taken for market in Lake Erie and other lakes and rivers of the interior States, and the fish is now regularly exposed for sale and usually cited in the market quotations in all the large cities. The decrease in the output of whitefish and lake herring in Lake Erie and elsewhere has also had much to do with the rise of the carp as a commercial fish.

Of the many States in which the carp is now taken for home supply and for market there are few in which the introduction of the fish has been more successful or in which it has attained greater commercial importance than in Illinois. The stocking of the streams and ponds of that State was accomplished some years ago by the United States Fish Commission in cooperation with the State commission of Illinois. The fish has rapidly propagated and distributed itself, and is now a very important factor in the supply of fish food in the region, the increase of the fish in the Illinois River being especially noteworthy. The State fish commissioners in their report for 1890 refer to this fish as follows:

> The success attending the introduction of carp-culture in Illinois can not be estimated in dollars and cents, and has never been fairly placed before the people. Adverse criticism has, in many instances, had the effect of creating an undue prejudice against the fish. Lack of care and ignorance as to the methods of culture have done much more to cause the impression that carp are not profitable to raise. Still, the facts are that a very large number of those who prepared ponds for their reception, and gave them ordinary care, are successfully producing a profitable supply of fish every year as food, and good food, at a comparatively trifling expense. In addition to this, evidences are numerous to show that our streams are full of these fish, and they are entering into the supply of food at almost every point where fish are taken for market. Hundreds of very large carp have been taken this season from the pools along the Illinois River, and the fishermen report very large catches from the river itself very often. These are the product of the planting by the commission of carp furnished by the United States Fish Commission, in the public waters of the State, a report of which plant, with list of streams planted, was published in a former report.

The information at hand indicates that the Illinois River is perhaps as well stocked with carp as any other stream in the United States. Numerous instances might be cited of the wonderful multiplication of the fish in the waters of the State, but a single reference to this river will be sufficient to show the abundance of the fish and its commercial importance. In August, 1893, Dr. S. P. Bartlett, field superintendent of the United States Fish Commission, brought to the attention of the office the following information:

At Meredosia, Ill., in Morgan County, a shallow lagoon 6 miles long and three-quarters of a mile wide at the average stage of the water communicates with the Illinois River. This lagoon is known as Meredosia Bay. In this bay, on August 9, a fisherman using a 900-yard seine caught 25,000 pounds of carp averaging 7 pounds apiece. Some of the fish weighed 20 pounds. On August 17 the same fisherman secured 12,000 pounds of carp in the same place. The fisherman received from 7 to 10 cents per pound for the fish that weighed 7 pounds

or over and 3 to 5 cents per pound for those under that size. He had an offer from New York dealers for all the carp he could catch at the rate of 3½ cents per pound in rough state.

The statistical inquiries of the Commission in the Great Lakes in 1894 disclosed a very large catch of carp in Lake Erie in the previous year. In nearly every county bordering on the lake relatively large quantities of carp were taken and sold, the aggregate catch being 627,000 pounds, valued at $16,245. The principal part of the yield was obtained in the shallow water of the western end of the lake, Erie, Ottawa, and Lucas counties, in Ohio, having the largest catch. In Michigan, 41,900 pounds were taken; in Ohio, 581,360 pounds, and in Pennsylvania and New York, 3,740 pounds.

## TWO VOYAGES TO REMOTE FISHING-GROUNDS.

In the report of this division for 1891 mention was made of the trip of a Gloucester vessel to Africa for mackerel. The continued scarcity of mackerel in the western part of the Atlantic Ocean prompted another experimental voyage of a Gloucester schooner to the coast of the Old World. On June 22, 1893, the *Nannie C. Bohlin*, of 124 tons, after baiting with menhaden, sailed from Newport for Stavenger, Norway, fitted with seines and lines suitable for taking the large mackerel which are found on that coast. The vessel arrived at her destination July 13, to find that the season had not yet opened. In a few days, however, the vessel sailed for the fishing-grounds, which consist of two banks lying between 120 and 160 miles off the coast. Some fish were secured with the seine at the start, but later the more primitive method of drailing was resorted to. The largest haul of the seine was reported to be only 6 barrels. Unfortunately for the success of this venture, the weather was unfavorable for fishing during most of the season, and only a few fish were observed schooling, and the vessel was forced to return home with only 59 barrels of mackerel. This small fare was, however, larger than the average catch of the fleet on the United States coast.

As exemplifying the sailing qualities of the new class of New England fishing schooners, it may be mentioned that this vessel accomplished the trip from Norway to Massachusetts—a distance of 4,400 miles—in 22 days, during a third of which time head winds were encountered. It will be recalled that the famous racing yacht *Valkyrie* required 30 days to make a passage that was 800 miles shorter. The *Bohlin* is the same vessel whose seaworthiness was specially referred to in the report of this division for 1891. A mackerel voyage to Norway made by the Gloucester schooner *Notice* in 1877 was likewise unsuccessful.

The halibut fishing schooner *Carrie W. Babson*, 86 tons, of Gloucester, in 1893 visited a region but rarely sought by United States fishing vessels. The schooner sailed May 29 for Labrador and Baffin Bay. In Davis Strait so much ice was met with that the fishing-grounds off

the northern part of Labrador could not be tested, and the vessel sailed for the west coast of Greenland, which was safely reached after the experience of much difficulty in crossing Davis Strait. On the shore of Greenland a comparatively good fishing season was passed, and the vessel returned to Gloucester on October 5 with about 80,000 pounds of fletched halibut, 21 barrels of fins, and 11 barrels of salmon and salmon trout. The captain of the vessel thinks this region offers advantages for profitable fisheries, and intends to resume his explorations of the coast of Greenland and the region north of Hudson Strait.

### BOSTON FISH BUREAU.

This is an association of persons engaged in the fish trade, chiefly in Boston, Gloucester, and New York. In its aims and organization it occupies a unique position in the United States fishing industry. It is primarily intended to furnish its members with reliable, prompt, and private information regarding the catch, the receipts, and the general condition of the fish trade, but the entire fishery interests of the section are indirectly benefited, and it is, in fact, a fisheries intelligence bureau. The Commission has for many years received the confidential daily reports of the bureau. These contain much valuable information as to the movements of the fishing fleet, the abundance of fish, the condition of the different branches of the industry, the state of the markets, prices of fish, etc., and are very useful to the division. The annual reports of the bureau, compiled by the secretary, Mr. Frederick F. Dimick, while applying primarily to the New England vessel fisheries, also contain much information on important fisheries of other sections of the United States, as well as of foreign countries. The statistical and descriptive data with which these reports are filled make them extremely valuable for reference.

## PROPOSED WORK OF THE DIVISION.

### FISHERIES OF THE MINOR INTERIOR WATERS.

The investigation of the fresh-water fisheries of the rivers and lakes of the interior States, recommended in a previous report of the division, can probably be undertaken during the next fiscal year. The recent completion of statistical inquiries in all the coastal sections and in the basin of the Great Lakes makes the canvass of these minor waters opportune and desirable. It is anticipated that the extent of these fisheries will in the aggregate be enormous, and that some very interesting methods and apparatus will be found, of which little is now known outside of circumscribed limits. It will be the purpose of the division to pursue these inquiries as means and time will permit, until the fresh-water fisheries of each State and Territory shall have been covered. The small force of agents available for the field work will hardly be able to canvass the entire country in less than two seasons.

## PREPARATION OF FISHERY PRODUCTS.

The Commission receives numerous inquiries as to the methods employed in smoking, salting, canning, and otherwise preparing or preserving fishery products for market. Especially in those sections in which the fisheries are undergoing rapid development is there great demand for information of this character. While the Commission has from time to time published much bearing on this subject, the material is scattered through a number of volumes and is not available for distribution. Even in the comprehensive quarto series of reports issued by the Commission this matter was not especially considered.

It is therefore proposed that, at as early a time as practicable, this division make a special investigation of this subject to serve as the basis for a comprehensive, practical report, which shall contain descriptions of the various processes of preserving fish and other economic water animals in the United States. To these may be properly added accounts of the methods adopted in other countries.

## UTILIZATION OF WASTE PRODUCTS.

A topic of no little consequence to the commercial fishermen is the proper utilization of their catch and of the by-products resulting from the cleaning, curing, or canning of the catch. In nearly every important branch of the fisheries there is more or less waste of products having value as food, fertilizer, oil, etc. One of the most conspicuous cases in which a disregard for the value of refuse products results in a great loss to the fishing interests is that of the salmon-canning industry of the Pacific Coast. In this branch probably 20,000,000 pounds of salmon heads, tails, trimmings, and viscera are annually thrown away, which could, at a very slight cost, be converted into a high-class fertilizer, and would probably yield considerable quantities of a valuable oil. Numerous instances of this kind might be cited. In a previous discussion of this subject[1] the following statements were made:

> The increased attention paid to the utilization of refuse products of fish in some parts of the United States, especially New England, where not many years ago they were generally thrown away, marks an advance in our industrial life. Every waste product of fish and other aquatic animals resulting from their cleaning, curing, and canning has a commercial value in a crude state or after further manipulation, but in most regions no regard is paid to anything but the actual flesh, and many thousands of dollars are thus annually lost to a class that is least able to afford it. As one instance of the loss our fishing interests are yearly incurring, mention may be made of the economic value of the roe of fishes as an article of food. Practically, the eggs of only two species of fishes—the sturgeon and mullet—are utilized in this country, but there is hardly a fish whose roe is not suitable to be made into a valuable caviar, which could meet with ready sale abroad as well as at home, and would be an important addition to our fishery output, in that it would represent the expenditure of little time and money and the sacrifice of no additional fish. In the utilization and appreciation of our resources we can emulate the Chinese to decided advantage.

[1] Remarks on the maintenance and improvement of the American fisheries. Bulletin United States Fish Commission, 1893.

It is suggested that as soon as convenient, in connection with the other investigation previously referred to, a systematic inquiry be made in all the important fishing regions with a view to determine the extent to which waste products are utilized, the methods employed in so doing, the value of the secondary products, and to ascertain what other waste material not now employed might be rendered of value to the fishermen. Much information bearing on this subject is already in the possession of the office, but it is only in a special investigation that the matter can be thoroughly considered. The issuance of a report, in which the value of the various secondary fishery products is pointed out and the methods of preparing them for market shown, would be of great benefit to a large part of the fishing population. Dr. J. Lawrence-Hamilton, in a paper[1] presented to the World's Fishery Congress, at Chicago, in 1893, estimated that upwards of £2,000,000 ($10,000,000) annually is lost to the fishermen of the United Kingdon owing to failure to work up the waste fishery products; and it is known that in the United States an immense loss results from this cause which could be easily averted.

## FISHERIES INTELLIGENCE BUREAU.

The success which has attended the establishment of a fisheries intelligence service in Canada suggests the advisability of having a similar bureau in the United States. There seems no reason to doubt that great advantage would thus accrue to the coast fishing interests, and that such a service would be almost unanimously welcomed by fishermen, dealers, outfitters, and others.

The idea of a fisheries intelligence office seems to have first taken practical shape in Norway, where the service has attained great perfection and is recognized as being of inestimable benefit to the fisheries. The intelligence bureau of the Canadian fisheries department is organized on the plan of the Norwegian service, and is likewise regarded by the fishermen as an extremely valuable aid in their work.

The following brief outline of the organization and functions of the Canadian bureau is sufficient to show the scope and importance of the work:

The headquarters of this service is at Halifax, Nova Scotia. About 40 observers in the principal fishing centers of the maritime provinces communicate with the main office by means of a telegraphic cipher-code. The information conveyed consists chiefly of news concerning the weather; the movements of the fishing fleet; the presence, movements, and abundance of fish; the presence and abundance of bait, and other data intended to facilitate the operations of the fishermen. From Halifax the reports are sent out by telegraph to newspapers in the fishing towns, and to local agents, by whom they are posted in con-

[1] Reforms and improvements suggested for the fisheries of Great Britain and Ireland. Bulletin United States Fish Commission, 1893.

spicuous places, as weather reports are displayed in the United States. The entire service is maintained at an annual expense of $2,500, most of which sum represents telegrams. The observers are usually light-house keepers, customs officers, weather officials, and other employees of the Government, who are paid very small salaries—$15 to $25 annually—in addition to their regular compensation. In some places fishermen, telegraph operators, and other private persons are connected with the service, who receive more pay.

During a visit of the writer to a number of the New England and Canadian fishing centers in 1893 the importance of this subject was brought to his attention in many ways, and the desirability of instituting a bureau on the east coast of the United States, under the supervision of the Commission, was forcibly suggested to him. Fishermen, fish-dealers, and vessel-owners in Gloucester, Boston, and other fishing ports, who voluntarily mentioned the matter or to whose attention it was brought, spoke confidently of the value which such a bureau would have in certain important fisheries; and it would appear that the whale, mackerel, cod, herring, menhaden, halibut, haddock, and, probably, all other ocean fisheries would be greatly benefited.

The New England and Middle States would chiefly profit by the founding of such a service, although the vessel fishermen of the entire coast would receive valuable information. To properly equip the bureau, there should be at least 50 agents located at suitable coast points in each State, probably as far south as North Carolina, and the employment of a number of observers in the Canadian provinces in regions frequented by the United States fishermen would also be necessary. By relying chiefly on the services of light-house keepers, life-saving men, local fishermen, and others, to whom a nominal salary would be acceptable for the slight aid rendered in addition to their regular duties, the annual cost of the service would probably be under $5,000. There are times each year when the daily saving to the fleet in time and fish, through the information furnished by such a bureau, would much more than counterbalance the entire expense of the service.

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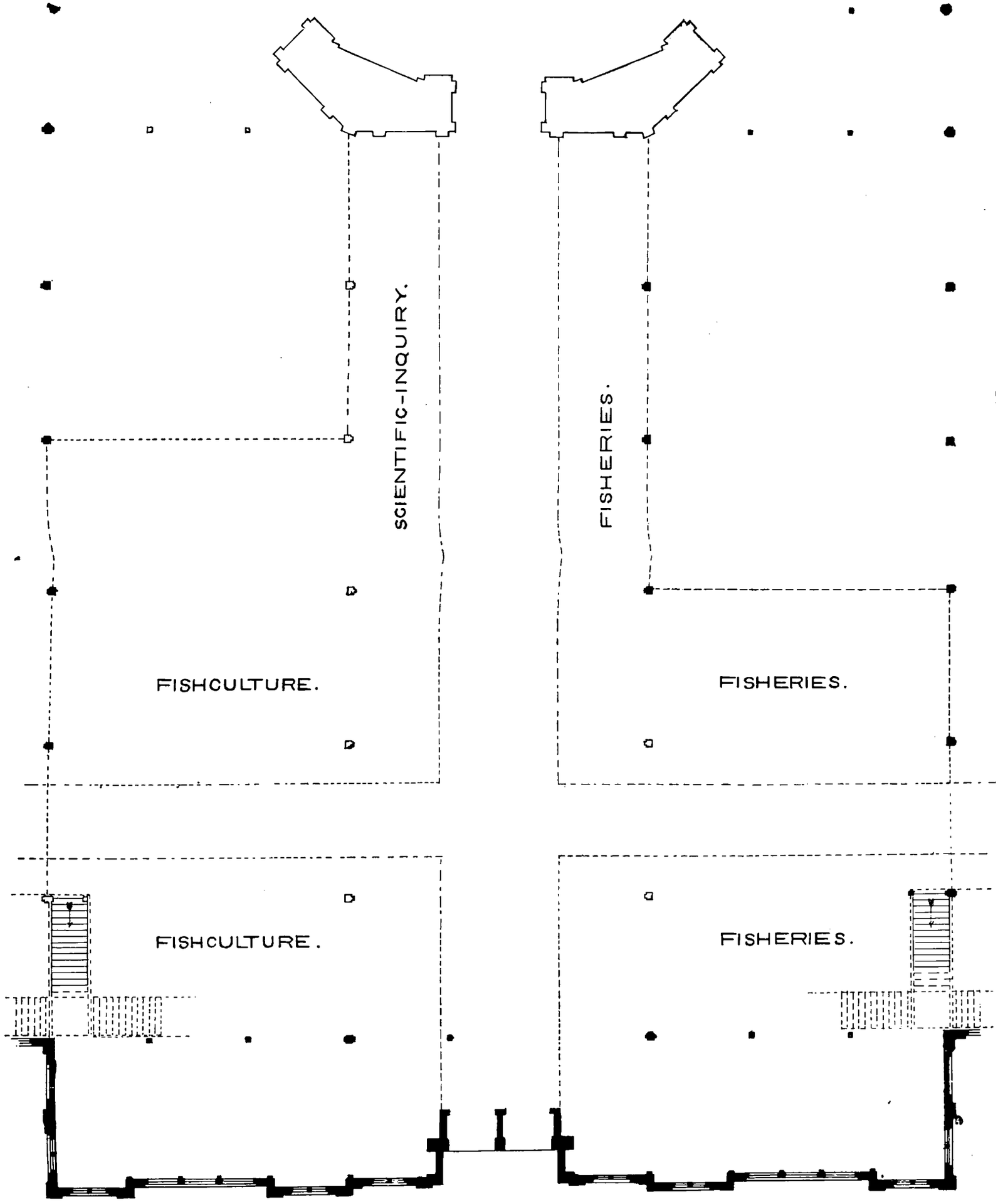


FLOOR PLAN OF THE FISH COMMISSION EXHIBIT AT THE COLUMBIAN EXPOSITION, 1893.

# 1.—REPORT OF THE REPRESENTATIVE OF THE UNITED STATES FISH COMMISSION AT THE WORLD'S COLUMBIAN EXPOSITION.

## SKETCH OF THE EXHIBIT.

The Commissioner of Fish and Fisheries was directed by the act of Congress approved April 25, 1890, to join with the several Executive Departments in the preparation of an exhibit illustrating the functions of the Government at the World's Columbian Exposition. The representation of the Departments was intrusted to one member from each of them, and one from the Smithsonian Institution and National Museum, as well as one from the Fish Commission; these representatives to constitute a board of management and control. The representative of the Fish Commission, nominated by the Commissioner August 18, 1890, was Capt. J. W. Collins, assistant in charge of the division of fisheries. Captain Collins tendered his resignation as representative December 27, 1892, and Commissioner McDonald then designated Dr. Tarleton H. Bean, assistant in charge of the division of fish-culture, to succeed him.

No active work was undertaken until April 1, 1891, upon which date certain employees of the Commission were detailed for special duty in connection with the preparation of the exhibit, and such additional assistants as were required were employed.

The building No. 210 Tenth street NW., Washington, D. C., was leased for the use of the Fish Commission exhibit May 1, 1891. On August 13, 1891, the equipment of the building was reported complete, and W. P. Sauerhoff was detailed to work, under Mr. Ravenel's direction, upon the preparation of fish-cultural apparatus. The building was given up March 15, 1893, after the exhibit had been shipped to Chicago.

The general plan and scope of the exhibit were outlined by Captain Collins, and, with the approval of the Commissioner, active measures were soon after begun, with the assistance of E. C. Bryan, chief special agent in charge of administration and fisheries; W. deC. Ravenel, special agent in charge of fish-culture; William P. Seal, in charge of construction of aquarium, and Dr. J. A. Henshall, in charge of the angling exhibit.

Mr. Seal resigned his position as special agent in charge of the aquarium December 31, 1892, and on the following day, upon the designation by the Commissioner of Fish and Fisheries, Prof. S. A. Forbes, director of the State Laboratory of Natural History at Champaign, Ill., was appointed to take charge of the aquarial exhibit. He was assisted by

Mr. L. G. Harron, who had supervision of the salt-water section, and Mr. Alexander Jones, who superintended the fresh-water division.

Mr. Bryan severed his connection with the exhibit on January 10, 1893, and was replaced by Mr. Ravenel.

Dr. J. A. Henshall resigned his position as special agent in charge of the angling exhibit January 16, 1893, and the work to which he had been assigned was performed by the representative, Dr. Bean.

The preparation of the fisheries section included the construction of a series of boat and vessel models, together with sail and builders' plans of fishing vessels, the collection of fishes and other marine animals, and the preparation of casts of gelatin and papier mâché, the mounting of skins of seals, sea lions, and other objects of the fisheries, the collection of nets and other apparatus, fishermen's clothing, photographs and other illustrations of the fisheries and fishery industries of the United States, and the securing of a typical series of fishing and angling appliances from manufacturing firms.

The series of vessel models, built under the personal supervision of Capt. J. W. Collins, was illustrative of modern vessels engaged in the fisheries of New England, Chesapeake Bay, Gulf of Mexico, and the Pacific and Arctic oceans. It embraced also types of historical interest as showing the development of fishing craft, with suggestions for important improvements in vessel construction.

The boat models included types of those in common use in Chesapeake Bay and the North Carolina sounds, the Gulf of Mexico, the Great Lakes, and those used by natives of Alaska. These latter were accompanied by the netting and fishing appliances, clothing, and other equipment of the people.

The fish casts were made chiefly from specimens of important food and economic species which were obtained at Gloucester, Boston, and Woods Hole, Mass.; New York; Norfolk and Cape Charles City, Va.; Washington, D. C.; Tampa, Key West, and Cedar Keys, Fla.; Sandusky, Ohio; Quincy and Meredosia, Ill., and San Francisco, Cal.

Reference is made elsewhere to persons who, through their interest in the undertaking, forwarded many rare fishes. Numerous specimens were secured through dealers, and important collections were made by employees of the Commission; as, for example, Mr. V. N. Edwards, in Woods Hole, Mass.; Dr. J. A. Henshall, in Florida; Dr. S. P. Bartlett, in Illinois; Mate James A. Smith, U. S. N., in North Carolina; F. N. Clark, in Michigan; W. F. Page, in Missouri; Charles G. Atkins, in Maine; Rudolph Hessel, in Washington, D. C.; George A. Seagle, in Virginia; Capt. W. E. Dougherty, in California, and A. B. Alexander, in California and elsewhere on the Pacific Coast.

Lieut. Robert Platt, U. S. N., took an active part in the collection of marine animals with the steamer *Fish Hawk*, and sent details of men to help in the preparation and return of the exhibit.

The following superintendents of stations were present during the whole or part of the Exposition period in connection with the aquarial

FISH-CULTURAL SECTION.—MODELS OF LEADVILLE STATION, COLORADO, BATTERY STATION, MARYLAND, UNITED STATES FISH COMMISSION CAR NO. 1, BESIDES VARIOUS FORMS OF HATCHING, COLLECTING AND TRANSPORTATION APPARATUS, WITH 70-FOOT CASE CONTAINING VESSEL MODELS IN THE BACKGROUND.

and fish-cultural exhibits: Dr. S. P. Bartlett, Frank N. Clark, H. D. Dean, J. J. Stranahan, as was also Mr. J. F. Ellis, superintendent of the car and messenger service, who gave personal direction to matters of transportation for the aquarium and fish-hatchery.

A large series of photographs, already in the possession of the Fish Commission and the National Museum, was transferred to the exhibit, and many new illustrations showing recent changes in the methods and development of the fisheries were secured by detailing employees for work in suitable regions. These details included S. G. Worth for duty in the New England States and in the South; Messrs. C. H. Townsend, A. B. Alexander, and W. A. Wilcox on the Pacific Coast; Dr. H. M. Smith, C. H. Stevenson, and Ansley Hall at various field stations. This work, in most cases, was performed in addition to regular duties. Dr. Smith also prepared the statistical charts showing the extent of the fisheries of the United States.

The exhibit of the division of inquiry respecting food-fishes was prepared under the direction of Mr. Richard Rathbun, assistant in charge of the division. In that section were to be found illustrations of the marine laboratory and fish-cultural station at Woods Hole, models and illustrations of the vessels of the Commission, specimens of the seines, trawls, nets, dredges, and other collecting apparatus, together with wire rope used in dredging operations and the other accessories for scraping the ocean bottom.

The apparatus used in sorting and preserving collections was also exhibited. There was a model of the sounding machine used in deep-sea work, with examples of the various thermometers used in physical observations. The results of scientific explorations of the Commission appear in the form of charts and models of the areas over which the vessels made their investigations.

In the cases preserved in alcohol or in a dry state were many curious inhabitants of the deep sea as well as the surface waters—the crinoids, corals, crabs, sea-pens, starfish, sea-urchins, the various invertebrate animals that form the food of fishes, foraminifera, sponges, worms, and mollusks. In the latter class extensive series of oysters were displayed to show the rate of growth on different kinds of bottoms, the method of attachment of the spat, the injuries produced by starfish, drills, and other enemies of the oyster.

The dredging apparatus included appliances for collecting in depths greater than 3 miles, and was therefore of especial interest to the public. This division was further enriched by a collection of about 150 flexible casts of fishes painted from the fresh or living specimens in faithful imitation of nature.

In the installation of the exhibit of the scientific section, as well as in its return to Washington, valuable assistance was rendered by Mr. C. H. Townsend, naturalist of the *Albatross*

The preparation of the exhibit of the fish-cultural section was directly in charge of Mr. W. deC. Ravenel, upon plans prepared with the assist-

ance and approval of the Commissioner. In that section the apparatus of modern fish-culture was shown by means of models and full-sized specimens as far as possible in operation, and an historical series showing the development of modern appliances, as well as their geographical variation. This included apparatus for collecting and carrying eggs and for transporting spawning fish, hatching apparatus, rearing apparatus, models and pictures of hatching and rearing establishments, and collections showing the methods and results of fish-culture.

Eggs in various stages of development were shown preserved in brine or alcohol, and fish reared at the various stations were illustrated by means of painted casts and alcoholic specimens. The food and the enemies of fish were exhibited in various ways. There was also a collection of fish-cultural literature.

### PRACTICAL FISH-CULTURE.

To illustrate practically the fish-cultural work of the Commission, a number of modern forms of trout and salmon troughs, shad and whitefish tables, and cod boxes were erected in the exhibit, and operations conducted during the entire Fair with real and artificial eggs. The apparatus was as follows: Two hatching tables, 8 feet long, 3 feet wide, and 3 feet high, equipped with McDonald jars for hatching eggs of shad, whitefish, and pike perch; four representative salmon and trout troughs, 8 feet long, 12 inches wide, and 8 inches deep, one for hatching trout eggs on gravel, one on trays, the Clark-Williamson combination, one of the Atkins pattern, such as is used in hatching the Atlantic and landlocked salmon in Maine, and the other with a Stone salmon basket, commonly used on the Pacific Coast. A set of McDonald cod boxes and Chester jars was also provided for illustrating work with cod and other floating eggs. As it was not possible to obtain live eggs throughout the season, it was necessary to provide a substitute, so that there should be no cessation in our work. Through the ingenuity of Mr. S. G. Worth, superintendent of Central station, artificial eggs were made of resin for illustrating the methods employed in hatching the floating and semi-buoyant varieties.

Salmon and trout eggs preserved in brine were used in the troughs. These eggs were the dead ones picked out of the hatching troughs at the different stations of the Commission during the previous winter, and answered the purpose well. Credit is due Mr. J. J. Stranahan for this idea. The artificial eggs having been found to be of greater specific gravity than fresh water, and it having been demonstrated that eggs kept in brine would soon decay in fresh water, it was necessary to equip this composite hatchery so that either fresh or salt water could be used in each form of apparatus. The fresh water was furnished by the Exposition Company and was pumped from Lake Michigan. This was found to be fairly good for hatching operations, and ranged in temperature from 42° F. in May to 74° in August, and down again to 47° in October.

The salt water was a saturated solution, and was manufactured from time to time as needed. This water was circulated by means of two pumps driven by water pressure, the pumps lifting the water from the storage tanks below the floor, into which the troughs and other forms of apparatus emptied, into the tanks overhead, from which the water was furnished by gravity to the hatching apparatus.

Eggs of various kinds were hatched during the months of May, June, parts of July and September, and all of October. At the opening of the exhibition, May 1, there were in the hatchery 800,000 shad eggs, 3,000,000 pike-perch, and 84,000 yellow-perch, and by the end of June 16,550,000 pike-perch eggs, 700,000 yellow-perch, 800,000 shad, and 154,000 eggs of the common sucker had been received and cared for and 6,900,000 fry hatched. Of these 3,700,000 pike-perch fry, 700,000 yellow-perch, and 100,000 suckers were planted in Lake Michigan near Jackson Park.

The shad eggs were all lost on account of the extremely low temperature of the water (average 42° F.), though some of them showed signs of life as late as May 13.

On June 29, 20,000 black-spotted trout eggs were received from Leadville and placed on the wire trays and in the gravel trough. The temperature of the water at that time was 64°, and the eggs commenced hatching two days after they arrived. By July 9 they were all hatched, with a loss of about 8,000. The fry commenced feeding on July 14, and were carried with fair success in our troughs, notwithstanding the high temperature of the water, until, owing to an accident to the machinery, the Exposition Company was compelled to shut off the water, which killed most of the fry on hand.

Arrangements had been made for obtaining the supply of quinnat-salmon eggs from California, and on September 23 a package containing 50,000 was received in good condition. These were placed in the Stone salmon baskets and Atkins trough, and were all hatched by October 7, with a loss of about 29,000. The fry were successfully carried in our rearing troughs until the close of the Exposition, when 19,000, the balance on hand, were shipped by one of the Fish Commission cars to Northville, Mich. A consignment of 54,000 lake-trout eggs, from Alpena, was received on October 9, and another of 40,000 quinnat-salmon eggs was received on the 19th of the same month from Clackamas. This latter package arrived in first-class condition. These eggs were placed in the hatching troughs, where they remained until the close of the Exposition, when they were shipped to Mr. Frank N. Clark at the Northville station. In addition to the hatching operations, several thousand trout furnished from the Northville station were cared for in our rearing troughs during the summer in the Government building.

## THE AQUARIUM.

The east wing of the Fisheries building was fitted up by the Columbian Exposition Company for the aquarial exhibit of the Fish Commission.

The engineering duties in the preparation of this exhibit at first devolved upon W. B. Bayley, U. S. N., and afterwards upon I. S. K. Reeves, U. S. N. The Commissioner personally assisted in the installation of the live-fish exhibit, having previously determined by experiment the principles of successful management.

In the course of these experiments sea-anemones were kept alive in an aquarium fitted up with air circulation and with water half artificial, the aeration having been effected by means of a succession of fine jets lowered to the bottom of the tank.

A full report upon this part of the exhibit was published in the Bulletin of the Commission for 1893, pages 143 to 190. It will be necessary only to give here a brief sketch of its main features.

The aquarium was a circular structure of 125 feet in diameter, forming the east annex of the Fisheries building. Upon the completion of the annex it was turned over to the Fish Commission for the purpose of making its aquarial display. Tanks of various sizes, made of cement, slate, glass, and iron, filled all the available exhibition space of the building. Some of them were large enough to accommodate the largest fish that could be transported alive. For example, one tank in the fresh-water series was about 50 feet in length. Nearly one-third of the tank capacity was devoted to the exhibition of salt-water animals and plants. The water was brought from the ocean at Morehead City, N. C., and was stored in a reservoir under the Fisheries building. This reservoir was 46¾ feet long, 18⅜ feet wide, and 8½ feet deep. From this reservoir water was pumped into a pressure tank 30 feet in diameter and 5 feet deep, located at the top of the Fisheries building. From this height it was conveyed into the aquarium tanks, after leaving which it passed through a sand and gravel filter back again into the reservoir.

Rubber pumps for the circulation of the salt water were located under the Fisheries building and were operated by electricity. All the pipes and connections with which the salt water came in contact were made of hard rubber or were lined with that material. About 60,000 gallons were required for the supply of the tanks.

The fresh water was obtained from the city waterworks, and was filtered before entering the aquaria. On some occasions during the Exposition as much as 750,000 gallons of fresh water passed through the tanks in twenty-four hours.

The salt water was constantly aerated by means of two hydraulic pumps which delivered the air into a galvanized air cylinder at a pressure of about 7 pounds per square inch. From this cylinder the air was conducted to the backs of the salt-water aquaria by iron pipes, and each aquarium received its supply of air by rubber tubing, into which were inserted plugs of basswood, through which the air was forced.

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FISH-CULTURAL SECTION.—SHAD AND WHITEFISH HATCHING TABLES AND TROUT AND SALMON TROUGHS LOOKING FROM SOUTH ENTRANCE TO BUILDING, WITH OTHER FORMS OF FISH-CULTURAL APPARATUS IN THE BACKGROUND.

Marine fishes and plants were obtained at various localities along the east and west coasts and the Gulf of Mexico. The fresh-water supplies were drawn chiefly from the Potomac, Mississippi, and Great Lake basins, as also from the hatching establishments of the Commission. A principal object of the exhibit was to show the important food and game fishes of typical localities, as well as numerous species which were notable on account of their colors, their forms, and their singular habits. The kinds of fishes and other forms of animal life shown were as follows:

| Species. | Number. | Species. | Number. | Species. | Number. |
|---|---|---|---|---|---|
| Paddle-fish | 23 | Viviparous perch | 8 | Pike perch | 300 |
| Bullhead catfish | 83 | Ling | 1 | Yellow perch | 282 |
| Spotted catfish | 2,724 | Dogfish | 24 | White perch | 196 |
| Carp | 211 | Toadfish | 10 | Sea bass | 17 |
| Tench | 36 | Alewives | 9 | Black bass | 1,944 |
| Golden tench | 20 | Angel-fish | 3 | Warmouth bass | 384 |
| Golden ide | 150 | Stingray | 2 | Rock bass | 47 |
| Goldfish | 350 | Remora | 6 | Calico bass | 33 |
| Redhorse | 50 | Sea-raven | 53 | White bass | 83 |
| Fresh-water drum | 23 | Burrfish | 64 | Striped bass | 35 |
| Gizzard shad | 24 | Shark | 1 | Crappie | 500 |
| Brook sucker | 201 | Sand shark | 4 | Sunfish | 695 |
| Shiner | 20 | Sea-urchin | 1 | Red snapper | 7 |
| Stickleback | 25 | Starfish | 185 | Scup | 112 |
| Garfish | 11 | Alligator | 1 | Cod | 3 |
| Minnows | 3,965 | Sea eel | 7 | Tautog | 70 |
| Quinnat salmon | 9 | Lamper eel | 3 | Flounder | 25 |
| Grayling | 204 | Crayfish | 500 | Pompano | 46 |
| Loch Leven trout | 2,049 | Blue crab | 53 | Tomcod | 32 |
| Rainbow trout | 26 | Spider crab | 21 | Cunner | 25 |
| Von Behr trout | 2,068 | Hermit crab | 52 | Kingfish | 83 |
| Black-spotted trout | 50 | King crab | 5 | Mussels | 250 |
| Brook trout | 2,607 | Lady crab | 6 | Turtles | 3 |
| Lake trout | 54 | Whitefish | 48 | Clams (barrels) | 2 |
| Saibling | 10 | Lake herring | 99 | Lizard | 3 |
| Hogchoker | 46 | Muskellunge | 3 | Sea anemone | 37 |
| Scallop | 8 | Pike | 103 | Sea moss (tanks) | 2 |
| Skate | 36 | Pickerel | 73 | Red sponge (tank) | 1 |

*Water for the aquarium.*—It was at first proposed to use the constituents of salt water and make from them the amount necessary for supplying the marine aquarium at the World's Fair by the addition of fresh water. Bitter water, salt, and lime were purchased in New Bedford, Mass., and shipped to the Fisheries building. The lime residuum from salt-water evaporation, upon analysis by the chemist of the Agricultural Department, was pronounced almost pure calcium sulphate. One hundred and fifty sacks of natural sea salt, 3 bushels of lime residuum, and 40 barrels of bitter water were obtained for the purpose. Before this was finally used the Commissioner instituted a series of experiments in his office at Washington and found that bitter water offers no advantage, and it was feared that some deleterious effect would result from its use. The original plan was abandoned, and it was determined to transport natural sea water from a point on the Atlantic coast.

*Transportation of marine animals.*—It was found very difficult to ship large skates in water tanks; therefore the superintendent of the Woods Hole station was instructed to experiment in keeping such animals in clean sea weed, cotton fabric, or burlaps, providing for a free

circulation of air. They were inclosed in crates and were sprinkled once an hour by hand with salt water. In order to keep down the temperature of the salt water the Commissioner advised that direct connection be made to permit circulation of the water to the aquaria and back from the reservoir without pumping it up into the tank on the top of the Fisheries building.

*Food for aquarium animals.*—The principal articles of food used in the aquarium were beef liver and beefsteak. It was sometimes difficult to obtain these, and parties were sent to the lagoons to seine for small minnows, which were fed to the fish as a substitute for other meats. Clams and mussels were forwarded from various parts of the east coast, and small fresh-water crustaceans were obtained by tow nets and other apparatus in the fresh waters in the vicinity of Chicago to feed the paddle-fish.

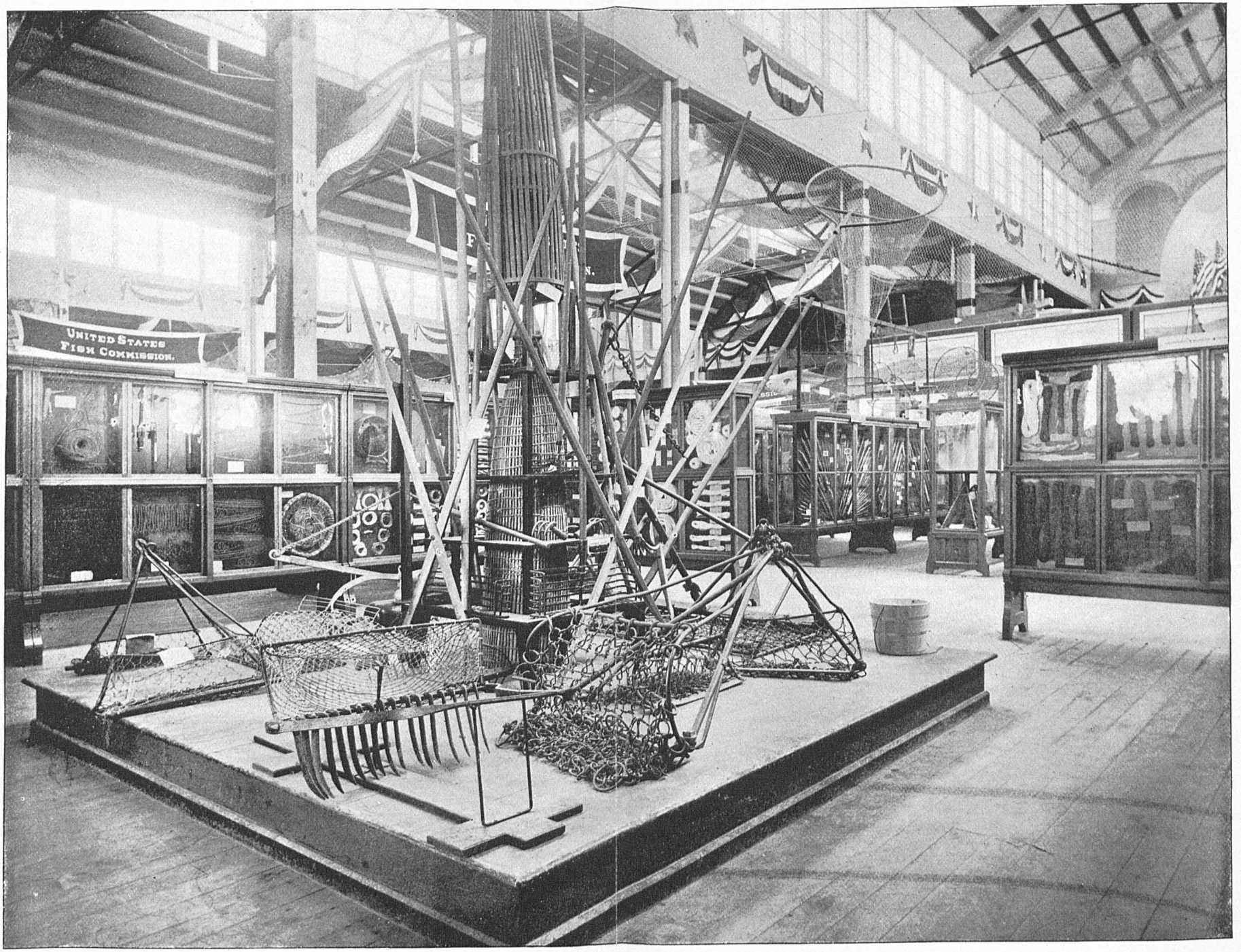
## WORLD'S FISHERIES CONGRESS.

One of the natural outgrowths of the Fish Commission exhibit in Chicago was the relation in which the Commission stood to the World's Congress Auxiliary, organized under the direction of a committee of the Columbian Exposition, of which C. C. Bonney was general chairman.

The Commissioner of Fisheries called a preliminary meeting in Chicago April 25, 1893, associating with himself Dr. G. Brown Goode, Prof. S. A. Forbes, and Dr. T. H. Bean, for the purpose of organizing a Fisheries Congress. With these gentlemen were united Mr. E. G. Blackford, of New York; N. K. Fairbank and A. Booth, of Chicago; and R. E. Earll, of Washington. After the preliminary meeting Chairman Bonney officially appointed the committee just named, and the work of organization was immediately entered upon. Men of prominence in the fisheries, fish-culture, and scientific investigation in various parts of the world were designated to form an advisory council, and invitations were sent out requesting attendance at the sessions of the congress and asking for contributions. The responses to this call were numerous, and the communications brought together were of a very important character, embracing papers upon fishery laws and regulations, science in relation to the fisheries and fish-culture, methods employed in the capture and utilization of fishery products in all parts of the world, together with statistics of fisheries and essays upon fish-cultural topics.

Associated with the general committee was a committee of State commissioners of fisheries, through whom it was arranged to hold meetings of those commissioners during the time occupied by the meetings of the Fisheries Congress. Mr. E. A. Brackett, of Winchester, Mass., was the chairman of the committee of organization.

The formal sessions of the Fisheries Congress opened in a hall in the Memorial Art Palace, Chicago, on October 16, at which time Hon. Marshall McDonald delivered the opening address as chairman of the




VIEW OF PART OF FISHERIES SECTION.

On the platform are various types of dredges and rakes used in the oyster, clam, and other molluscan fisheries. In the central tier are wicker and slat traps fished for eel, catfish, etc. The cases contain twines, nets, lines, and various forms of tackle employed in the economic fisheries.

congress. Dr. G. Brown Goode, Hon. E. G. Blackford, and Dr. Hugh M. Smith acted as chairmen of the principal sections of the congress. The meetings were brought to a close on October 19 by a fish banquet in the hall of the New York State building, in Jackson Park, in which the members of the Fisheries Congress, the conference of State commissioners of fish and game, and their invited guests participated. Hon. T. W. Palmer presided and delivered the opening address. Other speakers of the evening were Hon. Carter H. Harrison, mayor of Chicago; Messrs. Andrews, Bowman, and Breslin, of New York; Commissioner McDonald, J. J. Quelch, commissioner of British Guiana, and John Foord, secretary of the New York World's Fair Commission.

The papers prepared for the World's Fisheries Congress have been published, and form volume XIII of the Bulletin of the U. S. Fish Commission.

A complete descriptive catalogue of the Fish Commission exhibit was prepared, but the plan and scope of the several sections will be sufficiently shown by means of the following synopsis:

## CATALOGUE OF THE EXHIBIT.

### SCIENTIFIC INQUIRY SECTION.

1. **Laboratories for Marine Exploration.**

   *Illustrations of Zoological Stations:* (1) Laboratory at Woods Hole, Mass., 1875. (2) Laboratory at Woods Hole, Mass.

2. **Exploring Vessels.**

   *Models:* (1) Steamer Albatross. (2) Steamer Fish Hawk. (3) Schooner Grampus.
   *Illustrations:* (1) Steamer Albatross. (2) Steamer Fish Hawk. (3) Schooner Grampus.

3. **Collecting Apparatus.**

   *Nets:* (1) Seines. (2) Beam trawls. (3) Towing nets.
   *Dredges:* (1) Naturalist's deep-sea dredge. (2) Naturalist's boat dredge. (3) Benedict rake dredge. (4) Oyster dredge.
   *Tangles.*

4. **Accessories for Dredging and Trawling.**

   Dredge rope (steel-wire dredge rope; splices in dredge rope). Iron dredge block. Sigsbee accumulator. Weights for beam trawl.

5. **Apparatus for Assorting Collections.**

   Rocker sieves. Table sieves. Hand sieves.

6. **Apparatus for Preserving Collections:** *Tanks.*

7. **Apparatus for Deep-Sea Sounding:**

   Sigsbee sounding machine (model).

8. **Apparatus for Physical Observations.**

   *Thermometers:* Deck thermometer. Professor Baird's protected thermometer. Miller-Casella deep-sea thermometer. Negretti & Zambra thermometer.
   *Thermometer cases and accessories:* Wooden cases. Brass cases. Reading lens.
   *Salinometers:* Hilgard salinometer.

9. Results of Explorations.

*Charts and models.*

*Collections:*

1. Marine animals in alcohol:
   (*a*) Deep-sea animals: Crinoids, corals, crabs, sea-pens, starfish, sea-urchins, etc.
   (*b*) Surface animals: Entomostraca, etc., forming food of fish.
   (*c*) Shallow-water animals: Mollusks, crustaceans, etc.
2. Marine animals: Foraminifera. Sponges. Corals. Mollusks, etc.
3. Microscopic slides: Of fish eggs, fish embryos, fish food, and Foraminifera.

FISH-CULTURAL SECTION.

10. Transportation Apparatus.

*Apparatus for collecting and carrying eggs:*

Models and specimens: Wroten bucket. Wroten bucket improved. Collins's can. McDonald's egg reel. McDonald's crate. McDonald's crate for egg reel. Atkins's egg box. Green's egg box. Clark's egg case. Clark's whitefish crate. Clark's foreign egg case. Mather transportation box. Taylor's egg-transportation can. Trout boxes used in 1872.

11. Apparatus for Transporting Fry.

*Models and full-sized apparatus:*

(*a*) Models: Car No. 1. Clark's transportation can.

(*b*) Specimens: Stone's transportation can. Automatic transportation can. Mulertt's transportation can. McDonald's trout can. Zolinsky's carboy. Mortimer's sole aquarium. Carp transportation pail. Carp transportation kettle. Wood-bound can, full size. Messenger's complete outfit. Bucksport transportation can. Ferguson's transportation can. Fish Commission transportation can. Stranahan transportation keg. Box for native food-fishes.

(*c*) Accessories: Siphon strainer. Monroe Green's aerator and cooler. Siphon tube, bag, and cage. Dip nets of various sizes. Water bucket.

12. Apparatus for Carrying Spawning Fish.

*Models and specimens:*

(*a*) Models: Group of salmon dory cars.

(*b*) Specimens: Maitland's salmon car. Seal's transportation tub.

13. Hatching Apparatus.

*Models and specimens:*

(*a*) For floating eggs: Chester wave box. Chester semi-rotating hatcher. Chester cod box. Cone with automatic siphon. Stand of cones with automatic siphon. McDonald's cod hatcher. Cod box. McDonald's cod box. McDonald's improved cod box. McDonald's mackerel tubs. McDonald's hatching bucket. Ferguson's submerged bucket.

(*b*) For semi-buoyant eggs: Wroten's bucket. Green's shad box. Brackett's shad box. Wright's submerged box. Ferguson's submerged bucket. Mather's shad can. Bell-Mather shad cone. Ferguson's improved cone. Models of cones and buckets. McDonald's Y-shaped box. Bower's V-shaped box. Chase's whitefish jar. McDonald's jar, old style. McDonald's universal hatching jar. Clark's jar. Apparatus used on cars. De Lawder-Wroten shad hatcher.

(*c*) For heavy eggs: Garlick's hatching box. Stone's charred trough. Coste's hatching grills. Williamson's hatching trough. Stone's salmon basket. Bucksport hatching trough. Brackett's hatching trough. Holton's hatching box. Clark's hatching trough. Hatching trough with glass strip trays. Mather's hatching trays. Atkins's hatching crate.

14. Rearing Apparatus.

Clark's trout-rearing troughs: Whitefish tanks. Shad tanks.

(*a*) Accessories: Ainsworth's spawning race. Mather's spawning cone. Spawning pans. Spawning buckets. Page's egg scale. Egg funnels for whitefish and shad. Series of nets from Central station, Washington, D. C. Series of nets from Northville station, Mich. Series of nets from Battery station, Md. Nippers, brass and wood. Dippers. Strainer dippers. Hume's spawning box. Rubber boots. Oil clothing. Pan for washing eggs. Salmon dip net. Tray for washing eggs. Siphon bags. Siphon cages. Siphon tubes. Aquaria.

(*b*) Accessories to pond culture: Seines. Dip nets. Farm profit boiler. Meat chopper. Gun. Garden rake.

15. Hatching and Rearing Establishments.

*Charts:*

(*a*) Chart giving names and location of stations and output of each station for fiscal year 1891–92.

(*b*) Chart showing work of the Commission from 1872 to 1892.

*Models of hatching establishments:*

(*a*) Hatching houses: Put-in-Bay hatchery. Leadville hatchery. Havre de Grace hatchery. Gloucester, Mass., hatchery.

(*b*) Floating hatchery. Hatching barge.

*Illustrations of hatching stations* (showing buildings, exterior and interior, methods employed in collecting, hatching, rearing, and distributing fish fry and eggs):

(*a*) Green Lake. Grand Lake stream. Bucksport and Craig Brook, Me. Gloucester cod station and Woods Hole, Mass. Central station and Fish Commission fish ponds, Washington, D. C. Battery station, Havre de Grace, Md. Bryan Point shad station, Md. Wytheville station, Va. Duluth station, Minn. Alpena and Northville stations, Mich. Put-in-Bay station, Ohio. The Quincy (Ill.) station. Neosho station, Mo. Leadville station, Colo. Fort Gaston, McCloud, and Baird stations, Cal. Clackamas, Oreg.

(*b*) Floating stations: Hatching barge. Steamer Fish Hawk.

16. Methods and Results of Fish Culture.

Lay figures: Group illustrating shad fishing and spawning. Group illustrating cod fishing and spawning.

Chart showing the effect of fish-culture on the shad fishery.

Painted casts of fishes reared by the Fish Commission:

(*a*) Brook trout, 1, 2, 3, and 4 years old. Von Behr trout, 1, 2, 3, and 5 years old. Loch Leven trout, 1, 2, 3, and 6 years old. Lake trout, 1 and 2 years old. Landlocked salmon, 1 year old. Rainbow trout, 1 and 2 years old. Whitefish, 5 years old. Carp, tench, goldfish, black bass, etc.

(*b*) Alcoholic and brine specimens: Eggs in different stages. Fry, yearlings and adults.

Protection of Fish (assistance in ascending streams):

Duncannon fishway. Shaw's spiral fishway. Swazey's oblique fishway, old style. Swazey's oblique fishway, new style. Worrall's expanding sluice fishway. Worrall's chute fishway. Brewer's single-groove fishway. Brewer's double-groove fishway. Steck's fishway. Smith's inclined-plane return fishway. Lawrence fishway. Holyoke fishway. Everleth's self-adjusting fishway. Pike's spiral fishway. Atkins's spiral fishway. Bangor fishway. McDonald fishway, old style. McDonald fishway, section 6, Great Falls, Potomac River.

**Illustrations: Photographs:** McDonald's fishway, Fredericksburg, Va.

FISHERIES SECTION.

17. Objects of the Fisheries.

*Mammals:*

1. Sirenians: Manatee (cast).
2. Cetaceans:
   (*a*) Dolphins: Common dolphin (cast). Bottle-nose dolphin (cast). Blackfish (cast). Grampus (cast). Harbor porpoise (casts).
   (*b*) Sperm whales: Pygmy sperm whale (cast).
3. Carnivores:
   (*a*) Earless seals: Harbor seal (mounted group).
   (*b*) Eared seals: Northern fur seal (mounted group). Steller's sea lion (mounted group).

*Birds:* Fish-eating birds, 80 skins.

*Reptiles and Batrachians:*

1. Alligators: Florida alligator (mounted skin).
2. Turtles and tortoises: Loggerhead turtle (cast). Hawk's-bill turtle (mounted shell). Green turtle (cast). Soft-shell turtle (cast). Snapping turtle (cast). Spotted turtle (cast).
3. Snakes: Water snake (cast).
4. Frogs: Bullfrog (cast). Green frog (cast). Pickerel frog (cast).

*Fish:* Casts of 150 species of marine and fresh-water food-fishes. Color drawings of fishes. Maps showing the distribution of halibut, cod, mackerel, and other kinds. Living marine and fresh-water fish in aquarium.

*Invertebrates:* Living sea-anemones, starfish, crabs, lobsters, mollusks, algæ, etc., in aquarium.

18. Fishery Apparatus.

*Vessels:* (1) Models of sloops, ketches, schooners, steamers. (2) Pictures of vessels. (3) Vessel fittings. (4) Instruments of navigation (logs, compasses, clocks, etc.). Fishermen's clothing, etc.

*Boats:* (1) Models. (2) Full-sized boats. (3) Pictures.

*Canoes:* (1) Bark. (2) Skin. (3) Wood.

*Nets:* Pounds. Weirs. Pots. Seines. Cast nets. Dip nets. Trawls. Dredges.

*Lines:* Trawl lines. Hand lines. Accessories (rods, reels, floats and sinkers, gaff hooks, creels, bait boxes, fly books, etc.).

*Appliances for seizing:* Rakes. Tongs. Hooks for sponge. Accessories (water glass).

*Appliances for striking:* Spears. Lances. Bows (and arrows). Guns.

*Lures:* Artificial flies; artificial minnows, frogs, etc.

*Charts of fishing grounds.*

19. Illustrations of Fisheries.

*Fishermen:* Professional; anglers; lay figures.

*Fishermen's dwellings. Fishing towns.*

*Special fisheries:* Mammals; reptiles; fishes; mollusks; crustaceans; sponges.

20. Statistics of Fisheries.

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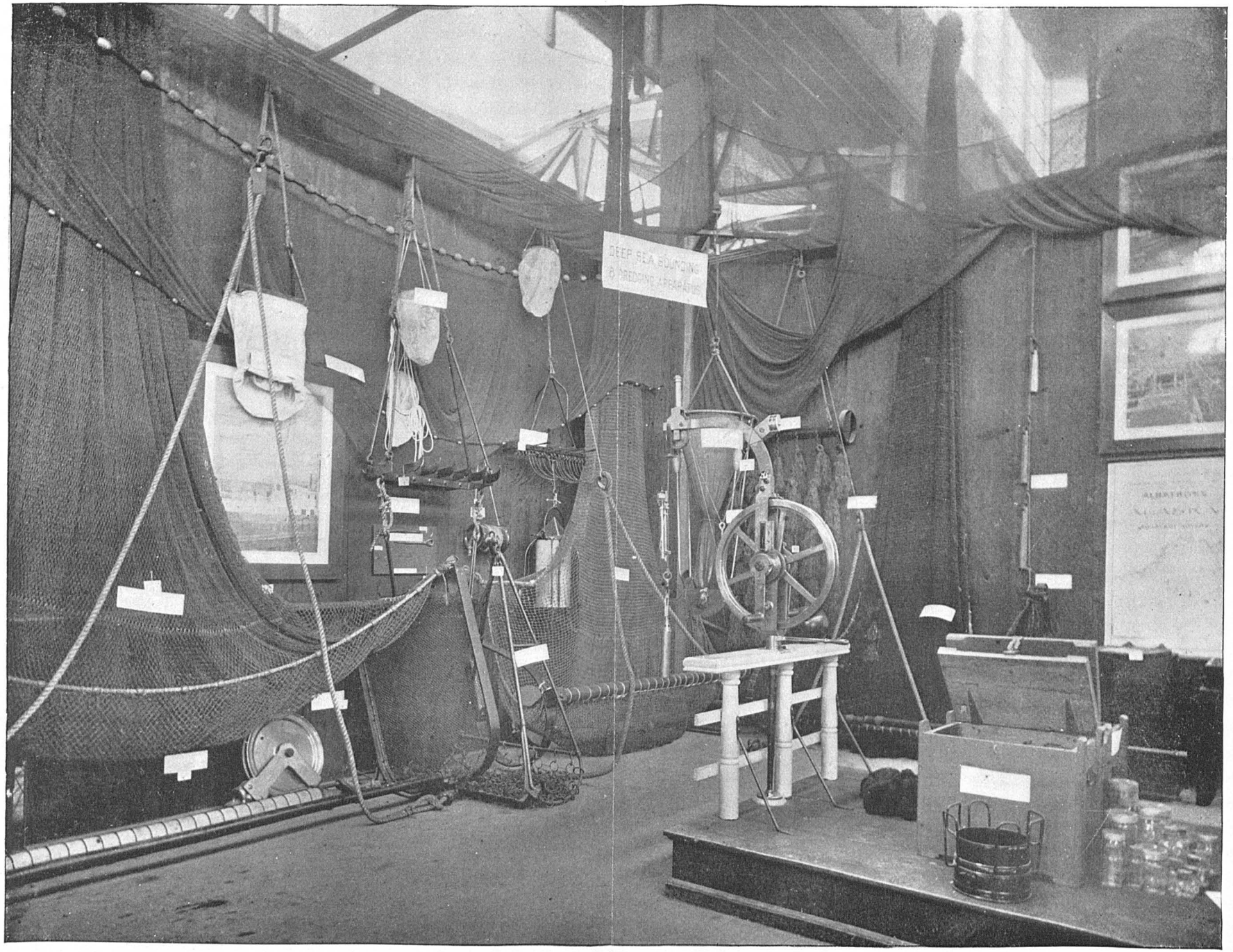



APPLIANCES USED IN THE STUDY OF THE SEA FISHERIES.

## INSTALLATION OF THE EXHIBIT.

The delivery of boxes in the Government building began early in December, 1892, the freight having been consigned to Capt. J. F. Aytoun, local agent of the board of management and control at Chicago. All of the materials were on the space by April 15. A temporary office was constructed on the ground floor in January, 1893, for use during installation, and permanent offices were completed on the gallery in April. Late in February, 1893, Mr. W. P. Sauerhoff was sent to Chicago to commence unpacking and setting up cases, and about the end of March the active work of installation was begun, under the supervision of Dr. Bean and Mr. Ravenel.

The installation was seriously hindered by unfavorable weather, but was finished by the end of April, both in the Government building and in the aquarium in the Fisheries building. The hatching apparatus and pumps in the fish-cultural section were working satisfactorily, and supplies of eggs had been obtained, so that the entire exhibit was ready for the inspection of visitors upon the opening day.

The exhibit was located in the northern portion of the Government building, between the Agricultural Department on the east and the Interior Department on the west. Its space was 150 feet from east to west, by 95 feet in depth along the western border, and 120 feet in depth along the eastern line.

This space was continued backward along the west side of the main north and south aisle by a strip 15 feet wide and 75 feet long, and on the east side of the same aisle by a strip of the same width 50 feet in length, the narrow strips extending to the rotunda.

The western portion of this space was devoted entirely to the fisheries exhibit; the eastern portion to the divisions of fish-culture and scientific inquiry.

The general arrangement is shown by the accompanying floor plan, and the details of the exhibits may be seen from the illustrations which form part of this report.

The superficial area, including the aisles, amounted to 16,000 square feet, while the aquarial exhibit in the east annex of the Fisheries building had an area of nearly 10,000 square feet.

## FOREIGN VISITORS TO THE EXHIBIT.

The exhibit attracted the attention of a great many visitors from foreign countries who were interested in the apparatus and methods employed by the National Fish Commission. The following are among those who called during the Exposition and to whom the operations of the Commission were explained in greater or less detail. Many of the

persons named made reports to their Governments upon the subject, embracing in them an account of the exhibit of the Commission:

Dr. Henri de Varigny, in behalf of the minister of public instruction and fine arts, and delegate of the minister of commerce, Paris, France.
Mr. A. Caméré, chief engineer of bridges and roads, Paris.
Mr. Pung Kwang Yu, first secretary of the Chinese legation and commissioner to the World's Columbian Exposition.
Dr. Nicolas Borodine, St. Petersburg and Uralsk, Russia.
Dr. Einar Lönnberg, delegate of the royal Swedish board of agriculture, Stockholm.
Mr. Paul Hillman, agricultural student, Rustorf, Germany.
Dr. Gaston Bodart, assistant I. R. Austrian commissioner.
Mr. E. A. C. Landmark, government inspector of fresh-water fisheries for Norway, Christiania.
Mr. Ivan Janschul, professor of political economy in the University of Moscow, Russia.
Hon. L. O. Smith, ex-member of the Swedish Senate, Stockholm.
Mr. Frederico Atristain, Mexican commissioner to the Columbian Exposition.
Mr. Carlos Young, Montevideo, Uruguay.
Mr. A. Hinkelmann, director of fisheries, Kiel, Germany.
Mr. Nobuakira Yamataka, imperial Japanese commissioner.
Mr. Tamotsu Murata, member of the House of Peers, chief counsel of the Society of Fisheries, Japan.
Mr. K. Tawara, secretary Imperial Japanese Commission.
Mr. Y. Yambe, secretary Imperial Japanese Commission.
Mr. Sakayo Sawatari, commissioner of Japanese Fisheries Society.
Mr. N. Yanagimoto, Okinawa, Japan.
Mr. T. Kondo, Osaka, Japan.
Mr. L. Z. Joncas, M. P., Quebec, Canada.
Dr. Ernst Ehrenbaum, Royal Biological Station, Helgoland.
Mr. Fernando Ferrari Perez, general secretary Mexican World's Fair Commission.
Dr. Emile Poussié, delegate of the Agricultural Society of Melun, France.
Comte de Balincourt, lieutenant, French Navy.
Mr. Albert Gomez Ruano, special commissioner of education from Uruguay.
Mr. Henri Giudicelli, commissioner of fine arts for France.
Constantine de Rakouza Soustcheffsky, commissioner-general for Russia to the Columbian Exposition.
Dr. Oscar Nordqvist, inspector of fisheries of Finland, Helsingfors.
Mr. J. J. Armistead, proprietor of Solway fisheries, Dumfries, Scotland.

## COURTESIES RENDERED TO THE U. S. FISH COMMISSION.

From the U. S. National Museum were obtained numerous objects illustrating fish, fisheries, and fish-culture, some of which were on exhibition in the fisheries section of the Museum, and others stored among the duplicate collections. The officers of the Museum cooperated most heartily with the Commission in bringing together a valuable and comprehensive exhibit.

To Dr. Goode personally the Commission is indebted for the loan of a series of chromolithographs which form part of the illustrations of Game Fishes of the United States, for which he wrote the text, which was published by Charles Scribner & Sons in 1880. He lent, also, a number of fish-cultural books to make the series exhibited more nearly complete.

Through the courtesy of Hon. W. M. Meredith, Chief of the Bureau of Engraving and Printing, Washington, a supply of macerated greenback pulp was obtained for the purpose of making casts of fishes.

The Department of Agriculture assisted the Commission in its investigation of a fish disease, which proved very destructive during the progress of the Exposition, by the detail of Dr. Charles W. Stiles, who made a study of the parasite and prepared a report upon its life-history and the methods of its destruction.

Through the intervention of the late Hon. F. B. Stockbridge the Commissioner obtained permission from Mr. Howard Page, 26 Broadway, New York City, to use a sufficient number of tank cars belonging to the Standard Oil Company to convey salt water from the North Carolina coast to Jackson Park, Chicago, to be used in maintaining marine animals and plants in the aquarium. Free transportation for the salt water was obtained from Richmond, Va., to Chicago through the liberality of Mr. M. E. Ingalls, president of the Chesapeake and Ohio and the Cleveland, Cincinnati, Chicago and St. Louis railroads.

One of the cars of the Commission was sent from Chicago to Wisconsin for living specimens of muskellunge, black bass, and other fishes, in which undertaking Mr. C. L. Ryder, agent of the Milwaukee, Lake Shore and Western Railroad at Milwaukee, furnished free transportation for the car and its attendants. He also provided the service of Mr. J. B. Carlin, one of the conductors on the road, who was thoroughly familiar with the region to be visited, as a guide and helper for the trip, and he proved of great assistance on that occasion and subsequently.

In the selection of available localities for collecting marine materials along the southern coast, the advice of Dr. W. K. Brooks, of Johns Hopkins University, Baltimore, was profitably followed by the Commission.

In the collection of live fish and other objects in North Carolina, the agent of the Commission was assisted by Mr. George N. Ives and Mr. William Arendell, of Morehead City, and Mr. W. S. Chadwick, of Newbern.

Mr. T. J. Griggs, fish commissioner of Iowa, cooperated with Dr. Bartlett in securing specimens of black bass and other fish at Muscatine Slough during the entire course of the Exposition, as well as in their transportation to the aquarium.

To Mr. R. Ulrich, superintendent of the landscape gardening department of the Columbian Exposition, the Commission is indebted for flowering plants by means of which its space in the Government building was beautified.

A very useful device for recording the pressure of the water in the main supplying the Government building was furnished by Bristol's Manufacturing Company, of Waterbury, Conn. A pressure gauge was set up in proximity to the water motors, enabling us to show upon dials a constant record of the pressure. Thus, when it fell below a point to which the pumps were adjusted, it was easy to ascertain where the fault lay and to give the proper notice to the Exposition authorities.

On July 25, 1893, the water was turned off at one of the pumping stations at Jackson Park to make repairs, but fortunately no loss occurred in the aquarium. Men were up all night for the purpose of making water connections with hose borrowed from the fire department

Thanks are due to Marshal Murphy, chief of the fire department, for permission to connect hose with the plug outside of the aquarium building, in the event of its becoming necessary to shut off the water again for repairs or any other purpose.

During the progress of the Exposition the Imperial Japanese Commission, through Commissioner C. Matsudaira, signified its intention to present the fisheries exhibit of Japan to the U. S. Fish Commission at the close of the Exposition. After consultation with the Commissioner of Fish and Fisheries the gift was accepted, and a few articles desired by the Japanese Commission were promised them in exchange for their valuable collection, which filled 46 cases. These articles were deposited in the Fisheries section of the United States National Museum upon their arrival in Washington.

Mr. Kokichi Mikimoto, of Miyeken, Japan, on behalf of the Japanese Central Association, also presented numerous specimens showing the growth of the pearl oyster for seven years.

Acknowledgments are due to the following persons for gifts of model-of vessels and boats used in the fisheries: Gillman Hodgkins, Lamoine, Me.; Louis King, Lamoine, Me.; Newell B. Coolidge, Lamoine, Me.: Coolidge & Bros., Lamoine, Me.; Robert Dority, Sargentville, Me.; D. D. Hodgkins, Lamoine, Me.; J. Brown, Lubec, Me.; Board of Trade, New Bedford, Mass.; L. D. Ashby, Noank, Conn.; E. J. Tull, Pocomoke City, Md.; H. Brusstar & Bro., Newport News, Va.; W. W. Sweat, Tampa, Fla.

From Mr. A. R. Crittenden, Middletown, Conn., was obtained an old-time quadrant used by a fishing captain until about 1840.

A model of a fish car or live box, used by fishermen of Cape Fear, N. C., and made in the shape of a boat, was presented by Lieut. Robert Platt, U. S. N.

Mr. J. M. K. Southwick, Newport, R. I., presented to the Commission a model of fish marketman's car, used by fishermen of southern New England for keeping live fish and lobsters.

Mr. Charles L. Marsh, Solomons, Calvert County, Md., presented for exhibition a pair of his patented deep-water oyster tongs, with photographs illustrating their use.

Capt. E. P. Herendeen, while at Point Barrow, Alaska, obtained specimens of the whalebone gill nets used by the Eskimo in fishing, and an ancient fishing spear from the Mackenzie River basin, through a native of Herschel Island.

Mr. F. E. Brown and Capt. E. Pierce, of New Bedford, Mass., lent a unique collection of whaling apparatus, including many articles of historic value as well as the principal implements now used by whalers.

Mr. John A. Sawyer sent from the same place a darting gun harpoon which had been strangely bent in the body of a whale.

The American Needle and Fish Hook Company, New Haven, Conn., furnished a large series of hooks manufactured on automatic machinery.

The T. J. Buell Company, Whitehall, N. Y., lent spoons, minnow gangs, leaders, and lures for fishing.

Charles Kerrison, jr., Charleston, S. C., sent a case of hooks with barbs shaped like the point of an arrow.

Edward Pitcher, Brooklyn, N. Y., furnished a large series of hooks, squids, swivels, sinkers, and other angling appliances.

Mr. G. M. Skinner, of Clayton, N. Y., furnished a series of his fluted spoon baits.

Messrs. Welch & Graves, Natural Bridge, N. Y., forwarded a specimen of trolling apparatus consisting of a glass tube in which a live minnow can be used as a lure without injury.

J. & S. Allen, Walpole, Mass., lent a series of silk and linen fishing lines.

G. H. Mansfield & Co., Canton, Mass., provided a series of enameled waterproof braided fishing lines.

A very large collection of rods, made at their several factories, were furnished by the Montague Rod Company, of Montague City, Mass. This series included split bamboo, lancewood, and various other styles.

Messrs. Abbey & Imbrie, New York City, lent for exhibition many of the finest types of rods used by anglers, including the celebrated Queen's Jubilee gold-mounted and jeweled fly rod, which was valued at $2,000, and was accompanied by an engraved gold reel. This handsome collection also contained lines of high grade and a variety of high class reels for salmon, tarpon, bass, and trout fishing; also fly books and boxes and a steel tarpon gaff.

The Andrew B. Hendryx Company, of New Haven, Conn., lent 211 reels, representing all grades of their workmanship, and mounted and labeled them in handsome cases at their own expense. This exhibit was so arranged as to show all parts of the reel from the outside, as well as the separate pieces used in reel construction.

Mr. Charles F. Orvis, of Manchester, Vt., provided the exhibit with four of his patent perforated reels, designed for drying the rod without removing it from the reel. The collection of flies manufactured by Mr. Orvis and arranged with angling scenes by Mrs. Mary Orvis Marbury, contained 428 flies for trout, salmon, black bass, etc., and 157 photographs representing angling in nearly all parts of the United States and Canada.

D. W. C. Farrington, Lowell, Mass., exhibited a beautiful series of flies and bugs made by himself for his own use, together with a mounted half skin of a brook trout around which the flies were arranged.

T. W. Rudolph, Chicago, Ill., furnished his ventilated tackle box, his minnow trap, floating minnow bucket, and floating live net, and these were afterwards presented to the Commission for its permanent exhibit in Washington.

G. L. Bailey, Portland, Me., furnished his patent landing-net frame with patent ring.

A figure representing a modern angler was clothed and fitted out by A. G. Spalding & Bros., of Chicago, with a Kosmic rod, reel, line, net, and the angler's suit.

R. D. Hume, of Gold Beach, Oreg., presented for exhibition a spawning box for holding salmon when taking eggs or milt, such as he uses on Rogue River, Oregon.

The Colorado Fish Commission, through Mr. O. G. French, secretary of the Colorado World's Fair Commission, lent a trout transportation can, a spawning can, a zinc hatching tray, and a pair of nippers.

Mr. Henry W. Elliott, 317 Detroit street, Cleveland, Ohio, lent his valuable series of water-colored paintings, illustrating the fur-seal and other related fisheries of Bering Sea.

Permission was obtained from Harper & Bros., Scribner & Co., the Outing Magazine Company, the Cosmopolitan Magazine Company, the Century Magazine Company, and Frank Leslie's Publishing Monthly Magazine Company to borrow illustrations from their respective magazines for the use of the Fish Commission exhibit.

In the preparation of the illustrations of Alaskan fisheries, Mr. Ivan Petrofl's sketches were utilized, and he also superintended the construction of certain models showing native fishing methods.

Mr. Alexander Agassiz, Cambridge, Mass., furnished plans and photographs of the Zoological Laboratory at Newport, R. I., besides memoirs by himself, Garman, Hillman, De Pourtales, and Whitman.

Hon. J. J. Grinlinton, commissioner for Ceylon, presented copies of the Handbook and Catalogue of the Ceylon Courts.

Hon. Arthur Renwick, executive commissioner for New South Wales, furnished numerous copies of a catalogue of Australian mammals and of a work on edible crustaceans and fishes, which were intended partly for the library of the Commission and partly for distribution from its office.

Acknowledgments are due to Capt. William T. Lee, of Gloucester, Mass., and Capt. William M. Ellis, for specimens of rare and curious fishes obtained by them on La Have Bank.

Also to F. F. Dimick, Boston, Mass., for a curious flounder, and to Capt. Alfred Bradford, of Gloucester, for a collection of flounders taken with the beam trawl.

Miss E. E. Davidson, Jamaica Plains, Mass., lent two cases of stuffed European fishes prepared in accordance with the process of her father, Dr. Davidson.

E. A. Holmes, Eastport, Me., sent a living albino lobster.

## COURTESIES RENDERED BY THE FISH COMMISSION.

On October 31, 1893, after the close of the Exposition, all of the aquarium fishes and other animals and plants not otherwise assigned by the Commissioner, such as brood fishes to be returned to the stations from which they were shipped and a small part of the marine species for the aquarium at the office in Washington, were transferred to Prof. S. A. Forbes for the State Laboratory of Natural History at Champaign, Ill. It was the intention to give this material to the South Park commissioners, of Chicago, but after operating the establishment for a few days these commissioners found themselves unable to maintain it and it was turned over to Professor Forbes for the State of Illinois.

On February 21, 1894, permission was given to James R. Barrie, of New York City, to have two photographic prints made from each negative belonging to the U. S. Fish Commission exhibit, Mr. Barrie desiring to use these prints in the illustration of a sumptuous work on the World's Fair.

Mr. J. H. Crockwell, agent of Halligan's Illustrated World's Magazine, was given permission to make photographs of the Fish Commission exhibit for reproduction in his magazine.

## FINANCIAL STATEMENT.

The total allotment to the United States Fish Commission of the funds appropriated by Congress for the preparation, maintenance, and return of the Government exhibit, after deducting 5 per cent for common expenses of the board of management, was $89,205. This sum was increased by resolution of the board in May, 1893, by granting permission to use a further sum of $4,000, or so much thereof as might be necessary, for carrying out the plan of the Fish Commission exhibit as formulated by the Commission and approved by the board of management. Of that sum, however, only $584.60 was required. The total expenses of the exhibit to September 30, 1894, amounted to $89,789.60.

The various items for which the above expenditure was incurred are as follows:

| | | |
|---|---|---|
| 1. | Salaries | $41,215.35 |
| 2. | Travel | 3,327.80 |
| 3. | Subsistence | 6,631.16 |
| 4. | Office equipment | 5,081.62 |
| 5. | Transportation and freight | 3,998.37 |
| 6. | Scientific inquiry | 376.40 |
| 7. | Fish-culture | 1,612.04 |
| 8. | Fishery exhibit | 9,956.46 |
| 9. | Installation and maintenance | 2,537.62 |
| 10. | Exhibition furniture | 8,012.10 |
| 11. | General equipment | 331.23 |
| 12. | Labels | 654.10 |
| 13. | Packing and repacking | 1,838.13 |
| 14. | Aquarium, equipment | 1,877.55 |
| 15. | Aquarium, temporary labor | 595.88 |
| 16. | Aquarium, collection and food for fishes | 1,713.79 |
| | Total | 89,789.60 |

Salaries, $41,215.35, may be subdivided as follows:

| | |
|---|---|
| 1. Administration and office force | $15,951.79 |
| 2. Installation, maintenance, and return | 7,054.06 |
| 3. Fish-cultural section | 5,130.25 |
| 4. Fisheries section | 5,890.41 |
| 5. Aquarium | 7,188.84 |
| Total | 41,215.35 |

The amount expended for subsistence may be classified as follows:

| | |
|---|---|
| 1. Preparatory work | $358.45 |
| 2. Installation and maintenance | 3,400.97 |
| 3. Aquarium | 2,871.74 |
| Total | 6,631.16 |

## RETURN AND DISPOSITION OF THE EXHIBITS.

The extensive collection of fishery objects presented to the U. S. Fish Commission by the Imperial Japanese Commission at the close of the Exposition was deposited in the U. S. National Museum.

The large case made for the boat and vessel models of the exhibit was also turned over to the Museum and adapted for use in the section of naval architecture.

All the vessel and boat models, canoes, fishing apparatus, clothing, marine animals, fishery products, fishery illustrations, etc., not needed by the Commission were deposited upon their return to Washington in the fisheries section of the National Museum. Articles and materials belonging to the exhibit such as could be utilized in the work of the Commission were transferred to its central office after their return to Washington, in accordance with the instructions of the Treasury Department.

Respectfully submitted.

TARLETON H. BEAN,
*Representative.*

Report U.S.F.C. 1894.

177° 176° 175° 174° 173° 172° 171° 170° 169° 168° 167° 166° 165° 164° 163°

60° 59° 58° 57° 56°

BERING SEA

ST. MATTHEW Id

NUNIVAK Id

NELSON Id

COOK STRAIT

KUSKOKWIM BAY

St. Paul I.

St. George I.

Otter I.

WATRUS I.

LINE I.

LINE II.

LINE III.

LINE IV.

LINE V.

LINE VI.

LINE VII.

LINE VIII.

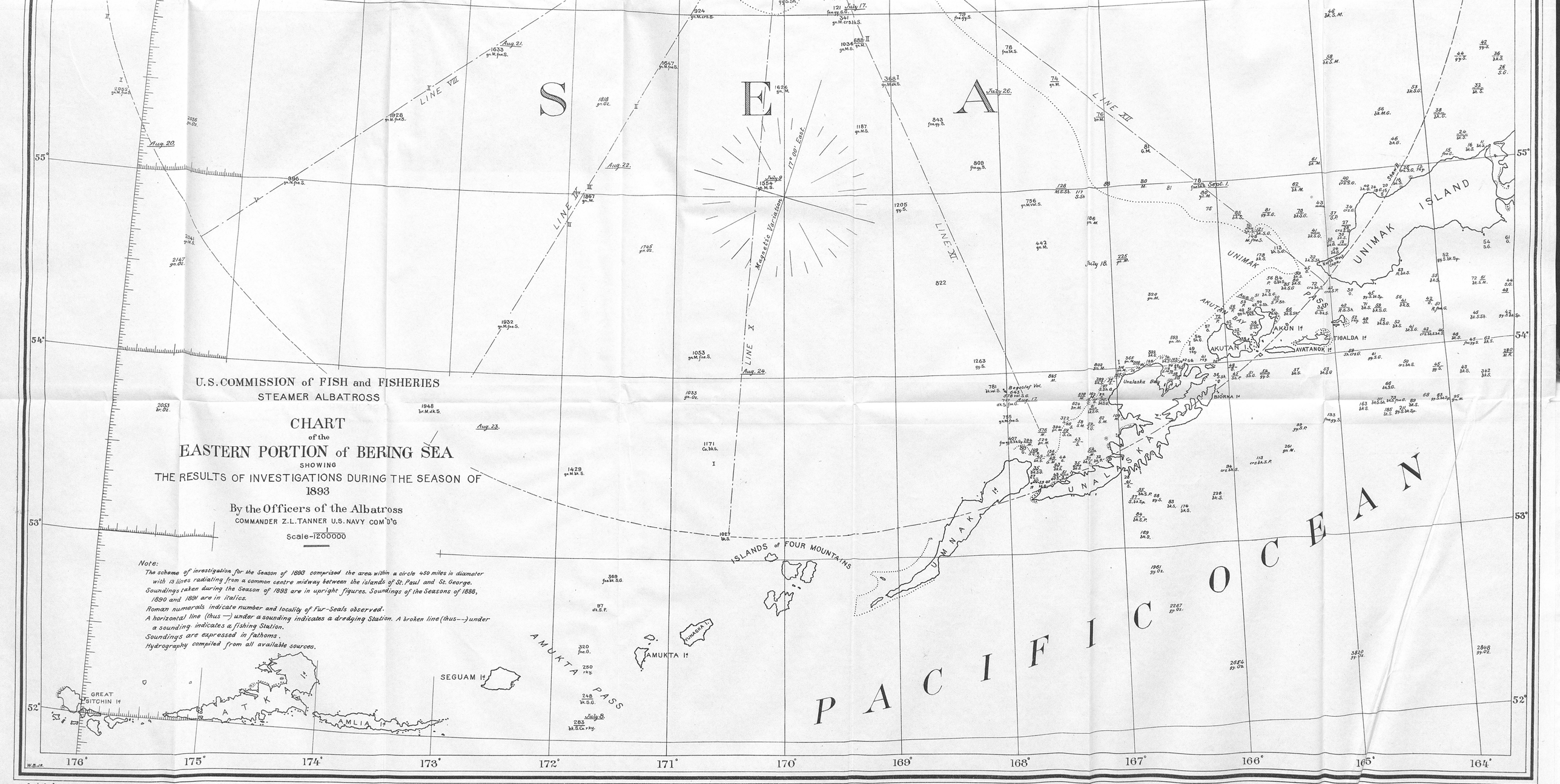
LINE XII.

LINE XIII.

17° Easterly Magnetic Variation

10° 45' Easterly Magnetic Variation

Aug. 1. Aug. 2. Aug. 3. Aug. 4. Aug. 5. Aug. 6. Aug. 7. Aug. 9. Aug. 10. Aug. 18. Aug. 19. Aug. 21. July 12. July 13. July 14. July 17. July 26. July 28. July 29. July 30. July 31. Sept. 2. Sept. 3.




Copied from a chart drawn by Harry Clifford Fassett Coast Cl...

W.B.-R.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

# 2.—REPORT UPON THE OPERATIONS OF THE UNITED STATES FISH COMMISSION STEAMER ALBATROSS FOR THE YEAR ENDING JUNE 30, 1894.

## OPERATIONS FROM JULY 1, 1893, TO MAY 1, 1894.

By Commander Z. L. TANNER, U. S. N., Commanding.

The *Albatross* was in latitude 51° 39′ N., longitude 172° 22′ W., at midnight June 30, 1893, en route from Unalaska to the Bay of Waterfalls, Adak Island, Aleutian Chain, where she arrived at 7.30 p. m. July 1.

We visited the bay under orders of the senior officer, commanding the United States naval force in Bering Sea, to ascertain if it was being used as a rendezvous by the sealing fleet. Its location on the Pacific side of the island, remote from the usual cruising grounds of the patrol fleet, its accessibility, ample supply of pure, fresh water from mountain streams, and driftwood conveniently strewn along the beaches made it the most desirable port for that purpose west of Sand Point (Humboldt Harbor), in the Shumagin group. There were no vessels in the bay at the time of our arrival, but recent beach fires, trampled grass, etc., plainly indicated the presence of visitors at no distant date. We subsequently boarded three schooners off the coast, all bound into the bay for water, and as they were among the last of the western-bound fleet it is highly probable that the harbor was visited by sealers earlier in the season.

The Bay of Waterfalls takes its name from a number of mountain streams which fall into it from the surrounding heights. It is 4 miles wide at the entrance, and penetrates the island in a northerly direction about 8 miles. Chapel Cove lies on the east side, 2 miles from the entrance. It was examined by the officers of this vessel, and found to afford fairly good anchorage for vessels of all classes in the outer bay in about 20 fathoms, while the inner cove furnishes almost perfect protection to small craft, such as hunters and sealers. Water could be procured early in the season, but the streams were dry at the time of our visit.

Cataract Bight was examined also. It lies on the east side of the bay, about 4 miles from the entrance, and affords good anchorage—the best in the Bay of Waterfalls—in from 15 to 20 fathoms. There is quite a large stream falling into the head of the bight, affording the most convenient watering-place in the vicinity. Anchorage may be found

at the head of the bay, and water procured from any of the numerous streams. The beaches were lined with driftwood.

We remained at anchor until the morning of July 5, under bright, clear skies and pleasant weather during the daytime, but the nights were misty, and an impenetrable wall of fog surrounded the island without a break, totally obscuring everything seaward.

Adak Island, like most of the Aleutian Chain, is mountainous and wholly devoid of timber; even the stunted growth of alder and willow found on some of the islands is lacking, at least in the region contiguous to the Bay of Waterfalls. The valleys and foothills are covered with a rank growth of grass and wild flowers, which extend high up the mountain sides wherever there is a handful of soil, mosses occurring on the barren heights.

The naturalists examined the region with the assistance of volunteers from the officers and crew, trawl-lines were set without result, and the seine was used wherever suitable beaches could be found, but the waters of the bay were nearly barren of fish, except in the immediate vicinity of fresh-water streams, where trout were plentiful and taken in large numbers. A few cod, chicken halibut, flounders, and a single Atka mackerel were caught by persistent fishing with hook and line from the ship's rail, and large numbers of fine trout were taken from the streams and lakes by fly fishermen. Land birds were extremely scarce, particularly ptarmigan, which are so plentiful on some of the other islands. The only apparent cause is lack of food in winter when the ground is covered with snow, for here the fresh buds of alder and willow which supply their wants in more favored localities are entirely lacking. The scarcity can hardly be attributed to foxes, for there were few, if any, on that part of the island visited by the collectors.

Remnants of a copper-fastened boat were found on the shore of a large lake lying about 2 miles northeast of the bay.

The fog broke at intervals on the morning of July 5, and at 8.40 a. m. we got under way and patrolled off the heads, boarding two sealers, taking several soundings, and finally anchoring in Chapel Cove for the night. A haul of the seine brought in a number of trout and young cod.

We were under way again at 2.30 a. m., on the 6th, and availed ourselves of the opportunity to further develop the great submarine trough lying south of the Aleutian Chain. Commencing a line of soundings near the entrance of the Bay of Waterfalls, it was carried in a southeasterly direction to 50° 03′ N., 174° 30′ W., in 2,802 fathoms, the maximum depth of 4,002 fathoms having been found in latitude 50° 28′ N., longitude 175° 10′ W. From the former position the line was extended in a northeasterly direction, recrossing the depression in 3,794 fathoms.

Two hauls of the beam-trawl were made in Amukta Pass on the 8th in 283 and 248 fathoms, respectively, the former proving quite rich in branching coral, sponges, hydroids, etc., while the latter was almost barren of life, the net being loaded with volcanic sand and gravel, very light and apparently subject to frequent shifting from the effect of currents.

Soundings were continued to the island of St. George, which we passed at 10 p. m. July 9, during a southerly gale with rain, fog, and short, chopping swell, peculiar to Bering Sea. Low speed during the remainder of the night brought us to St. Paul at 6.38 on the morning of the 10th. A landing was effected a few hours later at East Anchorage, and Mr. C. H. Townsend went to confer with the chief Treasury agent, Mr. J. B. Crowley, regarding a photographic survey of the seal rookeries on St. Paul and St. George.

While at the Bay of Waterfalls Mr. Townsend suggested planting a quantity of trout in the lakes of St. Paul Island, which heretofore have been entirely without edible fish, and, with this object in view, a number of fine adult specimens were taken and transported to the islands, where 20 were deposited in good condition in two of the most promising lakes.

Having secured the cooperation of the chief Treasury agent and procured from him necessary instructions to his subordinates on St. George, we steamed over to the latter island and landed Messrs. C. H. Townsend and N. B. Miller with apparatus for the prosecution of their photographic work and the platting of the outlines of the fur-seal rookeries in accordance with the plan previously inaugurated by Mr. J. Stanley-Brown.

While at St. Paul Island Mr. Adams, Treasury agent, visited the ship and reported that a schooner had been seen off Northeast Point on the 4th, sealing, and a brig had five boats out for seals on the 7th. As none of the patrol fleet was at the islands at the time, we proceeded to the locality mentioned, and, early on the morning of the 12th, boarded two whaling barks which were on a favorite cruising-ground, north and east of St. Paul; one of them reported a whaling schooner cruising in the vicinity, but we did not meet her. The east and north shores were examined during the morning, but we saw no vessels.

It was arranged before leaving St. George that we should return on the 15th to transfer Messrs. Townsend and Miller to St. Paul, hence our operations in the meantime were prosecuted with this end in view.

A line of soundings commencing north of St. Paul on the parallel of 57° 18′ N. was carried due west to the meridian of 173° 53′ W., in 150 fathoms. Beam-trawl and hand-lines were used frequently, special care having been given to serial temperature observations. Depths varied but little from 60 fathoms, with bottom of green mud, until, in 172° 43′ W., specimens of branching coral were brought up, and in 173° 18′ W., rocky bottom was first struck and carried to the next station, about 5 miles. The 100-fathom curve was then followed in a southerly and easterly direction, with frequent sounding, dredging, and temperature stations to the parallel of 56° 30′ N., thence due east to the vicinity of St. George, where we arrived at 8.40 a. m. July 14.

The results of fishing trials will be found in the report of the fishery expert; the contents of trawl, intermediate tow net, soundings, temperatures, etc., are tabulated for the sake of brevity, and will be referred to only incidentally in this report. Strict attention was given to the study

of the pelagic life and aquatic habits of the fur seal in so far as it could be done without serious interference with the work of deep-sea exploration. The numbers of seals seen, with dates, localities, etc., have been tabulated, and are shown in roman numerals on the appended chart. Fishing stations are indicated by a broken line (.....) and dredging stations by a horizontal line (———) drawn under soundings on the same chart.

Messrs. Townsend and Miller came on board at 11.30 a. m. on the 15th, having completed the primary photographic survey of the rookeries, and we were under way fifteen minutes later for St. Paul, arriving at 5.10 p. m. The flagship *Mohican* anchored near us two hours later. Arrangements having been completed, Messrs. Townsend and Miller were landed at 3.30 p. m. July 16, with photographic apparatus and other equipment, for the prosecution of their work on the rookeries.

Treasury Agent J. B. Crowley, having requested transportation to St. George, we left our anchorage at 4.30 p. m. and landed him at his destination five hours later. At daylight next morning we examined the north and west shores of the island, in compliance with verbal instructions of the senior officer; then started a line of investigations in a southerly and easterly direction, intending to extend it to Cape Makushin, but a gale sprung up during the night, forcing us to discontinue it and make the best of our way to Unalaska, where we arrived at 5.50 p. m. July 18. Several of the Arctic whaling fleet—transports, and other vessels—were found at anchor in the harbor.

Our movements to this time were governed, first by patrol duty, and later in attendance upon Mr. Townsend in his special work on the seal islands; but subsequently we were practically free to prosecute the work of the Fish Commission, and preparations were made accordingly.

Unexpected losses of dredging gear on the preliminary trips forced us to the conclusion that the older portion of the steel-wire rope had reached its limit of usefulness, and as it would be in constant use the remainder of the season we carefully overhauled the whole 3,600 fathoms on the reeling engine, and finally condemned 750 fathoms, replacing it by 1,000 fathoms of new rope. The deep-sea sounding reel having shown signs of distress after the 4,002-fathom sounding made early in the month, the wire was run off and a careful examination made, which showed it to be in good order in every respect, except that the flange of the drum opposite the friction groove was distorted by the great pressure of wire, giving it an irregular, wavy appearance. Fortunately, the metal was not fractured; so, after overhauling the wire, it was replaced, and the reel continued to do good service, although it would not be reliable in heavy work.

The plan for carrying out the explorations contemplated in the instructions of the Commissioner for the season of 1893 may be stated in a general way as follows: Taking into consideration the probable delays incident to the peculiar climatic conditions of Bering Sea, and the time consumed in coaling, it was considered probable that we would

have but 30 working days to cover the broad area under investigation, and the scheme finally adopted was based on the amount of work we could do within that limit of time.

The initial point, latitude 56° 51′ 30″ N., longitude 170° W., lies midway between the islands of St. Paul and St. George, and from this point as a center a circle was described 450 miles in diameter, and 13 radii were drawn to the circumference, at angles of about 28°. They were numbered from right to left for convenience of reference, No. 1 ending in latitude 57° 46′ 20″ N., the total length of lines aggregating about 3,700 miles.

We sailed at 5 p. m. July 25, towed the whaling bark *Stamboul* out of the harbor, then steamed direct to St. George with mail for the island, but rough weather prevented a landing, so we ran on to St. Paul and delivered it to the *Mohican*. A quantity of trout, starry flounders, and clams, brought from Unalaska to stock the waters of St. Paul, were landed and properly distributed immediately after our arrival.

Having communicated with Mr. Townsend and ascertained that his work was progressing satisfactorily, we got under way at 10.20 a. m. July 28, and commenced explorations in accordance with the plan before described. Line I was first developed until its intersection with a previous line from Cape Newenham, and was completed on the evening of the 29th, when we started for the eastern extremity of line II. A gale sprang up, however, which caused a dangerous sea and forced us to haul off to the northward and westward until we deepened our water and the swell became more regular. We reached the line on the morning of the 30th, and continued work during the day and following night under great difficulties and no little discomfort from a heavy, vicious sea; it moderated, however, during the morning of the 31st and the work progressed more rapidly. We reached the vicinity of St. Paul about noon. Mr. N. B. Miller returned on board during the afternoon, and took charge of the scientific department, which had been ably conducted by Passed Assistant Surgeon T. A. Berryhill, U. S. Navy, during the absence of the naturalists.

Leaving the anchorage at 3.40 a. m. August 1, we commenced the development of line III, which ran in a northerly direction; made the island of Nunivak at 10 a. m. on the 2d, passing about 15 miles to the westward of it in from 14 to 19 fathoms, and reached the northern extremity of the line, in latitude 60° 28′ N., longitude 168° 08′ W., at 4.33 p. m. Then, turning sharply to the westward, investigations were extended toward the most northern station of radial line IV, which was occupied at 6.40 a. m. August 3. It is 11 miles ENE. (mag.) from Cape Upright, St. Matthew Island, and, the weather being clear at the time, the headland was plainly visible; Pinnacle Rock and Hall Island could be seen also.

Extending the line in the direction of the initial point, excellent progress was made, the weather being exceptionally favorable; made the high land of St. Paul at 4 p. m. August 4, and at 7.44 anchored for

the night off the north shore of the island in 9 fathoms. We were under way at 2.45 a. m. next morning, and commenced the development of line V, which was completed on the 6th, in latitude 59° 54′ N., longitude 174° 17′ W. A marked feature of this line was the uniformity in depth of water, 10 fathoms being the maximum variation, while for over 100 miles it did not exceed 2 fathoms.

We reached line VI at 5 a. m. August 7, in 58° 10′ N. and 176° 40′ W., the depth having increased from 71 to 1,744 fathoms in 35 miles. No attempt was made at dredging or trawling in such great depths, from a lack of time, investigations being confined to sounding, temperatures, and seal observations until we were within the 100-fathom curve. An increasing breeze from the northward and westward gave us a leading wind, with which excellent time was made between stations, but a heavy sea interrupted our work to some extent. The line was completed about noon August 8, and we came to an hour later at East Anchorage, St. Paul, to communicate with Mr. Townsend and insure his transportation to St. George at the proper time for a second series of rookery views at that place.

This matter having been satisfactorily arranged, we left the island at 1.15 a. m. August 9, and commenced the development of line XIII, which ran in an easterly direction. Fog prevailed during the morning, but commenced breaking away at 8 a. m., and it finally proved one of the most pleasant days of the season. The line was developed rapidly under favorable conditions of weather, and the last station, which lies in latitude 56° 10′ N., longitude 163° 25′ W., near the northern limits of Slime Bank, was occupied at 9.46 a. m. August 10. The snow-covered peaks of Pavlof and Shishaldin were seen at daylight, and a little later Aghileen Pinnacles and Amak Island came into view, the weather still remaining remarkably clear.

As soon as the line was completed we started for Unalaska for coal, but early in the afternoon the wind increased rapidly from the southwest, and the evidences of approaching bad weather were so apparent that we ran into Shaw Bay and passed a quiet night, although it was blowing a strong gale at midnight, with furious squalls. This bay is easy of approach, has no outlying dangers, water shoals gradually from 20 fathoms, and it affords good protection with winds from southwest to southeast. It was still blowing a fresh gale at 5.20 next morning when we got under way, but by hugging the land we kept in comparatively smooth water until we reached the vicinity of the Northwest Cape of Unimak, when the wind died out and fog set in which lasted with occasional intervals until our arrival at Dutch Harbor at 5.35 p. m.

We commenced coaling at 10 a. m. August 14, and finished at 11.12 a. m. on the 16th. Ten minutes later we cast off from the wharf, hoisted boats, and proceeded to sea, anxious, if possible, to make up for a part at least of our unexpected detention in port. It was our intention to resume work at the southern extremity of radial line XI, near Chernofski; and, starting out with light winds and pleasant weather, we

anticipated a speedy and interesting trip while skirting the northern shores of Unalaska; but off Cape Cheerful a dense fog rolled down from the heights of Makushin and shut out everything a ship's length from us; a breeze sprang up a few minutes later, light at first and variable in direction, but increasing rapidly, until within a short time we were driving into the teeth of a southwest gale—a typical illustration of the rapid atmospheric changes experienced in Bering Sea. The conditions were so unfavorable for the prosecution of our work that we ran into Chernofski for the night, anchoring at 8.30.

Chernofski Bay is the most secure harbor near the western extremity of Unalaska, if not in the whole of Bering Sea. The inner basin is perfectly landlocked, and being surrounded by low land or moderate elevations it is not subject to the much-dreaded "woollies," as the furious mountain-bred squalls of northern regions are called. The *Albatross* visited the harbor in August, 1890, and by careful observations with artificial horizon determined the position of the southwest point of the entrance to the inner basin to be in latitude 53° 23′ 06.5″ N., longitude 167° 30′ 33.8″ W., the Greek church in the village bearing N. 5° 30′ W., true, 0.64 mile. The longitude depends upon that of the point opposite the wharf in Iliuliuk Harbor, being in 166° 31′ 44.2″ W., as shown on Coast Survey chart No. 821. Information concerning the observations above mentioned will be found in my report for the fiscal year ending June 30, 1891.

The wind subsided during the night, and at 6.30 the following morning we left the harbor and commenced work on line XI, making corrections in the coast line of the northeastern extremity of Umnak Island in passing. A line of soundings was run from the latter point to Bogoslof over the line where a reef was shown on the older charts, and which looked so formidable that for many years vessels avoided the passage. Seven hundred fathoms was the least water found, and we saw no indications of foul ground, yet a subsequent experience while passing the volcano in a gale readily accounted for the natural belief in its existence. We were running before a heavy, regular sea until abreast of Bogoslof, when suddenly it lost all semblance of regularity as far as the eye could reach in the direction of Umnak, high combers running apparently in every direction in a remarkable manner, giving the impression of breakers, and had we not recently sounded over the region we also would have looked with suspicion upon it and perpetuated its bad name. The phenomenon was doubtless caused by a strong current setting against the wind.

Bogoslof Volcano was in active eruption, as usual. We made a partial examination of it in 1890, which was verified and extended during our late visit. The latitude of the cone of Old Bogoslof was, by good observations, sea horizon, found to be 53° 54′ N.

Having developed line XI to the vicinity of St. George, we called at that island in the afternoon of the 18th to communicate with Mr. Town-

send, and upon his reporting the completion of the special work to which he had been assigned on the islands, he was taken on board and resumed his duties in charge of the scientific department.

We were detained about an hour at St. George, then took up the development of line VII, and carried it to its western extremity in latitude 56° 21′ N., longitude 176° 45′ W., where the depth of water reached 2,049 fathoms. The station was occupied at 2.11 a. m. August 20; then, changing direction to the southward, we reached the terminus of radial VIII at 4.21 the same day, in latitude 54° 38′ N., longitude 175° 25′ W., with a depth of 2,041 fathoms. We followed line VIII to the 100-fathom curve, then took up radial IX, and developed it to latitude 53° 48′ N., longitude 173° 11′ W., in 1,948 fathoms.

Indications of bad weather were unmistakable on the morning of the 22d; a brisk breeze from the southward and eastward sprung up during the afternoon, and at midnight it was blowing a fresh gale from E. by S., with rapidly falling barometer. At 11.50 p. m. stopped the engines, set fore storm staysail, and hove to with wind on port quarter. The gale having moderated to a strong breeze, we started ahead at 7.30 a. m. August 23, and reached the outer extreme of line X at 10.25 p. m., in 1,027 fathoms, latitude 53° 09′ N., longitude 170° 31′ W. The wind backed to the northward during the day, and at 10 p. m. was blowing a moderate gale from northwest, with rough cross sea, yet work was continued under low speed and at the expense of great wear and tear until 6.30 p. m. August 24, when the line was practically completed.

Radial line XII and a considerable area about the Pribilofs still remained unexplored, and we were anxious to finish it before going into port, but the gale was still blowing, with no immediate prospect of improvement, and as our fuel was nearly exhausted we concluded to return to Unalaska and procure a fresh supply. We passed Bogoslof at 5.45 a. m. and anchored in Dutch Harbor at 11 a. m. The flagship *Mohican*, *Ranger*, *Rush*, and H. B. M. S. *Champion* were found in port.

At the request of Captain Ludlow I called on the chief engineer of this vessel, A. M. Hunt, passed assistant engineer, U. S. N., for a report on the comparative merits of the best varieties of steaming coal used during the season, and received the following reply:

On May 31 we coaled ship at Union Bay with coal fresh from the Comox mines. It was washed coal, very clean, and free from slack, and probably of the finest quality that the mines furnish. It proved very satisfactory in every respect. It is a little slower in igniting than the Wellington or Nanaimo coals, and gives a good body of clear fire, with very light smoke as compared with other coast coals. Such clinker as forms breaks away from the bars readily, and does not form so close a blanket as to deaden the fires by preventing the passage of air through them. The soot formed does not adhere to the tubes, is granular rather than flaky, and is easily blown out with the steam tube sweeper. There was no difficulty in burning as many pounds of it per square foot of grate surface as of any other coal we have used.

The only coals with which I am able to make a comparison are the Welch Brymbo coal we received at the Mare Island Navy-Yard in May, 1893, and Wellington coal received from the North American Commercial Company at Dutch Harbor during July and August, 1893. The Brymbo coal was taken from a pile that had been

exposed for about a year, but was in fairly good condition. The Wellington coal was fresh from the mines and of good quality. The figures are from data taken from the steam log of this vessel and can not be considered as more than approximate, owing to the difficulty of getting runs with the different coals under the same conditions.

| | Percentage of ash. |
|---|---|
| Comox | 13½ |
| Brymbo | 10½ |
| Wellington | 15 |

The distance that can be steamed at economical speed by this vessel with equal amounts of coal is as follows: With Comox, about 6 per cent more than with Wellington and 3 per cent less than with Brymbo. From my experience with the Comox coal I do not hesitate to pronounce it superior for our purposes to any coast coal on the market.

Getting under way at 4.55 a. m. August 31, we examined the area embraced between Akutan and Akun islands, commonly called Akutan Bay, and looked into Akutan Harbor and other coves to ascertain whether any of the small sealers had taken refuge there. The beam trawl and hand-lines were used at several stations to determine the character of bottom and its fauna, thinking we might possibly find codfish or halibut. On the contrary, the bottom was composed largely of glacial mud and almost barren of life.

Arriving off the north head of Akun at 1.50 p. m., a vessel was reported from the masthead, standing to the southward through Unimak Pass. Gave chase, and at 3.50 boarded the American schooner *Lettitia*, from Sulima River for San Francisco with a cargo of salt salmon. As soon as the boarding officer returned, we steamed to the southward and westward, and at 6.30 p. m. anchored in Akun Cove for the night.

Getting under way at 4.15 the following morning, September 1, we took up radial line XII, the last of the series, in latitude 54° 36′ N., longitude 165° 27′ W., depth 113 fathoms, and developed it to the initial point. A northeasterly wind sprang up soon after we reached the line, and increased in force during the day until it became exceedingly difficult to carry on the work; yet we persevered until the evening of the 2d, and succeeded in covering a large portion of the unexplored ground in the region of the Pribilofs.

When in the vicinity of Otter Island a heavy break was seen over a reef which extends at least half a mile off its western extremity, as shown on canceled Coast Survey chart No. 886, but not charted on later issues. The charts of the Pribilof Islands have "breakers" marked about 2 miles N. by E. (magnetic) from Otter Island, directly between it and St. Paul, and while the existence of concealed dangers in the assigned position has been generally doubted, the spot has been given a wide berth in clear weather, and has proved the source of much anxiety to navigators during the almost constant summer fogs. The absence of breakers with the heavy swell then rolling in seemed to confirm their nonexistence, but to settle the question beyond doubt we steamed to the spot and sounded in 26 fathoms, sand and stones, then

dragged the beam-trawl nearly half a mile in the direction of St. Paul without changing the character of bottom or shoaling the water. Strong currents and tide rips are not infrequent near the islands, and under favoring conditions overfalls might occur bearing the general appearance of breakers.

An anchorage was found for the night in Village Cove, St. Paul Island.

A moderate to strong northeast wind was blowing on the morning of September 3, the weather overcast with drizzling rain and heavy sea, conditions most unfavorable for our work. As there was no immediate prospect of improvement, and we could not afford delay, we got under way at 5.20 a. m., and occupied the last few stations required to complete our scheme of exploration; then, at 3.15 p. m., started for Unalaska. The run was made under steam and sail with fresh, following wind, and at 12.55 p. m. September 4 we arrived at Dutch Harbor.

Our season's work in Bering Sea was completed under difficulties and at considerable expense of wear and tear. Our instructions contemplated a line of soundings and observation of seal life between the Pribilofs and the Commander Islands, providing it was found practicable, after the completion of the more important work in southeastern Bering Sea; and we looked forward to it as a satisfactory winding up of the season's exploration until the rapid succession of September gales put a stop to further operations.

Voluminous reports relative to patrol duty were made periodically to the senior officer commanding United States naval force in Bering Sea, and incidents connected with that service have been mentioned only where they have a bearing on the narrative of exploration.

The general results in the several branches under investigation during the season may be summarized as follows:

*Seal life.*—The observation of seal life was conducted with the greatest care, but was subordinate to other duties in so far that we did not deviate from our course or delay operations for that special purpose. The small numbers observed may seem strange in view of the fact that many thousands were constantly afloat; yet it is not really so, for they have become wary since they have been hunted so persistently by pelagic sealers. I have been told by sealers that it was the exception when large numbers were seen from the deck, and that some of the best catches are made on days when there are none sighted from the vessel. It is a common saying that you will not see a moving seal if he sees you first, and this is largely true, although occasionally curiosity induces them to approach a vessel, especially if she is lying to. A larger number will be seen from a sailing vessel than from a steamer moving through the water at the same speed, the vibrations of the propeller being distinguished at a greater distance than the wash of the water about the hull of the former.

To find seals it is necessary to hunt them as other game is hunted, and as we were constantly moving in the prosecution of other work, it

is safe to assume that we passed in the immediate vicinity of large numbers which were not seen, and that where we saw one there were others near by.

Very few were seen within 10 miles of the Pribilofs, except close to land in the vicinity of the rookeries and on the direct route between the islands. Even there an average of only four were observed each trip, yet many thousands are constantly traversing the region day and night through the entire season; in fact, the waters surrounding the islands are, of all areas in Bering Sea, the most frequently traveled by the feeding portion of the herd.

Seals were seen in varying numbers on 11 of the 13 radii, exclusive of those encountered near the rookeries.

On line I, 200 miles NE. by E. (mag.) of St. Paul Island.
On line III, 40 to 70 miles N. by E. (mag.) of St. Paul Island.
On line IV, 25 miles N. by W. (mag.) of St. Paul Island.
On line V, 40 to 200 miles NW. by W. (mag.) of St. Paul Island.
On line VI, 50 to 110 miles west (mag.) of St. Paul Island.
On line VII, 120 miles WSW. (mag.) of St. George Island.
On line VIII, 140 to 200 miles SW. (mag.) of St. George Island.
On line IX, 85 to 130 miles SSW. (mag.) of St. George Island.
On line X, 25 to 180 miles S. ¼ E. (mag.) of St. George Island.
On line XI, 40 to 60 miles SE. by S. (mag.) of St. George Island.
On line XIII, 12 miles north (mag.) of St. George Island.

The 100-fathom curve from the 170th to the 174th meridian is a favorite feeding-ground, where scattered seals were frequently observed from the decks of the vessel, a sure indication that it would have been a prolific hunting-ground had we hove to and sent out boats. Next to this region, the largest numbers were observed near the northern extremity of radial No. V, and it soon became evident that the August feeding-grounds were to the westward of the meridian of the Pribilof Islands. Earlier in the season they would doubtless have been found in greater numbers east of that meridian, where their food, composed largely of codfish, would still abound in the shoaler waters of eastern Bering Sea.

*Soundings.*—Depths inside of the 100-fathom curve were found to be remarkably regular, shoaling gradually where land was approached. Off the Kuskokwim, and thence to Nunivak, shoal water extends farther from land than in any portion of Bering Sea, while off the Aleutian Archipelago deep water frequently approaches very near to the coast line.

Depths of 2,000 fathoms or more are found in central Bering Sea, the eastern part having less than 100 fathoms. The western section is still unexplored. The 100-fathom curve lies on the summit of a steep, irregular bank, extending from the vicinity of the Northwest Cape of Unimak in a WNW. (mag.) direction to the meridian of St. George, approaching within 18 miles of the island; thence, about W. by S. (mag.), for 140 miles to the meridian of 173° 25′ W., where it turns abruptly to NW. by N. (mag.) for 140 miles, then WSW. (mag.) along

the southeasterly coast of Kamchatka, where an immense area over 200 miles in width at its eastern extremity remains unexplored.

*Character of bottom.*—Black sand and gravel occur on Baird and Slime banks, in Bristol Bay; also in Unimak Pass and off the north shore of Unalaska Island. Spots of black and gray sand occur north of the Pribilofs, but a large proportion of the vast area within the 100-fathom curve is dominated by green mud, having usually a proportion of fine sand, although this is not invariably the case.

In the deeper waters, even to depths exceeding 2,000 fathoms, green mud occupies a prominent place, with a small percentage of fine, gray sand, which during the season of 1890 we mistook for foraminifera. Clay occurred once only in Bering Sea, in latitude 55° 38′ N., longitude 170° 39′ W., at 1,171 fathoms. Rocky bottom was found occasionally near the 100-fathom line west of the Pribilofs.

*Water Temperatures.*—The surface temperature of the Pacific Ocean, south of the Aleutian Islands, during July and August, was from 48° to 50° F., while in Unimak and Amukta passes it was but 40°. Marked variations of temperatures have been noted in Bering Sea and commented upon by navigators, some of whom have ascribed the phenomenon to mysterious agencies. It can readily be accounted for, however, from natural causes. Inside of the 100-fathom line the surface temperatures were from 44° to 46°, while at the bottom they ranged from 35° to 40°, and between Nunivak and St. Matthew were as low as 31°. The temperatures at the surface fell with shoaling water, approximating to that of the bottom as the depths decreased, until in some instances both were the same. A fall of 3° to 4° was noted in approaching the Pribilof Islands.

Outside of the 100-fathom curve, and particularly between the seal islands and Amukta Pass, the surface temperature was about 47°, or 4° higher than inside of the curve and 3° lower than the Pacific outside of the pass. This condition is owing to natural causes also, as the weight of current is from the warmer waters of the Pacific through the archipelago into the colder region of Bering Sea.

The mean surface temperature in the harbor of Unalaska during July, August, and the first week of September was 50°.

Serial temperatures observed showed frequent mingling of warmer and colder waters.

*Currents.*—Regular tides were found inside of the 100-fathom curve, the flood strongest and setting to the northward, the ebb running in the opposite direction. They were greatly affected by winds and the proximity of land, and around the Pribilof group they were particularly strong and erratic. Outside of the 100-fathom curve there was a general northerly set, light, however, and greatly affected by prevailing winds.

*Intermediate tow-net.*—This apparatus was used frequently with good results between 25 and 250 fathoms.

*Codfish.*—The only known cod fishing-grounds of commercial value in Bering Sea are Baird and Slime banks, in Bristol Bay. They are

taken in other places, such as the Hospital Bank, an unimportant locality on the Kulukak ground, where fishing vessels from Baird Bank sometimes seek shelter during northerly and northeasterly storms; also along the shores of the Aleutian Islands, where a sufficient quantity are secured for local consumption. Banks have been reported in various parts of Bering Sea, but we have no data at present that would justify a fisherman in visiting them as a commercial venture.

A vessel can anchor anywhere inside of the 100-fathom line and by persistent fishing take enough to "fill the decks," to use a common expression, where a mess for all hands has been caught. The same may be done in calm, smooth weather, when the ship is lying dead in the water, yet the locality might be worthless commercially; and, in fact, such is the case over the greater portion of Bering Sea.

The search for cod in paying quantities would be confined to spots where the bottom is free from mud, and a glance at the chart will show the prescribed areas where success would be probable.

First, a stretch of 60 miles or more will be observed ESE. (mag.) of St. George Island, in from 70 to 80 fathoms, coarse sand and gravel, and fine dark sand near the 100-fathom curve. Another spot having favorable indications lies about 50 miles NE. by N. (mag.) from the island, in 40 fathoms, gray sand and rocky, and fine gray sand. A region of considerable area, having promising features, lies from 180 to 200 miles NE. (mag.) of St. Paul Island in from 20 to 30 fathoms, fine gray sand and shells. A spot about 42 miles N. by W. ½ W. (mag.) from northeast point of St. Paul Island has been reported as a bank, and has favorable indications, in about 40 fathoms, sand and gravel. There are other places between the above spot and Nunivak where a certain degree of success might be expected, although our examination did not develop a particularly rich fauna.

There is also a region near the 100-fathom curve, in from 70 to 90 fathoms, fine gray sand and rocky bottom, lying from W. by S. to SW. by W. (mag) of St. Paul Island, which promises well, although the depth is greater than fishermen are in the habit of resorting to in this region.

The report of the fishery expert, Mr. A. B. Alexander, gives the experience of this vessel in fishing with hand-lines from the rail, but in considering the results it must be remembered that the vessel was always under way, frequently drifting rapidly before boisterous winds and heavy seas. The duration of trials never exceeded twenty minutes, and other work was frequently carried on when line fishing was impracticable; hence some of the most favorable localities escaped a fair trial with hook and line.

It is reasonable to suppose that the presence of cod varies with the seasons in the shoal waters of Bering Sea as in other localities, and that they will be found in greater depths as summer approaches.

*Halibut.*—The *Albatross* has never taken halibut in any considerable quantities in Bering Sea, and none of large size. The conditions under

which trial lines have been used are particularly unfavorable for the capture of this slow-biting fish. Trawl lines set on favorable bottom near the 100-fathom line would be an interesting experiment, from which good results might be expected to follow.

*Fishing trials.*—It may be asked why we did not make more extended fishing experiments at the various stations. There are several reasons, among them the necessity of completing the lines as quickly as practicable in that region of fogs, to prevent the vessel from drifting out of her course, it being desirable to locate the stations as accurately as possible as bases for future exploration. Another and vital reason was the lack of time.

*Occupation of a station.*—The following details are given as an evidence of the time and labor required for the full occupation of a station:

When the vessel is under sail and steam, as often happens, the former is clewed up, and furled, if necessary, before the station is reached. Having arrived on the desired spot, a sounding is made, say, in 60 fathoms, surface and bottom temperatures being taken; time, 3 minutes. Serial temperatures are then observed in 5, 10, 20, 30, 40, and 50 fathoms; time, 10 minutes. As many fishing lines as the watch on deck can attend are put over for 15 minutes, followed by the beam-trawl with a scope of 150 fathoms on the dredge rope; time, 6 minutes. The trawl is then dragged 15 minutes, and hoisted aboard in 10 minutes, the haul having occupied 31 minutes. The surface tow-net was in operation while the trawl was on the bottom. The intermediate tow-net follows the beam-trawl, and is lowered to 50 fathoms in about 4 minutes, towed 10 minutes, messenger sent down to close the lower net; time, 3 minutes, and it is then hoisted on board in about 3 minutes, the haul having occupied 20 minutes. Thus 1 hour and 19 minutes are required for the full occupation of a station in 60 fathoms, under favorable conditions. A detention of 2 minutes would be about the average if we were simply running a line of soundings in the same depth.

It would require 3 hours at least to set a trawl line in addition to the operations detailed, and satisfactory trials with hand lines can only be made from boats. Further investigations in this direction are desirable, but they should be taken up when the vessel is not required to maintain her position on a line, and can afford to wait for favorable weather, as she will frequently find it necessary to do in Bering Sea.

On September 8, at 6 p. m., we left Dutch Harbor under the following orders from Commander Nicoll Ludlow, United States Navy, commanding the United States naval force in Bering Sea:

You will proceed to sea as soon as ready, and so far as possible complete your work in and about Bering Sea in connection with your investigations, under the instructions of the United States Commissioner of Fish and Fisheries, and your patrol work which is carried on at the same time. You will return to Dutch Harbor by the 10th of September, fill up with coal, and return to San Francisco via Sitka. Should the weather and other circumstances permit, you will take the route to the north of the Sannak, on your way to the eastward, and keep a sharp lookout en route for the British steamer *Warlock*, the British schooner *Diana*, and the American

schooner *Czarina*. The latter vessel is liable to seizure for receiving cargo from the schooner *C. G. White* at Caton Harbor. The other two vessels are liable to seizure—the *Warlock* if found otter hunting, as it is suspected she is, or loitering in our harbors if not in distress, as she cleared for Petropaulovski August 2 from Sand Point, and the *Diana* (late *Sea Lion*) for escaping after seizure at Sand Point September 28, 1892. The schooner *Emma*, with Hansen, the rookery raider, on board, is probably in or about the Sannak otter hunting. She was enrolled at Juneau and licensed for coasting trade only, and if hunting is being run without proper clearance.

This order is inserted to show that while we were accorded every practicable facility for the prosecution of our special work, it did not relieve us from patrol and other duties required of the vessels composing the Bering Sea fleet.

The navigation of Bering Sea is complicated during the summer season by almost constant fogs. It is difficult at all times in the vicinity of land, from lack of soundings and accurate surveys, and it has been our custom to do what we could for the improvement of charts by taking soundings, correcting coast lines, and giving reliable astronomical positions when it could be done without materially interfering with our legitimate work. Great difficulty has frequently been experienced in making Unalaska in thick weather in the absence of soundings, and we have from time to time run lines from the 100-fathom curve to Unalaska Bay, which were supplemented after our departure from Unalaska by a line from Priest Rock, off Kalekhta Point, to the north head of Akutan, and thence to Akun, the route usually followed by steamers between Unimak Pass and Unalaska. These soundings, with others we have made in the vicinity of the Fox Islands, will, when plotted on a chart of large scale, greatly assist the navigator, inasmuch as it will make the lead available.

We anchored in the south arm of Akun Cove at 1.27 p. m. September 8, for the double purpose of giving the naturalists an opportunity of exploring the region and to make an early start next morning for the inner passage to the eastward. Akun Cove affords convenient and safe anchorage with all winds except from SE. to NE. It has three arms, two of which, the middle and southern, have been surveyed. It has no permanent settlement, but during the fishing season temporary camps are formed by natives who resort to the place for the purpose of taking salmon. The fishing was closed during the season of 1893, however, from natural causes.

At the head of the cove, and separated from it by a narrow shingle beach, lies a beautiful lake of considerable size, which usually finds an outlet to the sea through a small creek; but the storms of the previous winter threw up stones and gravel until the mouth was completely blocked, thus effectually excluding the fish from their usual spawning grounds. Yet thousands of fine red salmon were seen patrolling the shores, vainly searching for an entrance to the lake, and the beach was lined with the carcasses of the many victims to the vital instinct of reproduction. When the tide was low, fresh water from the lake percolated through the obstruction at the mouth of the creek, forming a

small rivulet up which spirited dashes were frequently made by the more vigorous males, until, becoming exhausted, they rolled and floundered back into the waters of the bay.

At 1 o'clock next morning, September 9, we left our snug anchorage in a drizzling rain and fog, but it lighted up at intervals, giving us momentary sight of islands and headlands by which the course was checked, and during the forenoon occasional views of the snow-covered heights of Unimak were obtained.

At 5.10 a. m. Seal Cape, or Cape Khituk of the older charts, was abeam about 1½ miles distant, and, the fog having partially lifted, we could see the graceful slopes of Progromnia sweeping down from the lower snow line to the shores. The cape is a vertical rocky cliff 150 feet high, with grassy slopes on either hand, through which flow numerous mountain streams that finally fall into the sea from cascades, or over small shingle beaches; about a mile to the eastward rises a steep hill, 500 feet in height, with its sides extending to the water's edge.

The charts show an island off Seal Cape, but it does not exist. The cape itself seems to be detached when seen from a distance, but a nearer view shows it to be connected with the main island. Promontory Cape has a small off-lying rocky islet, and the error may have occurred from the latter cape being mistaken for the former.

The snow-covered peak of Shishaldin, 9,000 feet in height, is beautifully symmetrical when seen in a northerly direction, and while it was obscured most of the morning, we were able to get a good bearing of the summit, which seemed to verify the position assigned it on the older charts, where it was placed in latitude 54° 45′ N., longitude 163° 59′ W. Two elevations rising above the snow line lie to the eastward of Shishaldin; the first is exceedingly rugged in outline, and has a double peak which is approximately in latitude 54° 45′ 30″ N., longitude 163° 44′ W.; the second peak, having a dome-shaped summit, is in 54° 45′ 30″ N. and 163° 34′ W. The relative positions were determined by cross bearings and a run of 15 miles, based on Cape Lazaref, being in latitude 54° 34′ N. and longitude 163° 34′ W. The elevated region west of Shishaldin was enveloped in clouds and fog.

Cape Lazaref is a bold rocky point, or, rather, three rocky points, all lying within a mile and a half, with small sand beaches intervening, and has a rocky ledge partly above water extending off in a southeast direction about a mile.

Cape Pankof has three rugged rocky points, and a reef partially above water extends about a quarter of a mile E. by S. from the middle one.

Having passed the latter cape, we laid a course for Umga Island, intending to verify its position by the run and bearings, but before reaching it the fog shut down and we saw nothing more until next morning, having anchored for the night to the westward of Deer Island. We were about 2 miles from Umga when it was shut out, and saw distinctly that there was but one island instead of two, as shown on some

charts; it was about 150 feet in height. The summit was in line with Cape Pankof at NE. by N. (mag.), as shown on United States Fish Commission charts and on Coast Survey chart No. 8800.

It is to be regretted that we were unable to examine the region more thoroughly, for the various charts show greater discrepancies than in any other locality on the Pacific side of the peninsula.

The fog partially lifted at daylight next morning, and at 5.35 we got under way and steamed to the eastward through the channel between North Cape and Deer Island. The *Rush* being observed at anchor near the head of King Cove, we steamed in and boarded her to ascertain if we could be of assistance; also to get the latest information concerning the vessels supposed to be still out sea-otter hunting. The commanding officer reported all well and that the last otter hunter had left the Sannaks. Having obtained the desired intelligence, we left the commodious and convenient bay without anchoring, and at 8.35 a. m. came to in Bailey Harbor, where the naturalists spent the day in exploring the region with fairly good results.

Bailey Harbor has an inner and an outer bay, divided by a broad shingle spit, extending from the western shore nearly two-thirds across. The only directions required to enter the outer harbor are to favor the eastern shore in order to give the flats on the opposite side a wide berth, as they cover at high water. The inner bay is entirely landlocked, and affords a secure harbor in from 5 to 8 fathoms near its center. To enter, favor the east side as before, and take a mid-channel course through the narrow passage, carrying about 9 fathoms. In the absence of surveys, it would be prudent to anchor off the inner side of the shingle spit. The head of the bay and western shore are lined with huge bowlders.

Leaving Bailey Harbor at 4.42 p. m. the same day (September 10), we anchored at 6.05 off Belkofsky, a village having a population of 160, and, next to Unalaska, the largest native settlement west of Kadiak. Its principal industry is sea-otter hunting. We called to learn from Captain Lenard himself the particulars concerning the rock bearing his name, which is shown on the charts to the southward of the Sannaks, in about latitude 54° N. We did not meet him, however, as he had removed to another locality.

Belkofsky Bay is open from SW. to SE., and is not safe with strong winds between those points. The best anchorage for a stranger is in 10 fathoms, with the church bearing WNW. (mag.). It is claimed by some that better holding-ground may be found farther to the eastward, which may be true. The western part of the bay is strewn with bowlders, which endanger a vessel's ground tackle and should be avoided.

A reef, partially bare at low water, extends from the Inner Iliasik to the mainland, and rising from it, about 60 yards from the latter shore, is a pinnacle rock, which is conspicuous. The only break in the reef occurs just outside of this rock, where there is a narrow channel having 2 fathoms at high water. It is used only by the smallest class of vessels.

We were detained by fog until 7 o'clock on the morning of the 11th, when a strong southeasterly wind drove it away sufficiently to allow us to proceed. Passing between Inner and Outer Iliasik islands, we favored the latter to avoid a reef that makes out about 100 yards from the former, then took a mid-channel course between Goloi and the mainland. The north end of Goloi Island and Moss Cape terminate in low shingle points, and the northern extremity of Dolgoi in a series of wedge-shaped bluffs, having their vertical thick ends outward.

Seal Cape, which forms the east side of Coal Bay, terminates in a flat-topped mound about 100 feet high, with low land between it and the mainland. A conical rock opened out from the cape at about WSW. (mag.), and this was the only rock we observed disconnected from the shore line.

The shores of Beaver Bay were partially obscured by mist, but high land was observed to extend from the eastern extremity of Seal Cape to the vicinity of the entrance to Otter Bay, and thence to within 4 or 5 miles of Cape Aliaksin.

There were no apparent outlying dangers in Unga Strait, and the chart was found to be unusually accurate, cross bearings of principal points plotting within reasonable limits.

At 3 p. m. we anchored in a cove on the west side of Portage Bay, which we have called "Albatross Anchorage." The naturalists and parties of volunteer collectors went out immediately after our arrival, and continued their explorations until the moment of departure.

Albatross Anchorage is a small cove lying on the west side of Portage Bay, near its head, between Three Finger Point and Peninsula Bluff. We anchored between the above points, where we were protected from the swell caused by a heavy southerly wind, and riding to a long scope of chain we found ample swinging room with 3½ fathoms at low water. Small vessels may go farther in and secure better protection by keeping well over on the southern side to avoid a ledge which uncovers at half tide. Large vessels would anchor in the open bay to the eastward of Three Finger Point or Peninsula Bluff. To enter Portage Bay take a mid-channel course. A spit making out about 300 yards from Reef Point was the only outlying danger observed.

A reconnoissance of Albatross Anchorage and adjacent portion of Portage Bay was made by the officers of this vessel. The position of the north extremity of Three Finger Point, by observations with artificial horizon, was found to be latitude 53° 34′ 40″ N., longitude 160° 38′ 16″ W., H. W. F. & C., $0^h$ $13^m$, approximate; rise and fall, about 8 feet. The names of points correspond with those of our chart of the anchorage.

Getting under way at 1.50 p. m., September 12, we steamed through Gorman Straits, and thence for the south coast of Kadiak.

The existence of Scotland Rock in the position assigned it on the charts has been questioned, and while we can not confirm its existence or location with certainty, we saw a small conical rock about 10 feet in

height, a little open of the west tangent of Karpa Island when the latter bore NW. ½ N. (mag.) 11 miles distant.

The Semidi Islands were sighted at daylight on the morning of September 13, and half an hour later Chirikof became visible. The accuracy of the delineation of this island on the charts has been doubted by so many navigators that we took the opportunity to verify it by steaming along its south and east shores and taking angles on prominent points until we satisfied ourselves that it was laid down practically correct. The diverse opinions regarding the platting of this island may be accounted for from the fact that passing vessels lay a course to clear its southern extremity, which is high, and this carries them so far from the long, low northern extension that they do not see it even in clear weather.

The Trinity Islands were sighted at 3 p. m., and at 8 a. m. the following morning, September 14, we took a departure from Ugak Island and steamed offshore to intersect a rhumb line from Cape Greville to Cape Edgecumbe, for the purpose of running a line of soundings between those points, this course having been decided upon after a conference with Captain Ludlow and at his request, which was based upon the following experience of the U. S. S. *Mohican* while en route from Sitka to Kadiak:

At meridian, June 21, 1893, she was in latitude 57° 16′ N., longitude 143° 11′ W., with clear, pleasant weather, and after running 10.4 miles WSW. ½ W. (mag.) was found to be in discolored water, with quantities of seaweed and floating kelp; and although 160 miles from the coast, appearances were so suspicious that they commenced sounding, but found no bottom at 100 fathoms. Similar reports have been made of discolored water, drifting kelp, etc., in various localities of the Gulf of Alaska by sealers, whalers, and others, casting suspicion over the region, which could be removed only by sounding; and as the *Albatross* was the only vessel in the fleet having the necessary appliances, the senior officer considered it advisable for us to make the examination.

The first sounding of the series was made at 5.55 p. m., September 14, in 838 fathoms, rocky bottom, latitude 57° 24′ N., longitude 149° 33′ W., and the maximum depth, 2,741 fathoms, was found in latitude 57° 14′ N., longitude 148° 06′ W., in the great submarine depression lying south of the Aleutian Chain and the Peninsula of Alaska. A depth of 2,099 fathoms was found in 57° 20′ N., 143° 26′ W., where the *Mohican* encountered discolored water. The line developed a great basin with no indications of shoaling water except at the terminals.

In reporting the operations of the *Albatross* it is the intention to confine ourselves generally to a simple statement of facts; yet it may not be out of place in this instance to call attention to similar phenomena in other seas as a possible explanation of the appearance of discolored water in various parts of the Gulf of Alaska.

On the Atlantic and Gulf coasts of the United States patches of discolored water have frequently been encountered many miles at sea

off the mouths of the great rivers. Discolored water and soundings of 52, 64, and 66 fathoms were reported between 5° 00′ N. and 5° 12′ N. and longitude 46° 43′ W. off the Amazon River, yet a cast of the lead in 5° 01′ N., 46° 44′ W., developed a depth of 1,876 fathoms. In the China Sea, off the great rivers, patches of discolored water are of frequent occurrence, and I have a vivid recollection of the anxiety their unexpected appearance caused me during my early cruising in those waters.

The Gulf of Alaska receives the drainage of the greatest glacial system in the United States, if not in the world; its waters reach the sea icy cold and ladened with mud, heavier than the warmer waters of the gulf, hence they find their way seaward in the great system of ocean circulation as submarine currents, until by gradual precipitation of glacial mud and increase of temperature the relative specific gravity is reversed and they appear on the surface in patches of discolored water.

Strong westerly winds and rough seas were encountered on the 15th, which interfered somewhat with the work of sounding, but moderate to smooth weather followed until our arrival in Sitka at 1.30 p. m. September 17. Leaving Sitka at 2.30 p. m. September 18, we entered Goletas Channel at 2.30 a. m. on the 21st, after a smooth and uneventful run; reached Seymour Narrows at 5.30 p. m., two hours after high water, and encountered an adverse current of about 9 knots per hour, with the swirls and whirlpools incident to the narrow and intricate pass. Its full strength was not felt until we reached the southern entrance, and being under one boiler and not particularly good fires we were barely able to hold our own for the few minutes required to raise sufficient steam to send us through. We anchored for the night near Oyster Bay, reached Union Bay at 9.30 the following morning, took on board 145 tons of Comox coal, and at 8.35 a. m. September 23 left for Port Townsend, arriving at 12.54 a. m. on the 24th.

We were detained at the latter port until 8.36 a. m. on the 26th, when we left for San Francisco, arriving at 12.15 a. m. September 30, and at Mare Island at 2.15 p. m.

Ensign Houston Eldredge, United States Navy, reported for duty October 17; Ensign E. A. Anderson, United States Navy, was detached on the 19th, and Ensign H. B. Wilson, United States Navy, on the 20th.

Passed Assistant Surgeon E. S. Bogert, jr., United States Navy, was ordered to take charge of the medical department of this vessel, in addition to his duties on board the *Boston*, on October 30, and having been finally detached from that vessel, he reported for duty November 4, relieving Passed Assistant Surgeon T. A. Berryhill, United States Navy, who was detached October 31. Passed Assistant Engineer A. M. Hunt, United States Navy, was detached on the 8th, Passed Assistant Engineer Howard Gage, United States Navy, being ordered to take charge of the engineer's department in addition to his duties on board the U. S. S. *Monterey*, to which vessel he was attached.

We are greatly indebted to Mr. Hunt for intelligent and faithful service during the time he was attached to the *Albatross*. He superintended the installation of new boilers, the general and thorough overhauling of machinery, and designed new propellers, which have given great satisfaction. He took an active interest in the work of the vessel, and was always ready to forward it in every possible way.

W. R. Rush, lieutenant junior grade, reported for duty November 6, and on the same day Mr. A. B. Alexander was ordered to special duty in connection with statistical investigations concerning the acclimated fishes of the Pacific Coast.

I was sent to the United States naval hospital at Mare Island on November 10 for treatment, having been taken with grippe October 17; I finally returned to the vessel December 9.

Ensign Philip Williams, United States Navy, reported for duty November 15, and on the following day Ensign C. F. Hughes, United States Navy, was detached.

Lieut. W. R. Rush, United States Navy, was detached December 15.

Passed Assistant Engineer Howard Gage, United States Navy, reported for duty in charge of the machinery on the 23d, having been detached from the *Monterey*.

The vessel was ready for sea on December 31, and sailed for San Diego January 2, 1894, arriving on the evening of the 4th, after a boisterous trip.

About the 1st of March, 1894, numerous articles appeared in the newspapers concerning an unprecedented destruction of fish life along the southern California coast, and particularly in the vicinity of Santa Monica and Redondo Beach. Thinking the matter worthy of attention, I directed Mr. N. B. Miller to take passage on board the steamship *Santa Rosa* on March 3, prepared to make an exhaustive investigation and preserve a sufficient number of specimens for future examination. He returned on the 6th and submitted the following report:

On the 25th of February an article appeared in the San Francisco *Examiner*, stating that all sorts of rumors were afloat to account for the great numbers of dead fish that had been coming ashore during the previous week, and that the line of fish extended from Santa Barbara to San Diego.

I commenced an investigation by going on board the different vessels as they arrived at this port from either the north or south. The schooner *Jessie D.* arrived on February 28 from Cerros Island. Captain Hardwick reported that between Point San Tomas and San Diego he passed through large numbers of fish swimming near the surface, and apparently going south; the greatest numbers of fish were seen at night, and he was unable to recognize any but barracuda; he thinks, however, there were other fish among them. The schooner *Excelsior* arrived the same day from San Pedro, and reported that no dead fish were to be seen on the surface of the water between that port and San Diego, but great numbers were observed on the beaches at Santa Monica, Redondo, and Newport. Captain Alexander, of the steamer *Santa Rosa*, reported the same facts, and suggested Redondo as the best place to make an investigation. The fishermen of San Diego have found no dead fish either at Point Loma or on the beach in False Bay.

In obedience to your order of March 3, I took passage on the steamer *Santa Rosa* the same day, arriving in Redondo Sunday morning, March 4. I commenced as soon as possible to get at the facts by personal observation, and obtained also the ideas of fishermen as to the cause of the destruction of such great numbers of fish. Some of the fishermen at first thought that giant powder had been used, as there had been heard a number of loud explosions offshore a short time before the dead fish were seen on the surface; others claimed to have seen the water spout up into the air. After an investigation it was found that none of the fishermen were out at the time, as the water was then too rough for fishing with safety.

The first appearance of these fish was on the 24th of February, and for the first two or three days very few were seen, but on the 28th thousands of fish appeared on the surface of the water, both dead and alive; the live ones appeared to be unable to keep below the surface, or were trying to avoid deep water; those that got too near the shore in shallow water were thrown upon the beach. Most of the dead ones were carried out to sea by currents, and were probably eaten by gulls, as not a gull has been seen along the shore since the first fish made their appearance.

I examined the beach for several miles at Redondo, and found barracuda, flatfish, sardines, whitefish, red rockfish, anchovies, sea bass, and yellow-fins; the most numerous of the large fish were barracuda and flatfish. In the distance of half a mile I counted 168 flatfish and 225 barracuda, and in the same distance were a thousand or more sardines and other small species. I secured a number of specimens of sardines, anchovies, and red rockfish alive as they were thrown upon the beach by the surf. At this date, March 4, very few fish of any kind were to be seen on the surface, and no dead ones. I also succeeded in getting some fine specimens of barracuda and flatfish alive.

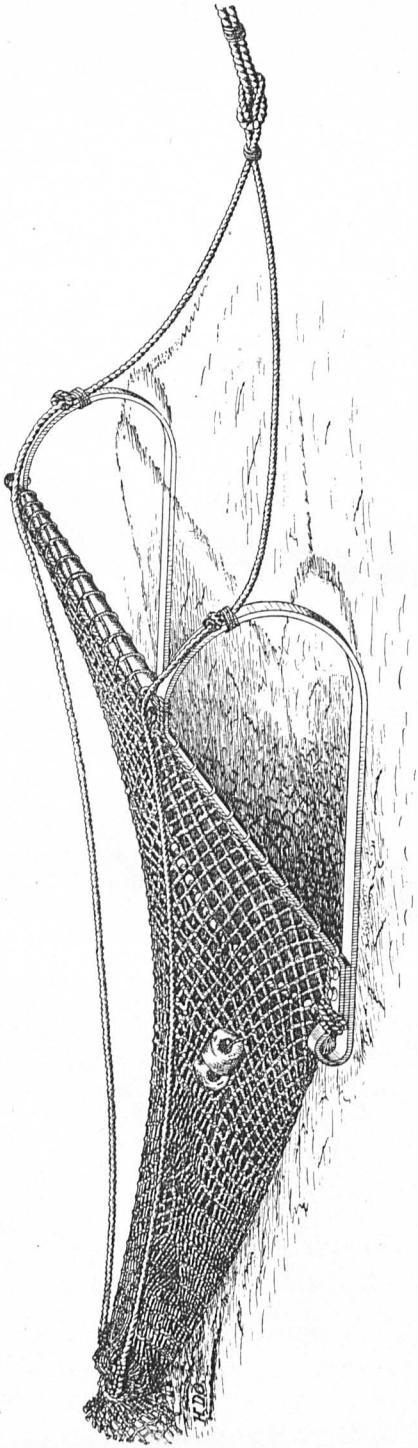
I examined very carefully a large number of fish, both living and dead; in every case the stomach of the fish was empty, and those that were thrown upon the beach dead had their gall bladders ruptured. The gills of the live ones were natural in color, but had patches of yellow slime attached to them which had a strong odor of petroleum. These fish are being used for food on the steamers and at the hotels, and also shipped to Los Angeles for the market, but no bad effects have as yet been reported from eating them.

Of course, such an unusual occurrence caused great excitement among the fishermen. Mr. E. P. Maxey, of Redondo, states that he was born on the coast of southern California and has been a fisherman most of his life, and that nothing of the kind has ever happened before.

It is an established fact that there are oil springs all along the southern California coast, in from 2 to 700 feet of water, and from 1 to 10 miles from shore; and, as new springs have occurred in localities where they have never before been seen, and at the same time that the fish first appeared on the surface, the only explanation probable is that some seismic disturbance has taken place in the ocean not far from the mainland which has caused new springs to burst forth, throwing out an unusual amount of oil and gas, and that one or more of these springs have appeared on the banks or feeding grounds of the fish. The fish in the immediate neighborhood of these springs were probably killed by the explosion; those farther away were doubtless stunned or affected by the escaping oil and gas, which caused them to come to the surface, and from the effects of which it took them several days to recover.

On March 5 I visited Santa Monica, but found very few fish on the beach, and none floating on the surface. On the return trip to San Diego I kept a careful lookout for floating fish, but saw none.

A scientific examination of San Diego Bay was commenced by Mr. Miller on the 23d of February and completed March 25. The beaches were examined with a seine; then the boat dredge and oyster tongs



BOAT BEAM TRAWL.

were brought into requisition, followed finally by a boat beam trawl which was devised for and first used on this work. The results of the investigation will be found in the records submitted by Mr. Miller, copies of which are hereto appended.

The boat beam trawl was found so eminently successful that it seems to be worthy of special notice. It may be described as follows (see Pl. I):

Beam: Iron pipe; length, 3 feet 6 inches; diameter, outside, 1¼ inches.

Runners: Size of iron, 1½ by ¼ inch, flat bar; length, 2 feet 7 inches; height, 1 foot 1 inch.

Net: Length, 7 feet; mesh, 2 inches; jacket, ½-inch mesh; jacket length, 2½ feet.

The bridles, of 9-thread manila, were seized to the front of runner with three turns of seine twine and the ends lashed in with the tail lashing, the intention being that the bridle stops shall part in case of fouling the bottom and allow the net to come up tail first.

We left the harbor of San Diego at 4 p. m., March 27, and reached Mare Island at 10.50 a. m. on the 30th, after a smooth, foggy trip. The *Albatross* was docked from March 31 to April 5. Messrs. C. H. Townsend and A. B. Alexander left for the Puget Sound region by rail on the 8th, to prosecute Fish Commission work in advance of the arrival of the *Albatross*.

On April 11, by direction of the Commissioner of Fish and Fisheries, I reported by telegram to the Secretary of the Navy for assignment to duty in connection with patrol service in Bering Sea during the approaching season, and on the 13th I received instructions from the latter to proceed with the *Albatross*, when ready for service, to Port Townsend, Wash., and there to report to Commander Clark, U. S. N., in command of the Bering Sea squadron. Leaving Mare Island navy-yard on the 14th, Port Townsend was reached on the 19th.

Ensign W. R. Shoemaker, U. S. N., reported for duty on the 29th, and Lieut. Commander F. J. Drake, U. S. N., detailed as my relief, visited the ship.

On April 30, with the permission of the senior officer, got under way at 9 a. m. and steamed out into the Straits of Fuca for the purpose of showing to Lieut. Commander Drake the various apparatus and methods employed in the process of submarine exploration. Returning, we anchored in Port Townsend again at 5 p. m.

At 1 p. m., May 1, I was relieved of the command of the *Albatross* by Lieut. Commander F. J. Drake, U. S. N., who assumed command. I signed the log book, and took receipts from Captain Drake for the vessel's outfit, stores, and equipment, forwarding the latter at once to the Fish Commission. I left the ship at 6 p. m. en route for my home.

## OPERATIONS FROM MAY 1 TO JUNE 30, 1894.

By Lieutenant-Commander F. J. DRAKE, U. S. N., Commanding.

On April 19, 1894, while on duty at the navy-yard, Norfolk, Va., I received orders from the Secretary of the Navy to proceed to Port Townsend, Wash., and take command of the United States Fish Commission steamer *Albatross*, relieving Commander Z. L. Tanner, United States Navy.

I reported to the Commissioner of Fish and Fisheries at Washington, D. C., on the 21st of April, left Washington on the 22d for Port Townsend, and arrived on the 28th, when I reported on board the U. S. S. *Mohican* to Commander C. E. Clark, United States Navy, commander in chief of the United States naval force in Bering Sea.

On Tuesday, May 1, at 1 p. m., a thorough inspection of the vessel was made by Commander Tanner and myself, previous to the transfer of command. All hands were then mustered aft. The usual reading of orders being concluded, Commander Z. L. Tanner turned over the ship and her crew to Lieut. Commander F. J. Drake, who assumed command.

The *Albatross* being reported ready for sea, received instructions the same evening, May 1, to hold in readiness to proceed to Unalaska as the pioneer ship of the Bering Sea fleet.

On the 3d I sent on board the *Mohican*, flagship of the Bering Sea squadron, eleven blue prints of the chart of the eastern portion of Bering Sea, showing the work of the *Albatross* in that region. The blue prints were accompanied by a letter of instructions, giving information for additional safety in navigating those waters; this letter was also—and primarily—a request that the commander in chief issue orders to the commanding officers of the several vessels of the squadron relative to observations with regard to fur-seal life which might be made by them while engaged in patrol duty, besides furnishing each vessel with one of the blue prints. It was further requested that all data so collected be turned in to the commander in chief at the end of the season, to be collated on board the *Albatross* as a part of the information sought on that subject for the Fish Commission.

On May 5, with the permission of the commander in chief, got under way at 10.45 a. m. and stood out of Port Townsend to convey Messrs. Townsend and Alexander to Stuart, Waldron, and Lucia islands in order that they might obtain certain information from the fishermen of that region relative to the waters adjacent to the international boundary line.

At Reid Harbor, Stuart Island, but little industry in fishing was found, except for open market. A seining party in charge of Mr. Alexander made a haul at the head of the harbor with fair results. The

fishermen say that a very good trade is carried on in salmon during July and August, when they pass up Haro Strait to the westward of San Juan Island.

At Waldron Island Messrs. Townsend and Alexander visited the fishing hamlets on both sides of Sandy Point, on the west end of the island, half a dozen fishermen being interrogated. Two hauls of the seine on the beach at Cowlitz Bay and fishing trials with hand lines resulted but indifferently. Lay at anchor for the night in Cowlitz Bay, Waldron Island, and at daybreak on the 6th steamed over to Lucia Island, arriving at 7.40 a. m. Here some valuable information was obtained and photographs secured of types of fishing vessels and boats. Seining and fishing parties were sent out, and a rich and varied collection was obtained. Returning, we left Lucia Island at 11.20 for Port Townsend, where we arrived at 6 the same afternoon.

On the 10th Messrs. Townsend and Alexander left the ship to continue their work in Puget Sound and among the boundary islands.

May 16 final orders for sailing were received: Next morning at early daylight the entire fleet got under way, the *Yorktown*, *Adams*, *Alert*, and *Corwin* going out by way of the Straits of Fuca to their respective patrol stations. The *Albatross* followed the flagship *Mohican* through Haro Straits, Active Pass, and Strait of Georgia to Tribune Bay (south side of Hornby Island, British Columbia), where we anchored for the night, having made a run of 129 miles from Port Townsend.

At 9 a. m. on the 18th got under way with the *Mohican*, and stood up the Strait of Georgia and through Discovery Passage for Seymour Narrows, which we passed through at 6 p. m. at high-water slack. Continued on up Johnstone Strait to Alert Bay, Cormorant Island, where we anchored at 2 o'clock the next morning. Captain Lennan, who had been sent on board the flagship at Port Townsend to act as their pilot during the run up the inside passage, returned on board shortly after anchoring.

We were under way again at 4.10 a. m. May 19, and stood out through Goletas Channel and Queen Charlotte Sound to sea, thence shaping course for Unalaska in obedience to sealed orders to "proceed there with all dispatch, coal, and sail for Attu Island for the purpose of landing Lieutenant Jacobs, U. S. R. M., and his assistant, then to return to Unalaska; on the way back, however, to endeavor to be off the principal passages between the western groups of islands during the daytime, if possible, so as to intercept any sealers which may come from the westward with the intention of entering Bering Sea."

May 20 proved to be a pleasant day, with moderate long swell from the southwest and light head winds. A succession of thick fogs were encountered until the forenoon of the 25th, when the barometer fell rapidly and it came on to blow a gale from the northeast. At 7 p. m., having arrived off Unimak Pass, the weather being thick and the horizon so obscured that objects could not be distinguished over a

quarter of a mile, hove to for the night. At 4 a. m. May 26 filled away under steam and sail on course for Unimak Pass and arrived at Dutch Harbor at 2.24 p. m. the same day.

The season was very backward at Unalaska, signs of approaching spring not then having made their appearance. The snow line was but little above the water's edge, and no grass was visible. During our stay in port it snowed part of the time each day. The anglers who tried the streams for trout reported that they had not yet commenced to bite.

Left Dutch Harbor the morning of May 31, with overcast sky and peaks of mountains enveloped in clouds. Shaped course for Attu Island, with vessel under full steam power. During the passage over the weather was pleasant, with occasional passing showers. A smooth sea with light westerly swell favored a quick passage, which was made without delay in 78 hours, arriving in Chichagof Harbor on June 4. Lieutenant Jacobs was landed the same day.

Hunting, seining, and collecting parties were dispatched on shore to gather such specimens as would best illustrate the commercial value of this island. As far as any trade is concerned, the few inhabitants of the village at the head of Chichagof Harbor, numbering 23 men, 48 women, and about 30 children, have apparently relapsed into a state of apathy from which only the advent of the company's steamer with supplies or the arrival of a vessel like the *Albatross* will arouse them. Game of any description is scarce at this season of the year, and only a few minor fox skins and straw baskets were offered in trade for plug tobacco, which evidently was in great demand. Seven frame houses, a thatched church built from driftwood, and a dozen or more mud huts constitute the village. I found that for three months—March, April, and May—these people had been subsisting on fish, all other provisions having been consumed. In consequence of their dilapidated condition and want of necessary supplies, I had issued from the paymaster's department, 10 pounds of tea, 50 pounds of sugar, and 105 pounds of sea biscuit, which was served out in equal shares to each family. These articles I deemed sufficient to sustain them until the arrival of the Alaska Commercial Company's supply steamer, which was not expected for some time.

Three hauls of the seine on the beach near one of the fresh-water streams on the south side of the bay yielded 300 salmon, 500 flounders, and 100 rock trout, with other minor species. Several Atka mackerel were caught from the ship's side. The natives here report that cod banks exist off the entrance to this harbor, where they make good catches in 50 to 60 fathoms, with sand and broken-shell bottom. Atka mackerel are also caught inshore on the south side of the harbor entrance in 20 to 30 fathoms, rocky bottom, and close to the ledges of outlying islets which form a barrier to the approach to the shore in this locality.

Tuesday morning, the 5th of June, got under way and steamed over to Agattu Island, about 30 miles SSE. (mag.) from Attu, to an entirely new field of investigation. Stood in and anchored in a broad, open bay on the eastern end of the island in 16 fathoms, sand and gravel. Sent seining, hunting, and fishing parties ashore in charge of Messrs. Townsend and Miller, and made fishing trials over the side, catching many cod and a few mackerel.

Little hydrographic work has been done around this island and, from the soundings taken when running in, this end appears to have a gradually sloping platform extending off 6 miles or more, which I should have developed, instead of making a reconnaissance, which was done by the officers on the afternoon of the 5th, had time permitted. At 6 miles it shows an average depth of 35 fathoms, gray sand and broken shells, which may extend well to the eastward and be a future field of examination. I have named this place McDonald Bay, in honor of the United States Commissioner of Fish and Fisheries.

On the morning of the 6th sent seining and fishing parties on shore with Mr. Townsend; weather thick, and blowing fresh from the southward. Ran a line of soundings out 6 miles over the platform to the eastward of Agattu; found the bottom irregular and studded with rocky patches, changing the soundings abruptly 8 to 10 fathoms. Therefore I deferred dredging in consequence of the probable loss of any apparatus sent to the bottom, and accordingly shaped a course due east (mag.) for the island of Kiska, on the Bering Sea side of this chain of islands. The conditions of weather were such as to make it impossible, with our limited time, to investigate more fully the banks to the eastward of Attu. This will have to remain for future work. The seining and fishing parties sent out at Agattu had negative results; but better conditions were looked for near Kiska, on the northeast side of the island.

With a strong westerly wind, the weather remained thick and foggy. This, in connection with the variable currents near these islands, would make the location of any platform suitable for dredging more or less doubtful. Had the weather remained pleasant for one or two days, I should have been able to have accomplished some good results, which would probably have been of interest to the Fish Commission. With unlimited time at this season of the year, I can readily see that a thorough examination of the platforms along these islands and in the several passes would undoubtedly open up a new field which would be productive of good results.

June 7, at 2 p. m., ran in and anchored in Kiska Harbor, on the east side of Kiska Island. Sent seining, fishing, and hunting parties on shore. Some salmon and trout were caught in a lake at the head of the bay. A few ptarmigan, ducks, and geese were secured by the hunters. Very little game appears to occur in this vicinity. The weather changed rapidly during the night to a stiff SE. blow, with rain, which drove in a dense fog, shutting out the land. On the 8th

it was foggy and rainy, with the wind moderating. Got under way and steamed off the NE. entrance to Kiska Harbor, and made a successful haul of the dredge in 35 fathoms, sandy bottom. A few specimens of fish, shells, sponges, etc., were obtained. Compelled to suspend operations for the day on account of heavy fog, we returned to anchorage in Kiska Bay. We were under way again at 9 a. m. June 9, and stood out of Kiska in a dense fog. Put over the dredge in 55 fathoms and made a successful haul. Several varieties of sponges, corals, a few fish, serpent starfish, etc., were obtained. Fishing trials from the ship and boats did not prove to be successful in the vicinity of this bay and entrance to harbor.

Shaped course for Atka, passing to the northward of Chugal and Khwostof islands. Arrived at Nazan Bay, Atka Island, the forenoon of June 10. Sent out seining, fishing, and hunting parties; very few fish were caught by any of the parties. From questioning the natives who fish around the islands, both at Attu and Atka, it appears that the Atka mackerel are caught on rocky ledges covered with kelp at Attu, near the entrance on the south shore of Chichagof Harbor, in 6 to 10 fathoms of water. It also appears from the statements made by the Aleuts that the Atka mackerel is fished principally on the side of ledges and islands where the tide runs strongest. Both spear and line are used.

Left Atka at 6 p. m. June 10 for Unalaska, passing to northward of intervening islands, and arrived in Dutch Harbor at 2 a. m. on the 12th.

During the forenoon of the 12th a whaleboat arrived in the harbor containing nine survivors of the whaling bark *James Allen*, which had been wrecked on the Agladak Reefs, east end of Amlia Island. The boat contained Captain Huntley and eight men, who had managed to reach this port in 32 days by coasting along the chain of islands. The bark was wrecked on the 11th of May, about 2.30 a. m., in attempting to pass into Bering Sea by the Seguam Pass. As the boat entered the harbor it was met by the steam launch of the *Bear*, then returning from Iliuliuk. From an interview held on board the *Bear* with the survivors, at which I was present, it was learned that the crew numbered fifty, all told. Five boats were lowered, and four got away from the wreck, the fifth boat being stove alongside. Several were drowned. One boat found its way to the Alaska Commercial Companys' station at Nazan Bay, Atka Island, on the 24th of May. The nine survivors in the boat were transferred on the 2d of June by the company's steamer *Dora* to the U. S. S. *Petrel*, and eventually were landed at Dutch Harbor. The captain's boat and one other, No. 3, kept together, and landed on the 12th of May on the north side of Amlia Island near the scene of the wreck. The fourth boat, containing the first and second mates and a crew of men, parted company with the others May 11, and was last seen well to windward under sail. This boat was the only one which managed to leave the wreck with an outfit of oars, spars, sails, compass, and charts.

No provisions were saved from the wreck or taken in the boats; hence, the only food obtained consisted of mussels, seaweed, and such fish as they could devise means to catch. The captain's boat and No. 3 coasted along the chain of islands, making a landing each night except two, when they were compelled to run before a westerly gale. No. 3 boat capsized off the Islands of Four Mountains; four men were drowned, and the remainder taken in the captain's boat, making a total of 23 men. One died the next day and was buried at sea. With 22 men he landed on the north shore, west end of Umnak Island, at an old deserted settlement, where huts were found which afforded shelter. Several days were passed here in resting and repairing the remaining boat. Captain Huntley then decided to take 8 of the strongest men and push on to Unalaska for relief and rescue of those left behind. He made the passage from Umnak to Dutch Harbor in ten days, with crew and boat.

It was decided by Captain Healy and myself that he should go immediately to the rescue of the men left on Umnak Island, as he had finished coaling, and that I should follow as soon as coaled and make a careful search of the shore lines of the islands from Dutch Harbor to Nazan Bay, and especially along the north shore of Amlia, as Captain Huntley, of the wrecked bark, believed that No. 4 boat had landed on the north side of Amlia Island, and in so doing had probably stove their boat, and consequently were unable to get away.

The *Albatross* sailed on the 13th, at noon, but encountered a gale and rough sea off Cape Makushin, which prevented a successful search of the shore line being made; hence, returned to our anchorage for the night. Got under way at 5.30 a. m., June 14, and continued search along the north shore of Unalaska, working westward; anchored at night in Chernofski Harbor, west end of Unalaska Island. Left at 5.30 on the morning of the 15th and continued the search along the north shore of Umnak Island. At noon stood off shore on account of a gale, heavy sea, and thick weather, which shut in the land at a distance of a mile, preventing further search. Stood to the westward along the chain of islands and anchored in Nazan Bay at 5 a. m., the 17th, in order to ascertain if any additional information had been obtained of No. 4 boat. It was learned, however, that nothing had been heard of the missing boat; hence, the *Albatross* left Nazan Bay at 7 a. m. and made a careful search of the shore line of Amlia and Seguam islands. A heavy fog and westerly wind then setting in, prevented the further search of Amukta and the Islands of Four Mountains. The *Albatross* was accordingly headed for Unalaska, as it was concluded that nothing more could be accomplished toward finding the missing boats, under the uncertain conditions of weather then existing. The circumstances also prevented utilizing any of this search to the advantage of the Fish Commission, which is to be regretted. Arrived at Dutch Harbor the evening of the 18th.

Sailed from Dutch Harbor at 8 p. m., June 21, for the Pribilofs. Arrived at St. George Island and anchored off the village at 8 p. m., June 22. Weather cloudy, rainy, and foggy, with fresh ENE. wind. For several days previous to the arrival of the *Albatross* communication with the shore from the north anchorage had been interrupted by heavy weather. At midnight got under way for St. Paul, where the *Albatross* arrived at 5 a. m., June 23. The Treasury agents reported that the seals were late this season in arriving, especially the cows.

At St. Paul orders were received for the *Albatross* to "cruise for ten days between a line drawn from St. Paul to Cape Newenham, and another from St. Paul to Akutan Island; then return to Unalaska. To go as far to the eastward as judgment seems best." One killing of 1,200 seals had taken place from the Reef Point rookery a few days previous to our arrival; another occurred on the 23d at Zapadnie rookery, of 1,000 seals. Fresh salmon were found in the seals' stomachs at the last killing.

Information was received from otter hunters at Unalaska the day of our departure that the majority of seals were entering Bering Sea through False Pass, or Isanotski Strait, between Unimak Island and Alaska Peninsula. It was therefore concluded that some information might be brought to light relative to the migratory habits of the seal by making an examination at this period of that portion of Bering Sea included between a line drawn from Amak Island W. by N. (mag.) to a point 20 miles NE. of St. Paul, and another line from Cape Lapin, west end of Shaw Bay, W. $\frac{1}{2}$ N. (mag.) to a point 20 miles SW. of St. George Island.

Accordingly, the *Albatross* sailed from St. Paul at 7 p. m., June 23, to cruise in search of pelagic sealers and investigate the supposed channel of migration, as outlined above. A part of the 24th and 25th was spent in examining this locality. A haul of beam trawl, also surface net, was made at a distance of $1\frac{3}{4}$ miles from and across the mouth of False Pass; the usual temperatures and a specimen of bottom water were taken. The trawl was drawn for thirty minutes, the haul being successful. The principal specimens consisted of flounders, alligator-fish, starfish, hermit crabs, and sponges; bottom composed of black volcanic sand. On consultation with the naturalists it was decided that fishing trials under these conditions would not be productive of any additional information in this locality. Up to this time no seals nor sealers had been seen, although favorable sealing weather; a very marked contrast to conditions supposed to exist, from all accounts.

The run was then made to Port Moller, where we arrived June 27 at 7 a. m. Neither seals nor sealers were seen in this locality; we therefore continued on to Port Haiden, which was reached that afternoon. The weather being unsettled, accompanied by thick fog and mist, together with the late hour of the day, I did not consider it advisable to examine this locality or employ the time allotted to cruising in making

a reconnoissance of this port. Hence, a course was laid for Cape Newenham with the intention of reaching the fishing grounds in that locality, situated at the northern limit of our patrol work.

After running 50 miles from Port Haiden light field ice was encountered at midnight of the 27th in latitude 57° 34′ N., longitude 160° 10′ W. At 1 a. m. it had become so thick and floating patches of such dimensions that further continuance of the same course, WNW. (mag.), would have been dangerous to the propellers; hence the *Albatross* was put about and by careful management pushed through the ice till open water was reached at 3 a. m., having been 3 hours in the ice field. The fog was thick when the ice was encountered, and the temperature fell to 32° F., with intense humidity, which increased the chilling effect of the atmosphere, causing everything about the ship to be covered with heavy moisture, and consequently in a dripping state. A moderate breeze was blowing at the time from the southward and westward. As we emerged from the ice, a shift of wind lifted the fog, when a view of the ice field demonstrated that it was closed to the WNW. with southern limit extending a SW. by S. and an E. direction from our position as far as the distant horizon. The dimensions of several of the cakes when alongside of the *Albatross* were found to be about 3 feet out of water and from 200 to 300 feet in length, varying in width from 50 to 75 feet. It was composed principally of old shore ice and some snow ice, which had undoubtedly found its way to this part of Bristol Bay from the numerous inlets and rivers at its head. Evidently this is characteristic of a late season at the head of the bay, which will undoubtedly have its effect upon the appearance of the salmon in the Nushagak River, owing to the low temperature of the water. This will probably delay the cannery industry of this region and give their yield a late market for this season's work.

The course having been changed to SW. by S. (mag.), skirting the ice limit, the weather changed somewhat, making a fair day for this region, much above the average. In the 42 days subsequent to our departure from Queen Charlotte Sound only 5 days of partial sunshine have been experienced. The remaining days were enveloped in fog, mist, rain, and several summer gales of slight duration.

A few scattered fishing trials, with hand lines, of 30 minutes' duration each, with 13 to 15 lines down, were made, commencing in latitude 57° 58′ N., longitude 166° 04′ W., on a line drawn between St. Paul and Cape Newenham, and 134 miles from St. Paul. The line extended NE. by N. (mag.) 95 miles toward Cape Newenham, then SE. by S. (mag.) for a distance of 90 miles, and finished on a line WSW. (mag.) in latitude 56° 58′ N., longitude 163° 45′ W. Scattering specimens only of codfish and two or three flounders were taken. The bottom at the various stations was composed largely of fine gray sand; the depth varied from 21 to 44 fathoms, the bottom temperature from 32° to 35° F. Soundings were continued at intervals in this region for the purpose

of filling in between the radial lines run by the *Albatross* on July 29 and 30 and August 10, 1893.

The position at noon June 30 was latitude 56° 59′ N., longitude 163° 02′ W.

The end of the fiscal year finds the *Albatross* engaged in patrol work connected with the Bering Sea squadron and making occasional soundings for hydrographic information. The confidential orders under which the vessel is performing patrol duty prevent legitimate work in the interest of the Fish Commission. Observations in this section in the study of seal life and the collection of data relative thereto, as well as the further development of the fishery resources of this region, can not be executed by the ship and her staff with any degree of satisfaction where sudden and frequent changes of base are ordered in the patrol work assigned, which is entirely foreign to the method and manner of investigation necessary in the study of the seal and its habits.

The following is a brief summary of the movements and operations of the *Albatross* during the year:

| | No. | | No. |
|---|---|---|---|
| Days steaming and under way | 138 | Hauls of intermediate tow-net, Tanner | 13 |
| Nautical miles run by log | 17,269.1 | surface tow-net | 40 |
| Ports and anchorages made | 61 | Fishing trials, hand-line | 79 |
| Hauls of beam-trawl | 102 | Bottom temperatures taken | 236 |
| rake-dredge | 5 | Serial temperatures taken, sets | 95 |
| dredge | 12 | Water densities taken | 230 |
| mud bag | 23 | | |
| tangles | 2 | | |

The following is the list of officers and assistants June 30, 1894: Lieut. Commander F. J. Drake, United States Navy, commanding; Lieut. A. F. Fechteler, United States Navy, executive officer and navigator; Ensign Houston Eldredge, United States Navy; Ensign W. R. Shoemaker, United States Navy; Ensign C. M. Fahs, United States Navy; Ensign Philip Williams, United States Navy; Passed Assistant Surgeon E. S. Bogert, jr., United States Navy; Assistant Paymaster Eugene D. Ryan, United States Navy; Passed Assistant Engineer Howard Gage, United States Navy. Captain's clerk, Harry Clifford Fassett. C. H. Townsend, resident naturalist; A. B. Alexander, fishery expert; N. B. Miller, general assistant; Capt. James E. Lennan, seal hunter.

# REPORT OF A. B. ALEXANDER, FISHERY EXPERT.

[Abstract.]

## INSHORE INVESTIGATIONS.

On May 30, 1893, the *Albatross* stopped at Comox, Vancouver Island, while en route for Bering Sea, for the purpose of coaling. During the detention at this port the drag seine was hauled to some extent, but the shores generally about here are unsuited to the use of such nets, being rocky in most places. No fishes of economic importance were secured, but clams were found to be abundant. The latter constitute one of the principal articles of food utilized by the small tribe of Indians, numbering about 100 persons, which camps in this locality during the summer months for the purpose of laying in a supply of salmon for winter use. These fish are either smoked or dried. For smoking they are hung on lines or poles near the roof of the huts or houses, where the smoke circulates freely among them; in drying, they are thrown upon the rocks or sand and left until sufficiently cured to permit of their being packed and shipped to the winter settlement of the tribe near the town of Union, 13 miles from the coast.

Hunting is the only winter occupation of these Indians. I saw no nets of any kind at the fishing settlement, and, from such information as was obtainable, I judge that all the salmon taken here are caught by trolling. Although plentiful enough to supply the wants of the local white and Indian population, salmon are not sufficiently abundant in this locality to induce the establishment of a cannery for their preparation.

Our next stopping-place was at Pender Island, British Columbia, 77 miles north of Comox, where we anchored for the night. Several hauls of a drag seine were made upon a fine beach near at hand, but without success, the strong current which sweeps by the island possibly accounting for the absence of fish.

St. Paul, Kadiak, was reached on June 7, and shortly after anchoring a seining party proceeded to a beach about 1½ miles east of the town, where a considerable number of flounders, sculpins, and salmon trout were captured in the net. The next morning a second visit was made to the same place with the object of laying in a stock of the trout, but only a single individual was secured. A few cod taken in the seine were small and sickly in appearance, but others procured by hand lines from the ship's deck were more thrifty-looking. We also noticed several native women and boys using hand lines from the beach and taking cod of the same character as those secured in our seine, but the white inhabitants always fish for cod and other bottom species a mile or two from the islands, where the condition of the fish is excellent.

In Humboldt Harbor, Popof Island, of the Shumagin group, 150 flounders and a few small salmon were seined at the mouth of a small

creek. Two halibut, weighing 5 pounds each, were the total result of a day's fishing with hand lines at the same place. A week later (June 16) repeated hauls were made with the drag seine in Humboldt Harbor, but all kinds of fish except flounders were as scarce as they had been on the previous trial. A few cod and halibut were taken from the ship with hand lines. They were in fine condition, but too small for market.

Seining was subsequently carried on at Northeast Harbor, Sandy Cove, and Yukon Harbor, of the Shumagin group, the two former being on Little Koniushi Island, the latter on Big Koniushi Island. Cod were plentiful at Sandy Cove, 50 being secured in a short space of time. Their range in weight was from 4 to 16½ pounds, the average weight being 7½ pounds. At Northeast and Yukon harbors only a few flounders were obtained, the beaches being composed of large stones and affording few places where the seine could be hauled.

Mist Harbor, Nagai Island, is one of the finest harbors in the Shumagin group for the establishment of a fishing station for cod, being entirely landlocked and of sufficient size to accommodate a large fleet of fishing vessels. The water is everywhere deep, over 20 fathoms occurring within an eighth of a mile of the shore at the entrance, and it is also very clear, the bottom being visible to a considerable depth. The fishing trials were, however, poorly rewarded, and the shores near the water's edge were observed to be almost entirely barren of animal life. The drag seine was employed in all parts of the harbor. One salmon was seen to jump at the mouth of a small mountain stream, but repeated hauls failed to secure us a single specimen. Later in the season the salmon probably strike in here in considerable numbers. Late in the day, by the use of a couple of hand lines off a rocky point not far from the ship's anchorage, I succeeded in catching a couple of cod weighing 3 pounds each, and it is possible that this species may enter the harbor abundantly at some other season.

The following morning a visit was paid to a small lake on the island about a mile from the entrance to the harbor, where over 20 small trout and a large quantity of sticklebacks were obtained by seining.

Sanborn Harbor, on the west side of Nagai Island, is well sheltered and offers many advantages for a fishing station. The drag seine was hauled there in many places and there were secured large numbers of two species of flounders, 6 adult salmon, besides many young salmon about 2 inches long, 8 salmon trout, and a dozen sculpins.

Collections were also made in a small lake adjacent to the harbor, which at one time was connected with the sea, but now has its outlet entirely cut off by a dam of rocks and wood built by fishermen. Its water, formerly salt or brackish, has become perfectly fresh, but in addition to several hundred small trout our seining catch consisted of a large number of starry flounders and a few tomcod. Neither the condition nor quality of the flounders appeared to have suffered from their presence in the fresh water, and they were eaten on board the ship.

Four visits were paid to Unalaska during the season, and more or less collecting was done at each. On June 28 the drag seine was hauled several times along the beach or spit which forms Dutch Harbor, but only 2 flounders and 4 sea trout were thus obtained. This beach has never afforded good results in previous trials; in most places it makes off very abruptly, and the bottom is nearly devoid of such life as attracts flounders and other food-fishes. Clams are fairly abundant, and at low tide the crews of whalers, men-of-war, and other vessels may frequently be seen collecting them.

On July 18 a party from the *Albatross*, in company with one from the whaling bark *Stamboul*, made a seining trip to Glacier Bay, about 7½ miles from Dutch Harbor, for the purpose of obtaining a supply of salmon. A whaleboat belonging to the latter ship was used for the trip, and three hauls of the large seine sufficed to fill it comfortably full with dressed fish. The next day a sufficient quantity was taken in the same place to supply the wants of four other whalers anchored in the harbor.

Before leaving Unalaska on this trip three-fourths of a barrel of clams, 80 starry flounders, and several hundred small trout were secured for transplanting to St. Paul Island, the fishes being intended for the lakes on that island and the clams for the muddy flats of a lagoon a short distance from the settlement. Starry flounders had always been quite abundant at Unalaska, but on this occasion we were unable to obtain more than 2 individuals after repeated hauls of the seine in several parts of the harbor. A visit was then paid to a fresh-water lake at Summer Bay, at the southern entrance to Unalaska Harbor, for the purpose of procuring the trout, but to our surprise many starry flounders were taken with them in the seine. The sea water does not approach nearer than one-third of a mile from the mouth of the lake, and no salt water ever enters it, but a rapid stream flows from the lake to the sea. The natives set nets for salmon across the stream during July and a part of August. It would, therefore, appear that the flounders must ascend the stream to the lake.

During the second week in August salmon and herring were the only fishes obtained by us in Unalaska Harbor, and neither of these species was then abundant. Herring strike this part of the island every season, generally by the 1st of August. They are then found close inshore in considerable numbers, but the writer has never seen them schooling, nor has he been able to learn that they do so. It is probable that they spawn in the spring about the same time that they do in southeastern Alaska.

Between the 4th and the 8th of September seine hauls were made in Summer Bay, but without success. Trout were numerous in the adjacent lake, and many were captured both by seining and by hook and line. Young salmon were also abundant.

Four days in the first part of July were spent at the Bay of Waterfalls, Adak Island. Salt-water fishes were not abundant, but trout

were numerous in the lakes and in the streams flowing from them. A few flounders and sculpins were the only species taken in the seine the first day. The following day a 40-foot seine was hauled in two of the lakes near the shore, resulting in the capture of trout and sticklebacks only. Quite a number of young salmon were caught at the mouth of a small stream which rushes down the side of a steep hill, but no salmon were found elsewhere in the bay, possibly due to the fact that on this side of the island there are no streams large enough for the ascent of these fishes.

The water at the mouth of the harbor is very deep. A cod trawl, baited with salt salmon, was set in 40 fathoms near the eastern side of the entrance, and was allowed to remain down seven hours. At the end of that time the catch consisted of 1 halibut weighing 10 pounds, 3 skates, 4 sculpins, and 3 starfish, this result not indicating a rich fishing bottom in that locality. One Atka mackerel, the only specimen secured here, was taken on a hand line from the ship's rail. It is possible that this species becomes abundant about the island at the proper season, especially in view of its proximity to Atka Island, where they occur in immense numbers.

On July 5 the ship anchored in Chapel Cove, a short distance from the previous locality. At this place the shore is mostly rocky, and only a few beaches were found where the seine could be employed. Two sea trout, and a quantity of young cod, from 2 to 3½ inches long, were the only fish secured by this means, and nothing was obtained by the use of hand lines from the ship.

### OFFSHORE INVESTIGATIONS, BERING SEA.

The first fishing trial with hand lines in the open waters of Bering Sea was made at dredging station[1] No. 3484, latitude 57° 18′ N., longitude 171° 54′ W., 60 fathoms, where 5 cod were taken on muddy bottom. They ranged in weight from 13 to 22 pounds, and were in good condition, showing no signs of disease, as frequently happens among the cod caught on the inshore grounds. At station No. 3485, latitude 57° 18′ N., longitude 172° 34′ W., 62 fathoms, one cod weighing 12 pounds and one large flounder (*Astherestes stomias*) were obtained by the same means. At the latter station the beam trawl brought up a large quantity of Alaskan pollock.

No trials with hand lines were made on either the 13th or 14th, but at station No. 3489, latitude 57° N., longitude 173° 44′ W., 184 fathoms, a small cod was captured in the beam trawl. A cod trawl was baited on the morning of the 13th, but no suitable bottom being found during these two days, it was finally set on the 15th off the village at St. George Island, but nothing was taken.

[1] There are two series of stations made by the *Albatross*, namely, dredging station and sounding station. The former are simply designated as "station," the latter as "hyd. station."

On July 17 seven hauls were made with the beam trawl in depths of 41 to 688 fathoms. At the first station, No. 3496, latitude 56° 32′ N., longitude 169° 45′ W., 41 fathoms, the catch consisted of sponges, small pieces of coral, a few shrimps, 7 sculpins, and 2 flounders, but nothing was secured on the hand lines, which were kept down twenty minutes. At stations Nos. 3497 and 3498, 86 and 142 fathoms, the same character of bottom was found to exist. At station No. 3500, latitude 56° 02′ N., longitude 169° 30′ W., 121 fathoms, the beam trawl gave indications of a rich bottom, the catch including sponges, hermit crabs, 3 sculpins, 12 red rockfish, 4 flounders, 1 cod, and several species of small fishes. Two subsequent hauls, made later in the day, were in too deep water for the capture of edible fishes.

Leaving St. Paul Island in the morning of July 28, fishing trials were made as follows during the day: Hand lines were used for ten minutes at station No. 3503, latitude 57° 06′ 15″ N., longitude 170° 11′ W., 17 fathoms, mud and fine sand, without taking any fishes. The same results were obtained at hyd. station No 3307, latitude 57° 03′ N., longitude 169° 54′ W., 35 fathoms, fine sand; and at station No. 3504, latitude 56° 57′ N., longitude 169° 27′ W., 34 fathoms, fine sand. The beam trawl used at the latter station brought up a large variety of animal life, but the only edible fishes were 4 flounders. The hand lines were again unsuccessful at hydrographic station No. 3308, latitude 57° 03′ N., longitude 168° 52′ W., 43 fathoms, sand and shells; and at station No. 3505, latitude 57° 09′ N., longitude 168° 17′ W., 44 fathoms, fine sand.

The only cod taken during the day was a single specimen captured in the beam trawl at the last mentioned station. This failure to take any cod with the hand lines during the day was doubtless due to the rapid drifting of the ship, caused by the prevalence of a strong breeze. The bottom over which we passed is considered good fishing ground early in the spring and late in the fall, previous to the appearance of the seals and after their departure. It has been the general experience of fishermen to find cod scarce about the Pribilof Islands during the summer months. In November and until the ice prevents making trips to the west grounds, the natives of both St. George and St. Paul have no difficulty in catching all the cod required for their use.

On July 29 six trials with hand lines were made, resulting in the capture of 47 cod and 1 flounder. The best fishing for the day was obtained at hyd. station No. 3312, latitude 57° 38′ N., longitude 165° 20′ W., 35 fathoms, where 17 cod were taken. Their average weight was 7½ pounds and their average length 26⅛ inches. The next best results were secured at station No. 3507, latitude 57° 43′ N., longitude 164° 42′ W., 31 fathoms, 14 cod being caught in a drift of only twelve minutes. They averaged 8¼ pounds in weight and 26¾ inches in length. The beam trawl at this station brought up mollusks, crabs, starfish, flounders, etc. These trials indicated a rich bottom and a good fishing ground, the depth of water also being convenient for fishing

operations. Ten cod were subsequently obtained at station No. 3508, latitude 58° 33′ N., longitude 164° 49′ W., 23 fathoms, the beam trawl hauled at the same place yielding mollusks, crabs, shrimps, starfish, and small fishes.

On July 31 two hand-line trials were made, but without success. One was at hydrographic station No. 3322, latitude 57° 10′ N., longitude 169° 05′ W., 42 fathoms; the other at station No. 3509, latitude 57° N., longitude 169° 43′ W., 35 fathoms. The failure to take cod at these two places occasioned no surprise, as they were too close to the Pribilof Island to make it probable that cod were at all abundant there.

A line of fishing and dredging stations was commenced on August 1, in 27 fathoms, 5 miles NE. ½ E. of Walrus Island, of the Pribilof group, being carried thence north (magnetic). At the first station the beam trawl brought up large quantities of the common sand-dollar (flat sea-urchin), many mollusks, and a few small crabs, but nothing was taken on the hand lines, five of which were kept down fifteen minutes. Four more stations were made during the day, 20 miles apart, but at none of them did the trial with hand lines prove successful. At most of these positions, moreover, the beam trawl showed little evidence of a rich bottom, such as would be expected to attract fishes, although it is reported that cod have been found abundant in a part of the region crossed by the line of investigations. At station No. 3513, latitude 58° 27′ N., longitude 169° 01′ W., 35 fathoms, 2 large flounders, a number of Alaskan pollock, and a bushel of crabs were captured in the beam trawl.

On August 2 five fishing and dredging stations were made and six cod were obtained, one having come up in the beam trawl. The first trial, at which one cod was secured on the hand lines, was in 13 fathoms, Northwest Cape of Nunivak Island, bearing NNE. ½ E., 19 miles distant. The next successful trial as regards the capture of cod was at station No. 3517, 24 fathoms, Northwest Cape bearing E. ¼ N., 51 miles distant. Four specimens were taken here. In this locality it is possible that a vessel anchoring for a short time would be able to toll a school of cod by the bait which naturally falls from the hooks. During the night the ship worked in the direction of St. Matthew Island.

Early the following morning, August 3, hand-line fishing was begun at hydrographic station No. 3348, latitude 60° 24′ N., longitude 170° 48′ W., 35 fathoms, and was continued later at a second station 21 miles NE. by E. ½ E. of Pinnacle Island. At both of those positions and at most of the sounding stations made in the vicinity of St. Matthew Island the bottom was found to consist of mud, and no fishes were captured on the hooks. Cod are known to occur in that locality, however, and halibut may also frequent the same waters, but it is not probable that either of these species is sufficiently abundant there to afford a profitable fishery. From the station last mentioned fishing trials and dredge hauls were made at intervals of 20 miles in a SSE. course in depths of

29 to 41 fathoms, the bottom continuing to consist largely of mud until we approached the Island of St. Paul, when more or less sand and pebbles were found. The only fish taken on the hand lines were three Alaskan pollock, a species frequently found on muddy bottom.

On the morning of August 5 a line of observations was commenced off St. Paul Island, extending in a NW. ½ W. direction from that island, the stations, as in previous days, being mostly 20 miles apart. Trials with hand lines were made at six different positions, beginning at hydrographic station No. 3353, latitude 57° 24′ N., longitude 170° 24′ W., and ending at station No. 3529, latitude 58° 36′ N., longitude 172° 24′ W. No fish were taken near the Pribilof Islands. The first cod, a single specimen, was caught at station No. 3527, latitude 57° 48′ N., longitude 171° 21′ W., 52 fathoms. The best fishing for the day was obtained at station No. 3528, latitude 58° 19′ N., longitude 172° 02′ W., 55 fathoms, the catch consisting of 4 cod, averaging 13¾ pounds in weight and 29¼ inches in length. The bottom of both of those stations was composed of mud, and the indications were not favorable to good fishing. During the day over 70 fur seals were seen, the first observed this season at a distance from the Pribilof Islands.

On the following day (August 6) hand lines were tried at four positions and cod were taken at two of them, only one at each, in depths of 57 and 59 fathoms, muddy bottom (hydrographic station No. 3357, latitude 59° 24′ N., longitude 173° 31′ W.; station No. 3531, latitude 59° 55′ N., longitude 174° 17′ W.). On August 7 the ship ran back to St. Paul Island on a S. by E. course from hydrographic station No. 3362, latitude 57° 41′ N., longitude 174° 05′ W., 77 fathoms, frequent trials being made for bottom fish, but without success.

During August 9 a course was run E. ½ S. from St. Paul Island, 10 cod being taken on the hand lines at six stations, the small number secured in this direction being explained by the fact that we were cruising over a common feeding ground of the fur seals.

Amak Island was sighted the next morning. Hand lines were put over at two stations, seventeen minutes being given to each trial, and the result at each being five cod. The sea was smooth and a light breeze blowing. This was in the region where cod are known to be plentiful, and had the forenoon been entirely given over to fishing a catch of 100 or more fish might have been expected. I have heard that the vessels which resorted to the cod banks of Bristol Bay in 1892 obtained better fares than ever before. The fish were also much larger and in better condition.

From Amak Island the ship proceeded to Shaw Bay, Unimak Island, and thence to Dutch Harbor and Chernofski Harbor, Unalaska. On August 17 hand lines were tried for nineteen minutes a short distance off the mouth of the latter harbor, in 43 fathoms, Western Head bearing S. ⅜ W. The weather was calm, the sea smooth, and the ship lay nearly stationary, but only one cod was captured. The bait used was recently salted salmon. Three years before we had found cod plentiful on these

same grounds, and their scarcity at this trial is not to be taken as an indication that they are absent from the region, the state of the tide and other conditions being sufficient to account for their biting at one time of day and not at another, as happens on other fishing-grounds.

As explained in a previous report, the fishing-ground off Chernofski extends only a short distance from the shore, the continental platform in this region being comparatively narrow. A run of 20 miles NNW. from the above position carried the ship into a depth of 407 fathoms. Hydrographic work was carried on during the remainder of the day in the direction of St. George Island, which we reached in the afternoon of the 18th. Two hauls of the beam trawl were made the same day between that island and St. Paul Island, in depths of 41 and 43 fathoms, only a small amount of material being obtained, and the hand lines employed in the same places failing to secure a single fish. The last station was 16 miles off the western end of St. George Island, which bore SE. $\frac{1}{2}$ E. From that position the hydrographic work was carried WSW. to a distance of about 225 miles from the island, mostly through deep water in which no fishing trials could be made.

On August 31 five trials with hand lines were made in Akutan Bay, formed by Akun and Akutan islands, the total catch amounting to 7 cod. The depth of water ranged from 36 to 51 fathoms. The beam trawl was also hauled twice in the same bay, bringing up 11 large and 24 small flounders and a number of sculpins, crabs, and shrimps. The indications point to a fair feeding-ground for fishes, and it is reasonable to suppose that the cod resort to this bay for spawning in the fall and winter months. Should that prove to be the case Akutan Bay would be a favorable locality at that season for small-boat fishing.

In the evening the ship anchored in Akun Cove, on the NE. side of Akun Island. At the head of this cove there is a small lake which is separated from the salt water by a narrow spit composed of pebbles, stones, and sand. Three good-sized trout, several small ones, and a number of young salmon were caught in this lake by means of a 120-foot drag seine.

During September 1 a line of soundings was carried from Akun Island on a WNW. $\frac{1}{4}$ W. course, the depths ranging from 74 to 96 fathoms. The beam trawl was used at four stations, but as the bottom seemed everywhere unfavorable to the occurrence of cod the hand lines were not put over.

On the following day dredging was carried on between St. George and St. Paul islands, and an attempt was also made to fish with hand lines, but the wind was fresh and the ship drifted too rapidly for the leads to be kept on the bottom. The inquiries made about these islands by the *Albatross* indicate that good fishing is confined to more or less scattered areas of bottom, the total extent of which is small, and a run of only a few miles would carry the ship from a favorable locality to one that seemed entirely barren. The best places are known to the inhabitants of the islands, who are able to locate them by bearings from the shore;

but the natives do not exert themselves specially to lay in a supply of either cod or halibut, their wants being so well provided for by the Government. The village of St. Paul secures its cod and halibut from two small fishing-grounds, one of which lies off the eastern end of Otter Island, the other about 1½ miles from the settlement.

The last trial with hand lines in Bering Sea was made at station No. 3558 (latitude 56° 58′ N., longitude 170° 09′ W.), 25 fathoms. Five cod and 3 sculpins were taken there in the course of fifteen minutes, the former averaging 12 pounds in weight. The total number of trials with hand lines in the sea during the summer had been 70, the total catch by that means amounting to 116 cod.

On September 8 the *Albatross* again anchored in Akun Bay. The charts locate a fishing village in this bay, but we found there only a single small building, which is occupied by fishermen during the salmon season. The salmon (red salmon) which run here are much superior to those about Unalaska Island, and every year parties come over from the latter island in order to obtain a supply. In one haul of the seine on the beach we succeeded in capturing all the salmon we could take care of, and all of the boats belonging to the ship could readily have been loaded.

Just back of the beach here there is a lake about 1½ miles long by ½ mile wide. We launched our dory into this lake and made about a dozen seine hauls, securing a quantity of trout and young salmon. We were puzzled at first to account for the presence of the salmon in the lake, but on a closer examination we found that there had been an outlet which the sea had closed up, the fresh water at the time of our visit forcing its way under the beach through gravel and stones. At the places where the fresh water was oozing through many salmon were endeavoring to effect an entrance into the lake. So active were they in their efforts that several had managed to work some 10 or 15 feet up the steep beach into a little pool about 6 inches deep.

Arriving back on board the ship at dark, we found that the crew had caught several cod with hand lines, and a halibut weighing 17 pounds.

From Akun Island the *Albatross* proceeded to Deer Island, located between the Sannak islands and the mainland, a night anchorage being made off the southern and western end of the island. Hand lines were thrown over there and in the course of 1½ hours 27 cod and 6 halibut were captured. The former averaged 6½, the latter 6½ pounds in weight. In most parts of this region cod are plentiful, and it is not necessary to go far from the harbors to find good fishing. Halibut do not seem to be so abundant, however, although they are at least sufficiently common to supply all local demands.

A day was spent in collecting in Bailey Harbor, which is located a short distance to the westward of Belkofski, a native village containing about 200 inhabitants. Salmon, several species of flounder, (chiefly the starry flounder), and young cod were taken abundantly with

the drag seine in all parts of the harbor. Dog and humpback salmon were seen jumping in every direction and dead individuals lined the shores on both sides. In a small stream fed by water oozing out of wet moss the writer counted 336 dead salmon and about the same number of living ones, but the latter looked as though they would not survive much longer, as they were covered with scars and bruises.

The stream was about 4 feet wide, in no place over 1 foot deep, and generally much less. Tall, thick grass obscured the course of most of the stream, and it could only be followed by forcing one's way through the rank growth. In so doing, one's foot would constantly come in contact with salmon, which would jump and rush upstream, making a great splashing as they went. Several attempts were made to drive a number downstream, but they were all unsuccessful. In many places the bottom of the stream was thickly covered with salmon eggs, the most of which were dead. The dead salmon filled the air with a sickening odor. As there is no large stream entering Bailey Harbor, the small ones become overcrowded with salmon, and thousands are obliged to remain in the bay without the chance of reaching fresh water.

Bailey Harbor would apparently be a desirable locality for a fishing settlement. It is well protected from the wind in most directions, but a heavy gale from the south would cause a heavy swell to enter, and yet a lee could be found by shifting from one side of the harbor to the other, as the occasion might require. Small boats could run into the inner harbor and find shelter from all kinds of weather. Fish are abundant and easily taken.

A run of 80 miles east brought us to Portage Bay, where we found shore collecting very poor as compared with Bailey Harbor. The water is very shallow and but few places exist which are favorable for seining. Only one large salmon and about a dozen small ones were taken. Flounders and sculpins are also scarce. Our seine catch consisted mainly of young cod, and 12 cod were caught on hand lines. Many dead salmon were lying on the beaches and some were floating on the waters of the bay. A mountain stream flows into the head of the bay, but as the tide was low at the time of our visit there, we made no attempt to seine at its mouth. Taken as a whole, Portage Bay does not seem to offer as many inducements for fishing as Bailey Harbor. The work in Portage Bay completed our fishery investigations for the season of 1893.

On June 19, 1894, I joined the ship at Unalaska, and on the evening of the 21st we sailed for the Pribilof Islands, where we arrived the following day. A drag seine was hauled in the lake on St. Paul Island, where a number of trout were planted last season. The seine reached nearly across the lake, and was hauled from one end of it to the other, with the object of determining whether the fish had survived the winter. Nothing was found to indicate that any of them were alive. The seine touched bottom, and had there been fish in this small body of water, it is very probable that a few would have been captured. The people

living on the Island of St. Paul say that the past winter was very severe, more so than for many years, and that the lake was frozen to the bottom. If this be true, the trout planted were undoubtedly killed by the ice.

The first ocean investigation was made with the beam trawl on June 26, off the northern entrance to Isanotski Strait, generally known as False Pass. The bottom here is composed of volcanic sand, and has very little on it to support a large amount of life. The principal part of the catch consisted of starfishes; the economic species were flounders and one small cod; the cod, however, was dead and considerably bruised, as if it had been washed about violently by the sea.

The first trial for bottom fish was made on June 29 at hydrographic station 3492, latitude 57° 59′ N., longitude 166° 04′ W., in 32 fathoms of water. Fifteen hand lines baited with salt salmon were put over, and fishing carried on for thirty minutes. The result of this trial was two cod. Another trial was made the same day at hydrographic station 3493, in latitude 58° 06′ N., longitude 165° 22′ W., 26 fathoms of water. The same time was given here as at the previous station. Four cod and two flounders were caught; the last-named species were taken on very small hooks, none being caught on the regular cod gear.

On the 30th three fishing trials were made, the first at hydrographic station 3495, in 27 fathoms, latitude 57° 28′ N., longitude 163° 14′ W. Nothing was taken here. At the next station, which was in latitude 56° 59′ N., longitude 163° 02′ W., in 34 fathoms of water, one cod, weighing 6¾ pounds, was taken. Later in the day we hove to and put over 13 hand lines, in 37 fathoms, for thirty minutes. The result of this investigation was the same as at the first station.

The result of the fishing trials made in this region was far different from what was anticipated; fairly good fishing was looked for. The ground lying between the Pribilof Islands and Cape Newenham has never been considered by fishermen to be as prolific as the banks farther south, yet at times cod may be expected in considerable numbers. The almost negative result of the above trials could not have been due to any fault of the bait, for it was such as we have always used, salt salmon, and of good quality. It seems reasonable to suppose that the low temperature of the water at the bottom where these fishing trials were carried on accounts for the scarcity of fish. A comparison of the bottom temperatures found this season with those of past years shows a difference of from 4° to 8°. The bottom temperature of water at the fishing stations thus far this season has varied from 32° to 35° F. A difference of a few degrees may prevent cod from migrating to favorite grounds. In past years it has been found that cod exist in greatest numbers in water ranging from 38° to 43°. The cause for the extra cold temperature of the water this season is no doubt due to a very late summer and considerable quantities of field ice.

# THE BLISH DISTANCE-FINDER.

By Commander Z. L. TANNER, U. S. Navy.

This simple and admirable little instrument was devised by John B. Blish, lieutenant, United States Navy. It has been used to advantage on board this vessel for about two years, and we have found it particularly valuable at night and in stormy weather.

With the course and distance and two bearings of a point of land, without computation or reference to books or charts, the instrument will give the distance of the point at the time of the first and second bearings, the distance to be run from second bearing to bring it abeam; also the distance at which it will be passed if the course is maintained. Repeated observations will show whether the vessel is actually making her course.

Referring to the sketch, Fig. I is a plan view, full size, and Fig. II a sectional view.

Scales of degrees and points are marked on the arc, and there is a scale of equal parts on CD, CE, and CF, which may be used as miles or fractions of a mile. A and B are silk threads pivoted at C and drawn under an elastic band which rests snugly in a groove surrounding the instrument, as shown in Fig. II. The band permits free movement of the arms, yet holds them in place when set. The vessel is supposed to be heading at all times from C to E, hence all bearings are plotted from E.

To use the distance finder, take a bearing of a point, note the number of degrees or points it bears from the ship's head, note the reading of the log, and set the arm A, counting the degrees from E; steer the same course until the bearing is sufficiently changed to make a good angle, then take another bearing, note distance run between first and second bearings, and set arm B on the number of degrees or points the object bears from the ship's head, counting from E as before. Then find the distance by log, GH, parallel with CE and between the arms A and B.

To find the distance of the point when the first bearing was taken, measure the interval CG on the scale CE or CD.

To find the distance of the point when the second bearing was taken, measure CH on CE or CD.

To find the distance to be run from the second bearing to bring the point abeam, read the interval HI on CE.

To find the distance the point will be when abeam, read CI on the scale CD, which is equal to the interval between CE and GHI, and may be read anywhere between those lines.

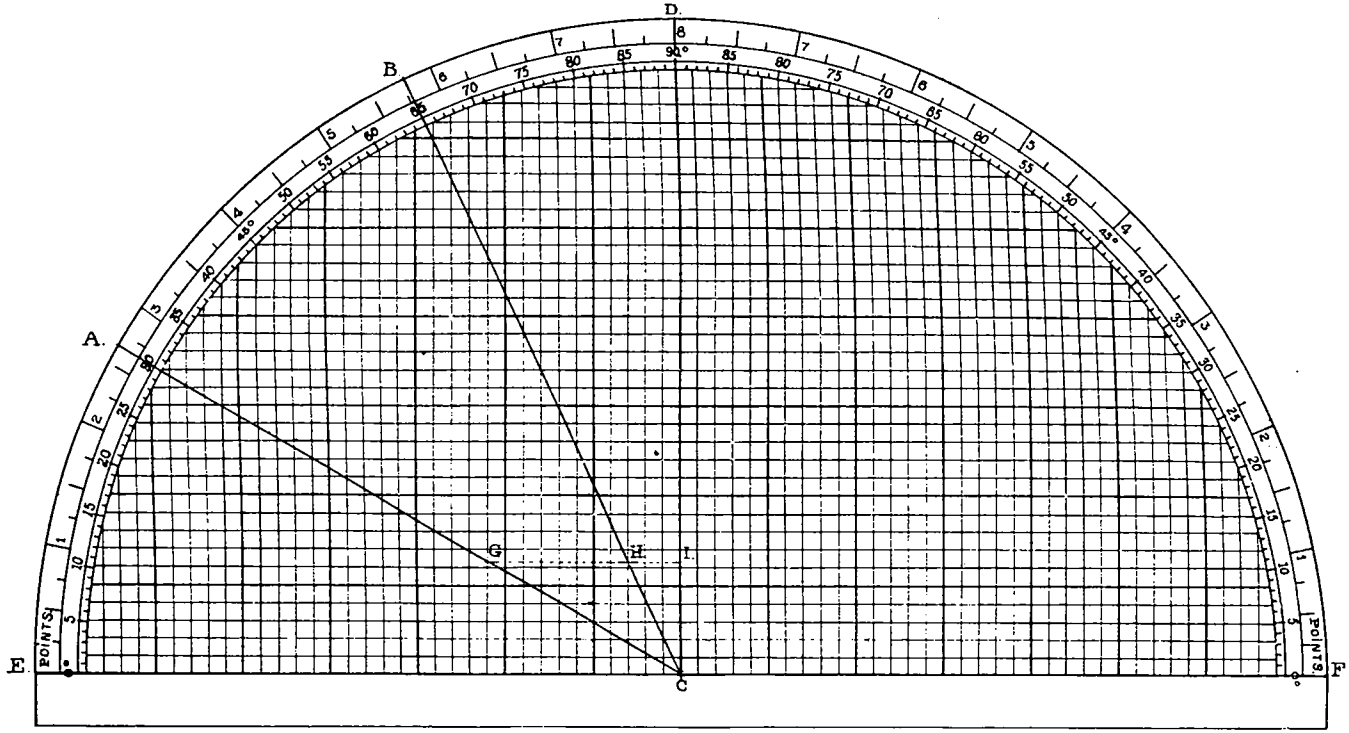



Figure I.

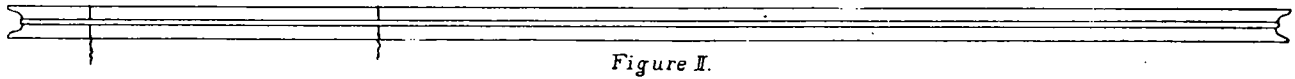


Figure II.

THE BLISH DISTANCE FINDER.

If the point is to be passed at a distance of 5 miles or less, it may be found convenient to have the lines on the scale represent half miles instead of miles. In reading the scale, fractions of a mile are estimated to tenths to correspond with the divisions of the patent log.

EXAMPLE.

First bearing, 30° from ship's head (or E).

Second bearing, 65° from ship's head (or E).

Distance by log between first and second bearings, 8 miles. Set arm A on 30° for first bearing, and arm B on 65° for the second bearing.

Then, 8 miles, the distance run, equals GH between the arms A and B.

CG measured on CE or CD equals 12.6 miles, distance of point at first bearing.

CH measured on CE or CD equals 7 miles, distance of the point at second bearing.

HI measured on CE or CD equals 3 miles, distance to be run from second bearing to bring the point abeam.

CI measured on CD equals 6.3 miles, distance the point will be from the vessel when it is abeam.

The distances CI and HI are those mostly used in practice, but if the distances CG or CH are required, grasp the arm A at G, or arm B at H, and swing them to CE or CD and read off the distance from the scale.

The distance finder in use on board the *Albatross* was improvised by Ensign Henry B. Wilson, United States Navy. The scales were marked in India ink on Irish linen writing paper, which was then glued to a wooden frame, and finally given several coats of shellac varnish. Sewing silk was used for the arms, which were held in place by an ordinary elastic band resting in the groove, and a small nail constituted the pivot.

It will be observed that the left quadrant of the semicircle is used in the description and the example; the right one may be used in like manner by assuming that the ship's head is at F. The instrument is used as though the vessel was at C, steering to E, on the line CE, but in reality she was at G when the first bearing was taken, at H at the time of the second bearing, steering for I, on the line GHI, and the pivot C is the point on which both bearings were taken.

The distance finder and Table 5A of the new Bowditch Navigator are constructed on the same principle.

## TABLES.

*Record of hydrographic soundings by the U. S. Fish Commission steamer Albatross for the fiscal year ending June 30, 1894.*

| Serial No. | Date. | Time of day. | Position. | | Depth. | Character of bottom. | Temperature. | | | Instrument used. | Weight of sinker. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lat. N. | Long. W. | | | Air. | Surface. | Bottom. | | |
| | 1893. | | ° ′ ″ | ° ′ ″ | *Fms.* | | ° F. | ° F. | ° F. | | *Lbs.* |
| 3240 | Apr. 26 | 10.00 a. m. | 36 48 15 | 121 59 05 | 266 | None obtained. | 58 | 54 | ..... | Sigsbee | 35 |
| 3241 | Apr. 27 | 8.33 a. m. | 37 29 00 | 123 01 20 | 301 | stf. gy. M | 54 | 53 | ..... | do | 35 |
| 3242 | June 5 | 1.15 p. m. | 57 40 00 | 143 18 00 | 2,064 | gy. oz | 48 | 47 | 35.0 | do | 60 |
| 3243 | June 6 | 9.01 p. m. | 57 44 00 | 150 45 00 | 59 | gy. S. Sh | 46 | 45 | ..... | Tanner | 25 |
| 3244 | June 8 | 7.00 p. m. | 56 48 00 | 152 30 00 | 87 | stf. M | 47 | 45 | ..... | do | 25 |
| 3245 | June 15 | 6.10 p. m. | 54 42 00 | 160 47 00 | 60 | bl. M | 47 | 44 | ..... | do | 25 |
| 3246 | June 17 | 8.10 a. m. | 54 56 15 | 159 01 00 | 48 | gy. S. P | 46 | 43 | ..... | do | 25 |
| 3247 | ...do... | 8.28 a. m. | 54 56 30 | 159 05 20 | 41 | gy. S. rky | 46 | 43 | ..... | do | 25 |
| 3248 | ...do... | 8.45 a. m. | 54 56 45 | 159 09 00 | 36 | gy. S | 46 | 43 | ..... | do | 25 |
| 3249 | ...do... | 9.01 a. m. | 54 57 45 | 159 11 00 | 38 | gy. S | 46 | 43 | ..... | do | 25 |
| 3250 | ...do... | 9.16 a. m. | 54 58 45 | 159 13 45 | 33 | S. brk. Sh | 46 | 43 | ..... | do | 25 |
| 3251 | ...do... | 9.52 a. m. | 55 01 30 | 159 16 30 | 27 | gy. S | 46 | 43 | ..... | do | 25 |
| 3252 | ...do... | 10.14 a. m. | 55 02 15 | 159 19 00 | 17 | fne. gy. S | 46 | 43 | ..... | do | 25 |
| 3253 | June 27 | 6.58 a. m. | 54 04 00 | 162 55 00 | 48 | S. G | 48 | 46 | ..... | do | 25 |
| 3254 | July 1 | 12.03 p. m. | 51 32 00 | 175 52 00 | 697 | bk. S | 43 | 48 | 36.6 | Sigsbee | 35 |
| 3255 | ...do... | 4.24 p. m. | 51 35 40 | 176 41 00 | 62 | crs. gy. S. Sh | 47 | 48 | ..... | Tanner | 25 |
| 3256 | ...do... | 5.51 p. m. | 51 35 40 | 176 46 15 | 46 | crs. gy. S | 48 | 48 | ..... | do | 25 |
| 3257 | July 5 | 9.47 a. m. | 51 33 30 | 176 50 00 | 57 | Sh | 50 | 47 | ..... | do | 25 |
| 3258 | ...do... | 10.06 a. m. | 51 32 00 | 176 49 00 | 78 | gy. S. Sh | 50 | 47 | ..... | do | 25 |
| 3259 | ...do... | 11.23 a. m. | 51 28 00 | 176 49 00 | 172 | gy. S. P | 50 | 47 | 39.4 | Sigsbee | 35 |
| 3260 | ...do... | 12.02 p. m. | 51 24 00 | 176 50 00 | 428 | gy. S. Sh | 52 | 44 | 38.6 | do | 35 |
| 3261 | July 6 | 8.53 a. m. | 51 19 00 | 176 39 00 | 1,622 | bk. S. brk. Sh | 48 | 44 | 38.5 | do | 35 |
| 3262 | ...do... | 11.03 a. m. | 51 11 00 | 176 25 00 | 2,350 | gy. oz. fne. S | 52 | 44 | 36.9 | do | 60 |
| 3263 | ...do... | 2.12 p. m. | 51 09 00 | 176 04 00 | 2,039 | gy. M. S | 52 | 44 | 37.3 | do | 60 |
| 3264 | ...do... | 6.27 p. m. | 50 41 00 | 175 30 00 | 3,323 | gy. M. S | 49 | 48 | 39.6 | do | 60 |
| 3265 | ...do... | 10.24 p. m. | 50 28 00 | 175 10 00 | 4,002 | br. oz | 50 | 49 | 34.6 | do | 60 |
| 3266 | July 7 | 2.44 a. m. | 50 16 00 | 174 51 00 | 3,191 | None obtained. | 50 | 48 | ..... | do | 60 |
| 3267 | ...do... | 6.22 a. m. | 50 03 00 | 174 30 00 | 2,802 | gy. oz | 50 | 49 | 35.0 | do | 60 |
| 3268 | ...do... | 12.23 p. m. | 50 31 00 | 173 54 00 | 3,067 | hard | 53 | 49 | ..... | do | 60 |
| 3269 | ...do... | 10.05 p. m. | 50 57 00 | 173 06 00 | 3,794 | br. oz. S | 49 | 48 | ..... | do | 60 |
| 3270 | July 8 | 3.47 a. m. | 51 23 00 | 172 18 00 | 2,320 | br. oz. S | 50 | 49 | ..... | do | 60 |
| 3271 | ...do... | 9.02 a. m. | 51 50 00 | 171 38 00 | 1,330 | fne. bk. S | 49 | 48 | ..... | do | 60 |
| 3272 | ...do... | 3.39 p. m. | 52 24 00 | 171 40 00 | 250 | rky | 48 | 44 | ..... | Tanner | 25 |
| 3273 | ...do... | 4.55 p. m. | 52 31 00 | 171 42 00 | 320 | fne. G | 47 | 41 | ..... | do | 25 |
| 3274 | ...do... | 6.44 p. m. | 52 44 00 | 171 35 00 | 97 | dk. S. P | 46 | 41 | ..... | Sigsbee | 35 |
| 3275 | ...do... | 7.53 p. m. | 52 54 00 | 171 29 00 | 369 | fne. bk. S. G | 45 | 40 | ..... | do | 35 |
| 3276 | July 9 | 11.06 a. m. | 55 04 00 | 170 11 00 | 1,554 | gn. M. S | 49 | 46 | ..... | do | 35 |
| 3277 | ...do... | 2.57 p. m. | 55 36 00 | 170 02 00 | 1,626 | gn. M | 48 | 47 | ..... | do | 35 |
| 3278 | ...do... | 6.48 p. m. | 56 06 00 | 169 58 00 | 68 | gy. S. Sh | 48 | 47 | ..... | do | 35 |
| 3279 | ...do... | 7.53 p. m. | 56 16 00 | 169 57 00 | 72 | gy. S. bk. Sp | 48 | 47 | ..... | Tanner | 35 |
| 3280 | ...do... | 9.46 p. m. | 56 35 00 | 169 55 00 | 52 | S. rky | 48 | 47 | ..... | do | 35 |
| 3281 | July 12 | 4.20 a. m. | 57 18 00 | 169 38 00 | 35 | gy. S. Sh | 42 | 42 | ..... | do | 25 |
| 3282 | ...do... | 7.01 p. m. | 57 18 00 | 172 20 00 | 62 | gn. M | 43 | 44 | 38.0 | do | 25 |
| 3283 | ...do... | 7.37 p. m. | 57 18 00 | 172 27 00 | 62 | gn. M. S | 43 | 44 | 36.0 | do | 25 |
| 3284 | ...do... | 9.53 p. m. | 57 18 00 | 172 43 00 | 62 | Co | 42 | 44 | 38.0 | do | 25 |
| 3285 | ...do... | 10.35 p. m. | 57 18 00 | 172 51 00 | 64 | gn. M | 43 | 44 | 37.0 | do | 25 |
| 3286 | ...do... | 11.38 p. m. | 57 18 00 | 173 00 00 | 65 | gn. M | 43 | 44 | 37.0 | do | 25 |
| 3287 | July 13 | 12.22 a. m. | 57 18 00 | 173 09 00 | 66 | gn. M | 42 | 44 | 37.0 | do | 25 |
| 3288 | ...do... | 1.09 a. m. | 57 18 00 | 173 18 00 | 67 | rky | 42 | 44 | 37.0 | do | 25 |
| 3289 | ...do... | 1.50 a. m. | 57 19 00 | 173 27 00 | 69 | rky | 42 | 43 | 37.8 | do | 25 |
| 3290 | ...do... | 2.30 a. m. | 57 19 00 | 173 30 00 | 71 | gn. M | 42 | 43 | 38.0 | do | 25 |
| 3291 | ...do... | 3.12 a. m. | 57 19 09 | 173 45 00 | 82 | rky | 42 | 42 | 37.8 | do | 25 |
| 3292 | ...do... | 6.14 a. m. | 57 16 00 | 173 46 00 | 78 | gn. M. fne. S | 43 | 43 | 37.9 | do | 25 |
| 3293 | ...do... | 7.02 a. m. | 57 11 00 | 173 42 00 | 77 | gy. S | 43 | 43 | 37.7 | do | 25 |
| 3294 | ...do... | 8.47 a. m. | 57 06 00 | 173 42 00 | 81 | gy. S | 43 | 43 | 38.0 | do | 25 |
| 3295 | ...do... | 12.37 p. m. | 56 51 00 | 173 37 00 | 516 | gn. M. S | 47 | 45 | 37.0 | Sigsbee | 35 |
| 3296 | ...do... | 4.41 p. m. | 56 42 00 | 173 18 00 | 80 | fne. gy. S. rky | 46 | 46 | 37.7 | do | 35 |
| 3297 | ...do... | 5.30 p. m. | 56 37 00 | 173 21 00 | 80 | fne. gy. S. bk. Sp | 46 | 46 | 37.7 | do | 35 |
| 3298 | ...do... | 6.14 p. m. | 56 32 00 | 173 24 00 | 797 | yl. M G | 46 | 46 | 36.2 | do | 35 |
| 3299 | ...do... | 7.25 p. m. | 56 29 00 | 173 19 00 | 1,188 | None obtained. | 47 | 46 | 35.5 | do | 35 |
| 3300 | ...do... | 10.18 p. m. | 56 30 00 | 172 56 00 | 74 | gy. S | 46 | 45 | 38.0 | do | 35 |
| 3301 | July 14 | 2.21 a. m. | 56 30 00 | 172 25 00 | 100 | fne. gy. S. bk. Sp | 46 | 44 | 38.0 | Tanner | 25 |
| 3302 | July 17 | 11.10 a. m. | 56 07 00 | 169 33 00 | 260 | fne. gy. S | 49 | 46 | 38.3 | Sigsbee | 35 |
| 3303 | ...do... | 10.47 p. m. | 55 24 00 | 168 34 00 | 843 | fne. gy. S | 48 | 45 | ..... | do | 35 |
| 3304 | July 18 | 2.41 a. m. | 55 09 00 | 168 11 00 | 809 | fne. gy. S | 51 | 45 | ..... | do | 35 |
| 3305 | ...do... | 5.28 a. m. | 54 56 00 | 167 44 00 | 756 | gn. M. vol. S | 50 | 46 | ..... | do | 35 |
| 3306 | ...do... | 8.42 a. m. | 54 42 00 | 167 39 00 | 442 | gn. M | 50 | 48 | ..... | do | 35 |
| 3307 | July 28 | 12.28 p. m. | 57 03 00 | 169 54 00 | 35 | fne. gy. S | 50 | 44 | 41.9 | Tanner | 25 |
| 3308 | ...do... | 5.19 p. m. | 57 03 00 | 168 52 00 | 43 | gy. S. Sh | 50 | 45 | 37.6 | do | 25 |
| 3309 | ...do... | 10.56 p. m. | 57 15 00 | 167 42 00 | 41 | fne. gy. S | 45 | 43 | 36.0 | do | 25 |
| 3310 | July 29 | 1.29 a. m. | 57 21 00 | 167 05 00 | 33 | fne. bk. S | 45 | 42 | 35.0 | do | 25 |
| 3311 | ...do... | 4.04 a. m. | 57 27 00 | 166 30 00 | 38 | fne. S. bk. M | 45 | 42 | 34.8 | do | 25 |

*Record of hydrographic soundings by the U. S. Fish Commission steamer Albatross for the fiscal year ending June 30, 1894*—Continued.

| Serial No. | Date. | Time of day. | Position. Lat. N. | Position. Long. W. | Depth. | Character of bottom. | Temperature. Air. | Temperature. Surface. | Temperature. Bottom. | Instrument used. | Weight of sinker. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1893. | | ° ′ ″ | ° ′ ″ | Fms. | | ° F. | ° F. | ° F. | | Lbs. |
| 3312 | July 29 | 9.46 a. m. | 57 38 00 | 165 20 00 | 35 | fne. S. dk. M | 45 | 42 | 35.5 | Tanner | 25 |
| 3313 | do | 5.14 p. m. | 58 13 00 | 164 47 00 | 26 | fne. gy. S | 44 | 42 | 41.4 | do | 25 |
| 3314 | do | 11.22 p. m. | 58 42 00 | 165 30 00 | 22 | gy. S | 43 | 41 | 41.8 | do | 25 |
| 3315 | July 30 | 2.04 a. m. | 58 51 00 | 166 11 00 | 21 | fne. gy. S | 42 | 41 | 41.0 | do | 25 |
| 3316 | do | 5.00 a. m. | 58 36 00 | 166 38 00 | 25 | fne. gy. S | 42 | 41 | 40.1 | do | 25 |
| 3317 | do | 8.31 a. m. | 58 22 00 | 167 04 00 | 29 | crs. gy. S | 44 | 42 | 37.0 | do | 25 |
| 3318 | do | 1.16 p. m. | 58 07 00 | 167 29 00 | 36 | gn. M. fne. S | 45 | 42 | 35.5 | do | 25 |
| 3319 | do | 5.50 p. m. | 57 52 00 | 167 54 00 | 38 | dk. M. fne. S | 46 | 43 | 37.5 | do | 25 |
| 3320 | do | 10.27 p. m. | 57 38 00 | 168 19 00 | 36 | fne. gy. S | 46 | 43 | 36.1 | do | 25 |
| 3321 | July 31 | 3.22 a. m. | 57 24 00 | 168 42 00 | 41 | gy. S. rky | 46 | 44 | 36.8 | do | 25 |
| 3322 | do | 6.40 a. m. | 57 10 00 | 169 05 00 | 42 | fne. gy. S. bk. Sp | 46 | 44 | 37.3 | do | 25 |
| 3323 | Aug. 1 | 4.44 p. m. | 58 08 30 | 169 14 00 | 38 | dk. M. fne. S | 47 | 45 | 31.8 | do | 25 |
| 3324 | do | 10.44 p. m. | 58 45 30 | 168 48 00 | 30 | fne. gy. S. M | 44 | 43 | 33.9 | do | 25 |
| 3325 | Aug. 2 | 1.16 a. m. | 59 04 00 | 168 34 00 | 24 | fne. gy. S. bk. Sp | 43 | 42 | 39.8 | do | 25 |
| 3326 | do | 7.36 a. m. | 59 41 00 | 168 06 00 | 22 | fne. gy. S. Sh | 42 | 41 | 41.1 | do | 25 |
| 3327 | do | 10.07 a. m. | 59 55 00 | 167 55 00 | 14 | gy. S | 42 | 42 | .... | Bassnett tube. | 25 |
| 3328 | do | 10.22 a. m. | 59 56 00 | 167 54 00 | 16 | gy. S. Sh | 42 | 42 | ..... | do | 25 |
| 3329 | do | 10.37 a. m. | 59 58 00 | 167 53 00 | 14 | fne. gy. S | 42 | 42 | ..... | do | 25 |
| 3330 | do | 11.35 a. m. | 60 00 00 | 167 53 00 | 14 | fne. gy. S | 42 | 42 | ..... | do | 25 |
| 3331 | do | 11.50 a. m. | 60 01 30 | 167 54 00 | 14 | fne. gy. S | 42 | 42 | ..... | do | 25 |
| 3332 | do | 12.05 p. m. | 60 03 00 | 167 55 00 | 14 | fne. gy. S | 42 | 42 | ..... | do | 25 |
| 3333 | do | 12.20 p. m. | 60 05 00 | 167 56 00 | 15 | fne. gy. S | 42 | 42 | ..... | do | 25 |
| 3334 | do | 12.35 p. m. | 60 06 30 | 167 57 00 | 16 | fne. gy. S | 42 | 42 | ..... | do | 25 |
| 3335 | do | 12.50 p. m. | 60 08 00 | 167 58 00 | 15 | fne. gy. S | 42 | 42 | ..... | do | 25 |
| 3336 | do | 1.05 p. m. | 60 09 30 | 167 59 00 | 15 | fne. gy. S. bk. Sh | 42 | 42 | ..... | do | 25 |
| 3337 | do | 1.20 p. m. | 60 11 00 | 168 00 00 | 16 | fne. gy. S | 42 | 42 | ..... | do | 25 |
| 3338 | do | 1.35 p. m. | 60 13 00 | 168 01 00 | 16 | fne. gy. S. bk. Sh | 42 | 42 | ..... | do | 25 |
| 3339 | do | 1.50 p. m. | 60 14 30 | 168 02 00 | 16 | fne. gy. S | 42 | 42 | ..... | do | 25 |
| 3340 | do | 2.05 p. m. | 60 16 00 | 168 03 00 | 16 | fne. gy. S | 42 | 43 | ..... | do | 25 |
| 3341 | do | 2.20 p. m. | 60 17 30 | 168 04 00 | 16 | fne. gy. S | 43 | 43 | ..... | do | 25 |
| 3342 | do | 2.35 p. m. | 60 19 00 | 168 05 00 | 16 | fne. gy. S | 43 | 43 | ..... | do | 25 |
| 3343 | do | 2.50 p. m. | 60 21 00 | 168 05 00 | 17 | fne. gy. S. bk. Sh | 43 | 43 | ..... | do | 25 |
| 3344 | do | 3.05 p. m. | 60 22 00 | 168 06 00 | 16 | fne. gy. S | 43 | 43 | ..... | do | 25 |
| 3345 | do | 3.20 p. m. | 60 24 00 | 168 07 00 | 19 | fne. gy. S. bk. Sh | 43 | 43 | ..... | do | 25 |
| 3346 | do | 3.35 p. m. | 60 26 00 | 168 08 00 | 19 | fne. gy. S | 43 | 43 | ..... | do | 25 |
| 3347 | do | 11.45 p. m. | 60 26 00 | 169 54 00 | 27 | gn. M. fne. S | 41 | 41 | 35.3 | Tanner | 25 |
| 3348 | Aug. 3 | 3.10 a. m. | 60 24 00 | 170 48 00 | 35 | bk. M | 42 | 42 | 32.0 | do | 25 |
| 3349 | do | 1.15 p. m. | 59 47 00 | 171 08 00 | 38 | dk. M | 43 | 43 | 31.8 | do | 25 |
| 3350 | do | 11.01 p. m. | 58 52 00 | 170 38 00 | 40 | bk. M | 45 | 44 | 30.8 | do | 25 |
| 3351 | Aug. 4 | 2.39 a. m. | 58 33 00 | 170 28 00 | 42 | None obtained | 46 | 43 | ..... | do | 25 |
| 3352 | do | 6.11 a. m. | 58 15 00 | 170 18 00 | 40 | gn. M. fne. S | 46 | 44 | 35.4 | do | 25 |
| 3353 | Aug. 5 | 4.15 a. m. | 57 24 00 | 170 24 00 | 37 | fne. gy. S. Sh | 47 | 43 | 40.3 | do | 25 |
| 3354 | do | 1.53 p. m. | 58 04 00 | 171 41 00 | 55 | gn. M | 48 | 45 | 37.4 | do | 25 |
| 3355 | do | 11.29 p. m. | 58 52 00 | 172 45 00 | 57 | gn. M | 46 | 44 | 35.3 | do | 25 |
| 3356 | Aug. 6 | 2.04 a. m. | 59 00 00 | 173 09 00 | 57 | gn. M | 45 | 43 | 34.2 | do | 25 |
| 3357 | do | 4.42 a. m. | 59 24 00 | 173 31 00 | 57 | gn. M | 45 | 43 | 35.7 | do | 25 |
| 3358 | do | 3.46 p. m. | 59 33 00 | 175 00 00 | 70 | gn. M | 51 | 46 | 36.7 | do | 25 |
| 3359 | Aug. 7 | 12.02 a. m. | 58 43 00 | 176 10 00 | 71 | gn. M | 44 | 44 | ..... | Sigsbee | 35 |
| 3360 | do | 5.02 a. m. | 58 11 00 | 176 38 00 | 1,744 | gn. M. fne. S | 45 | 44 | 35.5 | do | 35 |
| 3361 | do | 10.16 a. m. | 58 01 00 | 175 41 00 | 1,367 | gn. M. fne. S | 48 | 46 | 35.2 | do | 35 |
| 3362 | do | 5.10 p. m. | 57 41 00 | 174 05 00 | 77 | gn. M | 49 | 47 | 38.0 | do | 35 |
| 3363 | do | 11.12 p. m. | 57 25 00 | 172 50 00 | 69 | dk. gn. M. fne. S | 47 | 45 | 37.8 | Tanner | 25 |
| 3364 | Aug. 8 | 4.13 a. m. | 57 08 00 | 171 38 00 | 60 | gn. M | 47 | 45 | 37.8 | do | 25 |
| 3365 | Aug. 9 | 4.21 a. m. | 56 49 00 | 169 42 00 | 37 | fne. S. Sh | 46 | 44 | 40.9 | do | 25 |
| 3366 | do | 1.09 p. m. | 56 37 00 | 167 55 00 | 59 | gn. M. S | 49 | 46 | 38.0 | do | 25 |
| 3367 | do | 6.39 p. m. | 56 31 00 | 166 43 00 | 55 | dk. gn. M. fne. S. | 48 | 46 | 37.5 | do | 25 |
| 3368 | Aug. 10 | 12.18 a. m. | 56 23 00 | 165 28 00 | 48 | gn. M. fne. S | 48 | 45 | 36.5 | do | 25 |
| 3369 | do | 2.47 a. m. | 56 18 00 | 164 48 00 | 49 | fne. gy. S | 48 | 45 | 36.4 | do | 25 |
| 3370 | do | 7.10 p. m. | 54 53 15 | 164 25 40 | 20 | dk. gy. S. Lava | 53 | 47 | ..... | Bassnett tube. | 25 |
| 3371 | do | 7.20 p. m. | 54 52 00 | 164 26 20 | 17 | dk. gy. S. Lava | 53 | 47 | ..... | do | 25 |
| 3372 | do | 7.25 p. m. | 54 51 30 | 164 26 40 | 15 | dk. gy. S | 53 | 47 | ..... | do | 25 |
| 3373 | do | 7.30 p. m. | 54 51 00 | 164 27 00 | 14 | dk. gy. S | 53 | 47 | ..... | do | 25 |
| 3374 | do | 7.35 p. m. | 54 50 30 | 164 27 20 | 9 | dk. gy. S | 53 | 47 | ..... | do | 25 |
| 3375 | Aug. 17 | 7.13 a. m. | 53 25 00 | 167 33 00 | 43 | bk. S | 47 | 46 | 41.8 | Tanner | 25 |
| 3376 | do | 9.21 a. m. | 53 35 00 | 167 53 00 | 89 | G | 47 | 44 | 40.3 | Sigsbee | 35 |
| 3377 | do | 9.53 a. m. | 53 38 00 | 167 59 00 | 407 | fne. gy. S. bk. Sp | 48 | 44 | 37.9 | do | 35 |
| 3378 | do | 11.08 a. m. | 53 45 00 | 168 01 30 | 755 | gn. M. fne. S | 48 | 44 | 36.2 | do | 35 |
| 3379 | do | 12.10 p. m. | 53 52 00 | 168 01 30 | 717 | dk. S. fne. G | 48 | 47 | 36.5 | do | 35 |
| 3380 | do | 1.20 p. m. | 53 56 00 | 168 07 00 | 781 | bk. vol. S | 48 | 47 | 36.6 | do | 35 |
| 3381 | do | 2.57 p. m. | 54 04 00 | 168 14 00 | 1,263 | gy. S | 49 | 48 | 35.8 | do | 35 |
| 3382 | do | 7.05 p. m. | 54 30 00 | 168 35 00 | 822 | hard | 49 | 47 | 36.4 | do | 35 |
| 3383 | do | 11.16 p. m. | 54 56 00 | 168 56 00 | 1,205 | gy. S | 48 | 46 | 35.9 | do | 35 |
| 3384 | Aug. 18 | 3.20 a. m. | 55 22 00 | 169 17 00 | 1,187 | gn. M. S | 48 | 47 | 35.9 | do | 60 |
| 3385 | do | 7.20 a. m. | 55 50 00 | 169 24 00 | 1,036 | gn. M. S | 48 | 47 | 36.0 | do | 35 |
| 3386 | do | 9.01 a. m. | 55 50 00 | 169 27 00 | 341 | gn. M. crs. bk. S | 49 | 47 | 38.3 | do | 35 |
| 3387 | do | 10.25 a. m. | 56 09 00 | 169 29 00 | 292 | dk. M | 49 | 48 | 38.7 | Tanner | 25 |

*Record of hydrographic soundings by the U. S. Fish Commission steamer Albatross for the fiscal year ending June 30, 1894*—Continued.

| Serial No. | Date. | Time of day. | Position. | | Depth. | Character of bottom. | Temperature. | | | Instrument used. | Weight of sinker. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lat. N. | Long. W. | | | Air. | Surface. | Bottom. | | |
| | 1893. | | ° ′ ″ | ° ′ ″ | *Fms.* | | ° F. | ° F. | ° F. | | *Lbs.* |
| 3388 | Aug. 18 | 11.50 a. m. | 56 19 00 | 169 32 00 | 74 | gy. S. G | 49 | 48 | ..... | Tanner | 25 |
| 3389 | ...do ... | 10.18 p. m. | 56 47 00 | 170 34 00 | 57 | dk. M | 46 | 43 | ..... | ...do ..... | 25 |
| 3390 | Aug. 19 | 12.39 a. m. | 56 45 00 | 171 10 00 | 63 | fne. gy. S. bk. Sp | 46 | 45 | ..... | ...do ..... | 25 |
| 3391 | ...do ... | 2.56 a. m. | 56 42 00 | 171 45 00 | 65 | fne. gy. S. bk. Sp | 46 | 45 | ..... | ...do ..... | 25 |
| 3392 | ...do ... | 5.19 a. m. | 56 39 00 | 172 21 00 | 76 | gy. S. M | 47 | 45 | 38.9 | ...do ..... | 25 |
| 3393 | ...do ... | 8.02 a. m. | 56 36 00 | 172 56 00 | 346 | gn. M | 46 | 46 | 38.1 | ...do ..... | 25 |
| 3394 | ...do ... | 10.47 a. m. | 56 32 00 | 173 32 00 | 1,631 | bl. M. fne. S. G | 47 | 46 | 35.4 | Sigsbee | 35 |
| 3395 | ...do ... | 3.02 p. m. | 56 29 00 | 174 26 00 | 1,787 | crs. bk. S | 48 | 47 | 35.4 | ...do ..... | 35 |
| 3396 | ...do ... | 8.11 p. m. | 56 25 00 | 175 35 00 | 2,000 | gn. M. fne. S. bk. Sp. | 47 | 47 | 35.4 | ...do ..... | 60 |
| 3397 | Aug. 20 | 2.11 a. m. | 56 21 00 | 176 45 00 | 2,049 | gn. M | 48 | 47 | 35.0 | ...do ..... | 60 |
| 3398 | ...do ... | 9.45 a. m. | 55 25 00 | 176 13 00 | 2,055 | gn. M. fne. S | 48 | 47 | 35.1 | ...do ..... | 60 |
| 3399 | ...do ... | 4.21 p. m. | 54 38 00 | 175 27 00 | 2,041 | gn. M. S | 56 | 49 | 35.1 | ...do ..... | 60 |
| 3400 | ...do ... | 11.18 p. m. | 55 00 00 | 174 32 00 | 1,996 | gn. M. fne. S | 48 | 47 | 35.3 | ...do ..... | 60 |
| 3401 | Aug. 21 | 4.48 a. m. | 55 23 00 | 173 38 00 | 1,928 | gn. M. fne. S | 48 | 47 | 35.5 | ...do ..... | 60 |
| 3402 | ...do ... | 10.04 a. m. | 55 46 00 | 172 44 00 | 1,833 | gn. M. fne. S | 51 | 48 | 35.1 | ...do ..... | 60 |
| 3403 | ...do ... | 10.52 p. m. | 56 26 00 | 171 04 00 | 171 | gn. M. fne. S | 50 | 46 | ..... | Tanner | 35 |
| 3404 | Aug. 22 | 1.07 a. m. | 56 18 00 | 170 34 00 | 69 | gn. M. fne. S | 49 | 46 | 39.0 | ...do ..... | 25 |
| 3405 | ...do ... | 4.09 a. m. | 56 01 00 | 170 50 00 | 924 | gn. M. crs. S | 48 | 47 | 36.0 | Sigsbee | 35 |
| 3406 | ...do ... | 7.16 a. m. | 55 43 00 | 171 07 00 | 1,647 | gn. M. fne. S | 49 | 48 | 35.4 | ...do ..... | 60 |
| 3407 | ...do ... | 1.46 p. m. | 54 59 00 | 171 49 00 | 1,867 | gn. M | 49 | 48 | 35.1 | ...do ..... | 60 |
| 3408 | ...do ... | 8.03 p. m. | 54 17 00 | 172 30 00 | 1,932 | gn. M. fne. S | 48 | 47 | 35.0 | ...do ..... | 60 |
| 3409 | Aug. 23 | 9.25 a. m. | 53 48 00 | 173 11 00 | 1,948 | br. M. dk. S | 50 | 48 | 35.1 | ...do ..... | 60 |
| 3410 | ...do ... | 4.25 p. m. | 53 29 00 | 171 51 00 | 1,429 | gn. M. bk. S | 50 | 48 | 35.2 | ...do ..... | 60 |
| 3411 | ...do ... | 10.25 p. m. | 53 09 00 | 170 31 00 | 1,027 | bk. S | 50 | 48 | 35.8 | ...do ..... | 60 |
| 3412 | Aug. 24 | 9.00 a. m. | 53 38 00 | 170 39 00 | 1,171 | bk. S. C | 48 | 47 | ..... | ...do ..... | 60 |
| 3413 | ...do ... | 5.43 p. m. | 54 08 00 | 170 47 00 | 1,053 | gn. M. fne. S | 49 | 48 | ..... | ...do ..... | 60 |
| 3414 | Aug. 31 | 9.01 a. m. | 54 13 00 | 165 58 00 | 42 | dk. gy. S | 51 | 46 | 44.6 | Tanner | 25 |
| 3415 | ...do ... | 9.48 a. m. | 54 10 00 | 165 54 00 | 42 | dk. gy. S | 51 | 46 | 45.0 | ...do ..... | 25 |
| 3416 | ...do ... | 10.46 a. m. | 54 07 00 | 165 51 00 | 38 | bk. M. fne. S | 54 | 47 | 45.0 | ...do ..... | 25 |
| 3417 | ...do ... | 1.56 p. m. | 54 18 00 | 165 41 00 | 45 | G. brk. Sh | 51 | 46 | 45.9 | ...do ..... | 25 |
| 3418 | ...do ... | 3.49 p. m. | 54 26 00 | 165 28 00 | 84 | G. crs. bk. S | 50 | 46 | 41.5 | ...do ..... | 25 |
| 3419 | ...do ... | 5.52 p. m. | 54 14 00 | 165 33 00 | 23 | fne. gy. S | 55 | 47 | ..... | Bassnett tube. | 25 |
| 3420 | ...do ... | 5.57 p. m. | 54 13 45 | 165 33 30 | 23 | fne. gy. S | 55 | 47 | ..... | ...do ..... | 25 |
| 3421 | ...do ... | 6.03 p. m. | 54 13 30 | 165 34 00 | 28 | fne. gy. S | 55 | 47 | ..... | ...do ..... | 25 |
| 3422 | ...do ... | 6.09 p. m. | 54 13 15 | 165 34 30 | 25 | fne. gy. S. bk. Sp | 55 | 47 | ..... | ...do ..... | 25 |
| 3423 | ...do ... | 6.15 p. m. | 54 13 00 | 165 35 00 | 26 | fne. gy. S. Sh | 55 | 47 | ..... | ...do ..... | 25 |
| 3424 | Sept. 1 | 7.54 a. m. | 54 36 00 | 165 27 00 | 113 | bk. S. G | 50 | 46 | 39.0 | Tanner | 25 |
| 3425 | ...do ... | 2.17 p. m. | 55 12 00 | 166 36 00 | 81 | G. M | 53 | 49 | 39.9 | ...do ..... | 25 |
| 3426 | ...do ... | 9.28 p. m. | 55 47 00 | 167 53 00 | 78 | fne. bk. S | 49 | 47 | 38.8 | ...do ..... | 25 |
| 3427 | ...do ... | 11.30 p. m. | 55 59 00 | 168 19 00 | 79 | fne. gy. S | 49 | 46 | 39.0 | ...do ..... | 25 |
| 3428 | Sept. 2 | 1.37 a. m. | 56 11 00 | 168 45 00 | 97 | fne. dk. S | 48 | 46 | 39.0 | ...do ..... | 25 |
| 3429 | ...do ... | 5.03 a. m. | 56 22 00 | 169 09 00 | 77 | crs. S. G | 49 | 47 | 40.0 | ...do ..... | 25 |
| 3429a | ...do ... | 9.33 a. m. | 56 28 00 | 170 04 00 | 61 | gn. M. fne. S | 49 | 47 | 39.3 | ...do ..... | 25 |
| 3430 | ...do ... | 2.30 p. m. | 56 55 00 | 170 18 00 | 47 | gn. M. fne. S | 49 | 46 | 40.6 | ...do ..... | 25 |
| 3431 | Sept. 3 | 11.48 a. m. | 56 48 00 | 169 26 00 | 43 | gn. M | 47 | 45 | 39.0 | ...do ..... | 25 |
| 3432 | Sept. 8 | 7.28 a. m. | 54 01 30 | 166 23 00 | 42 | bk. S. G | 51 | 47 | 44.7 | ...do ..... | 25 |
| 3433 | ...do ... | 7.54 a. m. | 54 05 00 | 166 18 00 | 49 | rky | 52 | 47 | 43.2 | ...do ..... | 25 |
| 3434 | ...do ... | 8.39 a. m. | 54 09 00 | 166 15 00 | 54 | G. brk. Sh | 52 | 45 | 42.5 | ...do ..... | 25 |
| 3435 | ...do ... | 9.14 a. m. | 54 12 00 | 166 09 00 | 57 | dk. G | 51 | 45 | 42.1 | ...do ..... | 25 |
| 3436 | ...do ... | 10.46 a. m. | 54 16 40 | 165 50 00 | 49 | dk. gy. S | 51 | 45 | 44.0 | ...do ..... | 25 |
| 3437 | ...do ... | 12.00 m. | 54 18 00 | 165 40 00 | 50 | gy. S. brk. Sh | 57 | 46 | 43.0 | ...do ..... | 25 |
| 3438 | ...do ... | 12.27 p. m. | 54 15 30 | 165 32 00 | 51 | crs. dk. S. brk. Sh. | 57 | 46 | 42.9 | ...do ..... | 25 |
| 3439 | Sept. 9 | 7.56 a. m. | 54 27 00 | 163 55 00 | 52 | fne. gy. S. bk. Sp. | 52 | 48 | 46.5 | ...do ..... | 25 |
| 3440 | ...do ... | 10.02 a. m. | 54 32 00 | 163 31 00 | 54 | bk. S. G | 55 | 48 | 44.0 | ...do ..... | 25 |
| 3441 | ...do ... | 10.54 a. m. | 54 33 00 | 163 19 00 | 61 | bk. G | 55 | 48 | 42.8 | ...do ..... | 25 |
| 3442 | ...do ... | 12.50 p. m. | 54 39 00 | 163 05 00 | 35 | fne. G. brk. Sh | 53 | 47 | 45.0 | ...do ..... | 25 |
| 3443 | ...do ... | 1.11 p. m. | 54 40 00 | 163 03 00 | 37 | G. brk. Sh | 53 | 47 | ..... | ...do ..... | 25 |
| 3144 | ...do ... | 1.47 p. m. | 54 44 00 | 162 56 00 | 41 | rky | 53 | 47 | ..... | Bassnett tube. | 25 |
| 3445 | ...do ... | 2.10 p. m. | 54 46 00 | 162 52 00 | 30 | crs. dk. S | 51 | 48 | ..... | ...do ..... | 25 |
| 3446 | ...do ... | 2.40 p. m. | 54 48 00 | 162 50 00 | 33 | bk. S | 51 | 48 | ..... | ...do ..... | 25 |
| 3447 | ...do ... | 3.19 p. m. | 54 51 00 | 162 43 00 | 23 | rky | 51 | 49 | ..... | ...do ..... | 25 |
| 3448 | ...do ... | 3.35 p. m. | 54 52 00 | 162 41 00 | 15 | brk. Sh | 51 | 49 | ..... | ...do ..... | 25 |
| 3449 | ...do ... | 3.47 p. m. | 54 53 00 | 162 39 00 | 18 | G. brk. Sh | 51 | 49 | ..... | ...do ..... | 25 |
| 3450 | ...do ... | 3.58 p. m. | 54 53 30 | 162 38 00 | 15 | G. brk. Sh | 51 | 49 | ..... | ...do ..... | 25 |
| 3451 | ...do ... | 4.08 p. m. | 54 54 00 | 162 37 00 | 10 | bk. S. brk. Sh | 51 | 49 | ..... | ...do ..... | 25 |
| 3452 | Sept. 11 | 8.43 a. m. | 55 12 30 | 161 53 00 | 22 | bk. S. R | 52 | 48 | ..... | ...do ..... | 25 |
| 3453 | ...do ... | 10.43 a. m. | 55 18 00 | 161 18 00 | 32 | dk. S | 53 | 49 | ..... | ...do ..... | 25 |
| 3454 | ...do ... | 11.41 a. m. | 55 19 00 | 161 03 00 | 28 | crs. S. G. brk. Sh. | 52 | 49 | ..... | ...do ..... | 25 |
| 3455 | ...do ... | 12.43 p. m. | 55 23 30 | 160 54 00 | 31 | gy. S. bk. Sp | 52 | 49 | ..... | ...do ..... | 25 |
| 3456 | ...do ... | 12.58 p. m. | 55 24 30 | 160 49 30 | 32 | bk. S | 52 | 49 | ..... | ...do ..... | 25 |
| 3457 | ...do ... | 1.19 p. m. | 55 25 00 | 160 45 00 | 42 | fne. bk. S | 53 | 49 | ..... | ...do ..... | 25 |

*Record of hydrographic soundings by the U. S. Fish Commission steamer Albatross for the fiscal year ending June 30, 1894*—Continued.

| Serial No. | Date. | Time of day. | Position. | | Depth. | Character of bottom. | Temperature. | | | Instrument used. | Weight of sinker. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lat. N. | Long. W. | | | Air. | Surface. | Bottom. | | |
| | 1893. | | ° ′ ″ | ° ′ ″ | *Fms.* | | ° F. | ° F. | ° F. | | *Lbs.* |
| 3458 | Sept. 11 | 1.30 p. m. | 55 26 00 | 160 41 00 | 36 | brk. Sh | 53 | 49 | ..... | Bassnett | 25 |
| 3459 | ...do ... | 1.44 p. m. | 55 28 00 | 160 37 00 | 21 | brk. Sh | 53 | 49 | ..... | tube. | 25 |
| 3460 | ...do ... | 1.50 p. m. | 55 29 00 | 160 35 00 | 19 | G. brk. Sh | 52 | 48 | ..... | ...do ..... | 25 |
| 3461 | ...do ... | 2.01 p. m. | 55 30 00 | 160 34 30 | 13 | bk. S. Sh | 52 | 48 | ..... | ...do ..... | 25 |
| 3462 | ...do ... | 2.08 p. m. | 55 31 00 | 160 35 00 | 27 | fne. bk. S. Sh | 52 | 48 | ..... | ...do ..... | 25 |
| 3463 | ...do ... | 2.14 p. m. | 55 32 00 | 160 35 00 | 31 | fne. bk. S | 52 | 48 | ..... | ...do ..... | 25 |
| 3464 | ...do ... | 2.21 p. m. | 55 33 00 | 160 35 00 | 38 | bk. S | 52 | 48 | ..... | ...do ..... | 25 |
| 3465 | ...do ... | 2.28 p. m. | 55 34 00 | 160 35 00 | 38 | gy. S. Sh | 52 | 48 | ..... | ...do ..... | 25 |
| 3466 | ...do ... | 2.35 p. m. | 55 35 00 | 160 35 00 | 42 | bk. S | 52 | 49 | ..... | ...do ..... | 25 |
| 3467 | ...do ... | 2.40 p. m. | 55 35 30 | 160 35 00 | 31 | bk. S. Sh | 52 | 49 | ..... | ...do ..... | 25 |
| 3468 | ...do ... | 2.43 p. m. | 55 36 00 | 160 35 00 | 26 | bk. S | 52 | 49 | ..... | ...do ..... | 25 |
| 3469 | Sept. 14 | 8.00 a. m. | 57 14 00 | 151 52 00 | 46 | gy. S. brk. Sh | 48 | 47 | ..... | Tanner .. | 25 |
| 3470 | ...do ... | 5.56 p. m. | 57 24 00 | 149 33 00 | 938 | rky | 48 | 47 | 36.1 | Sigsbee .. | 35 |
| 3471 | ...do ... | 8.06 p. m. | 57 21 00 | 149 11 00 | 1,427 | bl. M. S | 49 | 47 | 35.1 | ...do ..... | 60 |
| 3472 | ...do ... | 10.52 p. m. | 57 18 00 | 148 38 00 | 1,961 | br. M. fne. S | 50 | 48 | 35.1 | ...do ..... | 60 |
| 3473 | Sept. 15 | 1.53 a. m. | 57 14 00 | 148 06 00 | 2,741 | br. M | 50 | 47 | 35.0 | ...do ..... | 60 |
| 3474 | ...do ... | 5.39 a. m. | 57 08 00 | 147 22 00 | 2,587 | br. M | 53 | 51 | 35.0 | ...do ..... | 60 |
| 3475 | ...do ... | 9.20 a. m. | 57 11 00 | 146 41 00 | 2,320 | gy. Oz | 57 | 51 | 35.0 | ...do ..... | 60 |
| 3476 | ...do ... | 1.10 p. m. | 57 15 00 | 145 52 00 | 2,150 | gy. Oz | 56 | 51 | 34.6 | ...do ..... | 60 |
| 3477 | ...do ... | 4.50 p. m. | 57 18 00 | 145 05 00 | 2,149 | gy. Oz | 59 | 52 | 35.1 | ...do ..... | 60 |
| 3478 | ...do ... | 8.44 p. m. | 57 20 00 | 144 17 00 | 2,119 | gy. Oz | 53 | 51 | 35.1 | ...do ..... | 60 |
| 3479 | Sept. 16 | 12.26 a. m. | 57 20 00 | 143 27 00 | 2,099 | gy. Oz | 53 | 51 | 35.1 | ...do ..... | 60 |
| 3480 | ...do ... | 4.35 a. m. | 57 17 00 | 142 28 00 | 2,034 | gy. Oz | 53 | 51 | 35.1 | ...do ..... | 60 |
| 3481 | ...do ... | 8.40 a. m. | 57 12 00 | 141 31 00 | 1,946 | lt. br. Oz | 55 | 52 | 35.1 | ...do ..... | 60 |
| 3482 | ...do ... | 1.02 p. m. | 57 09 30 | 140 37 00 | 1,826 | lt. br. Oz | 58 | 54 | 35.1 | ...do ..... | 60 |
| 3483 | ...do ... | 5.05 p. m. | 57 09 00 | 139 38 00 | 1,868 | br. Oz | 59 | 55 | 35.0 | ...do ..... | 60 |
| 3484 | ...do ... | 9.12 p. m. | 57 07 00 | 138 40 00 | 1,724 | br. and gy. Oz | 54 | 53 | 35.1 | ...do ..... | 60 |
| 3485 | Sept. 17 | 1.25 a. m. | 57 04 00 | 137 43 00 | 1,553 | gy. Oz | 53 | 51 | 35.1 | ...do ..... | 60 |
| 3486 | ...do ... | 5.28 a. m. | 57 01 00 | 136 46 00 | 1,270 | br. M | 53 | 52 | 35.1 | ...do ..... | 60 |
| 3487 | ...do ... | 7.44 a. m. | 57 00 00 | 136 12 30 | 756 | gn. M. S | 55 | 53 | 38.0 | ...do ..... | 35 |
| 3488 | ...do ... | 9.43 a. m. | 56 58 40 | 135 47 30 | 55 | rky | 55 | 54 | 45.0 | Tanner .. | 25 |

| Serial No. | Date. | Time of day. | Position. | | Depth. | Character of bottom. | Temperature. | | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lat. N. | Long. E. | | | Air. | Surface. | Bottom. | |
| | 1894. | | ° ′ ″ | ° ′ ″ | *Fms.* | | | | | |
| Hy. 3490 | June 6 | 9.00 p. m. | 52 46 30 | 175 27 00 | 2,237 | No specimen | 44 | 40 | ..... | |
| Hy. 3491 | June 7 | 5.06 a. m. | 52 41 30 | 176 24 00 | 2,107 | br. M. fne. S. | 40 | 39 | 3.50 | |
| Dr. 3598 | June 8 | 3.18 p. m. | 52 01 00 | 177 34 00 | 34 | bk. G | 43 | 40 | ..... | Beam-trawl. |
| Dr. 3599 | June 9 | 10.49 a. m. | 52 05 00 | 177 40 00 | 55 | rky. fne. S. Sh | 43 | 42 | ..... | Do. |
| | | | | *West.* | | | | | | |
| Dr. 3600 | June 26 | 3.41 p. m. | 55 06 00 | 163 28 00 | 9 | fne. dk. vol. S | 43 | 41 | 40.0 | Beam-trawl. |
| Hy. 3492 | June 29 | 1.08 p. m. | 57 59 00 | 166 04 00 | 32 | gy. S | 44 | 38 | 33.0 | Fished. |
| Hy. 3493 | ...do ... | 4.16 p. m. | 58 06 00 | 165 22 00 | 26 | fne. gy. S | 45 | 38 | 35.7 | Do. |
| Hy. 3494 | ...do ... | 11.55 p. m. | 58 24 00 | 163 38 00 | 21 | fne. gy. S | 40 | 37 | 34.5 | |
| Hy. 3495 | June 30 | 7.36 a. m. | 57 28 00 | 163 14 00 | 27 | fne. gy. S | 38 | 38 | 34.0 | Do. |
| Hy. 3496 | ...do ... | 12.03 p. m. | 56 59 00 | 163 02 00 | 34 | fne. gy. S | 42 | 40 | 32.0 | Do. |
| Hy. 3497 | ...do ... | 3.24 p. m. | 56 59 00 | 163 48 00 | 37 | fne. gy. S | 42 | 40 | 34.3 | Do. |
| Hy. 3498 | ...do ... | 9.34 p. m. | 56 58 00 | 165 15 00 | 44 | gn. M | 41 | 38 | 34.0 | |

*Record of dredging and trawling stations of the U. S. Fish Commission steamer Albatross.*

| Serial No. | Date. | Time. | Position. | | Temperatures. | | | Depth. | Character of bottom. | Wind. | | Drift. | | Instrument used, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lat. N. | Long. W. | Air. | Surface. | Bottom. | | | Direction. | Force. | Direction. | Distance. | |
| | 1893. | | ° ′ ″ | ° ′ ″ | ° F. | ° F. | ° F. | *Fms.* | | | | | *Miles.* | |
| 3477 | Apr. 26 | 9.20 a. m. | 36 50 00 | 121 59 45 | 54 | 51 | 46.5 | 80 | rky | North | 1 | | | L. B. T. |
| 3478 | ...do.... | 11.24 a. m. | 36 44 45 | 120 57 00 | 56 | 53 | ..... | 68 | gy. S. M. | SW | 2 | | | L. B. T., surface tow net. |
| 3479 | Apr. 27 | 6.55 a. m. | 37 28 00 | 123 00 00 | 52 | 50 | ..... | 276 | gn. M. fne. S. | WNW | 3 | | | L. B. T. |
| 3480 | July 8 | 11.02 a. m. | 52 06 00 | 171 45 00 | 50 | 47 | ..... | 283 | bk. S. Co. rky | West | 2 | | | L. B. T. |
| 3481 | ...do.... | 1.29 p. m. | 52 15 00 | 171 40 00 | 51 | 48 | ..... | 248 | bk. S. G. | West | 2 | | | L. B. T. and swabs. |
| 3482 | July 12 | 9.05 a. m. | 57 18 00 | 170 42 00 | 43 | 42 | 38.9 | 42 | gn. M. fne. S. | SW | 3 | WSW. ½ W | 0.7 | S. B. T. and swabs. |
| 3483 | ...do.... | 12.32 p. m. | 57 18 00 | 171 18 00 | 44 | 42 | 36.8 | 56 | gn. M. | SW | 3 | S. by E. | 0.5 | Do. |
| 3484 | ...do.... | 4.11 p. m. | 57 18 00 | 171 54 00 | 43 | 44 | 37.4 | 60 | bu. M. | SW. by W. | 3 | SW. ½ W. | 1.0 | L. B. T. and mud bag. |
| 3485 | ...do.... | 8.13 p. m. | 57 18 00 | 172 34 00 | 42 | 44 | 37.1 | 62 | gn. M. | SW. by W. | 2 | S. by W. ½ W. | 0.7 | L. B. T. |
| 3486 | July 13 | 3.51 a. m. | 57 19 00 | 173 53 00 | 43 | 43 | 38 | 150 | gn. M. fne. S. | SW | 1 | ESE. ½ E. | 1.0 | L. B. T. and mud bag. |
| 3487 | ...do.... | 7.24 a. m. | 57 10 00 | 173 45 00 | 43 | 43 | 37.6 | 81 | gn. M. fne. S. | SE. | 1 | | | Do. |
| 3488 | ...do.... | 9.14 a. m. | 57 05 00 | 173 47 00 | 45 | 45 | 37.3 | 106 | gn. M. gy. S. | SE. | 1 | E. ½ N. | 1.2 | Do. |
| 3489 | ...do.... | 10.22 a. m. | 57 00 00 | 173 14 00 | 47 | 46 | 38.5 | 184 | gn. M. gy. S. | SE. | 1 | E. ½ S. | 1.2 | Do. |
| 3490 | ...do.... | 3.09 p. m. | 56 47 00 | 173 14 00 | 46 | 46 | 38 | 78 | gn. M. fne. S. | E. by N. | 3 | NE. by E. | 1.3 | Do. |
| 3491 | July 14 | 4.05 a. m. | 56 32 00 | 172 28 00 | 45 | 44 | ..... | 103 | gn. M. fne. gy. S. | ENE | 3.5 | NE | 2.5 | Do. |
| 3492 | ...do.... | 8.12 a. m. | 56 32 00 | 171 50 00 | 46 | 45 | 37.8 | 70 | gn. M. fne. S. | NNE | 5 | NE. by E. | 0.8 | Do. |
| 3493 | ...do.... | 11.12 a. m. | 56 33 00 | 171 20 00 | 47 | 46 | 38.5 | 67 | gn. M. fne. S. | NNE | 4 | E. by S. | 0.3 | Do. |
| 3494 | ...do.... | 2.56 p. m. | 56 34 00 | 170 34 00 | 50 | 46 | 38.5 | 65 | gn. M. fne. S. | North | 3 | ENE | 1.2 | L. B. T. |
| 3495 | ...do.... | 5.55 p. m. | 56 37 00 | 170 01 00 | 46 | 45 | 38.5 | 56 | gn. M. fne. S. | North | 2 | NE. by E. | 1.2 | L. B. T. |
| 3496 | July 17 | 5.45 a. m. | 56 32 00 | 169 45 00 | 48 | 42 | 39.9 | 41 | gy. S. St. gn. M. | SW | 3 | SE. by E. | 0.1 | L. B. T. and mud bag. |
| 3497 | ...do.... | 8.09 a. m. | 56 18 00 | 169 38 00 | 48 | 42 | 38.7 | 86 | gy. S. bk. Sp. | SW | 3 | SE. by S. | 1.2 | Do. |
| 3498 | ...do.... | 9.10 a. m. | 56 13 00 | 169 36 00 | 48 | 45 | 38.6 | 112 | fne. gy. S. G. | SW | 3 | SE. by E. | 0.8 | Do. |
| 3499 | ...do.... | 9.51 a. m. | 56 12 00 | 169 35 00 | 49 | 46 | 38.5 | 162 | fne. gy. S. G. | SW | 3 | SE. by S. | 0.4 | L. B. T. |
| 3500 | ...do.... | 11.53 a. m. | 56 02 00 | 169 30 00 | 49 | 46 | 38.6 | 121 | fne. gy. S. G. | South | 3 | SE. by S. | 0.7 | L. B. T., surface tow net. |
| 3501 | ...do.... | 2.16 p. m. | 55 51 00 | 169 18 00 | 50 | 47 | 36.9 | 688 | gn. M. | South | 3 | SE. ⅝ E. | 4.0 | Do. |
| 3502 | ...do.... | 6.55 p. m. | 55 38 00 | 169 00 00 | 49 | 46 | ..... | 368 | gn. M. dk. S. | SSW | 3 | SE. ½ E. | 0.5 | Do. |
| 3503 | July 28 | 10.44 a. m. | 57 06 15 | 170 11 00 | 54 | 43 | 37.9 | 17 | gn. M. fne. S. | NW | 3 | NE. by E. ½ E. | 0.3 | S. B. T. |
| 3504 | ...do.... | 2.23 p. m. | 56 57 00 | 169 27 00 | 54 | 45 | 37.8 | 34 | fne. gy. S. bk. Sp. | WNW | 2 | NE. by E | 0.2 | L. B. T. |
| 3505 | ...do.... | 7.55 p. m. | 57 09 00 | 168 17 00 | 46 | 44 | 38.1 | 44 | fne. gy. S. | WNW | 4 | E. by N. | 0.5 | L. B. T. |
| 3506 | July 29 | 6.39 a. m. | 57 33 00 | 165 55 00 | 43 | 42 | 32 | 36 | gy. S. M. | NE | 2 | NNW. ½ W | 0.8 | L. B. T. |
| 3507 | ...do.... | 1.00 p. m. | 57 43 00 | 164 42 00 | 50 | 43 | 37.5 | 31 | fne. gy. S. | NNW | 2 | NNW. ⅛ W | 0.8 | L. B. T., surface tow net. |
| 3508 | ...do.... | 7.33 p. m. | 58 33 00 | 164 49 00 | 43 | 41 | 42 | 23 | fne. gy. S. Sh. | NW | 2 | W. ½ S. | 1.0 | Do. |
| 3509 | July 31 | 11.09 a. m. | 57 00 00 | 169 43 00 | 46 | 43 | 40.8 | 35 | fne. gy. S. Sh. | SE. | 1 | W. ½ S. | 0.3 | R. D. |
| 3510 | Aug. 1 | 6.14 a. m. | 57 12 30 | 169 51 00 | 47 | 43 | 40.1 | 27 | Sh. bk. S. | NE | 4 | NNW | 1.7 | L. B. T. |
| 3511 | ...do.... | 10.10 a. m. | 57 32 00 | 169 38 00 | 48 | 44 | 37.2 | 39 | fne. S. dk. M. | N. by E. | 4 | NW. by W | 0.6 | L. B. T. |
| 3512 | ...do.... | 1.34 p. m. | 57 49 30 | 169 27 00 | 49 | 45 | 36.6 | 38 | fne. S. gn. M. | NW | 3 | NE | 0.5 | R. D. |
| 3513 | ...do.... | 7.43 p. m. | 58 27 00 | 169 01 00 | 46 | 43 | ..... | 35 | fne. S. gn. M. | NNW | 4 | North | 0.7 | L. B. T. and mud bag. |
| 3514 | Aug. 2 | 4.05 a. m. | 59 22 00 | 168 21 00 | 40 | 40 | 40.8 | 21 | fne. gy. S. | NW. by W. | 4 | North | 0.6 | L. B. T. |
| 3515 | ...do.... | 10.43 a. m. | 59 59 00 | 167 53 00 | 42 | 42 | 41.8 | 13 | fne. gy. S. | NNW | 4 | North | 0.6 | L. B. T. and mud bag. |
| 3516 | ...do.... | 3.57 p. m. | 60 28 00 | 168 08 00 | 43 | 44 | 43.2 | 17 | fne. gy. S. | NW | 3 | WSW. ½ W | 0.2 | L. B. T. |
| 3517 | ...do.... | 8.01 p. m. | 60 27 00 | 169 04 00 | 41 | 41 | 40.3 | 24 | fne. gy. S. | West | 4 | WSW. ⅛ W | 1.0 | L. B. T., surface tow net. |
| 3518 | Aug. 3 | 6.40 a. m. | 60 22 00 | 171 42 00 | 41 | 42 | 33.9 | 36 | gn. M. | West | 3 | SSE. ½ E. | 1.0 | Do. |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3519 | ...do .... | 10.03 a. m. | 60 | 06 | 00 | 171 | 25 | 00 | 43 | 42 | 31.1 | 37 | bk. M. fne. S .... | SSE ..... | 2 | ESE ..... | 0.5 | Do. |
| 3520 | ...do .... | 4.10 p. m. | 59 | 28 | 00 | 170 | 57 | 00 | 43 | 43 | 32.2 | 38 | gn. M. fne. S .... | SE..... | 3 | E. by S ..... | 0.7 | L. B. T. and mud bag, surface tow net. |
| 3521 | ...do .... | 7.35 p. m. | 59 | 09 | 00 | 170 | 48 | 00 | 43 | 43 | 31.9 | 40 | gn. M. fne. S .... | SE..... | 5 | ESE..... | 0.5 | L. B. T., surface tow net. |
| 3522 | Aug. 4 | 9.24 a. m. | 57 | 58 | 00 | 170 | 09 | 00 | 46 | 44 | 35.7 | 41 | crs. gy. S. G .... | SW..... | 4 | SSE ..... | 1.0 | L. B. T. and mud bag, surface tow net. |
| 3523 | ...do .... | 1.18 p. m. | 57 | 39 | 00 | 170 | 02 | 00 | 47 | 45 | 38 | 39 | gn. M. fne. S .... | SSW ..... | 3 | SSE ..... | 0.7 | L. B. T., surface tow net. |
| 3524 | ...do .... | 4.08 p. m. | 57 | 24 | 00 | 169 | 56 | 00 | 46 | 45 | 40.3 | 36 | gy. S. P ..... | SSW ..... | 4 | SSE ..... | 1.3 | Do. |
| 3525 | ...do .... | 5.40 p. m. | 57 | 21 | 00 | 170 | 05 | 00 | 46 | 45 | 41.6 | 29 | bk. S. Sh ..... | SSE ..... | 4 | SE. $\frac{1}{2}$ E..... | 0.7 | R. D. |
| 3526 | Aug. 5 | 7.24 a. m. | 57 | 31 | 00 | 170 | 57 | 00 | 47 | 44 | 38.9 | 49 | dk. M. fne. S .... | SSW ..... | 3 | NW. by W..... | 0.8 | R. D. |
| 3527 | ...do .... | 10.35 a. m. | 57 | 48 | 00 | 171 | 21 | 00 | 48 | 44 | 38 | 52 | gn. M ..... | SSW ..... | 4 | NW. by W..... | 0.6 | L. B. T., surface tow net. |
| 3528 | ...do .... | 5.03 p. m. | 58 | 19 | 30 | 172 | 02 | 00 | 47 | 45 | 35.9 | 55 | dk. gn. M. fne. S. | SW..... | 3 | NW. by W..... | 0.7 | L. B. T. |
| 3529 | ...do .... | 8.18 p. m. | 58 | 36 | 00 | 172 | 24 | 00 | 46 | 45 | 36.1 | 56 | gn. M ..... | SW..... | 3 | WNW. $\frac{1}{4}$ W..... | 0.7 | L. B. T. |
| 3530 | Aug. 6 | 7.33 a. m. | 59 | 39 | 00 | 173 | 53 | 00 | 45 | 44 | 34.9 | 59 | dk. gn. M. fne. S. | Calm ..... | 0 | W. $\frac{1}{2}$ N ..... | 0.5 | L. B. T., surface tow net. |
| 3531 | ...do .... | 11.00 a. m. | 59 | 55 | 00 | 174 | 17 | 00 | 47 | 46 | 35.1 | 59 | gn. M ..... | SE..... | 1 | W. $\frac{1}{2}$ S ..... | 1.0 | Do. |
| 3532 | ...do .... | 7.40 p. m. | 59 | 12 | 00 | 175 | 39 | 00 | 48 | 44 | 34.8 | 77 | dk. gn. M. fne. S. | N. by E... | 3 | SE..... | 1.2 | Do. |
| 3533 | Aug. 7 | 7.42 p. m. | 57 | 34 | 00 | 173 | 33 | 00 | 47 | 46 | 39.2 | 70 | gy. S. bk. Sp..... | NW. by N. | 4 | NE ..... | 0.7 | L. B. T. |
| 3534 | Aug. 8 | 5.56 a. m. | 57 | 03 | 00 | 171 | 19 | 00 | 47 | 45 | 38.1 | 59 | gn. M ..... | NNW ..... | 5 | NE. by E..... | 0.9 | L. B. T. |
| 3535 | ...do .... | 8.56 a. m. | 57 | 02 | 00 | 170 | 46 | 00 | 48 | 45 | 39 | 52 | gn. M. fne. S .... | NNW ..... | 5 | NNE ..... | 0.8 | L. B. T. |
| 3536 | ...do .... | 10.18 a. m. | 57 | 05 | 00 | 170 | 35 | 00 | 48 | 45 | 42.4 | 40 | gn. M. fne. S .... | NNW ..... | 5 | NNE ..... | 0.5 | L. B. T. |
| 3537 | Aug. 9 | 6.55 a. m. | 54 | 45 | 00 | 169 | 06 | 00 | 45 | 43 | 38 | 49 | fne. gy. S..... | SW ..... | 2 | E. $\frac{1}{2}$ N. ..... | 1.0 | L. B. T., surface tow net. |
| 3538 | ...do .... | 10.13 a. m. | 56 | 41 | 00 | 168 | 29 | 00 | 48 | 46 | 38 | 59 | gn. M. S..... | West ..... | 2 | E. $\frac{1}{2}$ N..... | 0.8 | Do. |
| 3539 | ...do .... | 3.49 p. m. | 56 | 34 | 00 | 167 | 19 | 00 | 49 | 45 | 38.9 | 57 | gn. M. S..... | SW ..... | 3 | E. $\frac{1}{2}$ S ..... | 0.5 | L. B. T. and mud bag, surface tow net. |
| 3540 | ...do .... | 9.12 p. m. | 56 | 27 | 00 | 166 | 03 | 00 | 47 | 45 | 36 | 51 | gn. M. fne. S .... | SSW..... | 3 | East ..... | 0.6 | L. B. T., surface tow net. |
| 2541 | Aug. 10 | 5.19 a. m. | 56 | 14 | 00 | 164 | 08 | 00 | 48 | 46 | 36.1 | 49 | bk. M. fne. S .... | SSE ..... | 3 | E. $\frac{1}{2}$ N..... | 0.5 | L. B. T. and mud bag, surface tow net. |
| 3542 | ...do .... | 8.43 a. m. | 56 | 10 | 00 | 163 | 26 | 00 | 49 | 47 | 39.2 | 49 | dk. M. fne. S .... | SE..... | 3 | SE. by E. $\frac{1}{2}$ E.... | 0.7 | L. B. T., surface tow net. |
| 3543 | Aug. 18 | 4.17 p. m. | 56 | 41 | 00 | 169 | 39 | 00 | 48 | 44 | 42.7 | 43 | bk. S. Sh ..... | WNW .... | 2 | East ..... | 1.0 | Do. |
| 3544 | ...do .... | 7.20 p. m. | 56 | 50 | 00 | 169 | 59 | 00 | 47 | 44 | 41.1 | 41 | fne. gy. S. Sh .... | NW. by N. | 2 | WSW ..... | 0.5 | Do. |
| 3545 | Aug. 21 | 5.07 p. m. | 56 | 15 | 00 | 171 | 33 | 00 | 52 | 48 | 36 | 1,020 | gn. M. fne. S. C.. | West ..... | 5 | NNE. $\frac{1}{2}$ E ..... | 0.7 | Agassiz dredge, surface tow net. |
| 3546 | Aug. 31 | 11.24 a. m. | 54 | 12 | 00 | 165 | 42 | 00 | 54 | 47 | 45.6 | 36 | G. bk. S ..... | South..... | 2.4 | NW ..... | 1.0 | L. B. T. and mud bag. |
| 3547 | ...do .... | 12.38 p. m. | 54 | 16 | 00 | 165 | 45 | 00 | 54 | 47 | 45 | 51 | fne. bk. S..... | South..... | 2.3 | NNE. $\frac{1}{2}$ E ..... | 0.7 | L. B. T., surface tow net. |
| 3548 | Sept. 1 | 9.03 a. m. | 54 | 44 | 00 | 165 | 42 | 00 | 52 | 47 | 39.5 | 91 | bk. S..... | East ..... | 3 | W. $\frac{1}{2}$ S ..... | 1.5 | Do. |
| 3549 | ...do .... | 11.54 a. m. | 55 | 00 | 00 | 166 | 10 | 00 | 53 | 49 | 40.1 | 78 | fne. bk. S..... | E. by S.... | 5 | WNW ..... | 2.0 | Do. |
| 3550 | ...do .... | 4.26 p. m. | 55 | 24 | 00 | 167 | 02 | 00 | 51 | 48 | 39 | 76 | br. M ..... | NE ..... | 5 | NNW. $\frac{1}{2}$ W..... | 0.8 | Do. |
| 3551 | ...do .... | 6.56 p. m. | 55 | 36 | 00 | 167 | 28 | 00 | 49 | 47 | 39.1 | 74 | gn. M ..... | NE ..... | 3 | N. by W. $\frac{1}{2}$ W ... | 1.2 | Do. |
| 3552 | Sept. 2 | 6.35 a. m. | 56 | 28 | 00 | 169 | 28 | 00 | 50 | 47 | 39.8 | 54 | bk. S. rky ..... | North..... | 4 | NNW. $\frac{1}{2}$ W..... | 0.5 | L. B. T. |
| 3553 | ...do .... | 7.58 a. m. | 56 | 28 | 00 | 169 | 46 | 00 | 48 | 48 | 39.5 | 51 | fne. gy. S. M .... | NNE ..... | 3 | NNW. $\frac{1}{2}$ W..... | 0.8 | L. B. T., surface tow net. |
| 3554 | ...do .... | 10.33 a. m. | 56 | 34 | 00 | 170 | 19 | 00 | 48 | 47 | 39.5 | 62 | gn. M ..... | NE. by N.. | 4 | N. by W. $\frac{1}{4}$ W... | 0.7 | Do. |
| 3555 | ...do .... | 12.41 p. m. | 56 | 45 | 00 | 170 | 18 | 00 | 47 | 46 | 40.2 | 57 | gn. M ..... | NE. by N.. | 4 | N. by W. $\frac{1}{2}$ W... | 1.0 | Do. |
| 3556 | ...do .... | 3.21 p. m. | 56 | 57 | 30 | 170 | 33 | 00 | 49 | 46 | 41 | 49 | gn. M. fne. S .... | NE ..... | 4 | NW. by W..... | 1.5 | Do. |
| 3557 | ...do .... | 4.49 p. m. | 57 | 04 | 00 | 170 | 24 | 00 | 48 | 45 | 45 | 26 | S. bk. Sp ..... | NE ..... | 4 | NW ..... | 1.0 | L. B. T. |
| 3558 | Sept. 3 | 7.04 a. m. | 56 | 58 | 00 | 170 | 09 | 00 | 46 | 45 | 42.9 | 25 | S. dk. Sp. rky .... | NNE ..... | 4 | SE. by E. $\frac{1}{2}$ E.... | 1.0 | L. B. T. |
| 3559 | ...do .... | 9.17 a. m. | 56 | 56 | 00 | 169 | 52 | 00 | 47 | 46 | 42.5 | 39 | gy. S. brk. Sh .... | NE. by E.. | 4 | East ..... | 0.8 | L. B. T. and mud bag, surface tow net. |
| 3560 | ...do .... | 1.10 p. m. | 56 | 40 | 00 | 169 | 20 | 00 | 47 | 45 | 40.7 | 43 | fne. gy. S. bk. Sp. | NNE ..... | 3 | E. $\frac{1}{2}$ N..... | 0.7 | L. B. T. |
| 3561 | ...do .... | 2.51 p. m. | 56 | 31 | 00 | 169 | 17 | 00 | 48 | 45 | 40.7 | 48 | gy. S. bk. Sp .... | NE ..... | 3 | ESE..... | 0.8 | L. B. T. |

*Record of boat dredging and trawling stations of the U. S. Fish Commission steamer Albatross.*

| Serial No. | Date. | Time. | Position, San Diego Bay, California. | Temperatures. | | | Depth. | Character of bottom. | Drift. | | Instrument used, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Air. | Surface. | Bottom. | | | Direction. | Distance. | |
| | 1894. | | | ° F. | ° F. | ° F. | *Fms.* | | | *Mile.* | |
| 3562 | Mar. 19 | 9.25 a. m. | Coronado Wharf, SW., $\frac{3}{10}$ mile | 62 | 58 | ..... | 7 | S. bk. Sh | ..... | 0.3 | Boat dredge. |
| 3563 | ...do .... | 10.25 a. m. | Beacon No. 8, W. $\frac{3}{10}$ mile | 64 | 56 | ..... | 6$\frac{1}{2}$ | fne. S. bk. Sh | ..... | 0.3 | Do. |
| 3564 | ...do .... | 10.50 a. m. | Beacon No. 8, NW. by W. $\frac{1}{2}$ W., $\frac{3}{10}$ mile | 66 | 58 | ..... | 5 | fne. S. M. bk. Sh. | ..... | 0.3 | Do. |
| 3565 | ...do .... | 11.28 a. m. | Beacon No. 8, NW. by W. $\frac{1}{2}$ W., 1 mile | 64 | 58 | ..... | 4$\frac{1}{2}$ | fne. S. M. bk. Sh. | ..... | 0.3 | Do. |
| 3566 | ...do .... | 11.56 a. m. | Beacon No. 9, ESE., $\frac{4}{10}$ mile | 60 | 58 | ..... | 3 | fne. S. bk. Sh.... | ..... | 0.3 | Do. |
| 3567 | Mar. 21 | 9.37 a. m. | Beacon No. 10, SE. $\frac{1}{2}$ S., $\frac{3}{10}$ mile | 57 | 57 | ..... | 3 | fne. S. bk. Sh.... | ..... | 0.3 | Do. |
| 3568 | ...do .... | 9.52 a. m. | End National City Wharf, N. by E. $\frac{1}{2}$ E., 200 yards | 57 | 57 | ..... | 4 | hrd. bk. Sh | ..... | 0.3 | Do. |
| 3569 | ...do .... | 10.06 a. m. | End National City Wharf, NNW., $\frac{6}{10}$ mile | 59 | 57 | ..... | 6 | fne. S. bk. Sh | ..... | 0.3 | Do. |
| 3570 | ...do .... | 10.24 a. m. | End National City Wharf, N. by W. $\frac{1}{2}$ W., 1$\frac{2}{10}$ miles | 60 | 57 | ..... | 2 | fne. S. oyster Sh. | ..... | 0.3 | Do. |
| 3571 | ...do .... | 11.05 a. m. | End National City Wharf, N. by W. $\frac{1}{2}$ W., 1$\frac{7}{10}$ miles | 60 | 57 | ..... | 2 | hrd | ..... | 0.3 | Do. |
| 3572 | ...do .... | 11.18 a. m. | End National City Wharf, N. by W. $\frac{1}{2}$ W., 2$\frac{1}{10}$ miles | 58 | 56 | ..... | 2 | M. fne. S | ..... | 0.3 | Do. |
| 3573 | ...do .... | 11.44 a. m. | End National City Wharf, N. by W. $\frac{1}{2}$ W., 2$\frac{6}{10}$ miles | 58 | 56 | ..... | 1$\frac{1}{2}$ | M. S | ..... | 0.3 | Boat beam-trawl. |
| 3574 | ...do .... | 2.45 p. m. | Beacon No. 7, NW. by N., $\frac{1}{10}$ mile | 64 | 57 | ..... | 5$\frac{1}{2}$ | fne. S | ..... | 0.3 | Do. |
| 3575 | ...do .... | 3.12 p. m. | Beacon No. 7, E. $\frac{1}{2}$ N., $\frac{8}{10}$ mile | 64 | 57 | ..... | 6$\frac{1}{2}$ | fne. S | ..... | 0.3 | Do. |
| 3576 | ...do .... | 3.32 p. m. | Beacon No. 5, W., $\frac{6}{10}$ mile | 64 | 58 | ..... | 5 | fne. S. bk. Sh.... | ..... | 0.3 | Do. |
| 3577 | ...do .... | 4.03 p. m. | Beacon No. 5, NNW., $\frac{3}{10}$ mile | 65 | 57 | ..... | 6 | fne. S. bk. Sh.... | ..... | 0.3 | Do. |
| 3578 | ...do .... | 4.45 p. m. | Beacon No. 4, ESE., 300 yds | 59 | 56 | ..... | 6 | fne. S. bk. Sh.... | ..... | 0.3 | Do. |
| 3579 | Mar. 22 | 9.53 a. m. | Beacon No. 3, NNW. $\frac{1}{2}$ W., $\frac{7}{10}$ mile | 57 | 53 | ..... | 9 | hrd | ..... | 0.2 | Do. |
| 3580 | ...do .... | 10.13 a. m. | Ballast Point Light House, SSE., $\frac{8}{10}$ mile | 57 | 53 | ..... | 7 | hrd | ..... | 0.1 | Do. |
| 3581 | ...do .... | 10.29 a. m. | Ballast Point Light House, WSW. $\frac{1}{2}$ W., 300 yards | 56 | 53 | ..... | 12 | fne. S. R | ..... | 0.2 | Do. |
| 3582 | ...do .... | 10.55 a. m. | Point Loma Light House, SW. by W. $\frac{1}{2}$ W., $\frac{8}{10}$ mile | 59 | 54 | ..... | 6$\frac{3}{4}$ | fne. S. R | ..... | 0.2 | Do. |
| 3583 | ...do .... | 11.10 a. m. | Point Loma Light House, W. $\frac{1}{2}$ S., $\frac{6}{10}$ mile | 59 | 53 | ..... | 4 | fne. S. R | ..... | 0.2 | Do. |
| 3584 | ...do .... | 11.25 a. m. | Bell Buoy, W. $\frac{1}{2}$ S., 125 yds | 58 | 54 | ..... | 8 | fne. S. R | ..... | 0.3 | Do. |
| 3585 | Mar. 24 | 1.30 p. m. | Beacon No. 8, WNW., $\frac{1}{10}$ mile | 63 | 57 | ..... | 4 | fne. gy. S | ..... | 0.3 | Do. |
| 3586 | ...do .... | 1.50 p. m. | Beacon No. 9, ESE., $\frac{8}{10}$ mile | 63 | 57 | ..... | 4 | fne. gy. S | ..... | 0.4 | Do. |
| 3587 | ...do .... | 2.30 p. m. | Beacon No. 9, ENE. $\frac{1}{2}$ E., 300 yds | 64 | 57 | ..... | 3 | fne. gy. S | ..... | 0.2 | Do. |
| 3588 | ...do .... | 3.05 p. m. | Beacon No. 10, WNW., $\frac{3}{10}$ mile | 64 | 57 | ..... | 2$\frac{1}{2}$ | R. oyster Sh | ..... | 0.3 | Do. |
| 3589 | ...do .... | 3.25 p. m. | End National City Wharf, N. by W. $\frac{1}{2}$ W., $\frac{8}{10}$ mile | 64 | 57 | ..... | 3 | R. oyster Sh | ..... | 0.3 | Do. |
| 3590 | ...do .... | 3.50 p. m. | End National City Wharf, N. by W. $\frac{1}{2}$ W., 1$\frac{4}{10}$ miles | 65 | 57 | ..... | 3$\frac{1}{2}$ | R. bk. Sh | ..... | 0.3 | Do. |
| 3591 | ...do .... | 4.25 p. m. | Beacon No. 8, SW. $\frac{1}{2}$ S., $\frac{3}{10}$ mile | 64 | 57 | ..... | 4$\frac{1}{2}$ | R. bk. Sh | ..... | 0.4 | Do. |

NOTE.—All bearings are magnetic. Chart used, C. S. No. 5106.

*Record of dredging and trawling stations of the U. S. Fish Commission steamer Albatross.*

| Serial No. | Date. | Time. | Position. | | Temperatures. | | Depth. | Character of bottom. | Wind. | | Drift. | | Instrument used, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lat. N. | Long. W. | Air. | Surface. | Bottom. | | Direction. | Force. | Direction. | Distance. | |
| | 1894. | | ° ′ ″ | ° ′ ″ | ° F. | ° F. | ° F. | *Fms.* | | | | *Miles.* | |
| 3592 | Apr. 30 | 9.50 a. m. | 48 10 00 | 122 45 30 | 48 | 46 | ..... | 27 | R. S | SSE | 2 | W. by N | 0.3 | S. B. T. |
| 3593 | ...do .... | 10.29 a. m. | 48 11 30 | 122 48 00 | 48 | 46 | 46 | 37 | Rky | SSE | 2 | WNW | 0.3 | Ship's dredge. |
| 3594 | ...do .... | 10.47 a. m. | 48 12 00 | 122 50 00 | 50 | 46 | 46 | 36 | S. P | SSE | 2 | West | 0.4 | Tangles. |
| 3595 | ...do .... | 11.56 a. m. | 48 13 00 | 122 59 30 | 51 | 46 | 45 | 49 | Rky. G. S | ENE | 3 | South | 3.0 | Tangles. |
| 3596 | ...do .... | 1.08 p. m. | 48 14 30 | 122 58 00 | 53 | 46 | 44 | 81 | bu. M | West | 1 | SW. ¼ S | 0.8 | L. B. T. |
| 3597 | ...do .... | 2.08 p. m. | 48 15 00 | 123 00 00 E. | 53 | 46 | 45 | 67 | crs. bk. S | West | 2 | SW. ¼ W | 1.0 | L. B. T. |
| 3598 | June 8 | 3.24 p. m. | 52 01 00 | 177 34 00 | 43 | 40 | ..... | 34 | bk. G | SE. by E | 2 | SE | 2.0 | L. B. T. |
| 3599 | June 9 | 10.52 a. m. | 52 05 00 | 177 40 00 W. | 43 | 42 | ..... | 55 | rky. fne. S. Sh | Calm | 0 | NE. ¼ N | 0.3 | L. B. T. |
| 3600 | June 26 | 3.37 p. m. | 55 06 00 | 163 28 00 | 43 | 41 | 40 | 9 | fne. dk. vol. S | SW | 4 | SW | 1.0 | L. B. T. and surface tow net. |

*Record of intermediate tow-net stations of the U. S. Fish Commission steamer Albatross.*

[Condition of sea, smooth.]

| Serial No. | Date. | Time. | Position. | | | | | | Temperatures. | | | Depth (in fathoms). | Wind. | | Drift. | | Appearance of sky. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Latitude N. | | | Longitude W. | | | Air. | Surface. | Bottom. | | Direction. | Force. | Direction. | Distance. | | |
| | 1893. | | ° | ′ | ″ | ° | ′ | ″ | ° F. | ° F. | ° F. | | | | | | | |
| 31 | Apr. 26 | 10.11 a. m. | 36 | 48 | 15 | 121 | 59 | 05 | 58 | 54 | ..... | 5 to surface... | N..... | 1 | ..... | ..... | Clear .... | Entire net open. |
| 32 | Apr. 27 | 8.30 a. m. | 37 | 29 | 00 | 123 | 01 | 20 | 54 | 53 | 41.7 | 100 to surface.. | WNW.... | 3 | ..... | ..... | ...do ..... | All specimens from upper net. |
| 33 | Aug. 3 | 6.40 a. m. | 60 | 22 | 00 | 171 | 42 | 00 | 41 | 42 | 33.9 | 25 to surface.. | W ..... | 3 | ..... | ..... | Cloudy .. | |
| 33 | ...do .... | 6.40 a. m. | 60 | 22 | 00 | 171 | 42 | 00 | 41 | 42 | 33.9 | 25 fathoms* .. | W ..... | 3 | ..... | ..... | ...do ..... | Specimens from both nets. |
| 34 | ...do .... | 10.03 a. m. | 60 | 06 | 00 | 171 | 25 | 00 | 43 | 42 | 31.1 | 25 to surface... | SSE ..... | 2 | ..... | ..... | ...do ..... | |
| 34 | ...do .... | 10.03 a. m. | 60 | 06 | 00 | 171 | 25 | 00 | 43 | 42 | 31.1 | 25 fathoms* .. | SSE ..... | 2 | ..... | ..... | ...do ..... | Do. |
| 35 | Aug. 4 | 9.24 a. m. | 57 | 58 | 00 | 170 | 09 | 00 | 46 | 44 | 35.7 | 30 to surface.. | SW..... | 4 | ..... | ..... | ...do ..... | |
| 35 | ...do .... | 9.24 a. m. | 57 | 58 | 00 | 170 | 09 | 00 | 46 | 44 | 35.7 | 30 fathoms* .. | SW..... | 4 | ..... | ..... | ...do ..... | Do. |
| 36 | Aug. 6 | 7.33 a. m. | 59 | 39 | 00 | 173 | 53 | 00 | 45 | 44 | 34.9 | 43 to surface.. | Calm ..... | 0 | ..... | ..... | ...do ..... | |
| 36 | ...do .... | 7.33 a. m. | 59 | 39 | 00 | 173 | 53 | 00 | 45 | 44 | 34.9 | 43 fathoms* .. | Calm ..... | 0 | ..... | ..... | ...do ..... | All specimens from upper net. |
| 37 | ...do .... | 11.00 a. m. | 59 | 55 | 00 | 174 | 17 | 00 | 47 | 46 | 35.1 | 44 to surface... | SE..... | 1 | ..... | ..... | ...do ..... | |
| 37 | ...do .... | 11.00 a. m. | 59 | 55 | 00 | 174 | 17 | 00 | 47 | 46 | 35.1 | 44 fathoms* .. | SE..... | 1 | ..... | ..... | ...do ..... | Specimens from both nets. |
| 38 | Aug. 9 | 6.55 a. m. | 54 | 45 | 00 | 169 | 06 | 00 | 45 | 43 | 38 | 40 to surface... | SW..... | 2 | ..... | ..... | ...do ..... | |
| 38 | ...do .... | 6.55 a. m. | 54 | 45 | 00 | 169 | 06 | 00 | 45 | 43 | 38 | 40 fathoms* .. | SW..... | 2 | ..... | ..... | ...do ..... | Do. |
| 39 | Aug. 10 | 8.43 a. m. | 56 | 10 | 00 | 163 | 26 | 00 | 49 | 47 | 39.2 | 30 to surface.. | SE..... | 3 | ..... | ..... | ...do ..... | |
| 39 | ...do .... | 8.43 a. m. | 56 | 10 | 00 | 163 | 26 | 00 | 49 | 47 | 39.2 | 30 fathoms* .. | SE..... | 3 | ..... | ..... | ...do ..... | Do. |
| 40 | Aug. 18 | 4.17 p. m. | 56 | 41 | 00 | 169 | 39 | 00 | 48 | 44 | 42.7 | 30 to surface.. | WNW.... | 2 | ..... | ..... | Overcast. | |
| 40 | ...do .... | 4.17 p. m. | 56 | 41 | 00 | 169 | 39 | 00 | 48 | 44 | 42.7 | 30 fathoms* .. | WNW.... | 2 | ..... | ..... | ...do ..... | Do. |
| 41 | Aug. 20 | 4.03 p. m. | 54 | 38 | 00 | 175 | 27 | 00 | 56 | 49 | 35.1 | 125 to surface.. | NNE ..... | 3 | ..... | ..... | ...do ..... | |
| 41 | ...do .... | 4.03 p. m. | 54 | 38 | 00 | 175 | 27 | 00 | 56 | 49 | 35.1 | 125 fathoms* .. | NNE ..... | 3 | ..... | ..... | ...do ..... | Do. |
| 42 | Aug. 21 | 9.48 a. m. | 55 | 46 | 00 | 172 | 44 | 00 | 51 | 48 | 35.1 | 250 to surface.. | W ..... | 5 | ..... | ..... | ...do ..... | |
| 42 | ...do .... | 9.48 a. m. | 55 | 46 | 00 | 172 | 44 | 00 | 51 | 48 | 35.1 | 250 fathoms* .. | W ..... | 5 | ..... | ..... | ...do ..... | Do. |
| 43 | Aug. 22 | 1.29 p. m. | 54 | 59 | 00 | 171 | 49 | 00 | 49 | 48 | 35.1 | 100 to surface.. | SE. by S .. | 2 | ..... | ..... | Cloudy .. | |
| 43 | ...do .... | 1.29 p. m. | 54 | 59 | 00 | 171 | 49 | 00 | 49 | 48 | 35.1 | 100 fathoms* .. | SE. by S .. | 2 | ..... | ..... | ...do ..... | Do. |
| 44 | Sept. 1 | 9.03 a. m. | 54 | 44 | 00 | 165 | 42 | 00 | 52 | 47 | 39.5 | 50 to surface.. | E ..... | 3 | ..... | ..... | ...do ..... | |
| 44 | ...do .... | 9.03 a. m. | 54 | 44 | 00 | 165 | 42 | 00 | 52 | 47 | 39.5 | 50 fathoms* .. | E ..... | 3 | ..... | ..... | ...do ..... | Do. |
| | 1894. | | | | | | | | | | | | | | | | | |
| 45 | Apr. 30 | 1.08 p. m. | 48 | 14 | 30 | 122 | 58 | 00 | 53 | 46 | 44 | 4 to surface... | W ..... | 1 | SW. ½ S ... | 0.2 | Clear .... | Do. |

* Lower net closed at this depth by messenger.

*Record of fishing stations of the U. S. Fish Commission steamer Albatross.*

| Station No. | Date. | Time. | Position. Latitude N. | Position. Longitude W. | Depth (in fathoms). | Character of bottom. | Bait used. | Number of lines used. | Length of trial. | Fish taken. | Average weight. | Average length. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1893. | | ° ′ ″ | ° ′ ″ | | | | | *Minutes.* | | *Pounds.* | *Inches.* |
| 3482 | July 12 | 9.05 a. m. | 57 18 00 | 170 42 00 | 42 | gy. M. fne. S | Salt salmon | 4 | 10 | None | | |
| 3483 | ...do | 12.32 p. m. | 57 18 00 | 171 18 00 | 56 | gy. M | ...do | 6 | 15 | ...do | | |
| 3484 | ...do | 4.11 p. m. | 57 18 00 | 171 54 00 | 60 | blue M | ...do | 6 | 20 | 5 cod | 16 | 32⅝ |
| 3485 | ...do | 8.13 p. m. | 57 18 00 | 172 34 00 | 62 | gy. M | ...do | 8 | 20 | 1 cod* | 12 | 31 |
| 3496 | July 17 | 5.45 a. m. | 56 32 00 | 169 45 00 | 41 | gy. M | ...do | 4 | 15 | None | | |
| 3500 | ...do | 11.53 a. m. | 56 02 00 | 169 30 00 | 121 | fne. gy. S | | | | 1 cod | 8 | 28 |
| 3503 | July 28 | 10.44 a. m. | 57 06 15 | 170 11 00 | 17 | fne. bk. S | Salt salmon | 6 | 10 | None | | |
| 3307 | ...do | 12.27 p. m. | 57 03 00 | 169 54 00 | 35 | fne. gy. S | ...do | 7 | 20 | ...do | | |
| 3504 | ...do | 2.23 p. m. | 56 57 00 | 169 27 00 | 34 | fne. gy. S | ...do | 8 | 14 | ...do | | |
| 3308 | ...do | 5.18 p. m. | 57 03 00 | 168 52 00 | 43 | gy. S. Sh | ...do | 7 | 14 | ...do | | |
| 3505 | ...do | 7.55 p. m. | 57 09 00 | 168 17 00 | 44 | fne. gy. S | ...do | 8 | 15 | 2 cod† | 2⅜ | 16½ |
| 3311 | July 29 | 4.00 a. m. | 57 27 00 | 166 30 00 | 38 | fne. gy. S. M | ...do | 5 | 15 | 1 cod | 8 | 27 |
| 3506 | ...do | 6.39 a. m. | 57 33 00 | 165 55 00 | 36 | gy. S. and M | ...do | 8 | 15 | 2 cod | 7¾ | 25⅜ |
| 3312 | ...do | 9.46 a. m. | 57 38 00 | 165 20 00 | 35 | fne. dk. S. and M | ...do | 8 | 23 | 17 cod | 7½ | 26½ |
| 3507 | July 29 | 1.00 p. m. | 57 43 00 | 164 42 00 | 31 | fne. gy. S | ...do | 9 | 12 | 14 cod | 8½ | 26⅝ |
| 3313 | ...do | 5.14 p. m. | 58 13 00 | 164 47 00 | 26 | fne. gy. S | ...do | 8 | 15 | 3 cod‡ | 7⅝ | 26⅝ |
| 3508 | ...do | 7.33 p. m. | 58 33 00 | 164 49 00 | 23 | fne. gy. S. and Sh | ...do | 9 | 30 | 10 cod | 8¼ | 27¼ |
| 3312 | July 31 | 6.48 a. m. | 57 10 00 | 169 05 00 | 42 | fne. gy. S. bk. Sp | ...do | 7 | 14 | None | | |
| 3509 | ...do | 11.09 a. m. | 57 10 00 | 169 43 00 | 35 | fne. gy. S | ...do | 7 | 15 | ...do | | |
| 3510 | Aug. 1 | 6.14 a. m. | Walrus Island, SW. ½ W., distance 5 miles. | | 27 | bk. Sh. and S | ...do | 5 | 15 | ...do | | |
| 3511 | ...do | 10.10 a. m. | 57 32 00 | 169 38 00 | 39 | fne. P. bk. M | ...do | 9 | 15 | ...do | | |
| 3512 | ...do | 1.34 p. m. | 57 49 30 | 169 27 00 | 38 | fne. gy. S. gn. M | ...do | 11 | 15 | ...do | | |
| 3323 | ...do | 4.43 p. m. | 58 08 30 | 169 14 00 | 38 | fne. gy. S. bk. M | ...do | 10 | 15 | ...do | | |
| 3513 | ...do | 7.45 p. m. | 58 27 00 | 169 01 00 | 35 | fne. S. gy. M | ...do | 10 | 10 | ...do | | |
| 3514 | Aug. 2 | 4.10 a. m. | 59 22 00 | 168 21 00 | 21 | fne. gy. S | ...do | 6 | 15 | ...do | | |
| 3326 | ...do | 7.38 a. m. | 59 41 00 | 168 06 00 | 22 | fne. gy. S. Sh | ...do | 6 | 10 | ...do | | |
| 3515 | ...do | 10.45 a. m. | NW. Cape Nunivak Island, bearing NNE. ¼ E. 19 miles. | | 13 | fne. gy. S | ...do | 9 | 15 | 1 cod | 11½ | 29 |
| 3516 | ...do | 3.57 p. m. | NW. Cape ESE. distance 27 miles. | | 17 | fne. gy. S | ...do | 10 | 15 | None | | |
| 3517 | ...do | 8.03 p. m. | NW. Cape E. ¼ N. 51 miles. | | 24 | fne. gy. S | ...do | 8 | 23 | 5 cod§ | 8⅞ | 27½ |
| 3348 | Aug. 3 | 3.09 a. m. | 60 24 00 | 170 48 00 | 35 | bk. M | ...do | 6 | 15 | None | | |
| 3518 | ...do | 6.40 a. m. | Pinnacle Island, bearing SW. by W. ½ W., distance 21 miles. | | 36 | gn. M | ...do | 8 | 17 | ...do | | |
| 3519 | ...do | 10.22 a. m. | 60 06 00 | 171 25 00 | 37 | bk. M. fne. S | ...do | 8 | 10 | ...do | | |
| 3349 | ...do | 1.14 p. m. | 59 46 00 | 171 08 00 | 38 | sft. dk. M | ...do | 10 | 15 | ...do | | |
| 3520 | ...do | 4.10 p. m. | 59 28 00 | 170 57 00 | 38 | gy. M. fne. S | ...do | 9 | 15 | ...do | | |
| 3521 | ...do | 7.36 p. m. | 59 09 00 | 170 48 00 | 40 | gy. M | ...do | 10 | 14 | ...do | | |
| 3352 | Aug. 4 | 6.11 a. m. | 58 15 00 | 170 18 00 | 40 | gy. M. fne. S | Salt salmon, shells | 5 | 15 | ...do | | |
| 3522 | ...do | 9.24 a. m. | 57 58 00 | 170 09 00 | 41 | dk. gy. S. and G | ...do | 9 | 15 | ...do | | |

* And 1 *Astherestes* flounder.

† Taken in beam-trawl.

‡ And 1 flounder.

§ One taken in trawl.

*Record of fishing stations of the U. S. Fish Commission steamer Albatross*—Continued.

| Station No. | Date. | Time. | Position. Latitude N. | Position. Longitude W. | Depth (in fathoms). | Character of bottom. | Bait used. | Number of lines used. | Length of trial. | Fish taken. | Average weight. | Average length. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1893. | | ° ′ ″ | ° ′ ″ | | | | | *Minutes.* | | *Pounds.* | *Inches.* |
| 3523 | Aug. 4 | 1.20 p. m. | 57 39 00 | 170 02 00 | 39 | gy. M. fne. S. | Salt salmon, shells | 7 | 19 | None | | |
| 3524 | ...do | 4.08 p. m. | 57 24 00 | 169 50 00 | 36 | gy. S. P. | ...do | 7 | 15 | ...do | | |
| 3525 | ...do | 5.40 p. m. | 57 21 00 | 170 05 00 | 29 | bk. S. brk. Sh | ...do | 6 | 13 | ...do | | |
| 3353 | Aug. 5 | 4.15 a. m. | 57 24 00 | 170 24 00 | 37 | fne. gy. S. and Sh | ...do | 4 | 15 | ...do | | |
| 3526 | ...do | 7.25 a. m. | 57 31 00 | 170 57 00 | 49 | dk. M. fne. S. | ...do | 5 | 15 | ...do | | |
| 3527 | ...do | 10.36 a. m. | 57 48 00 | 171 21 00 | 52 | gy. M. | ...do | 6 | 15 | 1 cod | 11 | 29 |
| 3354 | ...do | 1.52 p. m. | 58 04 00 | 171 41 00 | 55 | gy. M. | ...do | 8 | 25 | 2 cod | 7½ | 26 |
| 3528 | ...do | 5.02 p. m. | 58 19 30 | 172 02 00 | 55 | dk. gy. M. fne. S. | ...do | 5 | 26 | 4 cod | 13¾ | 29¼ |
| 3529 | ...do | 8.19 p. m. | 58 36 00 | 172 24 00 | 56 | gn. M. | ...do | 6 | 15 | 1 cod | 8 | 27 |
| 3357 | Aug. 6 | 4.45 a. m. | 59 24 00 | 173 31 00 | 57 | gn. M. | ...do | 5 | 20 | ...do | 11 | 29 |
| 3530 | ...do | 7.33 a. m. | 59 39 00 | 173 53 00 | 59 | dk. gy. M. fne. S. | ...do | 6 | 15 | None | | |
| 3531 | ...do | 11.02 a. m. | 59 55 00 | 174 17 00 | 59 | gy. M. | Salt shells, cod | 9 | 25 | 12 cod | 11½ | 30 |
| 3358 | Aug. 8 | 3.46 a. m. | 59 33 00 | 175 00 00 | 70 | gy. M. | Salt salmon | 10 | 17 | None | | |
| 3364 | ...do | 4.13 a. m. | 57 08 00 | 171 38 00 | 60 | gy. M. | ...do | 4 | 15 | ...do | | |
| 3535 | ...do | 8.35 a. m. | 57 02 00 | 170 46 00 | 52 | dk. gn. M. fne. S. | ...do | 5 | 15 | ...do | | |
| 3536 | ...do | 10.19 a. m. | 57 05 00 | 170 35 00 | 40 | fne. S. dk. M | ...do | 5 | 15 | ...do | | |
| 3365 | Aug. 9 | 4.20 a. m. | 56 49 00 | 169 42 00 | 37 | fne. sh. S. | ...do | 4 | 15 | ...do | | |
| 3537 | ...do | 6.55 a. m. | 54 45 00 | 169 06 00 | 49 | fne. gy. S. | ...do | 6 | 15 | ...do | | |
| 3538 | ...do | 10.15 a. m. | 56 41 00 | 168 29 00 | 59 | gn. M. S. | Salmon shells | 7 | 18 | 3 cod | 13⅓ | 30⅔ |
| 3366 | ...do | 1.10 p. m. | 56 37 00 | 167 55 00 | 59 | gn. M. S. | Salt salmon, shells | 8 | 21 | 5 cod | 11 | 30 |
| 3539 | ...do | 3.50 p. m. | 56 34 00 | 167 19 00 | 57 | gn. M. S. | ...do | 8 | 17 | 2 cod | 8½ | 25½ |
| 3367 | ...do | 6.40 p. m. | 56 31 00 | 166 43 00 | 55 | dk. M. fne. S. | ...do | 6 | 7 | None | | |
| 3541 | Aug. 10 | 5.20 a. m. | 56 14 00 | 164 08 00 | 49 | bk. M. fne. S. | ...do | 5 | 17 | 5 cod | 11¼ | 30 |
| 3542 | ...do | 8.45 a. m. | 56 10 00 | 163 26 00 | 49 | dk. M. fne. S. | ...do | 9 | 17 | ...do | 11 | 29 |
| 3375 | Aug. 17 | 7.14 a. m. | Chernofski, bearing SE. ⅜ E. Western Head, S. ⅜ W. | | 43 | bk. S. | Salt salmon | 8 | 19 | 1 cod | 11 | 29 |
| 3543 | Aug. 18 | 4.18 p. m. | St. George Island, S. by S. ¾ S., distance 5½ miles. | | 43 | bk. S. brk. Sh | ...do | 7 | 15 | None | | |
| 3544 | ...do | 7.20 p. m. | Western end St. George, SE. ⅜ E., 16 miles. | | 41 | fne. gy. S. Sh | ...do | 7 | 14 | ...do | | |
| 3414 | Aug. 31 | 9.05 a. m. | 54 13 00 | 165 58 00 | 42 | bk. gy. S. M. | ...do | 9 | 15 | Asthenestes, flounder. | | |
| 3415 | ...do | 9.48 a. m. | 54 10 00 | 165 54 00 | 42 | dk. gy. S. | ...do | 9 | 11 | None | | |
| 3416 | ...do | 10.47 a. m. | 54 07 00 | 165 51 00 | 38 | bk. M. fne. S. | ...do | 9 | 16 | 2 cod | 8⅛ | 27 |
| 3546 | ...do | 11.26 a. m. | 54 12 00 | 165 42 00 | 36 | G. bk. Sh | ...do | 8 | 16 | 5 cod | 10⅞ | 30 |
| 3547 | ...do | 12.39 p. m. | 54 16 00 | 165 45 00 | 51 | fne bk. S. | ...do | 3 | 15 | None | | |
| 3558 | Sept. 3 | 7.04 a. m. | 56 58 00 | 170 09 00 | 25 | S. and dk. Sp. | ...do | 7 | 15 | 5 cod* | 12 | 29 |
| | Sept. 9 | 5.30 p. m. | Deer Island, bearing about SW., distance 3 miles. | | 12 | | ...do | 6 | 90 | 27 cod† | 6½ | 25 |
| | Sept. 11 | | Portage Bay | | 6 | dk. M., G. and S | Salmon-fed sculpin | 2 | 6 | 12 cod | 9⅛ | 29¾ |

* And 3 sculpin.

† And 6 halibut.

*Record of fishing stations of the U. S. Fish Commission steamer Albatross*—Continued.

| Serial No. | Date. | Time of day. | Position. | | | | Character of bottom. | Depth. | Temperature. | | | Bait used. | No. of lines. | Length of trial. | Food-fishes taken. | Cod. | | | | Average of cod. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lat. N. | | Long. W. | | | | Air. | Surface. | Bottom. | | | | | Sexes. | | Weight. | Length. | Weight. | Length. |
| | 1894. | | ° | ′ | ° | ′ | | *Fms.* | | | | | | *Min.* | | ♂ | ♀ | *Lbs.* | *In.* | *Lbs.* | *In.* |
| Hy. 3492 | June 29 | 1.00 p. m. | 57 | 59 | 166 | 04 | gy. S | 32 | 44 | 38 | 33 | Salt salmon | 15 | 30 | 2 cod | 1 | .... | 11 | 30 | .... | .... |
| | | | | | | | | | | | | | | | | .... | 1 | 9 | 29 | 10 | 29½ |
| Hy. 3493 | ...do .... | 4.17 p. m. | 58 | 06 | 165 | 22 | fne. gy. S | 26 | 45 | 38 | 35.7 | .....do | 15 | 30 | 4 cod, 2 flounders | 1 | .... | 5 | 25 | .... | .... |
| | | | | | | | | | | | | | | | | 1 | .... | 5 | 28 | .... | .... |
| | | | | | | | | | | | | | | | | 1 | .... | 4 | 22 | .... | .... |
| | | | | | | | | | | | | | | | | 1 | .... | 4 | 25 | 4½ | 25 |
| Hy. 3495 | June 30 | 7.36 a. m. | 57 | 28 | 163 | 14 | fne. gy. S | 27 | 38 | 38 | 34 | .....do | 13 | 30 | Nothing | .... | .... | .... | .... | .... | .... |
| Hy. 3496 | ...do .... | 12.03 p. m. | 56 | 59 | 163 | 02 | fne. gy. S | 34 | 42 | 40 | 32 | .....do | 14 | 30 | 1 cod | 1 | .... | 6¾ | 28 | 6¾ | 28 |
| Hy. 3497 | ...do .... | 3.24 p. m. | 56 | 59 | 163 | 48 | fne. gy. S | 37 | 42 | 40 | 34.3 | .....do | 13 | 30 | Nothing | .... | .... | .... | .... | .... | .... |

*Record of serial temperatures.*

| No. of station. | Date. | Time of day. | Depth. | Position. | | Air | Surface. | Bottom. | 5 fms. | 10 fms. | 15 fms. | 20 fms. | 25 fms. | 30 fms. | 40 fms. | 50 fms. | 60 fms. | 70 fms. | 80 fms. | 90 fms. | 100 fms. | 200 fms. | 300 fms. | 400 fms. | 500 fms. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lat. N. | Long. W. | | | | | | | | | | | | | | | | | | | | |
| | 1893. | | *Fms.* | ° ′ ″ | ° ′ ″ | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| Dr. 3482 | July 12 | 9.10 a. m. | 42 | 57 13 00 | 170 42 00 | 43 | 42 | 38.9 | 42.1 | 40.1 | ..... | 39.8 | ..... | 38.1 | ..... | | | | | | | | | | |
| Dr. 3483 | ...do .... | 12.40 p. m. | 56 | 57 18 00 | 171 18 00 | 44 | 42 | 36.8 | 44.1 | 43.6 | ..... | 38.2 | ..... | 37.7 | 36.8 | 36.7 | | | | | | | | | |
| Dr. 3484 | ...do .... | 4.20 p. m. | 60 | 57 18 00 | 171 54 00 | 43 | 44 | 37.4 | 44.8 | 46.8 | ..... | 47.8 | ..... | 47.5 | 44.6 | 45.9 | | | | | | | | | |
| Dr. 3485 | ...do .... | 8.20 p. m. | 62 | 57 18 00 | 172 34 00 | 42 | 44 | 37.1 | 45.0 | 44.8 | ..... | 38.6 | ..... | 39.0 | 36.1 | 36.1 | | | | | | | | | |
| Dr. 3486 | July 13 | 4.00 a. m. | 150 | 57 19 00 | 173 53 00 | 43 | 43 | 38.0 | 45.8 | 45.6 | ..... | 40.8 | ..... | 39.1 | 39.0 | 37.8 | 37.6 | 37.1 | 36.9 | 36.8 | 37.0 | *110.* | *130.* | *130.* | *140.* |
| Hy. 3301 | July 14 | 2.30 a. m. | 100 | 56 30 00 | 172 25 00 | 46 | 44 | 38.0 | 45.5 | 45.2 | ..... | 41.7 | ..... | 41.5 | 41.0 | 38.6 | 39.1 | 38.0 | 37.9 | 37.8 | ..... | 37.0 | 37.3 | 37.5 | 38.0 |
| Dr. 3494 | ...do .... | 3.00 p. m. | 65 | 56 34 00 | 170 34 00 | 50 | 46 | 38.5 | 44.6 | 44.2 | ..... | 39.6 | ..... | 37.9 | 38.0 | 37.7 | 37.8 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Hy. 3303 | July 17 | 11.00 p. m. | 843 | 55 24 00 | 168 34 00 | 48 | 45 | ..... | 47.0 | 42.0 | ..... | ..... | 39.9 | ..... | ..... | 38.1 | ..... | ..... | ..... | ..... | ..... | *200.* | *300.* | *400.* | *500.* |
| Hy. 3306 | July 18 | 9.00 a. m. | 442 | 54 42 00 | 167 39 00 | 50 | 48 | ..... | 46.8 | 45.6 | ..... | ..... | 42.4 | ..... | ..... | 38.9 | ..... | ..... | ..... | 38.8 | 38.3 | 38.3 | 38.4 | 38.0 | 38.5 |
| Dr. 3503 | July 28 | 10.50 a. m. | 17 | 57 06 15 | 170 11 00 | 54 | 43 | 37.9 | 41.5 | 42.3 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 38.6 | 38.2 | 38.1 | 38.1 | ..... | ..... |
| Dr. 3504 | ...do .... | 2.30 p. m. | 34 | 56 57 00 | 169 27 00 | 54 | 45 | 37.8 | 43.5 | 36.6 | ..... | 36.4 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Hy. 3308 | ...do .... | 5.30 p. m. | 43 | 57 03 00 | 168 52 00 | 50 | 45 | 37.6 | 45.1 | 45.6 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Dr. 3505 | ...do .... | 8.00 p. m. | 44 | 57 09 00 | 168 17 00 | 46 | 44 | 38.1 | 45.1 | 45.0 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Hy. 3309 | ...do .... | 11.00 p. m. | 41 | 57 15 00 | 167 42 00 | 45 | 43 | 36.0 | 42.0 | 41.9 | ..... | 34.8 | ..... | 38.5 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Hy. 3310 | July 29 | 1.30 a. m. | 33 | 57 21 00 | 167 05 00 | 45 | 42 | 35.0 | 41.9 | 42.2 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Hy. 3311 | ...do .... | 4.10 a. m. | 38 | 57 27 00 | 166 30 00 | 45 | 42 | 34.8 | 42.8 | 42.7 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Dr. 3506 | ...do .... | 6.50 a. m. | 36 | 57 33 00 | 165 55 00 | 43 | 42 | 32.0 | 42.3 | 42.7 | ..... | 39.2 | ..... | 33.5 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Hy. 3312 | ...do .... | 9.50 a. m. | 35 | 57 38 00 | 165 20 00 | 45 | 42 | 35.5 | 41.5 | 41.2 | 37.5 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Dr. 3507 | ...do .... | 1.10 p. m. | 31 | 57 43 00 | 164 42 00 | 50 | 43 | 37.5 | 41.0 | 41.0 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Hy. 3313 | ...do .... | 5.20 p. m. | 26 | 58 13 00 | 164 47 00 | 44 | 42 | 41.4 | 41.2 | 40.7 | ..... | 40.3 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Dr. 3508 | ...do .... | 8.00 p. m. | 23 | 58 33 00 | 164 49 00 | 43 | 41 | 42.0 | 41.7 | 42.6 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Hy. 3314 | ...do .... | 11.30 p. m. | 22 | 58 42 00 | 165 30 00 | 43 | 41 | 41.8 | 42.0 | 41.5 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Hy. 3315 | July 30 | 2.10 a. m. | 21 | 58 51 00 | 166 11 00 | 42 | 41 | 41.0 | 41.0 | 42.0 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Hy. 3316 | ...do .... | 5.10 a. m. | 25 | 58 36 00 | 166 38 00 | 42 | 41 | 40.1 | 40.2 | 40.3 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Hy. 3317 | ...do .... | 8.40 a. m. | 29 | 58 22 00 | 167 04 00 | 44 | 42 | 37.0 | 41.2 | 39.9 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Hy. 3319 | ... do .... | 6.00 p. m. | 38 | 57 52 00 | 167 54 00 | 46 | 43 | 37.5 | 43.0 | 42.8 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Hy. 3320 | ...do .... | 10.30 p. m. | 36 | 57 38 00 | 168 10 00 | 46 | 43 | 36.1 | 44.0 | 43.8 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Hy. 3321 | July 31 | 3.30 a. m. | 41 | 57 24 00 | 168 42 00 | 46 | 44 | 36.8 | 43.2 | 43.3 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Hy. 3322 | ...do .... | 6.50 a. m. | 42 | 57 10 00 | 169 05 00 | 46 | 44 | 37.3 | 43.1 | 42.8 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Dr. 3509 | ...do .... | 11.10 a. m. | 35 | 57 00 00 | 169 43 00 | 46 | 43 | 40.8 | 42.0 | 41.6 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Dr. 3510 | Aug. 1 | 6.20 a. m. | 27 | 57 12 30 | 169 51 00 | 47 | 43 | 40.1 | 43.5 | 43.1 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Dr. 3511 | ...do .... | 10.20 a. m. | 39 | 57 32 00 | 169 38 00 | 48 | 44 | 37.2 | 43.9 | 43.9 | ..... | 43.2 | ..... | 36.2 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Dr. 3512 | ...do .... | 1.40 p. m. | 38 | 57 49 30 | 169 27 00 | 49 | 45 | 36.6 | 44.0 | 43.6 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Hy. 3323 | Aug. 1 | 4.50 p. m. | 38 | 58 08 30 | 169 14 00 | 47 | 45 | 31.8 | 43.9 | 42.8 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Dr. 3513 | ...do .... | 7.50 p. m. | 35 | 58 27 00 | 169 01 00 | 46 | 43 | ..... | 42.1 | 41.6 | ..... | 30.9 | ..... | 31.0 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Dr. 3514 | Aug. 2 | 4.10 a. m. | 21 | 59 22 00 | 168 21 00 | 40 | 40 | 40.8 | 40.6 | 40.8 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Hy. 3326 | ...do .... | 7.40 a. m. | 22 | 59 41 00 | 168 06 00 | 42 | 41 | 41.1 | 41.1 | 41.1 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Dr. 3515 | ...do .... | 10.50 a. m. | 13 | 59 59 00 | 167 53 00 | 42 | 42 | 41.8 | 42.0 | 41.8 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Dr. 3516 | ...do .... | 4.00 p. m. | 17 | 60 28 00 | 168 08 00 | 43 | 44 | 43.2 | 42.3 | 43.2 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Dr. 3517 | ...do .... | 8.10 p. m. | 24 | 60 27 00 | 169 04 00 | 41 | 41 | 40.3 | 41.8 | 41.0 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Hy. 3347 | ...do .... | 11.50 p. m. | 27 | 60 26 00 | 169 54 00 | 41 | 41 | 35.3 | 41.3 | 41.1 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Hy. 3348 | Aug. 3 | 3.20 a. m. | 35 | 60 24 00 | 170 48 00 | 42 | 42 | 32.0 | 42.0 | 41.8 | ..... | 31.0 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dr. 3518 | ...do .... | 6.50 a. m. | 36 | 60 22 00 | 171 42 00 | 41 | 42 | 33.9 | 41.7 | 41.1 | | | | | | | | | | | | | | | | | | | | | |
| Dr. 3519 | ...do .... | 10.10 a. m. | 37 | 60 06 00 | 171 25 00 | 43 | 42 | 31.1 | 42.0 | 40.8 | | | | | | | | | | | | | | | | | | | | | |
| Hy. 3349 | ...do .... | 1.20 p. m. | 38 | 59 47 00 | 171 08 00 | 43 | 43 | 31.8 | 43.0 | 42.5 | | 29.8 | | 29.8 | | | | | | | | | | | | | | | | | |
| Dr. 3520 | ...do .... | 4.20 p. m. | 38 | 59 28 00 | 170 57 00 | 43 | 43 | 32.2 | 42.6 | 39.1 | | | | | | | | | | | | | | | | | | | | | |
| Dr. 3521 | ...do .... | 7.40 p. m. | 40 | 59 09 00 | 170 48 00 | 43 | 43 | 31.9 | 43.0 | 42.8 | | | | | | | | | | | | | | | | | | | | | |
| Hy. 3350 | ...do .... | 11.10 p. m. | 40 | 58 52 00 | 170 38 00 | 45 | 44 | 30.8 | 43.2 | 42.8 | | | | | | | | | | | | | | | | | | | | | |
| Hy. 3352 | Aug. 4 | 6.20 a. m. | 40 | 58 15 00 | 170 18 00 | 46 | 44 | 35.4 | 43.1 | 41.1 | | 40.0 | | 32.0 | | | | | | | | | | | | | | | | | |
| Dr. 3522 | ...do .... | 9.30 a. m. | 41 | 57 58 00 | 170 09 00 | 46 | 44 | 35.7 | 44.0 | 44.0 | | | | | | | | | | | | | | | | | | | | | |
| Dr. 3523 | ...do .... | 1.20 p. m. | 39 | 57 39 00 | 170 02 00 | 47 | 45 | 38.0 | 44.5 | 44.0 | | | | | | | | | | | | | | | | | | | | | |
| Dr. 3524 | ...do .... | 4.10 p. m. | 36 | 57 24 00 | 169 56 00 | 46 | 45 | 40.3 | 44.0 | 43.5 | | 42.3 | | 37.9 | | | | | | | | | | | | | | | | | |
| Dr. 3525 | ...do .... | 5.50 p. m. | 29 | 57 21 00 | 170 05 00 | 46 | 45 | 41.6 | 43.0 | 41.9 | | 41.3 | | | | | | | | | | | | | | | | | | | |
| Hy. 3353 | Aug. 5 | 4.20 a. m. | 37 | 57 24 00 | 170 24 00 | 47 | 43 | 40.3 | 43.3 | 42.9 | | | | | | | | | | | | | | | | | | | | | |
| Dr. 3526 | ...do .... | 7.30 a. m. | 49 | 57 31 00 | 170 57 00 | 47 | 44 | 38.9 | 44.2 | 43.9 | | 43.1 | | 39.1 | 37.2 | | | | | | | | | | | | | | | | |
| Dr. 3527 | ...do .... | 10.40 a. m. | 52 | 57 48 00 | 171 21 00 | 48 | 44 | 38.0 | 45.0 | 45.0 | | | | | | | | | | | | | | | | | | | | | |
| Hy. 3354 | ...do .... | 2.00 p. m. | 55 | 58 04 00 | 171 41 00 | 48 | 45 | 37.4 | 44.8 | 44.4 | | | | | | | | | | | | | | | | | | | | | |
| Dr. 3528 | ...do .... | 5.10 p. m. | 55 | 58 19 30 | 172 02 00 | 47 | 45 | 35.9 | 45.6 | 45.2 | | 44.5 | | 43.0 | 35.5 | 35.2 | | | | | | | | | | | | | | | |
| Dr. 3529 | ...do .... | 8.20 p. m. | 56 | 58 36 00 | 172 24 00 | 46 | 45 | 36.1 | 45.2 | 44.5 | | | | | | | | | | | | | | | | | | | | | |
| Hy. 3355 | ...do .... | 11.30 p. m. | 57 | 58 52 00 | 172 45 00 | 46 | 44 | 35.3 | 45.2 | 44.2 | | | | | | | | | | | | | | | | | | | | | |
| Hy. 3356 | Aug. 6 | 2.10 a. m. | 57 | 59 09 00 | 173 09 00 | 45 | 43 | 34.2 | 43.3 | 43.2 | | 39.0 | | 34.9 | 33.2 | 33.7 | | | | | | | | | | | | | | | |
| Hy. 3357 | ...do .... | 4.50 a. m. | 57 | 59 24 00 | 173 31 00 | 45 | 43 | 35.7 | 44.7 | 41.8 | | | | | | | | | | | | | | | | | | | | | |
| Dr. 3530 | ...do .... | 7.40 a. m. | 59 | 59 39 00 | 173 53 00 | 45 | 44 | 34.9 | 44.3 | 43.0 | | | | | | | | | | | | | | | | | | | | | |
| Dr. 3531 | ...do .... | 11.10 a. m. | 59 | 59 55 00 | 174 17 00 | 47 | 46 | 35.1 | 43.5 | 43.4 | | 33.6 | | 34.0 | 33.6 | 33.6 | | | | | | | | | | | | | | | |
| Hy. 3358 | ...do .... | 3.50 p. m. | 70 | 59 33 00 | 175 00 00 | 51 | 46 | 36.7 | 44.8 | 44.4 | | | | | | | | | | | | | | | | | | | | | |
| Dr. 3532 | ...do .... | 7.50 p. m. | 77 | 59 12 00 | 175 39 00 | 48 | 44 | 34.8 | 44.6 | 42.9 | | | | | | | | | | | | | | | | | | | | | |
| Hy. 3359 | Aug. 7 | 12.10 a. m. | 71 | 58 43 00 | 176 10 00 | 44 | 44 | ..... | 45.1 | 45.0 | | 45.0 | | 44.2 | 34.9 | 37.1 | 36.8 | | | | | | | | | | | | | | |
| Hy. 3360 | ...do .... | 5.20 a. m. | 1,744 | 58 11 00 | 176 38 00 | 45 | 44 | 35.5 | 35.9 | 35.0 | | | | | | | | | | | | | | | | | | | | | |
| Hy. 3361 | ...do .... | 10.30 a. m. | 1,367 | 58 01 00 | 175 41 00 | 48 | 46 | 35.2 | 46.7 | 45.8 | | | | | | | | | | | | | | | | | | | | | |
| Hy. 3362 | ...do .... | 5.20 p. m. | 77 | 57 41 00 | 174 05 00 | 49 | 47 | 38.0 | 46.0 | 45.5 | | 40.1 | | 39.0 | 38.0 | 38.1 | 38.1 | 38.0 | | | | | | | | | | | | | |
| Dr. 3533 | ...do .... | 7.50 p. m. | 70 | 57 34 00 | 173 33 00 | 47 | 46 | 39.2 | 45.9 | 45.0 | | | | | | | | | | | | | | | | | | | | | |
| Hy. 3363 | ...do .... | 11.20 p. m. | 69 | 57 25 00 | 172 50 00 | 47 | 45 | 37.8 | 46.1 | 45.3 | | | | | | | | | | | | | | | | | | | | | |
| Hy. 3364 | Aug. 8 | 4.20 a. m. | 60 | 57 08 00 | 171 38 00 | 47 | 45 | 37.8 | 44.4 | 45.0 | | 45.1 | | 39.6 | 38.1 | | | | | | | | | | | | | | | | |
| Dr. 3534 | ...do .... | 6.00 a. m. | 59 | 57 03 00 | 171 19 00 | 47 | 45 | 38.1 | 45.3 | 46.1 | | | | | | | | | | | | | | | | | | | | | |
| Dr. 3535 | ...do .... | 9.00 a. m. | 52 | 57 02 00 | 170 46 00 | 48 | 45 | 39.0 | 43.4 | 43.5 | | | | | | | | | | | | | | | | | | | | | |
| Dr. 3536 | ...do .... | 10.20 a. m. | 40 | 57 05 00 | 170 35 00 | 48 | 45 | 42.4 | 43.4 | 42.5 | | 42.2 | | 41.9 | | | | | | | | | | | | | | | | | |
| Hy. 3365 | Aug. 9 | 4.30 a. m. | 37 | 56 49 00 | 169 42 00 | 46 | 44 | 40.9 | 44.1 | 41.0 | | 40.0 | | 39.9 | | | | | | | | | | | | | | | | | |
| Dr. 3537 | ...do .... | 7.00 a. m. | 49 | 54 45 00 | 169 06 00 | 45 | 43 | 38.0 | 45.6 | 45.2 | | | | | | | | | | | | | | | | | | | | | |
| Dr. 3538 | ...do .... | 10.20 a. m. | 59 | 56 41 00 | 168 29 00 | 48 | 46 | 38.0 | 45.5 | 46.1 | | | | | | | | | | | | | | | | | | | | | |
| Hy. 3366 | ...do .... | 1.20 p. m. | 59 | 56 37 00 | 167 55 00 | 49 | 46 | 38.0 | 45.9 | 45.4 | | 38.8 | | 36.5 | 37.2 | 37.0 | | | | | | | | | | | | | | | |
| Dr. 3539 | ...do .... | 4.00 p. m. | 57 | 56 34 00 | 167 19 00 | 49 | 45 | 38.9 | 46.2 | 46.7 | | | | | | | | | | | | | | | | | | | | | |
| Hy. 3367 | ...do .... | 6.40 p. m. | 55 | 56 31 00 | 166 43 00 | 48 | 46 | 37.5 | 46.5 | 46.6 | | | | | | | | | | | | | | | | | | | | | |
| Dr. 3540 | ...do .... | 9.20 p. m. | 51 | 56 27 00 | 166 08 00 | 47 | 45 | 36.0 | 46.4 | 46.0 | | 34.1 | | 34.1 | 34.2 | | | | | | | | | | | | | | | | |
| Dr. 3541 | Aug. 10 | 5.20 a. m. | 49 | 56 14 00 | 164 08 00 | 48 | 46 | 36.1 | 46.9 | 47.2 | | 35.4 | | 34.9 | 35.2 | | | | | | | | | | | | | | | | |
| Dr. 3542 | ...do .... | 8.50 a. m. | 49 | 56 10 00 | 163 26 00 | 49 | 47 | 39.2 | 47.0 | 47.0 | | | | | | | | | | | | | | | | | | | | | |
| Hy. 3385 | Aug. 18 | 7.40 a. m. | 1,036 | 55 50 00 | 169 24 00 | 48 | 47 | 36.0 | 47.7 | 48.2 | | | | | | | | | | | | | | | | | | | | | |
| Dr. 3543 | ...do .... | 4.20 p. m. | 43 | 56 41 00 | 169 39 00 | 48 | 44 | 42.7 | 42.0 | 41.9 | | 41.3 | | 41.0 | 41.0 | | | | | | | | | | | | | | | | |
| Dr. 3544 | ...do .... | 7.30 p. m. | 41 | 56 50 00 | 169 59 00 | 47 | 44 | 41.1 | 44.6 | 43.0 | | | | | | | | | | | | | | | | | | | | | |
| Hy. 3392 | Aug. 19 | 5.30 a. m. | 76 | 56 39 00 | 172 21 00 | 47 | 45 | 38.9 | 46.0 | 46.0 | 46.6 | 42.4 | | 39.1 | 38.4 | 38.0 | 38.4 | | | | | | | | | | | | | | |

*Record of serial temperatures*—Continued.

| No. of station. | Date. | Time of day. | Depth. | Position. | | Air. | Surface. | Bottom. | 5 fms. | 10 fms. | 15 fms. | 20 fms. | 25 fms. | 30 fms. | 40 fms. | 50 fms. | 60 fms. | 100 fms. | 200 fms. | 300 fms. | 400 fms. | 500 fms. | 600 fms. | 700 fms. | 800 fms. | 900 fms. | 1,000 fms. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lat. N. | Long. W. | | | | | | | | | | | | | | | | | | | | | | |
| | 1893. | | *Fms.* | ° ′ ″ | ° ′ ″ | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| Hy. 3399 | Aug. 20 | 4.50 p. m. | 2,041 | 54 38 00 | 175 27 00 | 56 | 49 | 35.1 | 47.8 | 47.0 | ..... | ..... | 47.0 | ..... | ..... | 37.0 | ..... | 36.3 | 39.0 | 44.1 | 38.2 | 37.4 | 37.9 | 36.9 | 36.3 | ..... | 35.7 |
| Hy. 3402 | Aug. 21 | 10.30 a. m. | 1,833 | 55 46 00 | 172 44 00 | 51 | 48 | 35.1 | ..... | ..... | ..... | ..... | 39.4 | ..... | ..... | 38.3 | ..... | 37.0 | 39.0 | 38.1 | 38.2 | 37.8 | 38.0 | 37.2 | 36.4 | 36.2 | 38.9 |
| Dr. 3558 | Sept. 3 | 7.10 a. m. | 25 | 56 58 00 | 170 09 00 | 46 | 45 | 42.0 | 45.3 | 45.2 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Dr. 3559 | ...do.... | 9.20 a. m. | 39 | 56 56 00 | 169 52 00 | 47 | 46 | 42.5 | 45.0 | 45.0 | ..... | 41.1 | ..... | 41.0 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Hy. 3431 | ...do.... | 12.00 m. | 43 | 56 48 00 | 169 26 00 | 47 | 45 | 39.0 | 46.0 | 45.3 | ..... | 42.6 | ..... | 37.0 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| | 1894. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dr. 3600 | June 26 | 3.45 p. m. | 9 | 55 06 00 | 163 28 00 | 43 | 41 | 40.0 | 40.0 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |

*Record of ocean temperatures and specific gravities.*

[All specimens were taken at about 1 foot below the surface, by means of a specimen bottle.]

| Date. | Time of day. | Station. | Lat. N. | Long. W. | Depth. | Temperature by attached thermometer. | Temperature of the air. | Temp. of specimen at time specific gravity was taken. | Specific gravity. | Specific gravity reduced to 60° F. | Specific gravity reduced to 15° C. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1893. | | | ° ′ ″ | ° ′ ″ | | ° | ° | ° | | | |
| July 1 | 12 m | | 51 32 00 | 175 52 00 | Surface | 48 | 43 | 63 | 1.0248 | 1.025211 | 1.024391 |
| 2 | 12 m | Adak Island | | | do | 49 | 60 | 63 | 1.0246 | 1.025011 | 1.024191 |
| 5 | 12 m | | 51 23 00 | 176 49 00 | do | 42 | 52 | 63 | 1.0248 | 1.025211 | 1.024391 |
| 6 | 12 m | | 51 09 00 | 176 19 00 | do | 44 | 52 | 63 | 1.0244 | 1.024811 | 1.023991 |
| 7 | 12 m | | 50 31 00 | 174 02 00 | do | 50 | 52 | 63 | 1.0244 | 1.024811 | 1.023991 |
| 8 | 12 m | | 52 06 00 | 171 45 00 | do | 48 | 50 | 63 | 1.0244 | 1.024811 | 1.023991 |
| 9 | 12 m | | 55 06 00 | 170 10 00 | do | 46 | 49 | 63 | 1.0246 | 1.025011 | 1.024191 |
| Aug. 1 | 12 m | | 57 39 00 | 169 33 00 | do | 44 | 49 | 65 | 1.0236 | 1.024290 | 1.023470 |
| 1 | 6 p. m. | | 58 15 00 | 169 05 00 | do | 44 | 46 | 65 | 1.0234 | 1.024090 | 1.023270 |
| 1 | 12 p. m. | | 58 52 00 | 168 45 00 | do | 42 | 43 | 65 | 1.0234 | 1.024090 | 1.023270 |
| 2 | 6 a. m. | | 59 29 00 | 168 09 00 | do | 41 | 41 | 65 | 1.0234 | 1.024090 | 1.023270 |
| 2 | 12 m | | 60 03 00 | 167 55 00 | do | 42 | 42 | 65 | 1.0232 | 1.023890 | 1.023070 |
| 2 | 6 p. m. | | 60 28 00 | 168 17 00 | do | 44 | 43 | 65 | 1.0230 | 1.023690 | 1.022870 |
| 2 | 12 p. m. | | 60 25 00 | 170 10 00 | do | 41 | 41 | 65 | 1.0230 | 1.023690 | 1.022870 |
| 3 | 6 a. m. | | 60 19 00 | 171 41 00 | do | 42 | 41 | 65 | 1.0230 | 1.023690 | 1.022870 |
| 3 | 12 m | | 59 58 00 | 171 17 00 | do | 43 | 43 | 65 | 1.0230 | 1.023690 | 1.022870 |
| 3 | 6 p. m. | | 59 25 00 | 170 50 00 | do | 43 | 42 | 65 | 1.0230 | 1.023690 | 1.022870 |
| 3 | 12 p. m. | | 58 44 00 | 170 35 00 | do | 43 | 45 | 65 | 1.0230 | 1.023690 | 1.022870 |
| 4 | 6 a. m. | | 58 20 00 | 170 10 00 | do | 44 | 46 | 65 | 1.0230 | 1.023690 | 1.022870 |
| 4 | 12 m | | 57 48 00 | 170 04 00 | do | 45 | 46 | 65 | 1.0234 | 1.024090 | 1.023270 |
| 4 | 6 p. m. | | 57 23 00 | 169 55 00 | do | 45 | 46 | 65 | 1.0234 | 1.024090 | 1.023270 |
| 5 | 12 m | | 57 53 00 | 171 28 00 | do | 45 | 50 | 65 | 1.0236 | 1.024290 | 1.023470 |
| 5 | 6 p. m. | | 58 28 00 | 172 06 00 | do | 45 | 47 | 65 | 1.0238 | 1.024490 | 1.023670 |
| 5 | 12 p. m. | | 58 53 00 | 172 40 00 | do | 44 | 46 | 65 | 1.0232 | 1.023890 | 1.023070 |
| 6 | 6 a. m. | | 59 25 00 | 173 30 00 | do | 44 | 44 | 65 | 1.0232 | 1.023890 | 1.023070 |
| 6 | 12 m | | 59 54 00 | 174 18 00 | do | 46 | 48 | 65 | 1.0232 | 1.023890 | 1.023070 |
| 6 | 6 p. m. | | 59 25 00 | 175 20 00 | do | 45 | 50 | 65 | 1.0230 | 1.023690 | 1.022870 |
| 6 | 12 p. m. | | 58 46 00 | 176 12 00 | do | 44 | 44 | 65 | 1.0236 | 1.024290 | 1.023470 |
| 7 | 6 a. m. | | 58 10 00 | 173 30 00 | do | 44 | 46 | 65 | 1.0240 | 1.024690 | 1.023870 |
| 7 | 12 m | | 57 57 00 | 175 19 00 | do | 46 | 48 | 65 | 1.0240 | 1.024690 | 1.023870 |
| 7 | 6 p. m. | | 57 43 00 | 173 52 00 | do | 47 | 48 | 65 | 1.0242 | 1.024890 | 1.024070 |
| 7 | 12 p. m. | | 57 22 00 | 172 26 00 | do | 45 | 47 | 65 | 1.0238 | 1.024490 | 1.023670 |
| 8 | 6 a. m. | | 57 10 00 | 170 55 00 | do | 45 | 47 | 65 | 1.0234 | 1.024090 | 1.023270 |
| 8 | 12 m | St. Paul Island | | | do | 44 | 48 | 65 | 1.0232 | 1.023890 | 1.023070 |
| 9 | 12 m | | 56 39 00 | 168 13 00 | do | 46 | 48 | 65 | 1.0230 | 1.023690 | 1.022870 |
| 9 | 6 p. m. | | 56 33 00 | 166 50 00 | do | 46 | 48 | 65 | 1.0230 | 1.023690 | 1.022870 |
| 9 | 12 p. m. | | 56 22 00 | 165 20 00 | do | 45 | 48 | 65 | 1.0232 | 1.023890 | 1.023070 |
| 10 | 6 a. m. | | 56 12 00 | 163 48 00 | do | 47 | 49 | 65 | 1.0234 | 1.024090 | 1.023670 |
| 10 | 12 m | | 55 56 00 | 163 38 00 | do | 48 | 51 | 62 | 1.0240 | 1.024270 | 1.023450 |
| 11 | 12 m | | 54 20 00 | 165 42 00 | do | 48 | 52 | 62 | 1.0244 | 1.024670 | 1.023850 |
| 17 | 12 m | | 53 51 00 | 168 00 00 | do | 47 | 48 | 62 | 1.0248 | 1.025070 | 1.024250 |
| 17 | 6 p. m. | | 54 28 00 | 168 10 00 | do | 47 | 49 | 62 | 1.0246 | 1.024870 | 1.024050 |
| 17 | 12 p. m. | | 55 07 00 | 169 03 00 | do | 46 | 48 | 62 | 1.0242 | 1.024470 | 1.023650 |
| 18 | 6 a. m. | | 55 42 00 | 169 10 00 | do | 47 | 48 | 62 | 1.0243 | 1.024570 | 1.023750 |
| 18 | 12 m | | 56 19 00 | 169 32 00 | do | 48 | 49 | 62 | 1.0244 | 1.024670 | 1.023850 |
| 18 | 6 p. m. | | 56 45 00 | 169 40 00 | do | 44 | 47 | 62 | 1.0244 | 1.024670 | 1.023850 |
| 18 | 12 p. m. | | 56 48 00 | 169 59 00 | do | 43 | 46 | 62 | 1.0242 | 1.024470 | 1.023650 |
| 19 | 6 a. m. | | 56 40 00 | 172 30 00 | do | 45 | 46 | 62 | 1.0242 | 1.024470 | 1.023650 |
| 19 | 12 m | | 56 31 00 | 173 45 00 | do | 47 | 48 | 62 | 1.0240 | 1.024270 | 1.023450 |
| 19 | 6 p. m. | | 56 27 00 | 175 27 00 | do | 45 | 46 | 62 | 1.0244 | 1.024670 | 1.023850 |
| 19 | 12 p. m. | | 56 22 00 | 176 48 00 | do | 47 | 47 | 62 | 1.0246 | 1.024870 | 1.024050 |
| 20 | 6 a. m. | | 55 38 00 | 176 20 00 | do | 47 | 48 | 62 | 1.0246 | 1.024870 | 1.024050 |
| 20 | 12 m | | 55 08 00 | 175 56 00 | do | 48 | 51 | 62 | 1.0246 | 1.024870 | 1.024050 |
| 20 | 6 p. m. | | 54 40 00 | 175 30 00 | do | 48 | 49 | 62 | 1.0244 | 1.024670 | 1.023850 |
| 20 | 12 p. m. | | 54 58 00 | 174 31 00 | do | 47 | 48 | 62 | 1.0244 | 1.024670 | 1.023850 |
| 21 | 6 a. m. | | 55 17 00 | 173 33 00 | do | 47 | 49 | 63 | 1.0244 | 1.024811 | 1.023991 |
| 21 | 12 m | | 55 47 00 | 172 41 00 | do | 49 | 51 | 63 | 1.0242 | 1.024611 | 1.023791 |
| 21 | 6 p. m. | | 56 08 00 | 171 45 00 | do | 48 | 51 | 63 | 1.0244 | 1.024811 | 1.023991 |
| 21 | 12 p. m. | | 56 18 00 | 170 35 00 | do | 46 | 49 | 63 | 1.0244 | 1.024811 | 1.023991 |
| 22 | 6 a. m. | | 55 44 00 | 171 10 00 | do | 47 | 48 | 63 | 1.0246 | 1.025011 | 1.024191 |
| 22 | 12 m | | 55 09 00 | 171 39 00 | do | 48 | 49 | 63 | 1.0244 | 1.024811 | 1.023991 |
| 22 | 6 p. m. | | 54 46 00 | 171 53 00 | do | 48 | 49 | 63 | 1.0244 | 1.024811 | 1.023991 |
| 22 | 12 p. m. | | 54 25 00 | 172 12 00 | do | 47 | 48 | 63 | 1.0244 | 1.024811 | 1.023991 |
| 23 | 6 a. m. | | 54 08 00 | 172 23 00 | do | 47 | 49 | 63 | 1.0243 | 1.024711 | 1.023891 |
| 23 | 12 m | | 53 42 00 | 172 44 00 | do | 48 | 50 | 63 | 1.0244 | 1.024811 | 1.023991 |
| 23 | 6 p. m. | | 53 45 00 | 172 06 00 | do | 48 | 49 | 63 | 1.0242 | 1.024611 | 1.023791 |

*Record of ocean temperatures and specific gravities*—Continued.

| Date. | Time of day. | Station. | Lat. N. | Long. W. | Depth. | Temperature by attached thermometer. | Temperature of the air. | Temp. of specimen at time specific gravity was taken. | Specific gravity. | Specific gravity reduced to 60° F. | Specific gravity reduced to 15° C. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1893. | | | ° ′ ″ | ° ′ ″ | | ° | ° | ° | | | |
| Aug. 23 | 12 p. m. | ..... | 53 46 00 | 171 35 00 | Surface. | 47 | 49 | 63 | 1.0244 | 1.024811 | 1.023991 |
| 24 | 6 a. m. | ..... | 53 47 00 | 171 07 00 | ...do .... | 47 | 48 | 63 | 1.0244 | 1.024811 | 1.023991 |
| 24 | 12 m .... | ..... | 53 48 00 | 170 42 00 | ...do .... | 47 | 49 | 63 | 1.0243 | 1.024711 | 1.023891 |
| 24 | 6 p. m. | ..... | 53 52 00 | 169 38 00 | ...do .... | 48 | 49 | 63 | 1.0244 | 1.024811 | 1.023991 |
| 24 | 12 p. m. | ..... | 53 55 00 | 168 40 00 | ...do .... | 47 | 49 | 63 | 1.0244 | 1.024811 | 1.023991 |
| 25 | 6 a. m. | ..... | 54 06 00 | 167 32 00 | ...do .... | 45 | 46 | 63 | 1.0242 | 1.024611 | 1.023791 |
| 25 | 12 m .... | ..... | 54 00 00 | 166 34 00 | ...do .... | 45 | 48 | 63 | 1.0244 | 1.024811 | 1.023991 |
| 31 | 12 m .... | Akutan Bay | ..... | ..... | ...do .... | 47 | 54 | 63 | 1.0243 | 1.024711 | 1.023891 |
| 31 | 6 p. m. | Akun Cove | ..... | ..... | ...do .... | 47 | 55 | 63 | 1.0244 | 1.024811 | 1.023991 |
| Sept. 1 | 12 m .... | ..... | 55 00 00 | 166 10 00 | ...do .... | 49 | 53 | 63 | 1.0242 | 1.024611 | 1.023791 |
| 1 | 6 p. m. | ..... | 55 20 00 | 167 18 00 | ...do .... | 48 | 50 | 63 | 1.0238 | 1.024211 | 1.023391 |
| 2 | 12 m .... | ..... | 56 40 00 | 170 18 00 | ...do .... | 46 | 47 | 63 | 1.0238 | 1.024211 | 1.023391 |
| 2 | 12 p. m. | SW. Bay, St. Paul Island | ..... | ..... | ...do .... | 44 | 46 | 63 | 1.0238 | 1.024211 | 1.023391 |
| 3 | 6 a. m. | Off Otter Island | ..... | ..... | ...do .... | 45 | 46 | 63 | 1.0238 | 1.024211 | 1.023391 |
| 3 | 12 m .... | ..... | 56 48 00 | 169 26 00 | ...do .... | 45 | 47 | 63 | 1.0236 | 1.024011 | 1.023191 |
| 3 | 6 p. m. | ..... | 56 10 00 | 168 40 00 | ...do .... | 46 | 47 | 63 | 1.0238 | 1.024211 | 1.023391 |
| 3 | 12 p. m. | ..... | 55 38 00 | 167 45 00 | ...do .... | 45 | 46 | 63 | 1.0240 | 1.024411 | 1.023591 |
| 4 | 6 a. m. | ..... | 54 45 00 | 167 12 00 | ...do .... | 47 | 49 | 63 | 1.0240 | 1.024411 | 1.023591 |
| 4 | 12 m .... | ..... | 54 00 00 | 166 33 00 | ...do .... | 46 | 50 | 63 | 1.0240 | 1.024411 | 1.023591 |
| 5 | 12 m .... | Dutch Harbor | ..... | ..... | ...do .... | 47 | 53 | 63 | 1.0238 | 1.024211 | 1.023391 |
| 8 | 12 m .... | ..... | 54 18 00 | 165 30 00 | ...do .... | 46 | 57 | 63 | 1.0242 | 1.024611 | 1.023791 |
| 9 | 12 m .... | ..... | 54 37 00 | 163 16 00 | ...do .... | 47 | 53 | 63 | 1.0238 | 1.024211 | 1.023391 |
| 9 | 6 p. m. | Off Deer Island | ..... | ..... | ...do .... | 49 | 51 | 63 | 1.0232 | 1.023611 | 1.022791 |
| 10 | 12 m .... | Bailey Harbor | ..... | ..... | ...do .... | 50 | 52 | 63 | 1.0180 | 1.018411 | 1.017591 |
| 11 | 12 m .... | ..... | 55 20 00 | 161 01 00 | ...do .... | 49 | 52 | 63 | 1.0230 | 1.023411 | 1.022591 |
| 11 | 8 p. m. | Portage Bay | ..... | ..... | ...do .... | 50 | 51 | 63 | 1.0210 | 1.022011 | 1.021191 |
| 12 | 6 p. m. | Unga Strait | ..... | ..... | ...do .... | 50 | 51 | 63 | 1.0230 | 1.023411 | 1.022591 |
| 13 | 12 m .... | ..... | 55 37 00 | 155 38 00 | ...do .... | 49 | 52 | 63 | 1.0238 | 1.024211 | 1.023391 |
| 13 | 6 p. m. | ..... | 56 04 00 | 154 45 00 | ...do .... | 49 | 50 | 63 | 1.0240 | 1.024411 | 1.023591 |
| 13 | 12 p. m. | ..... | 56 30 00 | 153 43 00 | ...do .... | 47 | 48 | 63 | 1.0240 | 1.024411 | 1.023591 |
| 14 | 6 a. m. | ..... | 56 55 00 | 152 37 00 | ...do .... | 47 | 48 | 63 | 1.0240 | 1.024411 | 1.023591 |
| 14 | 12 m .... | ..... | 57 20 00 | 150 57 00 | ...do .... | 46 | 47 | 63 | 1.0242 | 1.024611 | 1.023791 |
| 14 | 6 p. m. | ..... | 57 18 00 | 150 12 00 | ...do .... | 47 | 48 | 63 | 1.0242 | 1.024611 | 1.023791 |
| 14 | 12 p. m. | ..... | 57 16 00 | 148 40 00 | ...do .... | 47 | 49 | 63 | 1.0240 | 1.024411 | 1.023591 |
| 15 | 6 a. m. | ..... | 57 10 30 | 147 10 00 | ...do .... | 51 | 53 | 63 | 1.0242 | 1.024611 | 1.023791 |
| 15 | 12 m .... | ..... | 57 15 00 | 146 05 00 | ...do .... | 51 | 56 | 63 | 1.0242 | 1.024611 | 1.023791 |
| 15 | 6 p. m. | ..... | 57 10 00 | 144 42 00 | ...do .... | 51 | 55 | 63 | 1.0242 | 1.024611 | 1.023791 |
| 15 | 12 p. m. | ..... | 57 08 00 | 143 18 00 | ...do .... | 51 | 53 | 63 | 1.0240 | 1.024411 | 1.023591 |
| 16 | 6 a. m. | ..... | 57 07 00 | 142 10 00 | ...do .... | 51 | 53 | 63 | 1.0242 | 1.024611 | 1.023791 |
| 16 | 12 m .... | ..... | 57 11 00 | 140 49 00 | ...do .... | 51 | 58 | 63 | 1.0240 | 1.024411 | 1.023591 |
| 16 | 6 p. m. | ..... | 57 08 00 | 139 05 00 | ...do .... | 54 | 57 | 63 | 1.0240 | 1.024411 | 1.023591 |
| 16 | 12 p. m. | ..... | 57 02 00 | 137 20 00 | ...do .... | 52 | 54 | 63 | 1.0240 | 1.024411 | 1.023591 |
| 17 | 6 a. m. | Sitka Sound | ..... | ..... | ...do .... | 52 | 54 | 63 | 1.0240 | 1.024411 | 1.023591 |
| 18 | 12 m .... | Sitka Harbor | ..... | ..... | ...do .... | 52 | 64 | 69 | 1.0180 | 1.019887 | 1.019067 |
| 19 | 12 m .... | ..... | 54 18 00 | 133 55 00 | ...do .... | 53 | 57 | 69 | 1.0234 | 1.024687 | 1.024067 |
| 19 | 6 p. m. | ..... | 53 42 00 | 133 22 00 | ...do .... | 55 | 67 | 69 | 1.0236 | 1.024887 | 1.024067 |
| 19 | 12 p. m. | ..... | 52 58 00 | 132 40 00 | ...do .... | 53 | 57 | 69 | 1.0236 | 1.024887 | 1.024067 |
| 20 | 6 a. m. | ..... | 52 16 00 | 131 58 00 | ...do .... | 53 | 56 | 69 | 1.0236 | 1.024887 | 1.024067 |
| 20 | 12 m .... | ..... | 51 37 00 | 131 03 00 | ...do .... | 55 | 60 | 69 | 1.0232 | 1.024487 | 1.023667 |
| 20 | 6 p. m. | ..... | 51 28 00 | 130 12 00 | ...do .... | 54 | 60 | 69 | 1.0232 | 1.024487 | 1.023667 |
| 20 | 12 p. m. | ..... | 51 15 00 | 129 15 00 | ...do .... | 53 | 55 | 69 | 1.0230 | 1.024287 | 1.023467 |
| 21 | 6 a. m. | ..... | 51 03 00 | 128 11 00 | ...do .... | 48 | 48 | 69 | 1.0228 | 1.024087 | 1.023267 |
| 21 | 12 m .... | Johnston Strait | ..... | ..... | ...do .... | 50 | 50 | 69 | 1.0218 | 1.023087 | 1.022267 |
| 21 | 6 p. m. | Seymour Narrows | ..... | ..... | ...do .... | 50 | 55 | 69 | 1.0212 | 1.022487 | 1.021667 |
| 21 | 12 p. m. | Oyster Bay, B. C. | ..... | ..... | ...do .... | 51 | 50 | 69 | 1.0192 | 1.020487 | 1.019667 |
| 22 | 6 a. m. | Bayne Sound | ..... | ..... | ...do .... | 54 | 53 | 69 | 1.0192 | 1.020487 | 1.019667 |
| 23 | 12 m .... | Gulf of Georgia | ..... | ..... | ...do .... | 56 | 61 | 69 | 1.0190 | 1.020287 | 1.019467 |
| 23 | 6 p. m. | Active Pass | ..... | ..... | ...do .... | 58 | 62 | 69 | 1.0102 | 1.011487 | 1.010667 |
| 26 | 12 m .... | Off Race Rocks | ..... | ..... | ...do .... | 52 | 54 | 69 | 1.0224 | 1.023687 | 1.022867 |
| 27 | 12 m .... | ..... | 46 04 00 | 124 58 00 | ...do .... | 56 | 59 | 69 | 1.0186 | 1.019887 | 1.019067 |
| 28 | 12 m .... | ..... | 42 39 00 | 124 39 00 | ...do .... | 52 | 57 | 69 | 1.0240 | 1.025287 | 1.024467 |
| 29 | 12 m .... | ..... | 39 11 00 | 124 03 00 | ...do .... | 53 | 56 | 69 | 1.0240 | 1.025287 | 1.024467 |

*Record of temperatures and specific gravities.*

| Date. | Time of day. | Station. | Lat. N. | Long. W. | Depth. | Temperature by attached thermometer. | Temperature of the air. | Temp. of specimen at time specific gravity was taken. | Specific gravity. | Specific gravity reduced to 15° C. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1894. | | | ° ′ ″ | ° ′ ″ | *Fms.* | ° | ° | ° | | |
| May 19 | 12 m | | 50 57 00 | 128 47 00 | Surface. | 47 | 51 | 64 | 1.0232 | 1.022928 |
| 19 | 6 p. m. | | 51 15 00 | 129 55 00 | ...do.... | 49 | 51 | 63 | 1.0236 | 1.023228 |
| 19 | 12 p. m. | | 51 30 00 | 130 42 00 | ...do.... | 47 | 48 | 62 | 1.0242 | 1.023650 |
| 20 | 6 a. m. | | 51 40 00 | 131 40 00 | ...do.... | 48 | 52 | 62 | 1.0244 | 1.023850 |
| 20 | 12 m | | 51 54 00 | 133 39 00 | ...do.... | 49 | 50 | 62 | 1.0244 | 1.023850 |
| 20 | 6 p. m. | | 52 15 00 | 134 50 00 | ...do.... | 49 | 52 | 62 | 1.0244 | 1.023850 |
| 20 | 12 p. m. | | 52 32 00 | 136 00 00 | ...do.... | 47 | 51 | 62 | 1.0244 | 1.023850 |
| 21 | 6 a. m. | | 52 46 00 | 137 05 00 | ...do.... | 46 | 48 | 62 | 1.0245 | 1.023950 |
| 21 | 12 m | | 53 07 00 | 138 24 00 | ...do.... | 44 | 48 | 62 | 1.0245 | 1.023950 |
| 21 | 6 p. m. | | 53 15 00 | 139 45 00 | ...do.... | 44 | 49 | 62 | 1.0246 | 1.024050 |
| 21 | 12 p. m. | | 53 20 00 | 141 06 00 | ...do.... | 43 | 46 | 62 | 1.0246 | 1.024050 |
| 22 | 6 a. m. | | 53 28 00 | 143 40 00 | ...do.... | 44 | 46 | 62 | 1.0244 | 1.023850 |
| 22 | 12 m | | 53 37 00 | 144 10 00 | ...do.... | 42 | 48 | 62 | 1.0244 | 1.023850 |
| 22 | 6 p. m. | | 53 43 00 | 145 30 00 | ...do.... | 42 | 48 | 62 | 1.0244 | 1.023850 |
| 22 | 12 p. m. | | 53 50 00 | 147 00 00 | ...do.... | 40 | 44 | 62 | 1.0244 | 1.023850 |
| 23 | 6 a. m. | | 53 56 00 | 148 25 00 | ...do.... | 39 | 42 | 62 | 1.0244 | 1.023850 |
| 23 | 12 m | | 54 07 00 | 149 50 00 | ...do.... | 38 | 42 | 62 | 1.0246 | 1.024050 |
| 23 | 6 p. m. | | 54 16 00 | 151 55 00 | ...do.... | 38 | 42 | 62 | 1.0246 | 1.024050 |
| 23 | 12 p. m. | | 54 20 00 | 153 20 00 | ...do.... | 38 | 42 | 62 | 1.0246 | 1.024050 |
| 24 | 6 a. m. | | 54 28 00 | 155 05 00 | ...do.... | 38 | 40 | 62 | 1.0246 | 1.024050 |
| 24 | 12 m | | 54 30 00 | 156 49 00 | ...do.... | 38 | 41 | 62 | 1.0246 | 1.024050 |
| 24 | 6 p. m. | | 54 32 00 | 157 55 00 | ...do.... | 39 | 43 | 62 | 1.0246 | 1.024050 |
| 24 | 12 p. m. | | 54 35 00 | 159 10 00 | ...do.... | 38 | 41 | 62 | 1.0244 | 1.023850 |
| 25 | 6 a. m. | | 54 18 00 | 160 25 00 | ...do.... | 38 | 40 | 62 | 1.0244 | 1.023850 |
| 25 | 12 m | | 53 57 00 | 161 48 00 | ...do.... | 38 | 43 | 62 | 1.0242 | 1.023650 |
| 25 | 6 p. m. | | 53 48 00 | 163 10 00 | ...do.... | 37 | 38 | 62 | 1.0242 | 1.023650 |
| 26 | 6 a. m. | Unimak Pass | | | ...do.... | 36 | 37 | 62 | 1.0236 | 1.023050 |
| 26 | 3 p. m. | Dutch Harbor | | | ...do.... | 39 | 40 | 62 | 1.0236 | 1.023050 |
| 31 | 12 m | | 54 03 00 | 167 54 00 | ...do.... | 38 | 40 | 62 | 1.0242 | 1.023650 |
| June 1 | 12 m | | 53 44 00 | 174 24 00 | ...do.... | 39 | 40 | 62 | 1.0244 | 1.023850 |
| 3 | 12 m | East | 53 20 00 | 178 45 00 | ...do.... | 41 | 48 | 62 | 1.0244 | 1.023850 |
| 5 | 8 a. m. | Attu Island | | | ...do.... | 41 | 44 | 58 | 1.0252 | 1.024140 |
| 5 | 6 p. m. | Aggattu Island | | | ...do.... | 40 | 44 | 58 | 1.0252 | 1.024140 |
| 8 | 12 m | Kyska Island | | | ...do.... | 40 | 44 | 58 | 1.0252 | 1.024140 |
| 9 | 12 m | East | 52 07 00 | 177 43 00 | ...do.... | 40 | 42 | 58 | 1.0253 | 1.024240 |
| 9 | 6 p. m. | ...do.... | 52 15 00 | 179 10 00 | ...do.... | 40 | 42 | 58 | 1.0253 | 1.024240 |
| 9 | 12 p. m. | West | 52 20 00 | 179 35 00 | ...do.... | 39 | 41 | 58 | 1.0254 | 1.024340 |
| 10 | 6 a. m. | | 52 23 00 | 178 20 00 | ...do.... | 40 | 43 | 58 | 1.0254 | 1.024340 |
| 10 | 12 m | Atka Island | | | ...do.... | 41 | 44 | 58 | 1.0254 | 1.024340 |
| 11 | 12 m | | 53 20 00 | 169 38 00 | ...do.... | 39 | 41 | 58 | 1.0252 | 1.024140 |
| 14 | 6 p. m. | Chernofski Harbor | | | ...do.... | 39 | 43 | 58 | 1.0210 | 1.019940 |
| 15 | 12 m | | 53 27 00 | 168 14 00 | ...do.... | 38 | 41 | 58 | 1.0252 | 1.024140 |
| 16 | 12 m | | 52 57 00 | 171 55 00 | ...do.... | 39 | 41 | 58 | 1.0254 | 1.024340 |
| 17 | 9 a. m. | Amlia Island | | | ...do.... | 39 | 40 | 58 | 1.0254 | 1.024340 |
| 22 | 8 p. m. | St. George Island | | | ...dd.... | 37 | 39 | 58 | 1.0246 | 1.023540 |
| 23 | 12 m | St. Paul Island | | | ...do.... | 38 | 44 | 58 | 1.0244 | 1.023340 |
| 24 | 12 m | | 57 34 09 | 167 58 00 | ...do.... | 36 | 39 | 58 | 1.0244 | 1.023340 |
| 24 | 6 p. m. | | 56 48 00 | 167 50 00 | ...do.... | 38 | 41 | 58 | 1.0244 | 1.023340 |
| 24 | 12 p. m. | | 56 10 00 | 167 40 00 | ...do.... | 38 | 39 | 58 | 1.0242 | 1.023140 |
| 25 | 6 a. .... | | 55 50 00 | 167 00 00 | ...do.... | 39 | 40 | 58 | 1.0242 | 1.023140 |
| 25 | 12 m m.. | | 56 12 00 | 165 45 00 | ...do.... | 39 | 41 | 58 | 1.0240 | 1.022940 |
| 25 | 6 p. m. | | 56 05 00 | 164 40 00 | ...do.... | 38 | 40 | 58 | 1.0240 | 1.022940 |
| 25 | 12 p. m. | | 55 45 00 | 163 50 00 | ...do.... | 38 | 40 | 58 | 1.0240 | 1.022940 |
| 26 | 6 a. m. | | 55 30 00 | 164 18 00 | ...do.... | 38 | 41 | 58 | 1.0240 | 1.022940 |
| 26 | 12 m | | 55 33 00 | 163 23 00 | ...do.... | 40 | 41 | 58 | 1.0240 | 1.022940 |
| 26 | 4 p. m. | | 55 08 00 | 163 30 00 | ...do.... | 40 | 43 | 58 | 1.0240 | 1.022940 |
| 26 | 4 p. m. | | 55 08 00 | 163 30 00 | Bottom, 9 fms. | 40 | 43 | 58 | 1.0240 | 1.022940 |
| 26 | 12 p. m. | | 56 10 00 | 162 03 00 | Surface. | 38 | 41 | 58 | 1.0240 | 1.022940 |
| 27 | 6 a. m. | | 56 17 00 | 160 50 00 | ...do.... | 37 | 40 | 58 | 1.0240 | 1.022940 |
| 27 | 12 m | | 56 31 00 | 159 48 00 | ...do.... | 40 | 43 | 58 | 1.0242 | 1.023140 |
| 27 | 6 p. m. | | 56 54 00 | 158 45 00 | ...do.... | 39 | 41 | 58 | 1.0242 | 1.023140 |
| 27 | 12 p. m. | | 57 20 00 | 159 55 00 | ...do.... | 35 | 37 | 58 | 1.0242 | 1.023140 |
| 28 | 6 a. m. | | 57 05 00 | 159 40 00 | ...do.... | 35 | 36 | 58 | 1.0242 | 1.023140 |
| 28 | 12 m | | 56 38 00 | 160 35 00 | ...do.... | 36 | 37 | 58 | 1.0242 | 1.023140 |
| 28 | 6 p. m. | | 56 55 00 | 161 45 00 | ...do.... | 40 | 39 | 58 | 1.0242 | 1.023140 |
| 28 | 12 p. m. | | 57 18 00 | 163 20 00 | ...do.... | 37 | 38 | 58 | 1.0240 | 1.022940 |
| 29 | 6 a. m. | | 57 38 00 | 164 50 00 | ...do.... | 38 | 38 | 58 | 1.0240 | 1.022940 |
| 29 | 12 m | | 57 56 00 | 166 10 00 | ...do.... | 38 | 39 | 58 | 1.0238 | 1.022740 |
| 29 | 6 p. m. | | 58 15 00 | 164 45 00 | ...do.... | 38 | 43 | 58 | 1.0238 | 1.022740 |
| 29 | 12 p. m. | | 58 18 00 | 163 35 00 | ...do.... | 37 | 40 | 58 | 1.0238 | 1.022740 |
| 30 | 6 a. m. | | 57 40 00 | 163 25 00 | ...do.... | 38 | 37 | 58 | 1.0236 | 1.022540 |
| 30 | 12 m | | 56 59 00 | 163 02 00 | ...do.... | 40 | 42 | 58 | 1.0234 | 1.022340 |
| 30 | 6 p. m. | | 56 58 00 | 164 20 00 | ...do.... | 40 | 43 | 58 | 1.0234 | 1.022340 |
| 30 | 12 p. m. | | 56 55 00 | 165 40 00 | ...do.... | 38 | 38 | 58 | 1.0236 | 1.022540 |

*Record of animal life, driftwood, kelp,*

FROM DUTCH HARBOR, UNALASKA ISLAND, FOR

| Date. | Meridian positions. | | Mean temperatures. | | Seals | Whales. | Little auks. | Cormorants. | Ducks. |
|---|---|---|---|---|---|---|---|---|---|
| | Latitude north. | Longitude west. | Air. | Water surface. | | | | | |
| 1893. | ° ′ ″ | ° ′ ″ | ° | ° | | | | | |
| July 1 | 51 32 00 | 175 52 00 | 44 | 44 | ..... | ..... | ..... | ..... | ..... |
| 2 | Bay of Waterfalls, Adak Island. | | 52 | 47 | ..... | ..... | ..... | ..... | ..... |

FROM BAY OF WATERFALLS, ADAK ISLAND,

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| July 5 | 51 23 00 | 176 49 00 | 49 | 45 | ..... | ..... | ..... | ..... | Few ..... |
| 6 | 51 09 00 | 176 19 00 | 50 | 47 | ..... | ..... | ..... | ..... | ..... |
| 7 | 50 21 00 | 174 02 00 | 51 | 49 | ..... | Two ..... | ..... | ..... | ..... |
| 8 | 52 00 00 | 171 45 00 | 47 | 44 | ..... | Many *killers.* | ..... | ..... | ..... |
| 9 | 55 00 00 | 170 10 00 | 47 | 45 | Three . | Two ..... | ..... | ..... | ..... |
| 10 | St. Paul Island, Pribilofs. | | 45 | 41 | Many.. | ..... | Great many. | ..... | ..... |

FROM ST. PAUL ISLAND, ON CRUISE IN BERING

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| July 11 | St. George Island, Pribilofs. | | 45 | 41 | Many.. | ..... | Great many. | ..... | ..... |
| 12 | 57 17 00 | 171 10 00 | 43 | 43 | Nine... | One..... | ..... | ..... | ..... |
| 13 | 56 56 00 | 173 40 00 | 44 | 44 | Fifteen | Fourteen . | ..... | ..... | ..... |
| 14 | 56 34 00 | 171 18 00 | 47 | 45 | Twenty | ..... | Several ... | ..... | ..... |
| 15 | St. George Island, Pribilofs. | | 46 | 42 | Many.. | One..... | Great many. | ..... | ..... |

FROM ST. GEORGE ISLAND TO DUTCH HARBOR,

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| July 16 | East anchorage, St. Paul Island, Pribilofs. | | 45 | 42 | Many.. | ..... | Great many. | ..... | ..... |
| 17 | 56 02 00 | 169 30 00 | 49 | 44 | Six .... | One..... | Great many. | ..... | ..... |
| 18 | 54 34 00 | 167 14 00 | 55 | 48 | One.... | One..... | ..... | ..... | ..... |
| 19 | Dutch Harbor, Unalaska Island. | | 56 | 49 | ..... | ..... | ..... | ..... | ..... |

FROM DUTCH HARBOR, UNALASKA

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| July 26 | 55 33 00 | 168 05 00 | 47 | 44 | One.... | ..... | ..... | ..... | ..... |
| 27 | East anchorage, St. Paul Island, Pribilofs. | | 46 | 43 | Many.. | ..... | Great many. | Few ..... | ..... |
| 28 | 57 05 00 | 170 04 00 | 49 | 43 | Two ... | ..... | Great many. | ..... | ..... |
| 29 | 57 41 00 | 164 58 00 | 46 | 42 | Two ... | ..... | ..... | ..... | ..... |
| 30 | 58 12 00 | 167 29 00 | 44 | 42 | One.... | ..... | ..... | ..... | ..... |
| 31 | 57 01 00 | 169 44 00 | 50 | 44 | Three.. | ..... | Great many. | ..... | ..... |
| Aug. 1 | 57 39 00 | 169 33 00 | 46 | 43 | One.... | One..... | ..... | Two ..... | ..... |
| 2 | 60 03 00 | 167 55 00 | 41 | 42 | ..... | ..... | ..... | ..... | ..... |
| 3 | 59 58 00 | 171 17 00 | 43 | 42 | ..... | ..... | ..... | ..... | One..... |
| 4 | 57 48 00 | 170 04 00 | 45 | 43 | One.... | ..... | Many..... | Few ..... | ..... |
| 5 | 57 53 00 | 171 28 00 | 48 | 44 | Three.. | ..... | ..... | ..... | ..... |
| 6 | 59 54 00 | 174 18 00 | 48 | 44 | Sixteen | ..... | ..... | ..... | ..... |
| 7 | 57 57 00 | 175 19 00 | 47 | 45 | One.... | ..... | ..... | ..... | ..... |

*etc., observed from deck of Albatross at sea.*

BAY OF WATERFALLS, ADAK ISLAND, ALASKA.

| Gulls. | Gonies. | Guillemots. | Petrels. | Puffins. | Terns. | Driftwood. | Kelp. | Remarks. |
|---|---|---|---|---|---|---|---|---|
| One..... | Many... | Many... | ..... | Many... | ..... | ..... | Much.. | Many whitegonies. |
| ..... | ..... | ..... | ..... | ..... | ..... | Much... | ..... | Driftwood on the beaches. |
| | | | | | | | | |

TO ST. PAUL, PRIBILOF ISLANDS, BERING SEA.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ..... | ..... | Few .... | ..... | Several . | ..... | ..... | ..... | |
| ..... | Several. | ..... | ..... | Many... | ..... | ..... | ..... | |
| ..... | Several | ..... | ..... | Few .... | ..... | ..... | ..... | |
| ..... | Few .... | ..... | Few .... | Few .... | ..... | ..... | Much.. | |
| Several . | Three (white). | Great many. | Several . | Great many. | Few .... | ..... | Much.. | |
| Many... | ..... | Great many. | ..... | Great many. | ..... | ..... | ..... | Many seals close to rookeries. |

SEA, AND TO ST. GEORGE ISLAND, PRIBILOFS.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Many... | ..... | Great many. | Several . | Many... | Few .... | ..... | ..... | Many seals close to rookeries. |
| Several . | Few .... | Many... | Many... | Many... | ..... | ..... | ..... | |
| Several . | Several . | Many... | Several . | Many... | Several . | ..... | ..... | |
| Several . | Few .... | Great many. | Several . | Many... | Several . | ..... | ..... | |
| Many... | ..... | Great many. | Many... | Many... | Few .... | ..... | ..... | Flock of Aleutian sandpipers. |

UNALASKA ISLAND, VIA ST. PAUL ISLAND.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Many... | ..... | Great many. | Few .... | Many... | Many... | ..... | ..... | Many seals near rookeries. |
| Many... | ..... | Great many. | Many... | Great many. | Many... | ..... | ..... | |
| Many... | ..... | Many... | Many... | Few .... | Many... | ..... | Little.. | |
| ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | |
| | | | | | | | | |

ISLAND, ON CRUISE IN BERING SEA.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Few .... | One..... | Many... | Few .... | Few .... | ..... | ..... | ..... | |
| ..... | ..... | Great many. | Many... | Many... | Many... | ..... | ..... | Many seals near rookeries. Few snipe. |
| Few .... | ..... | Great many. | Few .... | Several . | ..... | ..... | ..... | |
| Few .... | ..... | Several . | Few .... | ..... | ..... | ..... | ..... | Large flock of whale birds. |
| Several . | ..... | Many... | Several . | Several . | ..... | ..... | ..... | |
| Many... | ..... | Great many. | Many... | Many... | ..... | ..... | ..... | |
| Many... | ..... | Great many. | Many... | Many... | ..... | ..... | ..... | |
| Several . | One..... | Several . | Several . | ..... | ..... | ..... | ..... | One snipe near Nunivak Island. |
| Several . | ..... | Many... | Many... | Several . | ..... | ..... | ..... | Few snipe near St. Matthew Island. |
| Many... | ..... | Many... | Many... | Many... | Several . | ..... | ..... | |
| Many... | ..... | Many... | Many... | Few .... | ..... | ..... | ..... | Observed many varieties of petrels. |
| Few .... | ..... | Many... | Several . | ..... | ..... | ..... | ..... | |
| Many... | ..... | Many... | Several . | Many... | Few .... | ..... | ..... | |

*Record of animal life, driftwood, kelp, etc.,*

FROM DUTCH HARBOR, UNALASKA ISLAND,

| Date. | Meridian positions. | | Mean temperatures. | | Seals. | Whales. | Little auks. | Cormorants. | Ducks. |
|---|---|---|---|---|---|---|---|---|---|
| | Latitude north. | Longitude west. | Air. | Water surface. | | | | | |
| 1893. | ° ′ ″ | ° ′ ″ | ° | ° | | | | | |
| Aug. 8 | 57 07 00 | 170 22 00 | 46 | 44 | Five | Many | Many | Few | Few |
| 9 | 56 39 00 | 168 13 00 | 47 | 44 | | | | | |
| 10 | 55 56 00 | 163 38 00 | 51 | 46 | | One | | | |
| 11 | 54 20 00 | 165 42 00 | 53 | 47 | One | Great many. | | Few | |
| 12 | Dutch Harbor, Unalaska Island. | | 55 | 50 | | | | | |
| 16 | 53 58 00 | 166 33 00 | 51 | 46 | | Many *killers*. | | Several | Few |
| 17 | 53 51 00 | 168 00 00 | 48 | 46 | | | | Few | Few |
| 18 | 56 19 00 | 169 32 00 | 47 | 45 | | | | | |
| 19 | 56 31 00 | 173 45 00 | 47 | 46 | Two | | | | Several |
| 20 | 55 08 00 | 175 56 00 | 52 | 48 | Three | | | | |
| 21 | 55 47 00 | 172 41 00 | 50 | 47 | Eight | Many | | | |
| 22 | 55 09 00 | 171 39 00 | 49 | 47 | Seven | Many | | | |
| 23 | 53 42 00 | 172 44 00 | 49 | 47 | | | | | |
| 24 | 54 02 00 | 170 23 00 | 48 | 47 | One | | | | |
| 25 | 54 00 00 | 166 34 00 | 48 | 45 | One | | | | |
| 26 | Dutch Harbor, Unalaska Island. | | 49 | 46 | | | | | |
| 31 | 54 13 00 | 165 42 00 | 52 | 46 | | Many | Many | Several | Few |
| Sept. 1 | 55 00 00 | 166 10 00 | 51 | 47 | | Several | | | |
| 2 | 56 40 00 | 170 18 00 | 48 | 46 | Many | Three | | | |
| 3 | 56 48 00 | 169 26 00 | 47 | 45 | Many | | | | |
| 4 | 54 00 00 | 166 33 00 | 48 | 46 | | | | | |
| 5 | Dutch Harbor, Unalaska Island. | | 50 | 45 | | | | | |

*observed from deck of Albatross at sea*—Continued.

ON CRUISE IN BERING SEA—Continued.

| Gulls. | Gonies. | Guillemots. | Petrels. | Puffins. | Terns. | Driftwood. | Kelp. | Remarks. |
|---|---|---|---|---|---|---|---|---|
| Many | | Great many. | Several | Many | Many | | | Many seals near St. Paul Island. |
| Few | | Many | Many | Many | Few | | | One goose. |
| Few | One | Few | Few | Few | | | | One white gony. |
| Many | Few | Few | Many | Few | Many | | Much | Saw one seal off Akutan Pass. Large school of whales feeding off Unimak Pass, accompanied by large flocks of whale birds. |
| Few | | | | | | | | |
| Many | Several | Several | Few | Many | Few | | Much | Few Aleutian sandpipers. |
| Many | Few | Great many. | Several | Many | | | Much | Many phalaropes. |
| Many | | Few | Few | Few | | | | |
| Few | Several | Several | Many | Several | | Little | Much | Several pieces of driftwood seen in morning watch; 2 snipe seen in forenoon. |
| Many | One | | Several species; many. | | | | | Many phalaropes. |
| Many | Few | Few | Many | Few | | | | |
| | | | Several | Few | | | | Swallow flew on board. |
| | Few | | Many | Few | | | Much | One white gony. |
| | | Few | Few | Few | | | Much | |
| Few | | | | | | | | |
| Many | Many | Many | Many | Many | Many | | Much | Several porpoises in Unimak Pass. Several hawks and white gonies. Many whales, accompanied by large flocks of birds, in Unimak Pass. |
| Several | Few | Few | Few | Few | | | Much | Land hawk rested in rigging. |
| Many | | Many | Many | Many | Several | | | Many seals seen near Pribilofs. Many phalaropes. |
| Few | Few | Few | Few | Few | | | | Many seals near St. Paul Island. Few phalaropes. |
| Few | Few | Few | Few | Few | | | Little | |
| Few | | | | | | | | |

*Record of animal life, driftwood, kelp, etc.,*

FROM DUTCH HARBOR, UNALASKA

| Date. | Meridian positions. | | Mean temperatures. | | Seals. | Whales. | Little auks. | Cormorants. | Ducks. |
|---|---|---|---|---|---|---|---|---|---|
| | Latitude north. | Longitude west. | Air. | Water surface. | | | | | |
| 1893. | ° ′ ″ | ° ′ ″ | ° | ° | | | | | |
| Sept. 8 | 54 18 00 | 165 39 00 | 53 | 46 | ..... | One..... | ..... | ..... | Few ..... |
| 9 | 54 37 00 | 163 16 00 | 51 | 47 | ..... | ..... | ..... | Few ..... | ..... |
| 10 | Bailey Harbor, Alaska Peninsula | | 54 | 51 | ..... | Four..... | ..... | Many..... | ..... |
| 11 | 55 20 00 | 161 01 00 | 51 | 48 | ..... | Two ..... | ..... | ..... | ..... |
| 12 | Portage Bay, Alaska Peninsula. | | 50 | 50 | ..... | ..... | ..... | Many..... | Several ... |
| 13 | 55 37 00 | 155 38 00 | 50 | 48 | ..... | Several ... | ..... | ..... | ..... |
| 14 | 57 20 00 | 150 57 00 | 48 | 47 | ..... | Several ... | ..... | ..... | ..... |
| 15 | 57 15 00 | 140 05 00 | 55 | 50 | ..... | ..... | ..... | ..... | ..... |
| 16 | 57 11 00 | 140 49 00 | 56 | 53 | ..... | ..... | ..... | ..... | ..... |
| Sept. 17 | Sitka Harbor, SE. Alaska. | | 53 | 52 | ..... | Two ..... | ..... | ..... | ..... |

FROM SITKA, SOUTHEAST ALASKA, TO

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sept. 18 | Sitka Harbor, SE. Alaska. | | 56 | 51 | ..... | ..... | ..... | ..... | ..... |
| 19 | 54 18 00 | 133 55 00 | 60 | 53 | ..... | Two ..... | ..... | ..... | ..... |
| 20 | 51 37 00 | 131 03 00 | 59 | 55 | ..... | Many..... | ..... | ..... | Many..... |
| 21 | 50 29 00 | 126 15 00 | 54 | 49 | ..... | ..... | ..... | ..... | Many..... |
| 22 | Union Bay, Baynes Sound, British Columbia. | | 54 | 54 | ..... | ..... | ..... | ..... | ..... |
| 23 | 49 23 00 | 124 18 00 | 61 | 54 | ..... | ..... | ..... | ..... | ..... |
| 24 | Port Townsend, Wash. | | 61 | 51 | ..... | ..... | ..... | ..... | ..... |

FROM PORT TOWNSEND, WASH., TO

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Sept. 26 | 48 10 00 | 123 20 00 | 54 | 51 | ..... | ..... | ..... | ..... | ..... |
| 27 | 46 04 00 | 124 58 21 | 57 | 55 | ..... | Many..... | ..... | ..... | ..... |
| 28 | 42 39 00 | 124 39 30 | 56 | 54 | ..... | One..... | ..... | ..... | ..... |
| 29 | 39 11 00 | 124 03 00 | 61 | 53 | ..... | ..... | ..... | ..... | ..... |
| 30 | Raccoon Straits, San Francisco Bay. | | 64 | 58 | ..... | ..... | ..... | ..... | ..... |
| Oct. 1 | Navy-Yard, Mare Island, Cal. | | 68 | 62 | ..... | ..... | ..... | ..... | ..... |

*observed from deck of Albatross at sea*—Continued.

ISLAND, TO SITKA, SOUTHEAST ALASKA.

| Gulls. | Gonies. | Guillemots. | Petrels. | Puffins. | Terns. | Driftwood. | Kelp. | Remarks. |
|---|---|---|---|---|---|---|---|---|
| Few | | Several | Many | Several | | | Much | Small school of porpoises in Akun Cove; also few snipe and geese. |
| Many | Several | Many | Many | Many | | | Much | One white gony. |
| Many | | | Many | Few | Many | | | |
| Several | | | Several | | Few | | | |
| Many | | | | | Many | | | Few geese at Portage Bay. |
| Several | Few | | Many | | | | | Large flock of whale birds in company with school of whales. |
| Few | | | Many | | | Some | Much | |
| | | Few | Several | | | | | |
| | Few | | Several | | | | | |
| | Few | | | Few | | | | |

PORT TOWNSEND, WASH.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Several | Few | | | | | Little | Little | Several geese in Sitka Harbor. |
| Several | Several | | | Many | Few | Little | Much | |
| Several | Many | One | | Many | | Little | Much | Land hawk perched in rigging. |
| Many | Several | | | | | Much | Little | Porpoise in Seymour Narrows. |
| Many | Many | | | | | Much | | |
| Several | Many | | | | | Much | Much | |

NAVY-YARD, MARE ISLAND, CAL.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Few | | | | | Some | Little | |
| | Many | Several | Many | | | Large log. | Little | |
| | Few | Few | | Few | | | | Several blackfish and sharks. |
| | Few | Few | | Few | | | | |
| | Few | | | | | | | |

*Record of animal life, driftwood,*

FROM PORT TOWNSEND, WASH., TO DUTCH

| Date. | Meridian position. | | Mean temperatures. | | Seals. | Whales. | Auks. | Cormorants. | Ducks. |
|---|---|---|---|---|---|---|---|---|---|
| | Lat. N. | Long. W | Air D. B. | Sea surf. | | | | | |
| 1894. | ° ′ ″ | ° ′ ″ | | | | | | | |
| May 17 | 48 55 00 | 123 20 00 | 53 | 50 | ..... | ..... | ..... | Few ..... | ..... |
| 18 | 49 44 30 | 124 48 00 | 57 | 53 | ..... | ..... | ..... | Several ... | Several ... |
| 19 | 50 57 00 | 128 47 00 | 50 | 47 | ..... | ..... | ..... | Several ... | Several ... |
| 20 | 51 54 00 | 133 39 00 | 50 | 48 | ..... | Four..... | ..... | ..... | ..... |
| 21 | 53 07 00 | 138 24 00 | 48 | 45 | ..... | One..... | ..... | ..... | ..... |
| 22 | 53 37 00 | 144 10 00 | 46 | 41 | ..... | ..... | ..... | ..... | ..... |
| 23 | 54 07 00 | 149 59 00 | 41 | 39 | ..... | ..... | ..... | ..... | ..... |
| 24 | 54 30 00 | 156 49 00 | 41 | 38 | One.... | One..... | ..... | ..... | ..... |
| 25 | 53 57 00 | 161 48 00 | 40 | 37 | ..... | Large sch'l | Many.... | ..... | ..... |
| 26 | 54 08 00 | 166 11 00 | 38 | 37 | ..... | Several ... | Many..... | Few ..... | ..... |
| 27 | Dutch Harbor. | | 40 | 38 | ..... | ..... | ..... | ..... | ..... |

FROM DUTCH HARBOR, UNALASKA, TO CHICHAGOF HARBOR,

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| May 31 | 54 03 00 | 167 54 00 | 39 | 37 | ..... | ..... | ..... | ..... | Several ... |
| June 1 | 53 44 00 | 174 24 00 East. | 40 | 38 | ..... | ..... | ..... | ..... | ..... |
| 2, 3 | 53 20 00 | 178 45 00 | 44 | 39 | ..... | ..... | ..... | ..... | ..... |
| 4 | Chichagof Harbor, Attu Island. | | 42 | 42 | ..... | ..... | ..... | Several ... | Many..... |
| 5 | 52 37 00 | 173 45 00 | 41 | 39 | ..... | ..... | Many..... | Several ... | Many..... |
| 6 | 52 39 00 | 173 44 00 | 43 | 39 | ..... | ..... | Many..... | Several ... | Many..... |
| 7 | 52 19 00 | 177 30 00 | 41 | 39 | ..... | Many finbacks. | ..... | ..... | Few ..... |
| 8 | Kiska Harbor, Kiska Island. | | 42 | 40 | ..... | ..... | ..... | Few ..... | Few ..... |
| 9 | 52 07 00 | 177 43 00 West. | 42 | 39 | ..... | ..... | ..... | Few ..... | ..... |
| 9 | 52 25 00 | 177 15 00 | 42 | 40 | ..... | Many..... | Many..... | Few ..... | ..... |
| 10 | Nazan Bay, Atka Island. | | 43 | 40 | ..... | One..... | Many..... | Few ..... | Few ..... |
| 11 | 53 20 00 | 169 38 00 | 41 | 39 | ..... | Two ..... | Many..... | ..... | ..... |
| 12 | Dutch Harbor. | | 47 | 40 | ..... | ..... | ..... | ..... | ..... |

FROM DUTCH HARBOR, UNALASKA, TO NAZAN BAY,

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| June 13 | 53 57 00 | 166 31 00 | 50 | 41 | ..... | ..... | ..... | ..... | ..... |
| 14 | 53 55 00 | 167 05 00 | 42 | 39 | ..... | Two ..... | ..... | Few ..... | ..... |
| 15 | 53 27 00 | 168 14 00 | 41 | 39 | ..... | ..... | Many..... | ..... | ..... |
| 16 | 52 59 00 | 171 55 00 | 40 | 39 | ..... | Many..... | ..... | ..... | ..... |
| 17 | 52 11 00 | 173 03 00 | 41 | 39 | ..... | Many..... | Many..... | Few ..... | Several ... |
| 18 | 54 10 00 | 167 56 00 | 44 | 41 | ..... | ..... | ..... | ..... | ..... |
| 19 | Dutch Harbor. | | 47 | 43 | ..... | ..... | ..... | ..... | ..... |

FROM DUTCH HARBOR, UNALASKA, ON CRUISE IN EASTERN

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| June 22 | 55 40 00 | 168 35 00 | 40 | 38 | ..... | ..... | Grt. many | ..... | ..... |
| 23 | Village Cove, St. Paul Island. | | 41 | 37 | ..... | ..... | Grt. many | ..... | ..... |
| 24 | 57 34 00 | 167 58 00 | 39 | 37 | ..... | ..... | Many..... | ..... | ..... |
| 25 | 56 12 00 | 165 45 00 | 40 | 38 | ..... | Two ..... | ..... | ..... | ..... |
| 26 | 55 33 00 | 163 23 00 | 41 | 39 | ..... | ..... | ..... | Few ..... | ..... |
| 27 | 56 31 00 | 159 48 00 | 40 | 38 | ..... | ..... | ..... | ..... | Grt. many |
| 28 | 56 38 00 | 160 39 00 | 37 | 37 | Two ... | Several ... | ..... | ..... | ..... |
| 29 | 57 56 00 | 166 16 00 | 41 | 37 | Two ... | Five ..... | ..... | ..... | ..... |
| 30 | 56 59 00 | 163 02 00 | 40 | 39 | ..... | ..... | ..... | ..... | ..... |

*kelp, etc., observed at sea*—Continued.

HARBOR, UNALASKA ISLAND, ALASKA.

| Gulls. | Gonies. | Guillemots. | Petrels. | Puffins. | Terns. | Driftwood. | Kelp. | Remarks. |
|---|---|---|---|---|---|---|---|---|
| Few | | | | | Many | Much | Much | |
| Few | | | | | Many | Much | Much | |
| Many | | | Few | | Many | Much | Much | |
| Many | | | Many | Many | Many | | | Immense flocks of sea fowl following whales and feeding on surface life. |
| Few | | | Few | | | | | Four hawks. |
| | Few | | Few | | | | | |
| | Several | | Several | One | | | | |
| Few | Several | Several | Several | Few | | | | |
| Several | Several | Many | Many | Several | | | | |
| Many | Few | Many | Many | Many | Few | | Little | |
| Few | | | | | | | | |

ATTU ISLAND, AND RETURN TO DUTCH HARBOR.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Many | | Many | Many | Many | | | Little | Few porpoises. |
| Many | | Many | Many | Few | Few | | | |
| Several | 1 white | Many | Many | Many | | | | Several species of petrels. |
| Many | Several | Many | Many | Many | | | Much | Many jägers; many geese. |
| Many | | Many | Few | Many | | | Much | Several jägers; many geese. |
| Many | | Many | Few | Many | | | Much | Do. |
| Many | | Several | Several | Many | | | Much | Few snipe. |
| Few | | | | | | | Little | |
| Several | 1 white | Several | Several | | | | Little | |
| Few | Few | Many | Many | Many | | | Much | Immense flocks of sea fowl following large school of whales, feeding on surface. |
| Several | | | Many | Many | | | Much | Many geese. |
| Few | Few | Many | Many | Many | | | Much | |
| Several | | Several | | Few | | | Little | |

ATKA ISLAND, AND RETURN TO DUTCH HARBOR.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Few | Few | Many | Several | | | | Little | |
| Few | | Many | Several | Several | | | | |
| Few | 2 white | Many | Many | Many | | | Much | Several porpoises. |
| Few | 2 white | Many | Several | Several | | | | |
| Several | 1 white | Many | | Many | | | Much | |
| | 2 white | Many | Several | Several | | | Little | |
| Several | | | | | | | Little | |

PORTION OF BERING SEA, AND RETURN TO DUTCH HARBOR.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Many | Several | Grt.many | Many | | Several | | Some | |
| Many | | Grt.many | Many | Many | Several | | Little | |
| Several | | Many | Many | Many | Several | | | |
| | | Several | Several | | | | | Several species of petrels. |
| | | Many | | | | | | |
| Many | Many | Grt.many | Many | | Many | | | Great many geese. |
| Few | | Several | Few | | Few | | | Much floating ice. |
| | | Several | | | | | | |
| One | | Few | | Few | | | | |

*Meteorological and cruising record, and seal data.*

| Date. | Meridian position. | | Distance run per log. | Barometer. | | Temperature. | | | | | | State of the weather. | Force and direction of winds. | Rainfall. | State of sea. | Currents. | Force in knots per hour. | Number of hours sealing weather. | Number of fur seals seen. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Air. | | | | Water at surface. | | | | | | | | | |
| | Lat. N. | Long. W. | | Max. | Min. | Dry bulb. | | Wet bulb. | | | | | | | | | | | |
| | | | | | | Max. | Min. | Max. | Min. | Max. | Min. | | | | | | | | |
| 1893. | ° ′ ″ | ° ′ ″ | *Knots.* | | | | | | | | | | | | | | | | |
| July 1 | 51 32 00 | 175 52 00 | 261.0 | 30.08 | 29.96 | 48 | 41 | 47 | 40 | 49 | 40 | Overcast and foggy; thick. | NW., 2 | None | Smooth | N. 3° W. | 0.5 | 15 | 0 |
| 2 | Bay of Waterfalls, Adak Island. | | 59.8 | 29.98 | 29.78 | 60 | 44 | 58 | 43 | 49 | 45 | Clear and pleasant | NE., hauling to NW., 2 to 3. | None | | | | | 0 |
| 3 | do | | | 30.02 | 29.84 | 53 | 45 | 52 | 44 | 47 | 44 | Foggy and misty; clearing at times. | NNW., 5; N., 3; W., 2 | Light | | | | | 0 |
| 4 | do | | | 30.23 | 30.03 | 52 | 46 | 50 | 45 | 48 | 44 | Overcast and foggy; clear at times. | NW., 2, hauling to SSE., 2. | None | | | | | 0 |
| 5 | 51 23 00 | 176 49 00 | 19.1 | 30.29 | 30.22 | 52 | 46 | 51 | 45 | 47 | 44 | Thick and foggy; misty at times. | SE. and NNE., 2 | Light mist. | Smooth | | | 9 | 0 |
| 6 | 51 09 00 | 176 19 00 | 79.4 | 30.26 | 29.97 | 52 | 48 | 51 | 47 | 50 | 44 | Cloudy and misty | E'd, 3 to 5 | Moderate mist. | Smooth to moderate. | N. 52° W. | 0.15 | 10 | 0 |
| 7 | 50 31 00 | 174 02 00 | 144.6 | 30.12 | 29.97 | 53 | 49 | 52 | 48 | 50 | 46 | Cloudy; misty at times. | NNE., 4–2 | Light mist. | Moderating. | S. 80° W. | 1.0 | 12 | 0 |
| 8 | 52 06 00 | 171 45 00 | 139.1 | 30.11 | 30.06 | 50 | 45 | 49 | 44 | 49 | 40 | Foggy, misty, and rainy; wet. | NNW. to W. to NW., 2 | Moderate. | Smooth | S. 54° W. | 0.3 | 17 | 0 |
| 9 | 55 06 00 | 170 10 00 | 199.7 | 30.08 | 29.71 | 49 | 45 | 48 | 44 | 48 | 42 | Misty, drizzly, and stormy. | NW. to W., 2–4; WSW., 4–8. | Moderate. | Moderate to rough. | S. 83° E. | 0.4 | 8 | 3 |
| 10 | St. Paul Island, Pribilofs. | | 137.5 | 29.88 | 29.70 | 46 | 44 | 45 | 43 | 43 | 40 | Stormy to thick, misty and rainy. | SSW., 9; SW., 3 | Moderate. | Rough to moderating. | | | 0 | Many. |
| 11 | St. George Island, Pribilofs. | | 43.2 | 30.12 | 29.88 | 48 | 42 | 47 | 41 | 43 | 40 | Wet and disagreeable, rainy and foggy. | SSW., 3 | Moderate. | Gentle to smooth. | West | 0.5 | 18 | Many. |
| 12 | 57 17 00 | 171 10 00 | 107.7 | 30.22 | 30.12 | 44 | 42 | 43 | 41 | 44 | 42 | Overcast and cloudy to foggy. | S'd and W'd, 4–3 | None | Gentle to smooth. | S. 81° W. | 0.25 | 20 | 9 |
| 13 | 56 56 00 | 173 40 00 | 123.0 | 30.18 | 29.86 | 47 | 42 | 46 | 41 | 46 | 43 | Overcast, misty, and rainy. | SE., 1; E'd, 4 | Moderate. | Smooth to moderate. | N. 62° E. | 0.2 | 14 | 15 |
| 14 | 56 34 00 | 171 18 00 | 120.5 | 30.30 | 29.82 | 50 | 44 | 49 | 43 | 46 | 44 | Rainy and overcast to cloudy. | ENE., 5; NNE., 4; N., 3 | Light. | Moderate to smooth. | N. 83° W. | 0.7 | 0 | 20 |
| 15 | St. George Island, Pribilofs. | | 61.9 | 30.40 | 30.31 | 50 | 43 | 47 | 42 | 44 | 40 | Fair and pleasant | N'd and W'd to S'd and W'd., 3–2. | None | Smooth | | | 20 | Many. |
| 16 | East anchorage, St. Paul Island. | | 38.7 | 30.38 | 30.20 | 47 | 44 | 47 | 43 | 44 | 41 | Fair and pleasant to overcast and rainy. | WSW., 3; SSW., 2 | Moderate. | Smooth | | | 16 | Many. |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | 56 02 00 | 169 30 00 | 87.7 | 30.25 | 30.20 | 52 | 46 | 50 | 45 | 47 | 42 | Overcast and foggy... | SW., 3; squalls (9 to 11 p. m.), 6. | None.. | Smooth to increasing. | | | 16 | 6 |
| 18 | 54 34 00 | 167 14 00 | 130.4 | 30.18 | 30.01 | 60 | 50 | 58 | 49 | 50 | 47 | Cloudy and boisterous to overcast and rainy. | S'd, 6 | Moderate. | Moderate to rough; choppy. | N. 11° E.. | 0.9 | 0 | 1 |
| 19 | Dutch Harbor, Unalaska Island. | | 51.2 | 30.10 | 29.90 | 63 | 50 | 61 | 47 | 51 | 48 | Fair and pleasant..... | SE., 3; S. by W., 4; squalls, 6. | None.. | Smooth... | | | | |
| 20 | .....do..... | | | 30.12 | 30.08 | 56 | 49 | 54 | 47 | 51 | 47 | .....do..... | S. by W., 3; (mid. and p. m. watches) squalls, 6. | None.. | | | | | |
| 21 | .....do..... | | | 30.14 | 30.08 | 57 | 50 | 56 | 49 | 52 | 48 | .....do..... | SSW., 2; SW., 1..... | None.. | | | | | |
| 22 | .....do..... | | | 30.13 | 30.07 | 54 | 50 | 52 | 49 | 51 | 49 | Cloudy; partially clear in forenoon. | S., 1; NW. and N., 1..... | None.. | | | | | |
| 23 | .....do..... | | | 30.16 | 30.06 | 58 | 49 | 57 | 48 | 52 | 49 | Foggy to fair and pleasant. | Variable, 1; calm; SSE., 3. | None.. | | | | | |
| 24 | .....do..... | | | 30.05 | 29.88 | 70 | 57 | 69 | 55 | 53 | 52 | Cloudy and rainy..... | Calm; S'd, 1; calm ..... | Moderate. | | | | | |
| 25 | .....do..... | | | 29.96 | 29.84 | 68 | 47 | 66 | 45 | 54 | 43 | Fair and pleasant; windy. | S., 4; squalls, 6; SW., 6... | None.. | Moderate | | | 0 | 0 |
| 26 | 55 33 00 | 168 05 00 | 125.6 | 30.09 | 29.80 | 48 | 46 | 47 | 45 | 46 | 43 | Overcast and stormy; heavy rain middle and first watches. | S'd, and W'd, 7–4 ..... | Moderate. | Rough to moderate. | S. 79° E... | 0.7 | 0 | 1 |
| 27 | East anchorage, St. Paul Island. | | 130.2 | 29.86 | 29.66 | 48 | 45 | 47 | 44 | 44 | 42 | Overcast and foggy; drizzly at times. | SW., 4 till noon; NW., 5–7. | Light. | Moderate | | | 0 | Many. |
| 28 | 57 05 00 | 170 04 00 | 9.1 | 29.99 | 29.86 | 54 | 44 | 53 | 43 | 45 | 42 | Fair and pleasant..... | NW. and WNW., 3..... | None.. | Smooth ... | None ..... | | 10 | 3 |
| 29 | 57 41 00 | 164 58 00 | 171.3 | 30.00 | 29.76 | 50 | 43 | 49 | 41 | 43 | 41 | Overcast and misty to fair and pleasant. | NW., 3; NNW., 3; SE., 3. | Light mist. | Smooth... | N. 13° E.. | 0.2 | 16 | 2 |
| 30 | 58 12 00 | 167 29 00 | 160.0 | 29.71 | 29.24 | 46 | 42 | 45 | 41 | 43 | 41 | Overcast and stormy; driving mist. | E'd, 9; SE., 6 ..... | Heavy mist. | Rough.... | | | 0 | 1 |
| *31 | 57 01 00 | 169 44 00 | 112.8 | 29.57 | 29.21 | 56 | 45 | 55 | 44 | 46 | 42 | Misty and rainy; thick. | S'd and E'd, 4–3 ..... | Moderate. | Rough to moderating. | S. 56° E... | 0.7 | 0 | 3 |
| Aug. 1 | 57 39 00 | 169 33 00 | 61.2 | 30.00 | 29.58 | 49 | 43 | 47 | 42 | 45 | 42 | Fair generally; foggy 4 to 9 p. m. | NE'd, 4–6; N'd to NW., 3–4. | None.. | Moderate . | South..... | 0.04 | 8 | 1 |
| 2 | 60 03 00 | 167 55 00 | 155.5 | 30.02 | 29.98 | 43 | 40 | 42 | 39 | 44 | 40 | Overcast and misty ... | NW. to W ..... | Moderate mist. | Moderate . | S. 65° E ... | 0.4 | 4 | 0 |
| 3 | 59 58 00 | 171 17 00 | 157.9 | 30.05 | 29.85 | 45 | 41 | 44 | 40 | 44 | 41 | Overcast to rainy..... | W. 3; S'd and E'd, 2–4.... | Moderate. | Smooth ... | S. 47° W .. | 0.6 | 14 | 0 |
| 4 | 57 48 00 | 170 04 00 | 146.0 | 29.80 | 29.66 | 47 | 44 | 46 | 43 | 45 | 42 | Overcast and rainy.... | SE., 4–6; SW'd, 4; SE., 4.. | Moderate. | Moderate . | N. 48° E.... | 0.6 | 4 | 1 |
| 5 | 57 53 00 | 171 28 00 | 96.1 | 29.66 | 29.50 | 50 | 46 | 49 | 45 | 45 | 43 | Overcast, foggy, and misty. | SW., 3 ..... | Light mist. | Smooth; swell S'd and W'd. | None ..... | 0.08 | 6 | Many. |
| 6 | 59 54 00 | 174 18 00 | 154.9 | 29.49 | 29.34 | 52 | 44 | 50 | 43 | 46 | 43 | .....do..... | Variable, 1; N'd, 3 ..... | Light mist. | Smooth ... | N. 70° E... | 0.4 | 16 | 16 |
| 7 | 57 57 00 | 175 19 00 | 179.6 | 29.64 | 29.44 | 51 | 44 | 49 | 43 | 47 | 44 | Cloudy, but pleasant .. | N'd, 4–5..... | None.. | Moderate; long swell | N. 60° W.. | 0.3 | 13 | 1 |
| 8 | 57 07 00 | 170 22 00 | 182.2 | 29.76 | 29.63 | 48 | 44 | 46 | 43 | 45 | 43 | Fair and pleasant to overcast and cloudy. | NNW. to WNW., 5–3 .... | None.. | Moderate to rough. | West..... | 0.5 | 0 | 5 |

*Distance steamed during month, 2,513.5 knots; days under way and steaming, 23.

*Meteorological and cruising record, and seal data*—Continued.

| Date. | Meridian position. | | Distance run per log. | Barometer. | | Temperature. Air. | | | | Water at surface. | | State of the weather. | Force and direction of winds. | Rainfall. | State of sea. | Currents. | Force in knots per hour. | Number of hours sealing weather. | Number of fur seals seen. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Dry bulb. | | Wet bulb. | | | | | | | | | | | |
| | Lat. N. | Long. W. | | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | | | | | | | | |
| 1893. | ° ′ ″ | ° ′ ″ | *Knots.* | | | | | | | | | | | | | | | | |
| Aug. 9 | 56 39 00 | 168 13 00 | 80.9 | 30.05 | 29.78 | 49 | 45 | 47 | 44 | 46 | 43 | Fair and pleasant | SW., 2-3 | None | Smooth | East | 0.03 | 16 | 0 |
| 10 | 55 56 00 | 163 38 00 | 181.0 | 30.09 | 29.74 | 55 | 48 | 53 | 47 | 48 | 45 | do | SE., 3; SSE., 10 | None | Smooth to moderate. | N. 1° W | 0.3 | 14 | 0 |
| 11 | 54 20 00 | 165 42 00 | 126.2 | 29.81 | 29.68 | 57 | 49 | 55 | 48 | 49 | 46 | Overcast, foggy, and drizzly. | SE'd, 10-5. N., 1 | Light | Moderate to smooth. | None | 0.0 | 6 | 1 |
| 12 | Dutch Harbor, Unalaska Island. | | 50.0 | 29.84 | 29.37 | 61 | 49 | 60 | 48 | 53 | 48 | Overcast and cloudy; fair midday. | Variable, 1; SE., 4 (squalls, 6). | None | | | | | |
| 13 | do | | | 29.60 | 29.30 | 56 | 50 | 54 | 49 | 50 | 48 | Clear and pleasant | S'd, 3 | None | | | | | |
| 14 | do | | | 29.86 | 29.62 | 57 | 51 | 54 | 48 | 50 | 47 | do | S'd, 3; squalls, 6 | None | | | | | |
| 15 | do | | | 29.87 | 29.60 | 62 | 54 | 59 | 52 | 50 | 48 | Fair and pleasant | SE, 3 | None | | | | | |
| 16 | 53 58 00 | 166 33 00 | 5.9 | 29.79 | 29.63 | 57 | 45 | 55 | 44 | 49 | 44 | Fair to overcast and boisterous. | S'd. 2; SW., 6; S'd, 2 | Light | Rough to moderate. | | | 0 | 0 |
| 17 | 53 51 00 | 168 00 00 | 105.1 | 29.76 | 29.70 | 49 | 47 | 48 | 46 | 48 | 44 | Overcast and misty; fair at midday. | Variable, 1; W'd, 2 and 3 | Light mist | Smooth; swell S'd and W'd. | No account | | 13 | 0 |
| 18 | 56 19 00 | 169 32 00 | 166.8 | 29.72 | 29.61 | 49 | 46 | 48 | 45 | 48 | 43 | do | N'd and W'd, 3 | Moderate mist. | Smooth; swell N'd and W'd. | S. 28° W | 0.5 | 16 | Many. |
| 19 | 56 31 00 | 173 45 00 | 168.1 | 29.82 | 29.66 | 48 | 46 | 47 | 45 | 47 | 45 | Overcast and cloudy, but pleasant. | WNW., 4 | None | Moderate | S. 24° E | 0.4 | 12 | 2 |
| 20 | 55 08 00 | 175 56 00 | 175.1 | 29.81 | 29.69 | 56 | 48 | 55 | 47 | 50 | 46 | Drizzly to fair and pleasant. | N'd, 3 | Light drizzle | Smooth | S. 9° W | 0.2 | 16 | 3 |
| 21 | 55 47 00 | 172 41 00 | 156.5 | 29.80 | 29.74 | 52 | 48 | 51 | 47 | 49 | 46 | Clear and pleasant; sunny. | N'd and W'd, 4; W., 5 | None | Swell from N'd; gentle. | S. 38° W | 0.3 | 8 | 8 |
| 22 | 55 09 00 | 171 39 00 | 164.2 | 29.81 | 29.12 | 50 | 48 | 49 | 47 | 49 | 46 | Fair to stormy | SW., 3; E'd, 9 | Light | Smooth to rough. | S. 17° E | 0.1 | 14 | 7 |
| 23 | 53 42 00 | 172 44 00 | 124.7 | 29.03 | 28.81 | 50 | 48 | 49 | 47 | 48 | 46 | Stormy; driving mists. | ENE., 10; N'd, 5; NW'd, 9 | Much mist. | Rough | No account | | | 0 |
| 24 | 54 02 00 | 170 23 00 | 139.3 | 29.66 | 29.02 | 49 | 48 | 48 | 47 | 48 | 46 | Stormy and squally; misty. | W'd, 8-9 | Much mist. | Rough | No account | | 0 | 1 |
| 25 | 54 00 00 | 166 34 00 | 179.2 | 29.84 | 29.66 | 51 | 46 | 50 | 45 | 47 | 44 | Overcast and boisterous; rainy. | W'd, 7-6, S'd, 3; N., 1 | Moderate. | Rough | S. 38° W | 0.4 | 0 | 1 |
| 26 | Dutch Harbor, Unalaska Island. | | 8.5 | 29.93 | 29.74 | 52 | 47 | 50 | 46 | 47 | 45 | Overcast and cloudy; rainy at midday. | W., 4-3 | Light | | | | | |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 27 | ....do | | 29.97 | 29.80 | 52 | 45 | 50 | 44 | 47 | 45 | Fair and pleasant; showery at midday. | S., 2; NNE., 1 | Light | | | | |
| | 28 | ....do | | 29.87 | 29.75 | 53 | 45 | 51 | 44 | 49 | 44 | Cloudy, but pleasant | Variable, 1 | None | | | | |
| | 29 | ....do | | 30.11 | 29.86 | 51 | 45 | 50 | 44 | 47 | 45 | Fair to overcast and cloudy. | Calm; S'd, 2; E., 1; calm | None | | | | |
| | 30 | ....do | | 30.30 | 30.12 | 55 | 46 | 53 | 45 | 49 | 45 | Fair and pleasant | Calm; N., 2 | None | | | | |
| | *31 | 54 13 00 | 165 42 00 | 45.5 | 30.28 | 30.22 | 55 | 49 | 53 | 48 | 47 | 45 | Fair and pleasant; cloudy after sunset. | S., 2–3 | Light | Smooth | No account | 12 | 0 |
| Sept. | 1 | 55 00 00 | 166 10 00 | 104.6 | 30.21 | 29.66 | 54 | 48 | 52 | 47 | 49 | 45 | Misty; fair middle of day. | E., 4; NNE., 5 | Much mist. | Moderate | N. 53° W. | 0.3 | 0 | 0 |
| | 2 | 56 40 00 | 170 18 00 | 191.8 | 29.77 | 29.64 | 50 | 46 | 48 | 45 | 48 | 44 | Cloudy, but pleasant | N., 5; NNE., 3 | None | Moderate | S. 05° E | 0.4 | 0 | Many. |
| | 3 | 56 48 00 | 169 26 00 | 75.0 | 29.77 | 29.68 | 49 | 45 | 48 | 44 | 46 | 44 | Drizzly and rainy; disagreeable. | NE'd. 4–5 | Moderate. | Moderate | No account | | 8 | Many. |
| | 4 | 54 00 00 | 166 33 00 | 216.5 | 30.40 | 29.73 | 50 | 47 | 49 | 46 | 47 | 45 | Overcast to cloudy, but pleasant. | N'd, 4; WNW., 2 | None | Moderate | N. 64° W. | 0.5 | 0 | 0 |
| | 5 | Dutch Harbor, Unalaska Islands. | | 8.0 | 30.47 | 30.42 | 53 | 47 | 51 | 46 | 47 | 44 | Fair and pleasant | SW., 2 to 3; squalls, 5 | None | | | | | |
| | 6 | ....do | | | 30.46 | 30.18 | 55 | 48 | 53 | 47 | 48 | 46 | ....do | SW., 2; NE., 3 | None | | | | | |
| | 7 | ....do | | | 30.13 | 29.92 | 61 | 51 | 59 | 49 | 49 | 46 | Cloudy and blustery | SW., 4; squalls, 5 and 6 | Light | | | | | |
| | 8 | 54 18 00 | 165 39 00 | 48.0 | 30.24 | 30.08 | 57 | 50 | 55 | 48 | 47 | 45 | Fair to overcast and rainy. | WSW., 6; SSW., 3 | Moderate. | Moderate | No account | | 0 | 0 |
| | 9 | 54 37 00 | 163 16 00 | 101.7 | 30.06 | 29.90 | 54 | 48 | 52 | 46 | 49 | 45 | Rainy and foggy to fair to foggy. | WSW. to SE., 2 | Light | Smooth | No account | | 12 | 0 |
| | 10 | Bailey's Harbor, Alaska Peninsula. | | 61.9 | 29.32 | 29.82 | 58 | 51 | 57 | 50 | 55 | 47 | Foggy to fair to overcast. | SSW., 2–1 | None | Smooth | No account | | 4 | 0 |
| | 11 | 55 20 00 | 161 01 00 | 52.6 | 29.80 | 29.64 | 53 | 50 | 52 | 48 | 50 | 47 | Drizzly, foggy, and overcast. | SE., 2; SSE. to S., 4–3 | Light | Moderate | No account | | 0 | 0 |
| | 12 | Portage Bay, Alaska Peninsula. | | 26.0 | 29.88 | 29.68 | 53 | 48 | 51 | 46 | 51 | 49 | Fair and pleasant | S. to SSW., 3; W., 4 | None | Smooth | No account | | 4 | 0 |
| | 13 | 55 37 00 | 155 38 00 | 193.9 | 30.07 | 29.90 | 53 | 48 | 50 | 47 | 49 | 47 | ....do | N'd, 4–2 | None | Long swell S'd and E'd. | Tidal | 0.16 | 12 | 0 |
| | 14 | 57 20 00 | 150 57 00 | 206.0 | 30.24 | 30.02 | 50 | 47 | 49 | 46 | 48 | 46 | Rainy and misty | N'd, 2-4 | Moderate. | Moderate | West | 0.3 | 0 | 0 |
| | 15 | 57 15 00 | 146 05 00 | 178.4 | 30.45 | 30.26 | 61 | 50 | 60 | 49 | 54 | 47 | Clear and pleasant | N'd and W'd, 5 | None | Rough to moderate. | S. 46° W. | 1.2 | 0 | 0 |
| | 16 | 57 11 00 | 140 49 00 | 171.0 | 30.41 | 30.17 | 60 | 53 | 58 | 51 | 55 | 51 | ....do | WNW., 4; W., 3 | None | Moderating. | N. 48° E. | 0.1 | 6 | 0 |
| | 17 | Sitka, S. E. Alaska | | 174.0 | 30.15 | 29.98 | 59 | 48 | 57 | 47 | 55 | 50 | ....do | N'd and W'd, 3; SW., 2 | None | Smooth | N. 70° E. | 0.3 | 6 | 0 |
| | 18 | ....do | | 3.6 | 30.24 | 30.10 | 65 | 48 | 63 | 47 | 54 | 49 | ....do | N., 2; N'd and W'd, 4 | None | Smooth | No account | | 3 | 0 |
| | 19 | 54 18 00 | 133 55 00 | 187.5 | 30.10 | 29.92 | 67 | 54 | 64 | 53 | 55 | 52 | ....do | WNW., 4 | None | Moderate | Tidal | 0.15 | 0 | 0 |
| | 20 | 51 37 00 | 131 03 00 | 210.8 | 30.03 | 29.95 | 62 | 56 | 58 | 54 | 57 | 53 | ....do | N'd. 4 | None | Moderating. | N. 36° E. | 0.2 | 10 | 0 |
| | 21 | 50 29 00 | 126 15 00 | 207.1 | 30.20 | 30.04 | 63 | 45 | 61 | 44 | 53 | 46 | ....do | S'd and E'd, 1; calm | None | Smooth | No account | | 0 | 0 |
| | 22 | Union Bay, Baynes Sound, B. C. | | 124.9 | 30.25 | 30.20 | 60 | 49 | 59 | 48 | 58 | 50 | ....do | Calm generally | None | Smooth | No account | | | |
| | 23 | 49 23 00 | 124 18 00 | 27.8 | 30.25 | 30.16 | 71 | 53 | 68 | 52 | 59 | 50 | ....do | Calm generally | None | Smooth | No account | | | |
| | 24 | Port Townsend, Wash. | | 102.8 | 30.24 | 30.10 | 72 | 50 | 70 | 49 | 53 | 49 | ....do | W'd, 1–2 | None | | | | | |

*Distance steamed during month, 3,010.4 knots; days under way and steaming, 24.

*Meteorological and cruising record, and seal data*—Continued.

| Date. | Meridian position. | | Distance run per log. | Barometer. | | Temperature. | | | | | | State of the weather. | Force and direction of winds. | Rainfall. | State of sea. | Currents. | Force in knots per hour. | Number of hours sealing weather. | Number of fur seals seen. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Air. | | | | Water at surface. | | | | | | | | | |
| | Lat. N. | Long. W. | | Max. | Min. | Dry bulb. | | Wet bulb. | | | | | | | | | | | |
| | | | | | | Max. | Min. | Max. | Min. | Max. | Min. | | | | | | | | |
| 1893. | ° ′ ″ | ° ′ ″ | *Knots.* | | | | | | | | | | | | | | | | |
| Sept. 25 | Port Townsend Wash. | | ..... | 30.19 | 30.06 | 76 | 52 | 73 | 51 | 54 | 50 | Clear and pleasant | W'd, 2 | None | | | | | |
| 26 | 48 10 00 | 123 20 00 | 27.0 | 30.29 | 30.20 | 55 | 53 | 54 | 51 | 52 | 50 | Foggy to fair and pleasant. | Calm; SW., 2; WSW., 3. | None | Smooth | No account | | 0 | 0 |
| 27 | 46 04 00 | 124 58 21 | 210.0 | 30.26 | 30.18 | 59 | 55 | 58 | 54 | 59 | 52 | Fair and pleasant generally. | S'd, 2–1 | Light | Smooth | None | 0.0 | 13 | 0 |
| 28 | 42 39 00 | 124 39 30 | 211.0 | 30.19 | 29.99 | 59 | 54 | 57 | 53 | 57 | 52 | Fair to overcast and rainy. | S'd, 2–1 | Light | Smooth | N. 56° E | 0.5 | 12 | 0 |
| 29 | 39 11 00 | 124 03 00 | 208.6 | 30.12 | 29.95 | 68 | 54 | 65 | 52 | 55 | 51 | Overcast and rainy to fair. | NW., 4–5 | Light | Moderate | S. 76° W | 0.2 | 0 | 0 |
| *30 | Raccoon Straits, Bay of San Francisco. | | 123.7 | 30.08 | 29.97 | 76 | 53 | 72 | 51 | 64 | 52 | Clear and pleasant | NW., 4–2 | None | Smooth | No account | | 0 | 0 |
| Oct. 1 | Navy-yard, Mare Island, Cal. | | 16.7 | 30.18 | 30.00 | 77 | 60 | 69 | 58 | 65 | 59 | .....do | NW., 2; SW., 2 | None | | | | | |
| 2 | .....do | | ..... | 30.22 | 30.05 | 77 | 60 | 72 | 58 | 66 | 60 | .....do | Calm; SSW., 2 | None | | | | | |
| 3 | .....do | | ..... | 30.15 | 30.01 | 78 | 55 | 74 | 54 | 65 | 59 | .....do | W., 2 | None | | | | | |
| 4 | .....do | | ..... | 30.10 | 30.00 | 80 | 59 | 77 | 58 | 64 | 60 | .....do | WSW., 2 | None | | | | | |
| 5 | .....do | | ..... | 30.13 | 29.99 | 80 | 55 | 79 | 54 | 66 | 55 | .....do | Calm; S'd and W'd, 1–2 | None | | | | | |
| 6 | .....do | | ..... | 30.14 | 30.04 | 76 | 58 | 74 | 57 | 66 | 59 | .....do | W. and WSW., 1 | None | | | | | |
| 7 | .....do | | ..... | 30.21 | 30.08 | 73 | 58 | 70 | 55 | 66 | 59 | .....do | S'd and W'd, 2–1 | None | | | | | |
| 8 | .....do | | ..... | 30.11 | 29.98 | 72 | 60 | 69 | 59 | 65 | 60 | .....do | WSW., 1–2 | None | | | | | |
| 9 | .....do | | ..... | 30.20 | 29.93 | 69 | 56 | 66 | 55 | 65 | 59 | Drizzling to clear and pleasant. | S., 2, to W., 3 | Light | | | | | |
| 10 | .....do | | ..... | 30.30 | 30.19 | 70 | 53 | 67 | 52 | 66 | 59 | Clear and pleasant | W., 1, to SW., 2 | None | | | | | |
| 11 | .....do | | ..... | 30.36 | 30.20 | 68 | 54 | 65 | 52 | 63 | 59 | .....do | Calm; SW., 2 | None | | | | | |
| 12 | .....do | | ..... | 30.29 | 30.01 | 79 | 55 | 76 | 53 | 66 | 58 | .....do | Calm generally; SW., 1 | None | | | | | |
| 13 | .....do | | ..... | 30.07 | 29.88 | 80 | 55 | 76 | 55 | 66 | 59 | .....do | Calm; SW., 1 (8 a. m., 5 p. m.); calm. | None | | | | | |
| 14 | .....do | | ..... | 30.02 | 29.94 | 71 | 53 | 68 | 56 | 63 | 59 | .....do | Calm; SW., 2 | None | | | | | |
| 15 | .....do | | ..... | 30.22 | 30.00 | 64 | 56 | 60 | 54 | 63 | 59 | Fair generally; sun-showers middle of day. | SW., 2 | Light | | | | | |
| 16 | .....do | | ..... | 30.30 | 30.15 | 67 | 50 | 61 | 48 | 62 | 58 | Clear and pleasant | Calm; WSW. and SW., 2–3. | None | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | do | 30.22 | 30.04 | 69 | 47 | 65 | 46 | 62 | 57 | do | WSW., 2 | None | |
| 18 | do | 30.12 | 29.98 | 67 | 48 | 65 | 47 | 62 | 58 | Clear generally; fog 5 to 8 a. m. | Calm; WSW., 2 | None | |
| 19 | do | 30.11 | 30.02 | 64 | 51 | 60 | 53 | 60 | 55 | Clear and pleasant | WSW., 2 | None | |
| 20 | do | 30.24 | 30.10 | 66 | 52 | 62 | 50 | 61 | 55 | do | WSW. and SW., 2 | None | |
| 21 | do | 30.24 | 29.95 | 66 | 53 | 64 | 51 | 62 | 57 | do | W., 1, to WSW., 2 | None | |
| 22 | do | 30.00 | 29.80 | 65 | 53 | 63 | 51 | 61 | 58 | do | SW., 1 (occasionally) | None | |
| 23 | do | 30.11 | 30.02 | 71 | 55 | 69 | 53 | 61 | 59 | Fair and pleasant | Calm; W'ly, 1 (7 a. m., 3 p. m); calm. | None | |
| 24 | do | 30.26 | 30.10 | 67 | 57 | 64 | 56 | 61 | 59 | Cloudy and drizzly to fair. | SW. and SSW., 1 | Light | |
| 25 | do | 30.38 | 30.26 | 66 | 54 | 63 | 53 | 60 | 58 | Fair and pleasant | SW., 1-2 | None | |
| 26 | do | 30.22 | 30.14 | 67 | 52 | 64 | 52 | 60 | 54 | Overcast and foggy to fair. | S'd and W'd, 1-2 | None | |
| 27 | do | 30.19 | 30.01 | 75 | 52 | 70 | 52 | 60 | 57 | Foggy to clear and pleasant. | Calm generally; E'ly, 1 | None | |
| 28 | do | 30.20 | 30.08 | 61 | 53 | 59 | 52 | 60 | 57 | Fair and pleasant; cloudy. | S'd and Wd, 1-2 | None | |
| 29 | do | 30.25 | 30.18 | 65 | 55 | 62 | 54 | 60 | 57 | do | SW., 2 | None | |
| 30 | do | 30.24 | 30.12 | 64 | 54 | 63 | 54 | 60 | 57 | Rainy to fair and pleasant. | SW., 2 | Light | |
| †31 | do | 30.16 | 30.08 | 63 | 50 | 61 | 48 | 60 | 56 | Fair and pleasant; cloudy. | Calm; SW., 1-2 | None | |
| Nov. 1 | do | 30.20 | 30.10 | 65 | 55 | 64 | 53 | 60 | 57 | Fair and pleasant | Calm; SW., 2 (2 to 7 p. m); calm. | None | |
| 2 | do | 30.28 | 30.19 | 63 | 47 | 59 | 46 | 58 | 55 | Fair to clear and pleasant. | Calm; W., 2 | None | |
| 3 | do | 30.37 | 30.19 | 62 | 47 | 60 | 44 | 59 | 56 | Fair generally; mist 8 to 10 a. m. | W., 2; calm; SW., 2 | Light mist | |
| 4 | do | 30.24 | 30.01 | 65 | 52 | 62 | 51 | 60 | 55 | Foggy and misty to fair. | S'd and W'd., 1-2 | Light mist. | |
| 5 | do | 30.08 | 30.02 | 60 | 54 | 58 | 53 | 59 | 56 | Cloudy to overcast and rainy. | Calm; WSW. to SSW., 2-3. | Light | |
| 6 | do | 30.32 | 30.04 | 64 | 56 | 62 | 54 | 59 | 57 | Overcast and rainy to clearing. | SW., 2 | Moderate. | |
| 7 | do | 30.41 | 30.27 | 61 | 51 | 59 | 49 | 58 | 55 | Foggy to clear and pleasant. | Calm generally; SW'ly, 1 | None | |
| 8 | do | 30.42 | 30.28 | 61 | 49 | 58 | 48 | 58 | 54 | Foggy to fair and pleasant. | Calm; SW., 1 | None | |
| 9 | do | 30.31 | 30.22 | 63 | 53 | 61 | 53 | 59 | 55 | Cloudy to overcast, then clearing. | SW., 2; calm | None | |
| 10 | do | 30.35 | 30.19 | 65 | 51 | 62 | 50 | 58 | 55 | Fair generally; mist 4 to 6 a. m. | SW., 2 | Light mist. | |
| 11 | do | 30.37 | 30.22 | 70 | 55 | 64 | 51 | 59 | 55 | Clear and pleasant | W., 2 to SE., 2 | None | |
| 12 | do | 30.44 | 30.29 | 69 | 44 | 65 | 47 | 58 | 54 | do | Calm; NE'd, 2 (9 a. m., 5 p. m.); calm. | None | |
| 13 | do | 30.35 | 30.20 | 67 | 49 | 65 | 48 | 60 | 54 | do | Calm; variable 1 (10 a. m., 3 p. m.); calm. | None | |
| 14 | do | 30.38 | 30.22 | 71 | 52 | 66 | 51 | 58 | 55 | do | E. 1-3; ENE., 3; calm | None | |
| 15 | do | 30.34 | 30.13 | 69 | 48 | 64 | 47 | 58 | 54 | do | Calm generally; E., 1 | None | |

* Distance steamed during month, 3,454.2 knots; days under way and steaming, 27. † Distance steamed during month, 16.7 knots; days underway and steaming, 1.

*Meteorological and cruising record, and seal data*—Continued.

| Date. | Meridian position. | | Distance run per log. | Barometer. | | Temperature. | | | | | | State of the weather. | Force and direction of winds. | Rainfall. | State of sea. | Currents. | Force in knots per hour. | Number of hours sealing weather. | Number of fur seals seen. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Air. | | | | Water at surface. | | | | | | | | | |
| | | | | | | Dry bulb. | | Wet bulb. | | | | | | | | | | | |
| | Lat. N. | Long. W. | | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | | | | | | | | |
| 1893. | ° ′ ″ | ° ′ ″ | *Knots.* | | | | | | | | | | | | | | | | |
| Nov. 16 | Navy-yard, Mare Island, Cal. | | ..... | 30.17 | 29.95 | 57 | 48 | 56 | 47 | 57 | 54 | Fair generally; foggy and misty 6 a. m. to 12 m. | W., 1; SW., 2 | Light mist. | ..... | ..... | ..... | ..... | ..... |
| 17 | .....do | | ..... | 30.17 | 30.00 | 56 | 47 | 54 | 46 | 55 | 51 | Clear, but squally | N'd and W'd, 3–6 | None | ..... | ..... | ..... | ..... | ..... |
| 18 | .....do | | ..... | 30.14 | 29.99 | 65 | 49 | 61 | 47 | 55 | 53 | Clear and pleasant | Calm generally; variable, 1. | None | ..... | ..... | ..... | ..... | ..... |
| 19 | .....do | | ..... | 30.32 | 30.15 | 58 | 47 | 55 | 45 | 54 | 50 | .....do | Calm; E., 3 (5 a. m., 5 p. m.); calm. | None | ..... | ..... | ..... | ..... | ..... |
| 20 | .....do | | ..... | 30.34 | 30.24 | 58 | 40 | 56 | 39 | 54 | 49 | Fair; cooler | Calm; SW., 1 | None | ..... | ..... | ..... | ..... | ..... |
| 21 | .....do | | ..... | 30.25 | 30.12 | 56 | 49 | 55 | 48 | 53 | 50 | Overcast and threatening to fair. | Calm; S'd and W'd (8 a. m., 6 p. m.); calm. | None | ..... | ..... | ..... | ..... | ..... |
| 22 | .....do | | ..... | 30.26 | 30.16 | 62 | 49 | 60 | 48 | 54 | 51 | Cloudy and cool to overcast and drizzly. | SW., 2–1 | Light | ..... | ..... | ..... | ..... | ..... |
| 23 | .....do | | ..... | 30.25 | 30.11 | 63 | 54 | 60 | 53 | 55 | 53 | Fair to misty and drizzly. | Calm; SW. to SE., 2 | Light | ..... | ..... | ..... | ..... | ..... |
| 24 | .....do | | ..... | 30.08 | 29.90 | 61 | 54 | 60 | 53 | 54 | 53 | Overcast and rainy to cloudy. | Calm; SE. and S., 3–2 | Moderate. | ..... | ..... | ..... | ..... | ..... |
| 25 | .....do | | ..... | 30.22 | 30.06 | 58 | 52 | 57 | 51 | 54 | 52 | Cloudy and unsettled; showery. | WSW., 1; SSW., 2 | Light | ..... | ..... | ..... | ..... | ..... |
| 26 | .....do | | ..... | 30.22 | 30.12 | 61 | 51 | 59 | 50 | 56 | 51 | Overcast and stormy; rainy. | ESE., 1; SE., 2–3 | Heavy | ..... | ..... | ..... | ..... | ..... |
| 27 | .....do | | ..... | 30.25 | 30.17 | 61 | 52 | 59 | 51 | 55 | 52 | Overcast, drizzly, and rainy. | ESE., 1; S'd and W'd, 2–3 | Moderate. | ..... | ..... | ..... | ..... | ..... |
| 28 | .....do | | ..... | 30.34 | 30.21 | 64 | 52 | 62 | 50 | 55 | 52 | Cloudy to fair; drizzle 4 to 5 a. m. | Calm; SE., 3–2; calm | Light | ..... | ..... | ..... | ..... | ..... |
| 29 | .....do | | ..... | 30.38 | 30.29 | 60 | 54 | 59 | 53 | 55 | 52 | Overcast and rainy | Calm; SE., 2 | Moderate. | ..... | ..... | ..... | ..... | ..... |
| 30 | .....do | | ..... | 30.34 | 30.29 | 61 | 57 | 60 | 56 | 56 | 52 | Overcast, misty, and rainy. | SSW., 1 | Moderate. | ..... | ..... | ..... | ..... | ..... |
| Dec. 1 | .....do | | ..... | 30.41 | 30.33 | 64 | 54 | 62 | 53 | 56 | 52 | Cloudy and unsettled; showery in forenoon. | Calm; SW., 1 | Light | ..... | ..... | ..... | ..... | ..... |
| 2 | .....do | | ..... | 30.41 | 30.31 | 67 | 52 | 65 | 50 | 56 | 51 | Foggy to fair and pleasant. | Calm; NW. to E., 2 | None | ..... | ..... | ..... | ..... | ..... |
| 3 | .....do | | ..... | 30.51 | 30.40 | 64 | 51 | 62 | 50 | 55 | 51 | Clear and pleasant | E., 3; NE. to S., 2; calm | None | ..... | ..... | ..... | ..... | ..... |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | do | | 30.48 | 30.33 | 63 | 51 | 60 | 50 | 55 | 51 | Fair to clear and pleasant. | Calm; ENE., 2–1; calm | None |
| 5 | do | | 30.40 | 30.26 | 66 | 50 | 64 | 49 | 56 | 50 | Clear and pleasant | Calm; E. and ENE., 2 | None |
| 6 | do | | 30.44 | 30.32 | 67 | 49 | 61 | 48 | 54 | 51 | do | NE., 3 (squalls, 5); ENE., 3 | None |
| 7 | do | | 30.26 | 30.18 | 68 | 50 | 66 | 49 | 54 | 50 | do | Calm generally; SW. by 1 | None |
| 8 | do | | 30.29 | 30.17 | 70 | 56 | 67 | 55 | 62 | 51 | do | E., 1–2; calm at times | None |
| 9 | do | | 30.27 | 30.11 | 65 | 54 | 63 | 53 | 55 | 52 | do | E., 2; calm | None |
| 10 | do | | 30.16 | 30.03 | 61 | 50 | 59 | 49 | 55 | 51 | do | Calm; E., 2 | None |
| 11 | do | | 30.19 | 30.08 | 57 | 46 | 55 | 45 | 53 | 50 | Fair and pleasant; fog 4 to 8 a. m. | Calm generally; W., 1 | None |
| 12 | do | | 30.13 | 30.04 | 56 | 48 | 55 | 47 | 54 | 50 | Overcast and cloudy; rain 10 to 11 p. m. | Calm generally; SW., 1 | Light |
| 13 | do | | 30.16 | 30.08 | 58 | 51 | 57 | 50 | Dry dock. | | Cloudy; frequent rain showers. | Calm; S'd and W'd, 2 | Moderate. |
| 14 | do | | 30.45 | 30.11 | 59 | 46 | 57 | 45 | do | | Overcast and rainy to fair. | SW., 2–3 | Moderate. |
| 15 | do | | 30.57 | 30.47 | 53 | 42 | 57 | 41 | do | | Clear and pleasant | SW., 1; E., 2 | None |
| 16 | do | | 30.55 | 30.43 | 61 | 44 | 59 | 42 | do | | do | E'd, 2–3 | None |
| 17 | do | | 30.46 | 30.28 | 59 | 49 | 58 | 48 | do | | Fair to overcast and rainy. | E'd, 2; calm | Light |
| 18 | do | | 30.32 | 30.22 | 61 | 50 | 59 | 49 | do | | Rainy to clearing | Calm; SW'ly 1; calm | Light |
| 19 | do | | 30.27 | 30.19 | 54 | 50 | 53 | 49 | do | | Fair and pleasant to overcast. | Calm; N'd and W'd, 1 | None |
| 20 | do | | 30.26 | 30.18 | 55 | 52 | 53 | 51 | do | | Overcast and threatening. | NW., 1; NE., 2 | None |
| 21 | do | | 30.20 | 30.10 | 58 | 53 | 56 | 52 | do | | Overcast, rainy, and drizzly. | E'd, 1; calm | Moderate. |
| 22 | do | | 30.20 | 30.06 | 57 | 47 | 56 | 46 | do | | Overcast and drizzly to clearing. | Calm; WSW., 3 | Light |
| 23 | do | | 30.18 | 30.00 | 52 | 44 | 52 | 42 | 51 | 46 | Fair to overcast and rainy. | SW., 1–2; S'd and E'd, 2 | Light |
| 24 | do | | 30.24 | 29.93 | 53 | 46 | 52 | 45 | 51 | 46 | Rainy and drizzly to clearing. | S'd and W'd, 2 | Light |
| 25 | do | | 30.30 | 30.09 | 46 | 44 | 45 | 43 | 49 | 45 | Cloudy to overcast and disagreeable. | NE., 2–3 | None |
| 26 | do | | 30.02 | 29.78 | 50 | 46 | 48 | 44 | 49 | 45 | Overcast and drizzly | NNE., 3; ESE., 2; NE., 2 | Light |
| 27 | do | | 30.49 | 29.94 | 51 | 44 | 49 | 43 | 48 | 44 | Fair generally; showers 1 to 2 p. m. | Calm; E'd, 1–2 | Light |
| 28 | do | | 30.53 | 30.43 | 49 | 41 | 48 | 39 | 47 | 43 | Foggy and disagreeable. | Calm | None |
| 29 | do | | 30.50 | 30.33 | 46 | 35 | 45 | 34 | 46 | 40 | Cold and disagreeable; heavy fog. | Calm generally; variable, 1. | None |
| 30 | do | | 30.44 | 30.38 | 44 | 37 | 43 | 36 | 46 | 42 | Cloudy and cold; disagreeable. | N'd, 2–3 | None |
| 31 | do | | 30.39 | 30.18 | 44 | 42 | 43 | 41 | 46 | 44 | do | ENE., 2–3 | None |

*Meteorological and cruising record, and seal data*—Continued.

| Date. | Meridian position. | | Distance run per log. | Barometer. | | Temperature. Air. Dry bulb. | | Air. Wet bulb. | | Water at surface. | | State of the weather. | Force and direction of winds. | Rainfall. | State of sea. | Currents. Setting to the (true). | Currents. Force in knots per day. | Number of hours sealing weather. | Number of fur seals seen. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Lat. N. | Long. W. | | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | | | | | | | | |
| 1894. | ° ′ ″ | ° ′ ″ | Knots. | | | | | | | | | | | | | | | | |
| May 1 | Port Townsend, Wash. | | 24.8 | 30.53 | 30.44 | 51 | 42 | 50 | 40 | 47 | 45 | Cloudy to clear and pleasant; showery 6 to 8 a. m. | SW., 2; NE., 2; W'd, 2.. | Light... | Smooth... | No account | | | |
| 2 | .....do..... | | | 30.52 | 30.36 | 55 | 43 | 53 | 42 | 47 | 45 | Cloudy, but pleasant generally. | SW., 2; NE., 2; W., 3.... | Light... | | | | | |
| 3 | .....do..... | | | 30.36 | 30.02 | 53 | 46 | 52 | 44 | 47 | 45 | Overcast, drizzly, and rainy. | W., 4; S'd and E'd, 3; calm. | Heavy.. | | | | | |
| 4 | .....do..... | | | 30.10 | 29.93 | 51 | 47 | 50 | 46 | 47 | 46 | Overcast and rainy; disagreeable. | Variable, 1; S'd and W'd, 2-3. | Moderate | | | | | |
| 5 | 48 13 00 | 122 51 00 | 9.8 | 30.15 | 30.03 | 55 | 45 | 52 | 44 | 48 | 46 | Overcast, gloomy, and unsettled. | E., 3; NW., 1-3; S'd, 3... | Light mist. | Smooth... | No account | | | |
| 6 | 48 43 00 | 122 57 30 | 56.7 | 30.34 | 30.16 | 59 | 45 | 57 | 43 | 48 | 45 | Fair, but cool..... | S'd and W'd, 4-3..... | None... | Smooth... | No account | | | |
| 7 | Port Townsend, Wash. | | 55.1 | 30.26 | 30.01 | 54 | 45 | 52 | 44 | 48 | 46 | Overcast and rainy to clearing. | Variable, 1; SE., 3-4; NW., 3; SW., 4-6. | Moderate | | | | | |
| 8 | 48 40 00 | 122 33 00 | 52.7 | 30.49 | 30.26 | 54 | 45 | 52 | 43 | 52 | 46 | Clear and pleasant.... | WSW., 6; SW., 2; S'd, 2. | None... | Smooth... | No account | | | |
| 9 | Port Townsend, Wash. | | 49.9 | 30.58 | 30.28 | 54 | 45 | 52 | 43 | 52 | 46 | Fair and pleasant..... | S'd and W'd, 2; N'd, 2; SW., 2; calm. | None... | | | | | |
| 10 | .....do..... | | | 30.24 | 30.04 | 54 | 43 | 52 | 42 | 47 | 45 | .....do..... | E'ly, 1; W., 2-4..... | None... | | | | | |
| 11 | .....do..... | | | 30.21 | 30.12 | 58 | 45 | 57 | 44 | 51 | 46 | Overcast to fair and pleasant. | N'd and W'd, 1..... | None... | | | | | |
| 12 | .....do..... | | | 30.20 | 30.11 | 50 | 44 | 48 | 43 | 48 | 45 | Fair to overcast and drizzly. | Calm; W., 1-3..... | Light... | | | | | |
| 13 | .....do..... | | | 30.16 | 29.99 | 52 | 45 | 50 | 43 | 48 | 45 | Cloudy, but pleasant; showers 4 to 6 a. m. | S'd and W'd, 2..... | Light... | | | | | |
| 14 | .....do..... | | | 29.97 | 29.89 | 53 | 44 | 50 | 42 | 47 | 45 | Overcast and cloudy.. | SW., 2; W., 4-3; WSW., 2-3. | None... | | | | | |
| 15 | .....do..... | | | 30.19 | 29.90 | 50 | 45 | 48 | 44 | 47 | 46 | Overcast and disagreeable; rainy. | WSW., 2; SE., 28; calm.. | Heavy.. | | | | | |
| 16 | .....do..... | | | 30.30 | 30.20 | 57 | 46 | 55 | 45 | 48 | 46 | Overcast and cloudy.. | S'd and E'd, 2-1; calm... | Light drizzle. | | | | | |
| 17 | 48 55 00 | 123 20 00 | 66.8 | 30.30 | 30.17 | 58 | 48 | 57 | 46 | 54 | 46 | Clear and pleasant.... | W'ly, 1; calm..... | None... | Smooth... | No account | | | |
| 18 | 49 44 30 | 124 48 00 | 83.1 | 30.16 | 29.86 | 64 | 50 | 61 | 49 | 57 | 49 | Clear and pleasant generally. | Calm; W., 2; calm; W., 2. | None... | Smooth... | No account | | | |
| 19 | 50 57 00 | 128 47 00 | 176.7 | 30.02 | 29.88 | 53 | 48 | 52 | 47 | 49 | 46 | Fair and pleasant generally; showery 7 to 8 a. m. | SW., 3-2..... | Light... | Smooth... | No account | | | |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | 51 54 00 | 133 39 00 | 197.2 | 30.04 | 30.00 | 53 | 48 | 52 | 47 | 50 | 47 | Fair and pleasant | SW., 2-1 | None | Smooth | S. 42° E. | 2.7 | 16 | 0 |
| 21 | 53 07 00 | 138 24 00 | 209.8 | 30.13 | 29.99 | 51 | 46 | 50 | 45 | 48 | 43 | Foggy to overcast and cloudy. | SSW., 2; E'd, 2 | None | Smooth | N. 75° E. | 23.5 | 16 | 0 |
| 22 | 53 37 00 | 144 10 00 | 217.5 | 30.16 | 30.01 | 48 | 44 | 47 | 42 | 43 | 40 | Overcast and foggy | N'd and E'd, 3; E'd, 4 | None | Smooth | No account | | 16 | 0 |
| 23 | 54 07 00 | 149 59 00 | 230.2 | 30.08 | 29.93 | 43 | 40 | 42 | 39 | 40 | 38 | Foggy and misty | S'd and E'd, 4 | Light | Smooth | S. 85° E. | 21.2 | 16 | 0 |
| 24 | 54 30 00 | 156 49 00 | 241.4 | 30.06 | 29.81 | 44 | 39 | 43 | 38 | 39 | 38 | Foggy and thick | SE., by E., 4; E., 2 | None | Smooth sea, swell from E'd. | No account | | 0 | 1 |
| 25 | 53 57 00 | 161 48 00 | 206.0 | 29.77 | 29.19 | 43 | 37 | 42 | 36 | 39 | 36 | Gloomy, threatening, and stormy. | E., 4, to NE., 9 | Moderate | Moderate to rough. | East | 20.6 | 0 | 0 |
| 26 | 54 08 00 | 166 11 00 | 167.5 | 29.16 | 29.10 | 40 | 37 | 39 | 36 | 39 | 36 | Stormy, overcast, and gloomy. | NE., 9; NNW., 3; NE., 2-1. | Moderate | Rough to smooth. | No account | | 5 | 0 |
| 27 | Dutch Harbor, Unalaska Island. | | 22.5 | 29.29 | 29.16 | 41 | 39 | 40 | 37 | 39 | 37 | Overcast and stormy; snowing at times. | S'd and W'd, 1-3; squalls, 6. | Moderate | | | | | |
| 28 | ....do.... | | | 29.69 | 29.29 | 41 | 38 | 40 | 37 | 38 | 37 | Overcast and boisterous; snow, rain, and sleet at times. | W., 2; squalls, 6 | Moderate | | | | | |
| 29 | ....do.... | | | 29.78 | 29.70 | 51 | 38 | 50 | 37 | 39 | 37 | Cloudy, but pleasant, to overcast. | S'd and W'd, 1-2 | None | | | | | |
| 30 | ....do.... | | | 29.73 | 29.67 | 41 | 38 | 40 | 37 | 39 | 37 | Overcast and gloomy; snow in a. m.; rain in p. m. | NE., to NNW., 1 | Moderate | | | | | |
| *31 | 54 03 00 | 167 54 00 | 65.3 | 29.88 | 29.72 | 40 | 38 | 39 | 37 | 38 | 37 | Overcast and drizzly | S'd, 1; W., 2-3 | Moderate | Smooth | No account | | 13 | 0 |
| June 1 | 53 44 00 | 174 24 00 *East.* | 259.7 | 30.06 | 29.90 | 42 | 38 | 40 | 37 | 41 | 36 | Rainy and misty to cloudy, but pleasant. | W'd, 4; S'd, 4; SSE., 4 | Light | Smooth | East | 28.8 | 18 | 0 |
| 2, 3 | 53 20 00 | 178 45 00 | 272.6 | 30.01 | 29.83 | 49 | 39 | 48 | 38 | 41 | 38 | Cloudy, but generally pleasant. | SSE., 3; variable, 1; NW., 3. | Light | Smooth | N. 77° E. | 26.6 | 18 | 0 |
| 4 | Chichagof Harbor, Attu Island. | | 229.6 | 30.12 | 29.92 | 46 | 39 | 45 | 38 | 46 | 38 | Fair and pleasant | NW., 3; N'd, 1; calm | None | Smooth | S. 78° E. | 22 hrs. 20.3. | 8 | 0 |
| 5 | 52 37 00 | 173 45 00 | 31.9 | 30.14 | 30.09 | 46 | 37 | 45 | 36 | 41 | 38 | Fair to overcast, thick, and stormy. | Calm; S'd and W'd, 2-5 | Moderate | Smooth | No account | | 5 | 0 |
| 6 | 52 39 00 | 173 44 00 | 55.1 | 30.14 | 30.04 | 45 | 41 | 43 | 40 | 40 | 39 | Rainy, misty, and boisterous. | S'd and W'd, 7-3 | Heavy | Rough | No account | | 0 | 0 |
| 7 | 52 19 00 | 177 30 00 | 164.5 | 30.14 | 29.91 | 44 | 39 | 43 | 39 | 40 | 39 | Overcast and gloomy | SW., 3; SE., 3-5 | Light | Moderate to smooth. | None | 0 | 12 | 0 |
| 8 | Kiska Harbor, Kiska Island. | | 28.0 | 29.85 | 29.60 | 44 | 41 | 43 | 40 | 41 | 39 | Stormy, thick, and rainy. | S'd and E'd, 5; squally, 8; S'd and E'd, 2. | Moderate | Smooth to moderate. | No account | | 4 | 0 |
| 9 | 52 07 00 | 177 43 00 *West.* | 23.3 | 29.62 | 29.58 | 43 | 41 | 42 | 40 | 40 | 39 | Thick, foggy, and rainy | SE., 1; E'd, 3 | Moderate | Moderate to rough. | No account | | 2 | 0 |
| 9 | 52 25 00 | 177 15 00 | 189.1 | 29.58 | 29.41 | 43 | 41 | 42 | 40 | 41 | 39 | Thick, foggy, and drizzly. | E'd, 2; N'd and E'd, 2-3 | Moderate | Moderate to smooth. | S. 36° E. | 7.4 | 10 | 0 |
| 10 | Nazan Bay, Atka Island. | | 161.5 | 29.52 | 29.38 | 44 | 42 | 43 | 41 | 41 | 40 | Stormy, thick, and rainy. | S'd and W'd, 4-7; S'd and W'd, 4. | Moderate | Smooth to moderate. | No account | | 0 | 0 |
| 11 | 53 20 00 | 169 38 00 | 183.5 | 29.81 | 29.52 | 42 | 41 | 41 | 40 | 40 | 39 | Overcast and cloudy; misty at times. | S'd and W'd, 5 | Light | Moderate | South | 7.1 | 0 | 0 |
| 12 | Dutch Harbor, Unalaska Island. | | 133.5 | 29.85 | 29.52 | 54 | 41 | 53 | 40 | 42 | 39 | Cloudy to misty, stormy and rainy. | SW., 3-1; S'd and E'd, 2-4; squalls, 7. | Moderate | Smooth | No account | | 0 | 0 |
| 13 | 53 57 00 | 166 31 00 | 4.7 | 29.55 | 29.38 | 57 | 43 | 55 | 42 | 44 | 39 | Stormy, partly clear, to overcast and misty. | SE., 4; squalls, 6; S., 8; S., 4. | Light | Rough | No account | | 0 | 0 |
| 14 | 53 55 00 | 167 05 00 | 110.3 | 29.91 | 29.56 | 44 | 41 | 43 | 40 | 40 | 39 | Stormy, misty, and rainy. | S., 3-7; SSW., 5 | Moderate | Rough | No account | | 0 | 0 |

*2,133 knots per log; 18 days under way.

*Meteorological and cruising record, and seal data*—Continued.

| Date. | Meridian position. | | Distance run per log. | Barometer. | | Temperature. Air. | | | | Water at surface. | | State of the weather. | Force and direction of winds. | Rainfall. | State of sea. | Currents. | | Number of hours sealing weather. | Number of fur seals seen. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Dry bulb. | | Wet bulb. | | | | | | | | Setting to the (true). | Force in knots per day. | | |
| | Lat. N. | Long. W. | | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | | | | | | | | |
| 1894. | ° ′ ″ | ° ′ ″ | *Knots.* | | | | | | | | | | | | | | | | |
| June 15 | 53 27 00 | 168 14 00 | 85.0 | 30.01 | 29.94 | 43 | 40 | 42 | 39 | 40 | 38 | Stormy, misty, and thick. | SSW., 4-8; S., 6; S'd and W'd, 6-5. | Moderate | Rough.... | No account..... | | 0 | 0 |
| 16 | 52 59 00 | 171 55 00 | 188.7 | 30.18 | 29.98 | 42 | 39 | 41 | 38 | 39 | 39 | Overcast and misty; boisterous. | SW., 6-2..... | Moderate | Rough to moderate. | N. 56° E... | 14.5 | 0 | 0 |
| 17 | 52 11 00 | 173 03 00 | 171.8 | 30.16 | 29.94 | 43 | 40 | 42 | 39 | 40 | 39 | Overcast to foggy and misty. | SW., 3; S. to SSE., 3-4... | Light mist. | Smooth... | No account..... | | 12 | 0 |
| 18 | 54 10 00 | 167 56 00 | 231.3 | 29.93 | 29.68 | 47 | 41 | 46 | 40 | 44 | 39 | Foggy and rainy, thick and disagreeable. | S., 4; SW., 4; S., 2-3..... | Moderate | Smooth... | S. 17° E... | 19 hrs. 8.0 | 15 | 0 |
| 19 | Dutch Harbor, Unalaska Island. | | 60.6 | 29.76 | 29.60 | 50 | 45 | 49 | 43 | 44 | 43 | Rainy to cloudy and pleasant. | S'd and W'd., 3; squalls, 5-6. | Light... | ..... | ..... | ..... | ..... | ..... |
| 20 | ....do..... | | ..... | 29.78 | 29.70 | 52 | 43 | 50 | 43 | 45 | 42 | Cloudy, but pleasant.. | S'd, 3-5; NE., 3; NNW., 3; ESE., 3-5. | None.... | ..... | ..... | ..... | ..... | ..... |
| 21 | ....do..... | | ..... | 30.11 | 29.80 | 56 | 41 | 55 | 40 | 44 | 40 | Fair and pleasant; foggy outside. | S'd, 4; squalls, 6; S., 4; variable, 2. | None.... | Smooth... | ..... | ..... | ..... | ..... |
| 22 | 55 40 00 | 168 35 00 | 134.7 | 30.10 | 29.94 | 41 | 39 | 40 | 38 | 40 | 36 | Misty, drizzly, and foggy; thick. | Variable, 1; NNE., 4-6; ENE., 4-6. | Moderate | Smooth to choppy. | S. 13° W.. | 15 hrs. 5.0 | 8 | 0 |
| 23 | Village Cove, St. Paul Island. | | 129.0 | 29.99 | 29.90 | 44 | 39 | 43 | 38 | 39 | 36 | Misty and foggy; thick | SE., 2-4..... | Light mist. | Smooth... | No account..... | | 0 | 0 |
| 24 | 57 34 00 | 167 58 00 | 127.6 | 29.97 | 29.76 | 41 | 38 | 40 | 37 | 38 | 36 | Misty, drizzly, and foggy; thick. | SE. and SSE., 3; SW., 3-4. | Moderate | Smooth... | N. 39° W.. | 17 hrs. 5.1 | 14 | 0 |
| 25 | 56 12 00 | 165 45 00 | 185.4 | 30.00 | 29.91 | 41 | 39 | 40 | 39 | 39 | 38 | Foggy, misty, and rainy; thick. | SW., 4; SSE., 4; S., 4.... | Moderate | Smooth sea; SW. swell. | No account..... | | 16 | 0 |
| 26 | 55 33 00 | 163 23 00 | 184.0 | 30.03 | 29.91 | 43 | 40 | 42 | 39 | 40 | 38 | .....do..... | S., 4; S'd and W'd, 4..... | Moderate | Smooth to moderate. | N. 14° E... | 48 hrs. 12.3 | 12 | 0 |
| 27 | 56 31 00 | 159 48 00 | 202.9 | 30.17 | 30.04 | 43 | 37 | 43 | 36 | 41 | 35 | Foggy and misty; thick | W., 3; WSW., 4; W., 3; SW., 4. | Light... | Smooth... | No account..... | | 14 | 0 |
| 28 | 56 38 00 | 160 39 00 | 194.4 | 30.10 | 29.96 | 39 | 35 | 38 | 34 | 41 | 34 | Foggy to fair to foggy and misty. | SSW., 2; W'd, 1..... | Light... | Smooth... | No account..... | | 16 | 2 |
| 29 | 57 56 00 | 166 16 00 | 198.2 | 30.07 | 29.91 | 45 | 38 | 44 | 37 | 38 | 37 | Misty and foggy to fair. | W'd., 2-3..... | Light... | Smooth... | N. 22° E... | 8.6 | 14 | 2 |
| *30 | 56 59 00 | 163 02 00 | 177.1 | 30.15 | 29.93 | 46 | 35 | 45 | 34 | 41 | 37 | Foggy to fair and pleasant. | SW., 2; calm; SE., 2; NW., 3. | None.... | Smooth... | N. 56° E... | 5.3 | 18 | 0 |

*4,117.9 knots steamed per log; 28 days under way.

# 3.—DESCRIPTION OF A CLOSING TOW-NET, FOR SUBMARINE USE AT ALL DEPTHS.

By C. H. TOWNSEND,
*Assistant, United States Fish Commission.*

Recent experiments with closing tow-nets in submarine explorations have yielded so much accurate information concerning the vertical range of pelagic life that the construction of the Tanner intermediate tow-net in 1891[1] may be said to have inaugurated a new era in the study of the pelagic fauna, characterized by exact knowledge of the depth of the forms collected.

The vertical distribution of the pelagic life gathered with the open tow-nets of the *Challenger* expedition has necessarily been conjectural, the nets employed having been dragged open at all depths. Since then European investigators have employed several devices for closing submarine tow-nets, but direct evidence as to their reliability, so far as the writer is aware, seems to be lacking.

Open tow-nets of different forms have long been employed by the United States Fish Commission, while a closing collector, although of very limited capacity (the Sigsbee gravitating trap), has done service on the Coast Survey steamer *Blake;* but it was not until 1891 that a closing tow-net of large size was brought into use. The Tanner tow-net, closing tightly at any depth desired, has proved its efficiency during recent explorations conducted by the Fish Commission and by Mr. Alexander Agassiz, but its large size and somewhat complicated construction have prevented its use except by steam power from large vessels.

While towing a light surface-net behind one of the small boats of the *Albatross* in an Alaskan harbor in the summer of 1894, the idea of a very simple closing-net presented itself, which was at once experimented upon and gave satisfactory results. I at first used it in moderate depths only, but subsequently, having made one of heavier form than at first employed, the principle was found applicable to deep-sea work as well as near the surface.

[1] Tanner, Rept. U. S. Fish Com. 1889-91, pp. 259–260. Bull. U. S. Fish Com. 1894, pp. 143–151.

This form of towing-net is, on account of its lightness and simplicity, convenient for use by hand from all kinds of small sailing craft and open boats. It can be rolled into a small package with all its attachments and carried readily in one hand. With a light tow-line passed through a pulley slung from one of the boat davits of the Fish Commission steamer *Albatross*, it has been hauled in from depths of 20 and 30 fathoms by one man with very little exertion, and has not failed to work in a single instance.

In the summer of 1895 this net, constructed in larger and heavier form, with a net ring 3 feet in diameter, was used successfully on board the *Albatross* during fishery investigations in Bering Sea, at depths varying from 20 to 200 fathoms.

Following is a description of a closing-net of medium size constructed for use on the Fish Commission schooner *Grampus* (pl. 9, figs. 1 and 2): It consists of a tow-net with a folding-ring suspended by rope slings from a tripping-arm attached to the tow-line, and is operated at will by a messenger. The ring to which the net is attached is hinged to fold, for the purpose of closing the net, and is supported by two sets of slings of nearly equal length, one set attached near the hinges, supporting the net in an open position, the other attached at right angles to the hinges, supporting it in a closed position.

Closing is effected by means of a tripping-arm, from which the slings are suspended, and which, being tripped by a messenger, shifts the weight from the opening to the closing slings with the result of closing the net. The tow-line is attached to the lower end of the tripping-arm, the upper end of which is hooked to a ring on the tow-line. The opening slings are secured near the upper end of the arm, the closing slings to the lower end. A light messenger (pl. 9, fig. 3) sliding down the tow-line detaches the messenger-ring from the upper hook of the tripping-arm, shifting the weight from the opening to the closing slings. A spring catch in the upper hook of the tripping-arm keeps the messenger-ring from slipping out of place until struck by the messenger, while a heavy ring-shaped weight, released by the tripping of the arm, slips from the lower hook of the arm down the closing slings and keeps the jaws from opening after they have been closed by the messenger. The accompanying figures, showing the net in both open and closed positions, illustrate its workings clearly.

The tripping arm is merely a piece of half-inch brass, ordinarily about 2 feet in length and of the shape shown in the cut. The ring is 2 feet in diameter, made of $\frac{3}{4}$ by $\frac{1}{4}$ inch brass, and is essentially the same as that employed by Agassiz for use with his modified Chun-Petersen machine.[1] The messenger is a 2-pound bronze casting, in two parts, to lash around the towline. A small lead sinker is lashed to the bottom of the net, of sufficient weight to carry it down clear of the ring, as it is, of course, lowered vertically and the vessel from which it is operated

[1] Agassiz, Bull. Mus. Comp. Zool. 1892–93, vol. XXIII, p. 45, etc.

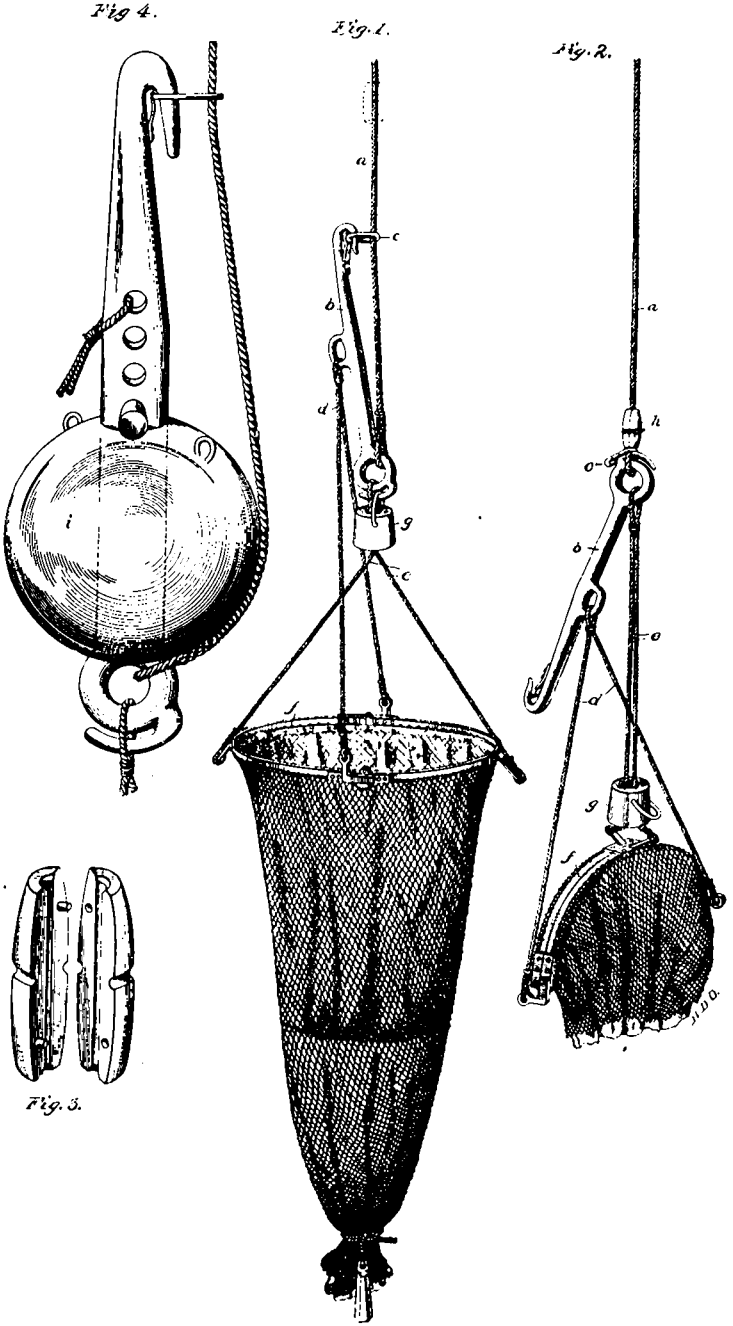



FIG. 1. Showing net in position for lowering and towing.
- *a*. Tow line.
- *b*. Tripping arm.
- *c*. Tripping ring.
- *d*. Opening slings.
- *e*. Closing slings.
- *f*. Folding net ring.
- *g*. Closing weight.
- *h*. Closing messenger. (See also Fig. 3.)

FIG. 2. Showing net closed for heaving in.

FIG. 3. Closing messenger.

FIG. 4. Showing heavy tripping arm used on steamer Albatross, with 60-pound sounding shot attached as sinker for proper strain on wire tow line in deep-sea work.
- *i*. Common sounding shot—60 pounds.

brought to a full stop. The net is light and of small mesh, preferably half inch. It is lined with bobbinet or mosquito netting, with a delicate inner lining of silk bolting-cloth, the last being the real collector, to which the outer nets act as supports.

In this combination of three nets all are of full width to the bottom, where they are closed by a lashing, the inner nets being secured rather slack, in order to avoid strain upon them in towing. As used on board the *Albatross*, by steam power at all depths, the net and its appliances have been constructed somewhat heavier and stronger. Additional weight is secured by passing the tripping-arm through a 60-pound shot, of the ordinary pattern used for sounding, the shot being secured by a bolt to prevent its slipping when the arm is capsized. (See pl. 9, fig. 4.)

A deep-sea tow-net, closed, with the folded jaws protecting its mouth, offers little resistance to the water, and can be heaved in rapidly without the danger of being torn away from an open and widespread net-ring, while the friction upon the contained organisms is reduced to the minimum.

The time gained in deep-sea work, with a folding-ring net which will permit of the steam winch reeling in at full speed, and the small stowage space required on shipboard for a net of this pattern, are matters of considerable importance. The readiness with which this net can be carried on deck by one man and attached to the wire dredge rope without complicated adjusting is perhaps the most important point of all in its favor, while its cost is less than that of any intermediate net hitherto employed.

This device has also been constructed in very light form, with a net ring 18 inches in diameter, for use in lakes or at very moderate depths, the heavier outside net being done away with, leaving merely the mosquito netting with its lining of silk bolting-cloth.

In this form it will be useful in gathering the minute life, crustacea, etc., of the Great Lakes, a knowledge of which is essential in its bearing upon the food of young whitefish and other important fishes now being propagated artificially.

The folding-ring tow-net is also available for use as an ordinary surface tow-net, without the employment of the messenger and the lead sinker.

The collections made by the *Albatross* during the past summer with the intermediate net were from depths of 20 to 200 fathoms, the net being lowered in one instance to 575 fathoms, when it accidentally touched bottom. The forms obtained consisted principally of minute crustacea, medusæ, annelids, and fishes, which have not yet been studied; but the ordinary surface tow-net having been used at the same stations as the intermediate net, the contents of the two nets were usually found to differ somewhat in character and quantity. As a rule, the surface net contained a slightly greater quantity of material than the intermediate net, but at some stations the reverse was the case, while the inter-

mediate net sometimes brought up forms not taken at all in the surface net. The towings, 18 in all, were made along the border of the submarine bank south of the Pribilof Islands during the month of August, from lat. 54° to 56° N. and long. 167° to 172° W. Soundings were from 75 fathoms, on the bank, to 1,901 fathoms beyond it. There can be no doubt that there is an abundance of pelagic life at 200 fathoms in this part of Bering Sea.

After some experience with the single tripping-arm described in the preceding pages, I designed a machine for *opening as well as closing* the jaws of the tow-net, which worked satisfactorily (plate 10). It is a combination of two tripping arms, for operating which two messengers are employed on the same tow-line, the second striking a separate detacher from the first. A rough experimental machine, constructed on board the *Albatross*, was used successfully in port, but did not have strength to withstand the strain of towing at sea. Experiments indicate, however, that a properly constructed machine of the same pattern would accomplish the desired result. Its use in place of the single tripping-arm permits of the folding-ring tow-net being lowered in a closed position, the closing-slings being attached to the right arm, the opening-slings to the left. The arms are bolted to a bar of brass about 2 feet long, suspended from the towline, and in position for use are hooked upright to detachers released by messengers. The first messenger tripping the right arm, the jaws of the net fall apart for towing. The second messenger, in turn, tripping the left arm, the weight is thrown back on the slings of the right arm, closing the jaws. A ring-shaped weight around the right slings, and suspended from a hook on the left arm, holds the jaws together for lowering. It is released upon the tripping of the left arm, and slips again to its position upon the right slings, holding the jaws together for heaving in.

The net being closed tightly in going down, it is not necessary to stop the vessel and lower it vertically.

Fig. 1.

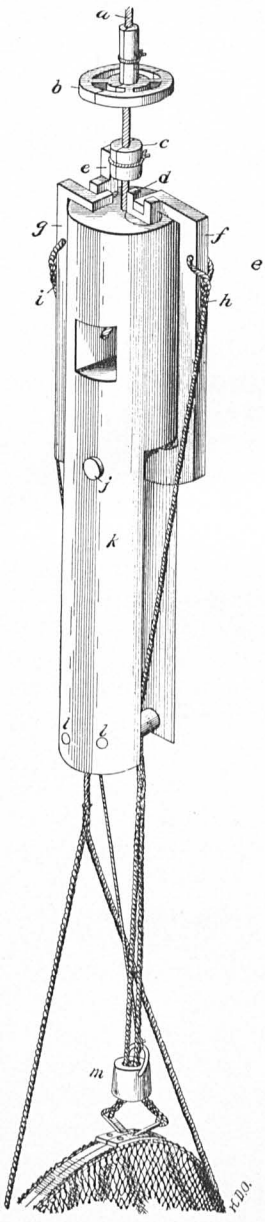



Fig. 2.

Fig. 3.

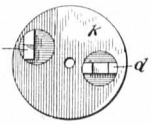



Fig. 4.

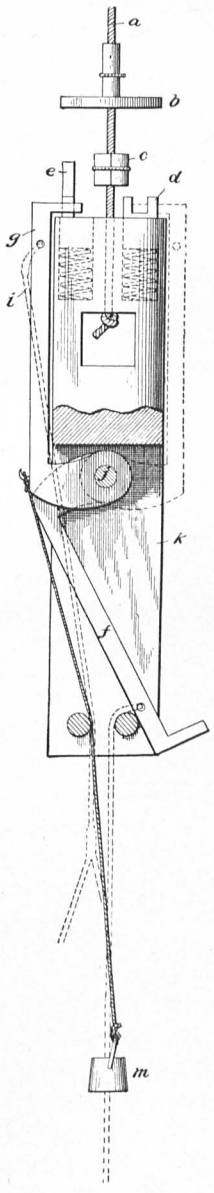



FIG. 1. Showing net in position for lowering.
- *a*. Wire tow line.
- *b*. Second messenger—to close.
- *c*. First messenger—to open.
- *d*. Plunger securing right arm.
- *e*. Plunger securing left arm.
- *f*. Right arm.
- *g*. Left arm.
- *h*. Closing slings.
- *i*. Opening slings.
- *j*. Bolt securing tripping arms.

FIG. 1. Showing net, etc.—Continued.
- *k*. Body of machine (2 feet 3 inches long).
- *l*. Bolts holding net lines on center of gravity.
- *m*. Closing weight.

FIG. 2. End view of second messenger

FIG. 3. End of machine, showing position of plungers.

FIG. 4. Showing right arm tripped, springs to plungers, and knot securing tow line.

# 4.—THE WHITEFISHES OF NORTH AMERICA.

By Barton W. Evermann and Hugh M. Smith.

## GENERAL REMARKS.

The whitefishes constitute one of the most interesting and important groups of food-fishes inhabiting the fresh waters of the Northern Hemisphere. In North America they are especially numerous as to species and individuals in the States forming the northern boundary of the United States, in the British possessions, and in Alaska, where there is scarcely a lake or river of importance in which the whitefishes are not represented by one or more species.

The distribution of these fishes, their geographical and individual variations, and their habits are perhaps as little known as are those of any group of fresh-water food-fishes of North America. Only two or three of the numerous whitefishes have been studied with even approximate completeness, and there is much yet to be learned regarding even the best-known species.

The close relationships of many of the whitefishes make a careful study of actual specimens the most essential step toward a fuller knowledge of these fishes. To the scarcity of specimens in collections, and, in the case of most species, the absence of complete series of examples representing different sexes, ages, conditions, seasons, etc., may be largely attributed the general deficiency of recorded information regarding the species of this group.

The United States Fish Commission has recently come into possession of a large amount of new material relating to the whitefishes of the Great Lakes basin and the specimens and data are available for a preliminary study of the group. It is not intended, however, to present a complete account of these fishes, since much more information will be required before such an effort will be warranted. In the present paper we have endeavored to give careful detailed descriptions of all the species of this group found in North America, together with what is now known of the geographic distribution of each. We consider most in detail those species found in the Great Lakes basin, but for purposes of comparison, and that the paper may be as complete as is now possible, we have included all the species of North America.

During 1893 and 1894 Mr. Richard Rathbun, of the United States Fish Commission, as the representative of the United States Government upon the International Fisheries Commission, conducted extensive inquiries and made large collections of the fishes found in the Great Lakes region of the United States. Among these collections were large series of the various species of whitefishes which constitute the principal material upon which this paper is based.

In order to determine the geographical distribution of each species of whitefish in the Great Lakes basin, we have studied not only these collections, but also those contained in the National Museum, and have examined and made notes upon multitudes of specimens in the field and at the various fish markets and fish companies' houses. In this paper are presented the results of these studies and the conclusions reached.

The following persons connected with the Fish Commission collected specimens of whitefishes from the localities named: Mr. Richard Rathbun, Lake of the Woods, Lake Superior, and Lake Huron; Mr. A. J. Woolman and Mr. U. O. Cox, Lake of the Woods and Lake Superior; Dr. J. T. Scovell and Mr. D. C. Ridgley, Lake Huron; Mr. Cloudsley Rutter, Lake Erie; Dr. R. R. Gurley, Lake Ontario; Prof. Barton W. Evermann and Mr. Barton A. Bean, Lakes Ontario, Champlain, and Memphremagog; Mr. Charles H. Stevenson and Mr. Ansley Hall, Lake Michigan; Mr. W. A. Wilcox, Lake Huron.

For other valuable specimens of whitefishes the Commission is indebted to Mr. Charles H. Strowger, of Nine Mile Point, N. Y., who forwarded us many specimens from Lake Ontario. Mr. Strowger has devoted many years to the study of the fishes of Lake Ontario, and has furnished us with a large amount of interesting information regarding the habits and abundance of the species found near Nine Mile Point. Hon. L. D. Miles, of Newport, Vt., has kindly sent us specimens from Lake Memphremagog. Mr. Woolman also forwarded market specimens of whitefishes from Lake Winnipeg and from small lakes in northern Minnesota.

The descriptions given in this paper of Alaskan species are based partly on the hitherto published descriptions and partly upon a reexamination of the specimens now in the National Museum. All the other descriptions have been drawn up from fresh specimens, in most cases numerous individuals of each species having been examined, including large series from the Great Lakes and considerable material from Lakes Champlain and Memphremagog and Lake of the Woods. We have also had a number of fresh specimens of the sisco of Lake Tippecanoe (for which we are indebted to Prof. P. H. Kirsch), and of Williamson's and Coulter's whitefishes.

Desiring to make this paper as useful as possible to the fishermen and others who make no claim to technical knowledge, we have avoided the use of uncommon technical terms whenever it seemed expedient and

have made the descriptions fuller and more explicit than would be otherwise required. To prevent the descriptions from being needlessly long, we have used the usual abbreviations and abridged phrases well understood by students of fishes; and that these may be understood by all, we give on plate 11 an explanation of such terms as may not be at once intelligible to the lay reader.

We present illustrations of all the American whitefishes, in the thought that they will prove of assistance to fishermen and others in identifying the different species. All of these except two have appeared in the publications of the Fish Commission or elsewhere. The drawings of the blackfin and the kieye were made by Mr. A. H. Baldwin for this report. The desirability of bringing together in one publication illustrations of all the species of the group will be at once apparent to everyone.

## THE COMMERCIAL IMPORTANCE OF THE WHITEFISHES.

The whitefishes are found in great abundance in the northern parts of North America, Europe, and Asia, and, viewed economically, are the most important fresh-water fishes of the grand divisions named, affording a larger food supply and supporting more extensive fisheries than any other group of fishes of the interior waters.

All of the whitefishes are of sufficient size to have food and commercial value, and in all settled communities they are utilized to a greater or less extent for local consumption or export, or both. The common whitefish and the lake herring are, however, so much more important than all other species combined that they alone are sufficient to give to this group the economic prominence which it has attained. In certain waters the menominee, the blackfin, the longjaw, the tullibee, and other whitefishes are of considerable importance.

In the United States the fishery for the various species of whitefishes is of great extent and importance, the value of the yield ranking among that of such well-known fisheries as the halibut, lobster, menhaden, haddock, bluefish, squeteague, alewife, sponge, fur seal, and lake trout, and, at the present time, exceeding the fisheries named, while the number of persons engaged in the fishery and the capital invested therein are very large. If to the value of the whitefish fisheries of the United States is added that of the fisheries in the Canadian provinces of Ontario, Quebec, Manitoba, and the Northwest Territory, the aggregate is enormous.

While economic fishing of greater or less extent is carried on for whitefishes in the Lake of the Woods, the Great Lakes, and numerous lakes in the more northern parts of the United States and in Canada, the fisheries in the Great Lakes far outrank those in other sections.

For detailed accounts of the whitefish fisheries in the United States waters of the Great Lakes, reference is made to the several reports

issued by the United States Commission of Fish and Fisheries, in which the methods and apparatus are described and full statistical data are given. Detailed statistical and descriptive matter relating to the whitefish fisheries of Canada will be found in the annual reports of the Department of Marine and Fisheries.

The body of water supporting the most extensive whitefish fisheries in the United States is Lake Michigan. Up to a comparatively recent year Lake Erie took precedence, but the serious decline in that lake has brought Lake Michigan to the front. Lake Erie ranks second, followed by lakes Huron, Superior, Ontario, and St. Clair, in the order named.

The aggregate quantity of whitefishes taken for market in the United States and Canada is now more than 76,000,000 pounds annually, with a value of over $2,400,000. These figures are based on the known yield in the Great Lakes and the British North American provinces in 1893 as given in the official reports, and in other parts of the United States in 1894. If to this catch is added the large quantities consumed locally by Indians, Eskimos, and others in Arctic America, Alaska, and the Western States, the total annual output of whitefishes in North America probably amounts to not less than 83,000,000 pounds, having a value of $2,800,000.

## THE GENERA AND SPECIES OF AMERICAN WHITEFISHES.

The range of variation among the individuals of each of the species of this group is very much greater than has usually been supposed. An examination of a large series of almost any one of the species shows astonishing differences, even among individuals taken in the same net and at the same time. Aside from the usual variations due to differences in age, sex, and season, there are other variations which manifestly bear no relation to those causes, and which are also independent of geographic influences. Among these are variations in the size of the mouth, the length and relative width of maxillary and mandible, the prominence of the lower jaw, and, most unexpected of all, a very considerable variation in the number and length of the gillrakers. The range in the number of scales in a longitudinal series is also very great. An examination of the tables of comparative measurements, which we give in connection with our discussion of the different species, will make plain the details of these diverse and extensive variations.

The most important characters which are used to separate the different species of whitefishes are the following: Size and shape of the mouth, size of the mandible, maxillary, and eye; relative length of the head and snout; size and position of the different fins; the teeth; the number and length of the gillrakers; the number and character of scales; the color; and the general form of the head and body.

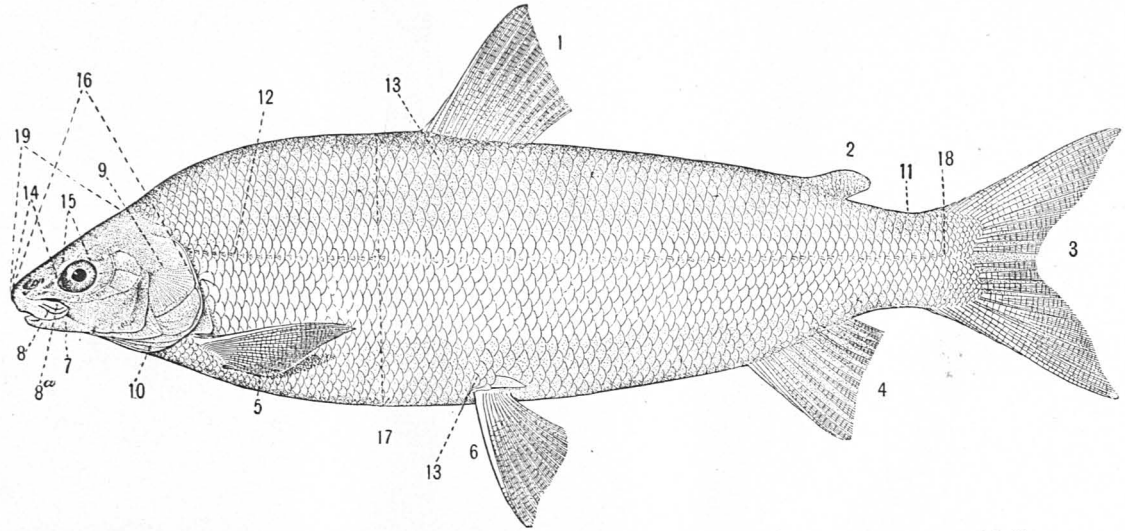
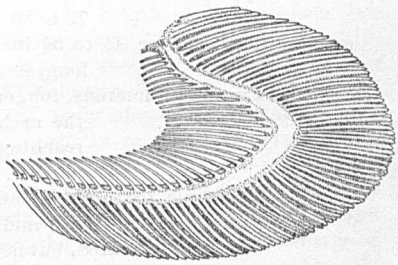



FIGURE OF A WHITEFISH SHOWING THE LOCATION OF PARTS USUALLY REFERRED TO IN DESCRIPTIONS.

1. Dorsal fin.
2. Adipose fin.
3. Caudal fin.
4. Anal fin.
5. Pectoral fin.
6. Ventral fin.
7. Lower jaw, or mandible.
8. Upper jaw, or maxillary,
8*a*. Supplemental maxillary.
9. Opercle.
10. Branchiostegals.
11. Caudal peduncle.
12. Lateral line.
13. Series of crosswise scales usually counted.
14. Snout.
15. Eye.
16. Head.
17. Depth.
18. Base of caudal.
19. Distance from snout to nape or occiput.

The measurements given in the descriptions in this paper are proportional. "Head 4" means that the length of the head is contained 4 times in the length of the fish, measured from the tip of the snout to the base of the tail or caudal fin. "Depth 5" means the greatest depth of the body is contained 5 times in the same length. The lengths of the eye, snout, maxillary, and mandible are compared with the length of the head; thus "eye 5" means the diameter of the eye (not the orbit) is contained 5 times in the length of the head. The snout is measured from its tip to the anterior rim of the orbit. The maxillary is the long, usually somewhat ovate, bone on side of upper jaw; the mandible is the bone forming the side of the lower jaw. The length of the maxillary and mandible is important.

The gillrakers of the first gill-arch afford one of the best characters for distinguishing the species of this group. The accompanying figure shows the first gill-arch of the bloater or longjaw. From this it may be seen that there are, in this case, 15 gillrakers on the upper or short limb of the arch, and 31 on the long limb; the length of the longest is contained $1\frac{1}{5}$ times in the diameter of the eye. These three facts are ordinarily stated thus: Gillrakers 15+31, the longest $1\frac{1}{5}$ in eye.



Gill-arch of the Longjaw.

The number of scales is also important. "Scales 8–77–7" means that there are 7 rows of scales in a vertical series between the base of the dorsal fin and the lateral line, or 8 including the scale in the lateral line; that there are 77 scales in a longitudinal series counted along the side from the gill-opening to the base of the caudal fin, and that there are 7 scales between the lateral line and the base of the ventral fin. The lateral line is the series of modified scales along the middle of the side.

The total number of species and subspecies of whitefishes recognized by us as at present known from the waters of America is 20, at least 10 of which are known to inhabit the basin of the Great Lakes. The whitefishes and lake herrings are now regarded by most students of American fishes as belonging to one or the other of two rather closely related genera, *Argyrosomus* and *Coregonus*, which may be distinguished as follows:

*a.* Mouth rather small, maxillary short and broad; mandible short; lower jaw usually included and overhung by the more or less projecting snout; premaxillaries broad, with the cutting edge nearly vertical or directed backward; gillrakers on the first arch few and short, usually fewer than 30...COREGONUS.

*aa.* Mouth rather large, maxillary long and narrow; mandible long; lower jaw usually more or less projecting beyond the upper; premaxillaries with the cutting edge nearly horizontal and directed forward; gillrakers on the first arch long and numerous, usually more than 35.....ARGYROSOMUS.

The following analytical key will enable one to identify with reasonable certainty the various species of whitefishes of America:

I. **Coregonus**, *the True Whitefishes:*

*a*. Cleft of mouth short, maxillary and mandible short; lower jaw not projecting beyond the upper; premaxillaries broad, with the cutting edge nearly vertical or directed backward; gillrakers on first gill-arch fewer than 30.

*b*. Gillrakers very short, thickish, about 12 to 16 on the lower limb of the arch; maxillary short and broad, not reaching eye; mouth very small.

*c*. Maxillary 3½ to 4 in head; gillrakers short and thick, 5 to 9+11 to 15; body oblong, the back not elevated.

*d*. Scales 60 to 64 in lateral line; snout blunt and decurved ..... *coulterii*, 1.

*dd*. Scales smaller, 72 to 90 in lateral line.

*e*. Supplemental maxillary bone rather narrow; scales 83 to 90.

*f*. Head moderate, blunt, 4 to 5 in body without caudal; tip of snout below level of eye; gillrakers 7 to 9+14 or 15, very short; lower fins pale ..... *williamsoni*, 2.

*ff*. Head very short, blunt, 5⅔ in body; gillrakers short but slender, about 7+14; fins all blackish ..... *kennicotti*, 3.

*ee*. Supplemental maxillary bone very broad, semicircular in shape; scales 72 to 80 ..... *richardsoni*, 4.

*cc*. Maxillary shorter, 4⅓ to 5¼ in head; gillrakers shorter, about 6+11; body long, slender, not compressed ..... *quadrilateralis*, 5.

*bb*. Gillrakers more numerous, longer and more slender, 17 to 20 on lower limb of the arch; maxillary longer, about 4 in head, about reaching pupil; mouth larger; preorbital long and narrow.

*g*. Tongue toothless, or nearly so; back decidedly elevated; head very low and short, especially in old examples.

*h*. Back elevated, but not greatly compressed; supplemental maxillary bone nearly twice as long as deep; head usually 5 to 5½ in length of body ..... *clupeiformis*, 6.

*hh*. Back elevated and greatly compressed; supplemental maxillary bone more than two-thirds as deep as long; head about 5 in length ..... *nelsonii*, 7.

*gg*. Tongue with 3 series of small teeth (not always evident); body elongate, compressed; lower jaw slightly included; head larger; gillrakers 10+15 to 17, about 2 in eye ..... *labradoricus*, 8.

II. **Argyrosomus**, *the Lake Herrings:*

*aa*. Cleft of mouth long, maxillary and mandible long, the former usually extending beyond vertical of pupil; lower jaw long and usually projecting beyond the sharp snout; premaxillaries with the cutting edge nearly horizontal and directed forward; gillrakers on first gill-arch numerous—more than 35.

*i*. Body elongate, herring-shaped; scales small, uniform in shape and size, the free edges convex.

*j*. Lower fins pale or merely tipped with dusky; scales punctate with dark specks.

*k*. Eye large, not much, if any, shorter than snout, its length 3½ to 4½ in that of head.

*l.* Head long and sharp, 4 in length of body; body very slender, the depth 5 to 6 in the length; maxillary 3 in head..... *osmeriformis*, 9.

*ll.* Head long, 4½ to 5 in length of body; body deeper and head less pointed; pectorals short, reaching about half way to ventrals.

*m.* Maxillary 3¼ to 3⅜ in head; lower jaw projecting beyond upper; gillrakers long and numerous, usually about 47 on first gill-arch ..... *artedi*, 10.

*mm.* Maxillary longer, 2⅞ to 3 in head; lower jaw scarcely or not at all projecting; gillrakers fewer, usually not more than 39 or 40 on first gill-arch..... *hoyi*, 11.

*lll.* Head shorter, about 5 in length of body; pectorals long, reaching more than half way to ventrals; maxillary 3⅛ in head..... *pusillus*, 12.

*kk.* Eye small, shorter than snout, about 5 times in length of head.

*n.* Head short, about 5 in length of body.

*o.* Body rather slender, the depth about equal to length of head..... *lucidus*, 13.

*oo.* Body deeper, the depth in adult greater than length of head ..... *laurettæ*, 14.

*nn.* Head long, 4 to 4½ in length of body; lower jaw strong; maxillary very long, 2¼ in head; mandible also very long, usually reaching posterior edge of orbit, at least half as long as head..... *prognathus*, 15.

*jj.* Lower fins all blue-black; body stout; mouth large; gillrakers numerous, usually at least 50 on the first gill-arch..... *nigripinnis*, 16.

*ii.* Body short, deep, and compressed, the curve of the back similar to that of the belly; scales large, larger forward and closely imbricated, the free margin often concave or notched..... *tullibee*, 17.

## DESCRIPTIVE LIST OF AMERICAN SPECIES OF WHITEFISHES.

In nomenclature and in sequence of species we follow Jordan & Evermann's Fishes of North and Middle America.[1] In the matter of synonymy, preceding the description of each species, we give reference only to the publications in which the various species were described as new. From the synonymy it may be seen that twenty-nine nominal species and subspecies of American whitefishes have been described, but these are now believed to represent only twenty really different forms. The species which have each been described as new more than once are the following: *Coregonus williamsoni*, twice; *C. quadrilateralis*, twice; *C. clupeiformis*, five times; *C. labradoricus*, three times, and *Argyrosomus artedi*, twice.

In connection with each reference we have given the locality from which the type specimens of the supposed new species were obtained. The types of only eight of these nominal species are in the collection of the United States National Museum. We give in parentheses the numbers which they bear on the Museum records.

### 1. Coregonus coulterii Eigenmann & Eigenmann.

COULTER'S WHITEFISH.

*Coregonus coulterii* Eigenmann & Eigenmann, American Naturalist, November, 1892, 961, Kicking Horse River at Field, British Columbia, one of the head streams of the Columbia River. (Type, No. 44875.)

*Description.*—Head, $4\frac{1}{2}$ to 5; depth, $4\frac{1}{2}$ to $5\frac{1}{2}$; eye, $3\frac{1}{5}$ to $3\frac{3}{5}$; snout, $4\frac{3}{5}$ to 5; maxillary, $3\frac{3}{5}$ to 4; mandible, $2\frac{3}{5}$ to 3. D. 9 or 10; A. 10 or 11. Scales, 8–60 to 64–6. Gillrakers, 5+11. Body rather slender, compressed, back not much elevated; head short; snout short, bluntly decurved; mouth small, nearly horizontal, the upper lip on a level with the lower line of orbit; maxillary short, broadly ovate behind, barely reaching vertical of pupil; lower jaw short, included, the mandible scarcely reaching vertical of posterior edge of pupil. Distance from tip of snout to occiput $1\frac{3}{5}$ in distance from occiput to origin of dorsal fin. Caudal peduncle long, slender, and compressed. Fins moderate; origin of dorsal much nearer snout than base of caudal, its height $1\frac{3}{5}$ in head and about equal to length of pectoral or longest anal ray. Gillrakers very short, fewer than in *C. williamsoni*. Scales large, firm. Color, pale bluish or lead-color above, becoming silvery on sides and white below; fins all plain. Size small, the specimens examined by us being 5 inches or under in total length.

This species is most closely related to *C. williamsoni*, from which it seems to differ in the larger scales and fewer gillrakers. Specimens of *williamsoni* the size of the types of *coulterii* nearly always show the parr

[1] Fishes of North and Middle America, Bull. 47, United States National Museum, part I, pp. 461–473, 1896.

marks usually seen in the young of most *Salmonidæ*, but our specimens of *coulterii*, all of which are young fish, show no traces of parr marks.

This species was described from the Kicking Horse River at Field, British Columbia, where more than a hundred specimens were obtained by Dr. Eigenmann, in 1892, at an elevation of 4,050 feet. One specimen was also secured by him from Kicking Horse River at Golden, British Columbia. It has not been obtained by any other collector. It does not appear to attain any considerable size or to be of any commercial importance. The largest specimens yet collected do not exceed 8 inches in length. The following table gives comparative measurements of seven individuals examined by us:

*Table of comparative measurements of specimens of Coulter's whitefish (C. coulterii).*

[The numbers by which specimens are designated in this and all other tables of this paper are those which the specimens bear in the Fish Commission collections.]

| No. | Locality. | Length. | Head. | Depth. | Eye. | Snout. | Maxillary. | Mandible. | Dorsal. | Anal. | Scales. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *Inches.* | | | | | | | | | |
| 189 | Kicking Horse River, Field, British Columbia. | 4½ | 4½ | 5½ | 3½ | 5 | 3⅜ | 3 | 10 | 11 | 7-60-6 |
| 190 | .....do..... | 4 | 4⅝ | 5½ | 3⅛ | 4⅝ | 3⅜ | 2⅞ | 9 | 10 | 8-60-6 |
| 191 | .....do..... | 3⅛ | 4⅛ | 5⅛ | 3⅛ | 4⅜ | 4 | 2⅜ | 9 | 10 | 8-62-6 |
| 192 | .....do..... | 4 5/16 | 4⅜ | 5⅝ | 3⅜ | 5 | 3⅛ | 2⅞ | 10 | 11 | 8-63-6 |
| 193 | .....do..... | 3⅞ | 4⅜ | 5¼ | 3⅜ | 4⅜ | 4 | 2⅝ | 10 | 11 | 8-64-6 |
| 194 | .....do..... | 4¼ | 4⅛ | 5⅛ | 3⅜ | 4⅜ | 3⅜ | 2⅝ | 10 | 11 | 8-61-6 |
| 195 | .....do..... | 3⅜ | 4⅛ | 5¾ | 3⅛ | 4⅜ | 3⅛ | 2¾ | 10 | 10 | 8-60-6 |

## 2. Coregonus williamsoni Girard.

ROCKY MOUNTAIN WHITEFISH; MOUNTAIN HERRING.

*Coregonus williamsoni* Girard, Proc. Ac. Nat. Sci. Phila. 1856, 136, Des Chutes River, Oregon.

*Coregonus couesii* Milner, Rept. U. S. Fish Comm. 1872–73 (1874), 88, Chief Mountain Lake, Montana. (Type, No. 14146.)

*Description.*—Head, 4½ to 5; depth, 4 to 5; eye, 4 to 5 (much larger in young); snout, about 4; maxillary, 4; mandible, 2¾. D. 11 to 14; A. 11 to 13. Scales, 9 or 10–78 to 87–8; gillrakers, 7 to 9+14 or 15, very short. Body moderately long, back gently elevated, the curve from middle of head to dorsal fin quite evenly convex. Head short, conic; snout gently decurved, pointed; mouth small, maxillary short and broad, scarcely reaching pupil, its direction nearly horizontal in the closed mouth; lower jaw included, the mandible short. Mouth very low; entirely below level of eye. Distance from tip of snout to occiput 1¾ in distance from occiput to origin of dorsal fin. Caudal peduncle rather stout; its least depth about 2¾ in head. Fins moderate; base of dorsal equal to height of fin, 1⅔ in head; origin of dorsal usually equally distant between tip of snout and posterior edge of adipose fin; adipose fin unusually large; anal base 1½ in height of fin or about 2 in head; pectoral rather short, 1⅙ in head; ventral still shorter, 1⅔ in head; caudal well forked, the lobes about equal to length of head.

Gillrakers few and short, the number usually not exceeding 25 and the length of the longest about 4 times in diameter of eye.

Color bluish above; sides silvery; under parts white; fins all plain, except in breeding males, when they are tipped with black; adipose fin and caudal frequently steel-blue in breeding males. The scales of the male at the breeding season are covered with tubercles, which have been described by Mr. Barton A. Bean as follows:

The tubercles on the scales at this time are very prominent, situated on the middle of the scales, milk-white in color, and forming horizontal lines along the body from head to tail. About 16 of these lines can be counted between the back and the ventral edge of the body. The tubercles show on the abdomen, but the color of that portion of the body and of the tubercles being similar they are indistinct. (Bull. U. S. Fish Comm. 1894, p. 55.)

The following table gives comparative measurements of 37 specimens of *Coregonus williamsoni.*

*Table of comparative measurements of specimens of Rocky Mountain whitefish (Coregonus williamsoni).*

| No. | Locality. | Sex. | Length. | Head. | Depth. | Eye. | Snout. | Maxillary. | Mandible. | Dorsal. | Anal. | Scales. | Gillrakers. Number. | Gillrakers. In eye. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | *In.* | | | | | | | | | | | |
| 186 | Shushwap Lake, Sicamous, British Columbia | | | 4¼ | 4⅜ | 4⅜ | 4 | 4 | 2⅝ | 12 | 11 | 9-84-8 | 7+15; 8+14 | 4 |
| 187 | do | | 3⅜ | 4½ | 5 | 3⅝ | 4½ | | | 12 | 12 | 10-87-8 | | |
| 188 | do | | 4⅛ | 4½ | 5⅛ | 3⅛ | 5 | | | 12 | 12 | 10-87-8 | | |
| 31 | Little Spokane River | | 14½ | 4⅝ | 4⅝ | 5 | 3⅛ | 4 | 2⅜ | 12 | 12 | 10-87-8 | 9+15; 8+15 | 4 |
| | do | ♂ | 11 | 5 | 4 | 4½ | 3 | | | 14 | 13 | 9-83-8 | ? +12; ?+12 | |
| | do | ♂ | 12½ | 5 | 4 | | | | | 13 | 13 | | | |
| 95 | Outlet Alturas Lake, Idaho | ♀ | | 5 | 4 | 5 | 3½ | | | 10 | 10 | 10-85-8 | 8+14; 8+13 | |
| 96 | do | ♀ | | 5 | 4½ | 4½ | 3½ | | | 12 | 10 | 10-78-8 | 7+12; 6+11 | |
| 97 | Junction of Salmon River and Alturas Creek, Idaho | ♀ | | 5½ | 4⅞ | 4⅜ | 3⅝ | | | 12 | 10 | 10-86-8 | 10+15; 8+13 | |
| 98 | do | | | 5 | 4⅝ | 4⅜ | 3⅜ | | | 12 | 11 | 10-89-8 | 8+13; 8+12 | |
| 103 | Outlet Alturas Lake, Idaho | | | 4⅝ | 5 | 4⅛ | 4 | | | 11 | 10 | 10-85-8 | 6+12; 8+11 | |
| 127 | Alturas Lake, Idaho | | | 4⅝ | 5⅛ | 4 | 4 | | | 12 | 11 | 10-90-8 | 9+13; 9+13 | |
| 128 | do | | | 4⅝ | 5⅛ | 4 | 4 | | | 12 | 11 | 10-86-8 | 8+10; 9+15 | |
| 129 | do | | | 5 | 5 | 4 | 3½ | | | 12 | 11 | 10-78-8 | 10+14; 9+13 | |
| 130 | do | | | 4⅛ | 5 | 3⅜ | 3⅜ | | | 12 | 11 | 10-78-8 | 8+13; 8+12 | |
| 131 | do | | | 4⅛ | 5⅛ | 4 | 3⅜ | | | 13 | 12 | 10-84-8 | 8+10; 8+11 | |
| 132 | do | | | 4⅛ | 4⅝ | 3⅜ | 4 | | | 12 | 11 | 10-87-8 | 8+12; 8+11 | |
| 133 | do | | | 4⅛ | 5 | 4 | 4 | | | 11 | 10 | 10-92-8 | 9+12; 7+15 | |
| 134 | do | | | 4⅛ | 4⅛ | 4 | 4 | | | 12 | 12 | 10-85-8 | 8+14; 10+15 | |
| 135 | do | | | 4⅜ | 5⅛ | 4 | 3⅛ | | | 11 | 10 | 10-82-8 | 9+14; 8+14 | |
| 136 | do | | | 4⅜ | 5 | 4⅛ | 4 | | | 12 | 10 | 10-82-8 | 9+15; 8+15 | |
| 137 | do | | | 4¼ | 5 | 3⅝ | 3⅛ | | | 11 | 10 | 9-82-8 | 7+13; 7+13 | |
| 153 | Payette River, a few miles below Payette Lake, Idaho | | | 5 | 4⅛ | 4 | 4 | | | 12 | 11 | 10-80-8 | 8+11; 8+12 | |
| 154 | do | | | 5 | 4⅜ | 4 | 4 | | | 11 | 11 | 10-79-8 | 7+12; 8+14 | |
| 155 | do | | | 5 | 4⅛ | 4⅛ | 4⅛ | | | 12 | 11 | 10-88-8 | 8+13; 8+12 | |
| 156 | do | | | 5⅛ | 4⅜ | 4 | 3⅜ | | | 13 | 11 | 10-83-8 | 9+12; 10+12 | |
| 157 | do | | | 4⅜ | 4⅛ | 4⅛ | 3⅜ | | | 12 | 12 | 10-81-8 | 9+12; 9+12 | |
| 158 | do | | | 5⅛ | 4⅜ | 4⅛ | 4 | | | 12 | 11 | 9-84-7 | 8+12; 7+12 | |
| 159 | do | | | 5 | 4⅜ | 4⅛ | 4 | | | 12 | 11 | 9-89-8 | 8+14; 9+15 | |
| 160 | do | | | 5 | 4⅛ | 4⅜ | 3⅜ | | | 10 | 9 | 9-83-8 | 9+12; 8+14 | |
| 161 | do | ♂ | | 5 | 4⅜ | 5 | 3½ | | | 13 | 12 | 9-81-7 | 8+13; 8+14 | |
| 162 | do | | | 5 | 5 | 4⅜ | 3⅜ | | | 12 | 11 | 9-85-7 | 9+14; 8+13 | |
| 182 | do | | | 4⅝ | 4⅜ | 4⅜ | 4¼ | | | 11 | 11 | 9-84-7 | 7+14; 6+13 | |
| 183 | do | | | 5 | 4⅛ | 4⅜ | 4 | | | 12 | 11 | 9-85-7 | 7+12; 7+14 | |
| 184 | do | | | 5 | 4⅛ | 4 | 3⅛ | | | 12 | 11 | 9-82-8 | 8+12; 8+12 | |
| | Snake River at Upper Salmon Falls, Idaho | | | 4⅜ | 5 | 3⅝ | 4 | | | 12 | 11 | 9-80-8 | 7+12; 7+13 | |
| | do | | | 4½ | 4¼ | 3⅝ | 4½ | | | 12 | 11 | 9-82-7 | 8+13; 7+12 | |

*Distribution.*—The Rocky Mountain whitefish is of wide distribution. It is found throughout the Rocky Mountain region from central Colorado and Utah northward through Wyoming, Idaho, western Montana, at least as far as the headwaters of the Columbia, and thence westward throughout the Columbia Basin. The most eastern locality from which it has been reported is Chief Mountain Lake, at the head of the Saskatchewan River, on the northern boundary of Montana. It was described from that lake in 1874 by Milner as *Coregonus couesii*. It is found only in the clearer, colder streams and lakes.

One of the authors of this paper has collected or observed this fish at the following places: Provo River, Provo, Utah; Jordan River, near Salt Lake City; Swan River, below Swan Lake, Montana; Jocko River, Ravalli, Mont.; Big Blackfoot River, Bonner, Mont.; Little Blackfoot River, Elliston, Mont.; Cottonwood Creek, Deer Lodge, Mont.; Snake River, President's Camp, Wyoming; Little Spokane River at Dart's Mill, Washington; Snake River at Upper Salmon Falls and Weiser, Idaho; Little Weiser River in Indian Valley, Idaho; and in the upper Salmon River Valley in Idaho in Alturas, Pettit, and Redfish lakes and their outlets. We have also examined specimens collected in 1892 by Messrs. A. J. Woolman and B. A. Bean in Flathead Lake, Montana; Post Creek, St. Ignatius Mission, Montana; Clark Fork, Thompson Falls, Montana, and Spokane and Little Spokane rivers, near Spokane, Wash.; also specimens collected in 1893 by Doctors Gilbert and Jenkins in Payette River, Payette, Idaho; Clearwater River, Lewiston, Idaho; Columbia River, Umatilla, Oreg.; Natches River, North Yakima, Wash., and Newaukum River, Chehalis, Wash.; also many specimens collected by Mr. T. M. Williams at Payette Lake, Idaho. Besides these we have examined specimens in the National Museum from Washington (Major Bendire); Provo, Utah (Dr. Yarrow); Portland, Oreg. (United States Fish Commission); Lake Tahoe (Dr. J. G. Cooper); Mill Creek and Garrison Creek at Walla Walla (Major Bendire); Montana (W. C. Harris); Clark Fork (W. C. Harris); Lake Cœur d'Alene (Bendire); White River, Meeker, Colo. (Jas. L. Foley); Utah Lake (Jordan), and Lake Tahoe (H. W. Henshaw).

This fish attains a length of a foot or more and a weight of 4 pounds, the average weight of adults being about 1 pound. Though not of much commercial importance as yet, it is eagerly sought after by the inhabitants of the region in which it is found and is held in high esteem as a pan-fish. At some seasons it readily takes the hook, especially when baited with salmon or trout spawn.

This whitefish spawns in late fall or early winter, at which time it runs up into the smaller streams. At the mountain lakes in Idaho, where it is an abundant fish, the spawning time appears to be in October or November. Then they ascend the inlets of the lakes in great numbers and spawn upon the same beds which are used by the redfish in August and September. During the summer the young are found in abundance in the lakes.

### 2a. Coregonus williamsoni cismontanus Jordan.

WHITEFISH OF THE UPPER MISSOURI BASIN.

*Coregonus williamsoni cismontanus* Jordan, Bull. U. S. Fish Comm., IX, 1889, 49, pl. 9, figs. 8, 9, Horsethief Springs Creek, a tributary of Madison River, Montana.

In the headwaters of the Missouri River is found a scarcely tangible variety of Williamson's whitefish which has received the above name. It is distinguished from *C. williamsoni* by the more slender body and somewhat lower fins. Head, 5; depth, 5 to 5½; pectoral, 1½ in head; ventral, 1⅘; longest dorsal ray, 1½. Scales in lateral line, 80 to 90.

A specimen 9 inches long, from Big Goose Creek, Sheridan, Wyo., gives the following measurements: Head, 4⅔; depth, 4½; eye, 5; snout, 3⅘; maxillary, 4⅓; mandible, 2⅘. Scales, 9–86–8. Length of pectoral, 1¼ in head; ventral, 1½; anal, 1½.

Differences between this and typical *williamsoni* are not marked, and the variety should probably not be recognized as having any real existence.

This whitefish has been collected by us in the following Missouri Basin localities: Red Rock River, Red Rock, Mont.; Beaverhead River, Dillon, Mont.; junction of Gibbon and Firehole rivers, Yellowstone Park; and Big Goose Creek, Sheridan, Wyo. It has been obtained by Dr. Jordan from Madison River below the falls, and from Horsethief Springs Creek, Montana. The National Museum contains specimens from Gallatin River, Montana (W. C. Harris); Gallatin and Madison rivers (J. E. Curtis), and Montana (E. Wernigk).

From these records it would seem that the center of abundance of this variety of whitefish is in the three forks (Jefferson, Madison, and Gallatin) which unite to form the Missouri northwest of the Yellowstone Park. The most eastern locality from which it is yet known is Sheridan, Wyo., where numerous young individuals were collected in July, 1893, by Prof. U. O. Cox, for the United States Fish Commission. These specimens were obtained in Big Goose Creek, which is tributary to Tongue River. Though the streams in the Black Hills to the east of Tongue River are clear and cold and well adapted to the habits of this fish, somewhat extended investigations in that region in 1892 and again in 1893 failed to discover any whitefish there.

### 3. Coregonus kennicotti Milner.

KENNICOTT'S WHITEFISH; BROAD WHITEFISH; MUKSUN.

*Coregonus kennicotti* Milner, in Jordan & Gilbert, Synopsis, 298, 1883, Fort Good Hope, British America. (Type, No. 8971.)

Head, 5⅔; depth, 4⅔; eye, 5½; snout about 4; maxillary, 4. D. 11; A. 14. Scales, 10–87 to 90–10. Gillrakers, 6 or 7+14, short and slender, 1¼ in eye. Head very blunt, premaxillaries wide and vertically placed; mouth inferior, the high, blunt snout but little projecting; maxillary

reaching slightly beyond the vertical at front of the eye, broadly ovate; preorbital narrow, its greatest width 5 times in its length and 3⅓ in eye; width of supraorbital bone 2½ in its length. Distance from snout to nape one-third distance from nape to front of dorsal; front of dorsal nearer tip of snout than base of caudal by a distance equal to length of snout and eye. Adipose fin large. Scales small, adherent, very regularly imbricated. Color probably very dark in life; in spirits, fins all blackish, with a bluish tinge (Gilbert). Large, reaching a length of 2 feet.

Dr. Bean says:

This is the *muksun* of the Russians, a name transferred from a Siberian species of similar appearance. The broad whitefish reaches the weight of 30 pounds, ranking next in size to the *inconnu* only. It is a food-fish of great excellence. Dall states that it is abundant in both winter and summer, spawning in September in the small streams falling into the Yukon.

The type of this species came from Fort Good Hope, British America. Murdock reports it from the Meade and Kuahroo rivers, Alaska; Townsend found it in the Kuwuk River, Dall and Turner in the Yukon; and it was recently obtained by Miss Elizabeth Taylor in Great Bear Lake. All the Alaskan references to *C. clupeiformis* probably belong to this species, or to *C. richardsonii*, if the latter be distinct from *C. kennicotti*.

### 4. Coregonus richardsonii Günther.

RICHARDSON'S WHITEFISH.

*Coregonus richardsonii* Günther, Cat., VI, 185, 1866, exact locality unknown.

Very similar to the common whitefish, also to the broad whitefish, with which it may prove identical. Scales 10–72 to 80–12; B. 9; D. 13; A. 13. Snout of moderate length, the lower jaw included; eye shorter than snout; maxillary reaching anterior edge of eye, 4 in head; supplemental bone short, broad, and semicircular; mandible shorter than least depth of tail. Pectoral longer than head without snout.

This species was described in 1866, the type locality being unknown, but it was somewhere in British America. It is a species of doubtful validity. Only the types are known. Dr. G. A. Boulenger has kindly sent us the following note regarding the types of this species which are in the British Museum:

I have examined the types (dry) of *Coregonus richardsonii*. There are about 20 gillrakers on the lower part of the anterior arch, the longest half the diameter of the eye. The maxillary extends to below anterior border of eye, and its length is 4 times in length of head, as stated by Günther, therefore a little shorter than in *C. clupeiformis*. Tongue with 4 series of teeth, as in *C. labradoricus*. It seems to agree best with *C. nelsoni* (description), but has fewer scales in lateral line. In short, I can not identify *C. richardsonii* with any of the forms known to me.

## 5. Coregonus quadrilateralis Richardson.

MENOMINEE WHITEFISH; FROSTFISH; SHADWAITER; PILOTFISH; CHIVEY; ROUND WHITEFISH; CHATEAUGAY SHAD; BLACKBACK.

*Coregonus quadrilateralis* Richardson, Franklin's Journ., 1823, 714, Fort Enterprise, British America.

*Coregonus novæ-angliæ* Prescott, Amer. Journ. Sci. Arts, XI, 1851, 342, Lake Winnipiseogee, N. H.

*Description.*—Head, $5\frac{1}{4}$ to $5\frac{1}{2}$; depth, $4\frac{2}{3}$ to $5\frac{1}{2}$; eye, 5 to $5\frac{2}{5}$; snout, $4\frac{1}{2}$ to 5; maxillary, $4\frac{4}{6}$ to $5\frac{1}{2}$; mandible, 3 to $3\frac{1}{5}$; D. 11 or 12; A. 11 or 12. Scales, 9 or 10–86 to 92–7 or 8. Gillrakers, 5 to 8+9 to 12, usually about 6+11, very short, the longest about 4 in eye.

Body long, slender, and round, not much elevated nor compressed, the back broad, and the body more nearly round than in any other whitefish. Head rather small and pointed; snout short, bluntly decurved, projecting somewhat beyond the included lower jaw; maxillary short and broad, scarcely reaching eye, the supplemental bone very narrow; mandible very short, barely reaching posterior line of pupil; mouth small, entirely below level of orbit. Top of head not arched, cranial ridges prominent. Distance from snout to occiput $2\frac{2}{5}$ in distance from occiput to origin of dorsal fin; origin of dorsal notably in front of insertion of ventrals, equidistant from tip of snout and posterior edge of adipose fin; caudal peduncle long, $1\frac{1}{5}$ in head, somewhat compressed. Base of dorsal fin short, $1\frac{1}{6}$ in longest ray or $1\frac{4}{5}$ in head; anal base short, $1\frac{2}{5}$ in longest anal ray or $2\frac{3}{5}$ in head; pectoral, $1\frac{2}{5}$ in head; ventral, $1\frac{3}{5}$; adipose fin small. Color silvery white, dusky on back and upper part of sides; under parts white; fins all pale except dorsal and caudal, which are more or less dark on tips.

The following table exhibits the variations in proportion of parts in the specimens examined critically by us:

*Table of comparative measurements of specimens of the Menominee whitefish (Coregonus quadrilateralis).*

| Number. | Locality. | Sex and condition. | Length. | Weight. | Head. | Depth. | Eye. | Snout. | Maxillary. | Mandible. | Dorsal. | Anal. | Scales. | Gillrakers. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | Number. | In eye. |
| | | | *In.* | *Oz.* | | | | | | | | | | | |
| 76 | Lake Michigan. | ♂ nearly ripe. | $14\frac{1}{4}$ | 12+ | $5\frac{1}{4}$ | $4\frac{3}{4}$ | $5\frac{1}{4}$ | $4\frac{1}{2}$ | $4\frac{4}{6}$ | $3\frac{1}{5}$ | 11 | 11 | 9-86-8 | 8+12; 8+12 | Very short. |
| 77 | .....do..... | ..... | $14\frac{3}{4}$ | 14— | $5\frac{1}{4}$ | $4\frac{3}{4}$ | $5\frac{2}{5}$ | $4\frac{3}{4}$ | 5 | $3\frac{1}{5}$ | 11 | 11 | 9-92-7 | 6+11; 6+11 | Very short. |
| 78 | .....do..... | ..... | $14\frac{1}{2}$ | 14- | $5\frac{1}{2}$ | $4\frac{3}{4}$ | $5\frac{1}{2}$ | $4\frac{3}{4}$ | $5\frac{1}{2}$ | $2\frac{1}{2}$ | 12 | 11 | 9-86-7 | 7+12; 7+10 | ..... |
| 224 | Lake Superior.. | ..... | ..... | ..... | $5\frac{1}{2}$ | $4\frac{1}{2}$ | 5 | 5 | 5+ | 3 | 12 | 11 | 10-88-8 | 5+10; 5+11 | 4 |
| 226 | Southampton, Ontario. | ..... | ..... | ..... | $5\frac{2}{3}$ | $5\frac{2}{3}$ | 5 | 5 | ..... | ..... | ..... | ..... | 10-92-8 | 7+11; 7+11 | 4 |
| 229 | Lake Superior.. | ..... | ..... | ..... | $5\frac{2}{3}$ | $5\frac{1}{2}$ | $4\frac{2}{3}$ | $4\frac{2}{3}$ | 5 | 3 | 12 | 12 | 10-88-8 | 5+10; 5+10 | 4 |
| 132 | Clear Water Pond, Industry, Maine. | ..... | ..... | ..... | ..... | ..... | 5 | $4\frac{3}{4}$ | $4\frac{2}{3}$ | 3+ | 11 | 11 | 9-86-7 | 5+11; 6+9 | $3\frac{1}{2}$ |
| 278 | Lake Superior.. | ..... | 15 | .... | $5\frac{1}{2}$ | $5\frac{1}{2}$ | $4\frac{1}{2}$ | $4\frac{1}{2}$ | 5 | $2\frac{1}{2}$ | 11 | 10 | 9-86-7 | ..... | ..... |
| 286 | .....do..... | ..... | 14 | .... | 5 | 5 | 5 | $4\frac{3}{4}$ | 5 | 3 | 11 | 10 | 8-81-7 | 5+12+5+11 | 4 |
| 287 | .....do..... | ..... | 16 | .... | $5\frac{1}{2}$ | $5\frac{1}{2}$ | $5\frac{1}{2}$ | $4\frac{3}{4}$ | $5\frac{1}{2}$ | 3 | 12 | 11 | 9-90-8 | 7+10; 7+10 | $4\frac{1}{2}$ |
| 288 | .....do..... | ..... | 17 | .... | 5 | 5 | $5\frac{1}{2}$ | $4\frac{1}{2}$ | 5 | 3 | 12 | .... | 9-85-7 | 6+10; 5+10 | $3\frac{3}{4}$ |

*Distribution.*—The Menominee is found in the lakes of New England, westward through the Adirondacks and the Great Lakes, thence northward into Alaska. In addition to the localities represented in the foregoing table, we have examined specimens in the National Museum from the following localities: Squattock, New Brunswick (Philip Cox); Farmington, Me. (Frank N. Whittier); Lake Winnipiseogee, New Hampshire (R. Appleton, Dr. W. W. Fletcher); "New Hampshire" (E. B. Hodge); "Adirondacks" (Verplank Colvin); White Lake, Oneida County, N. Y. (W. T. Loomis); Big Moose Lake, New York (Fred Mather); Northville, Mich. (F. N. Clark); Sault Ste. Marie (J. W. Milner), and Madaline Island, Lake Superior (Milner).

It has also been recorded from the following localities: Fort Enterprise, British America (type locality, Richardson); Lake Superior (Agassiz); Saumuss Lake and Fraser River, British Columbia (Günther; probably *C. williamsoni*); Lake Erie (Jordan); Lake Michigan (Jordan; Hoy); island of Kadiak, Alaska (Bean); Mackinaw Straits (Bean); Yukon River, at Fort Yukon (Turner); Nulato, Alaska (Bean); Kuskokwim River, Alaska (Bean); Putnam or Kuwuk River, Alaska (Bean); Slave Lake (Bean); Adirondack lakes, Meacham Lake, Chateaugay Lake, Lake Champlain, Big Moose Lake, the Fulton Chain, and Clear Pond (Fred Mather).

From the above it will be seen that this is one of the most—perhaps the most—widely distributed of the American whitefishes.

The Menominee attains a length of 12 to 15 inches and a weight of 2 pounds; the average weight of the fish taken for market, however, is under 1 pound.

### 6. **Coregonus clupeiformis** (Mitchill).

COMMON WHITEFISH; OTSEGO BASS; HUMPBACK WHITEFISH; BOWBACK WHITEFISH; HIGHBACK WHITEFISH.

*Salmo clupeiformis* Mitchill, Amer. Month. Mag., II, 1818, 321, Sault Ste. Marie.
*Coregonus albus* Le Sueur, Journ. Ac. Nat. Sci. Phila., I, 1818, 231, Lake Erie to Arctic Sea.
*Coregonus otsego* DeWitt Clinton, Med. and Phil. Register, III, 188, about 1824, Otsego Lake.
*Coregonus sapidissimus* Agassiz, Lake Superior, 344, 1850, Lake Superior.
*Coregonus latior* Agassiz, Lake Superior, 348, 1850, Lake Superior.

*Description.*—Head, $4\frac{3}{5}$ to $5\frac{1}{2}$; depth, $3\frac{5}{5}$ to $4\frac{1}{2}$; eye, about 5; snout, 4 to $4\frac{1}{2}$; maxillary, $3\frac{4}{5}$ to $4\frac{2}{5}$; mandible, $2\frac{1}{3}$ to 3. D. 11, occasionally 10; A. 11, sometimes 12. Scales 11–82 to 92–8. Gillrakers usually about 10 or 11+17 or 18, the longest about 2 in eye. Vertebræ 56. Body rather long and compressed, the back arched in front, especially so in the adult, the outline nearly straight posteriorly; ventral outline somewhat convex in front; bases of dorsal and anal fins not very oblique; back narrow; head small and short; snout short and rather blunt; mouth small, nearly horizontal; maxillary short, broadly ovate, its tip

reaching about to vertical of front edge of pupil, its width about one-half its length; mandible short, reaching about to posterior edge of eye; upper lip on a level with lower line of eye; lower jaw always included and the blunt snout projecting. Distance from tip of snout to nape $3\frac{1}{4}$ to 4 in distance from snout to origin of dorsal fin. Gillrakers not numerous, the number on the short arm of the arch varying from 7 to 11, on the long arm from 17 to 19; the total number, however, is usually 27 to 29; they are short and rather stout, the longest being contained from $1\frac{3}{5}$ to $2\frac{1}{8}$ times in eye. Fins moderate, the longest rays in pectoral, ventral, and dorsal about equaling length of head. Color, satiny-white all over, back with a faint olive-green shade; fins all white, except the caudal, which is usually slightly dark-edged.

The principal variations in the characters of this well-known fish are shown in the following table of detailed measurements:

*Table of comparative measurements of specimens of common whitefish (C. clupeiformis).*

| No. | Lakes where taken. | Sex and condition. | Length. | Weight. | Head. | Depth. | Eye. | Snout. | Maxillary. | Mandible. | Dorsal. | Anal. | Scales. | Gillrakers. Number. | Gillrakers. In eye. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | *In.* | | | | | | | | | | | | |
| 74 | Michigan | ♂ | $11\frac{5}{8}$ | 7 oz. | $5\frac{1}{8}$ | $4\frac{1}{8}$ | $4\frac{1}{2}$ | 4 | 4 | $2\frac{1}{2}$ | 11 | 11 | 10-80-? | 10+19; 9+17 | .... |
| 121 | Erie | ♂ spent. | $20\frac{3}{8}$ | $3\frac{1}{2}$ lbs. | $5\frac{3}{8}$ | $3\frac{5}{8}$ | 5 | 4 | $4\frac{1}{2}$ | 3 | 10 | 11 | 10-84-8 | 10+18; 10+18 | $1\frac{3}{8}$ |
| 122 | .....do.... | ♀ spent | $20\frac{1}{8}$ | $3\frac{3}{4}$ lbs. | $5\frac{1}{8}$ | $3\frac{3}{4}$ | $5\frac{1}{8}$ | 4 | $3\frac{3}{4}$ | $2\frac{1}{2}$ | 11 | 11 | 10-85-8 | 9+18; 8+17 | .... |
| 123 | .....do .... | ♀ spent. | 21 | $3\frac{3}{4}$ lbs. | $5\frac{1}{8}$ | $3\frac{3}{4}$ | $5\frac{1}{8}$ | 4 | 4 | $2\frac{1}{2}$ | 11 | 11 | 10-83-8 | 10+18; 10+19 | $1\frac{1}{4}$ |
| 124 | .....do..... | ♂ partly spent. | $22\frac{1}{2}$ | $4\frac{3}{4}$ lbs. | $5\frac{1}{4}$ | $3\frac{7}{8}$ | $5\frac{5}{8}$ | 4 | 4 | 3 | 10 | 12 | 10-82-8 | 11+19 | .... |
| 225 | Superior | ..... | ..... | ..... | 5 | $4\frac{1}{8}$ | 5+ | 4 | $3\frac{1}{2}$ | 3— | 10 | 11 | 10-92-8 | 10+18; 10+17 | 2 |
| 227 | .....do..... | ..... | ..... | ..... | 5 | $4\frac{1}{2}$ | 5 | $4\frac{1}{2}$ | $4\frac{3}{8}$ | $2\frac{1}{2}$ | 11 | 11 | 10-82-9 | 10+17; 10+18 | .... |
| 230 | .....do..... | ..... | ..... | ..... | $4\frac{7}{8}$ | 5 | $4\frac{3}{4}$ | $4\frac{5}{8}$ | 4+ | $2\frac{3}{4}$ | 11 | 11 | 9-85-8 | 7+18; 7+18 | 2+ |
| 231 | .....do..... | ..... | ..... | ..... | $4\frac{3}{4}$ | $4\frac{1}{2}$ | $4\frac{7}{8}$ | $4\frac{3}{4}$ | $4\frac{7}{8}$ | 3— | 11 | 12 | 11-87-9 | 10+17; 10+17 | 2 |
| 277 | Erie | ..... | 13 | ..... | $5\frac{1}{8}$ | 4 | $4\frac{3}{4}$ | $4\frac{7}{8}$ | 4 | $2\frac{3}{4}$ | 11 | 12 | 9-75-8 | 9+18; 10+18 | $2\frac{1}{8}$ |
| 384 | Winnipeg | ..... | $15\frac{1}{8}$ | ..... | 5 | $3\frac{3}{8}$ | $5\frac{1}{8}$ | 4 | 4+ | 3— | 11 | 12 | 10-81-8 | ..... | .... |

Among the numerous specimens of whitefish which we have examined, we have one which is of unusual interest. This is specimen No. 243, obtained by Mr. Cloud. Rutter from the Droziski Fish Company, at Dunkirk, N. Y., September 17, 1894. It is a fine example, 19 inches in total length. In external appearance it might very well pass for a true whitefish, but careful measurements and examination of its gillrakers show it to differ very materially from typical *C. clupeiformis*. It may be described as follows:

Head, 5; depth, $3\frac{1}{2}$; eye, $5\frac{1}{2}$; snout, 5; maxillary, 4; mandible, $2\frac{3}{5}$. D. 10; A. 11. Scales, 10–72–8. Gillrakers, 12+26 on one side and 13+24 on the other, the longest $1\frac{2}{5}$ in diameter of eye. Body stout and deep, compressed; head larger than in the typical whitefish, the mouth larger, maxillary longer and stouter, reaching to front of pupil; mandible longer, reaching posterior edge of eye; snout more pointed, less decurved, the lower jaw slightly projecting. Distance from tip of snout to nape $3\frac{1}{2}$ in distance from snout to origin of dorsal fin. Caudal

peduncle short and deep. From typical *C. clupeiformis* this specimen differs chiefly in the more numerous gillrakers, the somewhat heavier head, the larger mouth, longer maxillary, longer mandible, sharper snout, slightly projecting lower jaw, and the larger scales. In all of these respects the variations from *clupeiformis* are corresponding approximations to the characters possessed by the lake herring.

While we are not at all inclined to admit the occurrence in nature of hybrids among fishes, we are disposed to regard this specimen as a hybrid between the true whitefish (*C. clupeiformis*) and the lake herring (*A. artedi*). We are informed by Dr. Bean, until recently in charge of the Fish-cultural Division of the United States Fish Commission, that it has been a common practice among fish-culturists at the stations about the Great Lakes to fertilize the eggs of the true whitefish (*C. clupeiformis*) with the milt from the lake herring (*A. artedi*), and that this hybridizing has been carried on more or less for several years.[1] Plants of these hybrids have been made in various places, but chiefly in Lake Erie; and it is not at all unlikely that this specimen and all those which the Lake Erie fisherman occasionally get and which they call "mongrel whitefish" are really hybrids between the true whitefish and the lake herring. The number of such hybrids can not be great, however. During the entire season's work of the various Fish Commission parties on the different Great Lakes, only the one specimen which we have described was obtained. Mr. Rutter informs us that the fisherman say they occasionally get a "mongrel whitefish," but this, and possibly one other, are the only ones he saw.

*Distribution and abundance.*—The common whitefish is one of the most abundant species of whitefishes. It is found throughout the Great Lakes region from Lake Champlain to Lake Superior and Lake Winnipeg. We have examined specimens from Lake Champlain, Otsego Lake, each of the Great Lakes, and from Lake Winnipeg. We have seen no specimens from Lake Memphremagog or elsewhere east of Lake Champlain. Of the three species known to occur in Lake Champlain this is the rarest. The form described from Otsego Lake, N. Y., is a landlocked variety, scarcely worthy of recognition; the National Museum contains three specimens from this lake. In lakes Erie, Huron, Michigan, and Superior the whitefish is abundant, but is now most so in Lake Michigan. It occurs in diminished numbers west and north of Lake Superior, but we have few authentic records to establish the fact. It is reported commercially from Lake of the Woods, Lake Winnipeg, and the northwest Territories, but all the specimens of so-called whitefish which we have seen from the first-named lake belong to a very different species—the Musquaw River whitefish (*C. labra-*

[1] This is done, however, only as a last resort, when eggs of the whitefish can be saved which would otherwise be lost on account of an insufficient number of spawning male whitefish on hand at the collecting station.

*doricus*). The only specimen of the true whitefish which we have seen from any locality west of Lake Superior is an example obtained by Mr. Woolman in the Duluth market, and which is alleged to have come from Lake Winnipeg. All the records of the occurrence of this species west of Lake Superior need verification.

*Names, size, habits, etc.*—This fish is generally known as the whitefish throughout the United States and Canada. The landlocked race found in Otsego Lake, N. Y., has been designated by the singularly inappropriate and misleading name of "Otsego bass." Several local names have been applied to the fish in Lake Superior, in allusion to the nuchal hump which characterizes the breeding males. Mr. Woolman found that among the fisherman of the north shore of Lake Superior the names "highback whitefish" and "buffalo-back whitefish" were applied to this fish; the name "bowback" or "bowback whitefish" was heard by Mr. Wilcox in the eastern part of the same lake.

This fish attains a larger size than any other whitefish of North America. Examples weighing as much as 23 pounds, and possibly more, have been taken in the upper lakes. Lake Superior has the reputation of producing the largest fish. In all the lakes, however, fish weighing 10 to 14 pounds are taken. The average size of those obtained in the United States fisheries of the Great Lakes is probably under 4 pounds, the fish taken in gill nets being somewhat larger than those secured in traps.

The habits and movements of this fish are better understood than are those of any other American whitefish. It is chiefly to the late Prof. J. W. Milner that we are indebted for our knowledge concerning this fish in the Great Lakes. The results of his researches were originally published in the Report of the United States Commission of Fish and Fisheries for 1872–73, and have since been extensively copied; we refer to Milner's report for information on this subject.

The whitefish reaches maturity at the age of three or four years, and deposits from 10,000 to 75,000 eggs, the number depending on the size of the fish. The spawning capacity can be approximately gauged by allowing about 10,000 eggs for each pound of body weight. The spawning time is in the late fall, chiefly in the month of November. During the summer they retire to the deeper portions of the lakes, but as the time for spawning approaches they come into shoal water about the islands and in the bays and coves. In Lake Ontario they first appear on their spawning-grounds late in October and the season extends into December. The principal spawning-grounds are in Chaumont Bay, Three-mile Bay, and on the gravelly bars about the head of Fox Island and across to Point Peninsula. The bottom selected seems to be of gravel or of the peculiar rock known as "finger rock" or "honeycomb," at a depth of 20 to 30 feet. In Lake Erie the principal spawning-grounds are among the islands in the western end of the lake.

The whitefish makes regular migrations analogous to the movements of anadromous fishes in the coast rivers. These occur chiefly about the spawning season and are impelled by the reproductive instinct. There are also more or less regular movements at other times, but these are not well understood.

The whitefish rarely takes the hook. Its small mouth necessitates the ingestion of minute food, and examination of the stomach contents has shown that it subsists chiefly on crustaceans, mollusks, and insect larvæ.

Dr. S. A. Forbes, of Illinois University, has made a careful study of the first food of the common whitefish in Lake Michigan, and has reached the following conclusion:

> We are compelled to conclude that the earliest food of the whitefish consists almost wholly of the smallest species of Entomostraca occurring in the lake, since the other elements in their alimentary canals were evidently either taken accidentally, or else appeared in such trivial quantity as to contribute nothing of importance to their support. In fact, two species of Copepoda, *Cyclops thomasi* and *Diaptomus sicilis*, are certainly very much more important to the maintenance of the whitefish in this earliest stage of independent life than all the other organisms in the lake combined. As the fishes increase in size, vigor, and activity they doubtless enlarge their regimen by capturing larger species of Entomostraca, especially *Daphnia* and *Limniaclanus*. (Bull. Ill. State Lab. Nat. Hist., vol. 1, No. 6, p. 108, 1883.)

The common whitefish is generally regarded as one of the best food-fishes of North America. In the regions in which it is taken it is usually held in higher esteem than any other fish. Being a soft fish, it spoils rapidly, and in the condition in which it usually reaches the consumer its edible qualities have greatly deteriorated.

### 7. Coregonus nelsonii Bean.

HUMPBACK WHITEFISH.

*Coregonus nelsonii* Bean, Proc. U. S. Nat. Mus. 1884, 48, Nulato, Alaska. (Type, No. 29903.)

Head, 5; depth, 4; maxillary, 4; D. 12; A. 12. Scales, 10–88–8 (or 10 counting to middle line of belly). Gillrakers about 26 in number, the longest about 2 in eye. Body heavy forward; back greatly arched and compressed. Head small, snout rather pointed. Mouth small, the maxillary reaching front of eye. Distance from snout to nape about $2\frac{1}{3}$ in distance from nape to origin of dorsal, the latter a little nearer posterior base of adipose fin than tip of snout. Base of dorsal fin, $1\frac{2}{5}$ in longest ray or $1\frac{1}{2}$ in head.

This species is allied to *C. clupeiformis* and *C. labradoricus*, from which it may be distinguished by the greatly arched and compressed back.

It was described by Dr. Bean in 1884 from specimens collected by Mr. E. W. Nelson, at Nulato, Alaska; Mr. Townsend reports it from the Kuwuk River. It is known only from Alaska, from Bristol Bay northward.

Of this species Dr. Bean says:

This whitefish has long been known from Alaska, but it has been confounded with a Siberian species, *C. syrok*, from which it is really very different. The Russian name is *korabati;* the Tinneh tribes of the Yukon call it *kolokuh*. Dr. Dall speaks of it as a common species. He says it is rather bony, and inferior in flavor, and that it is generally used for dog feed except in times of scarcity.

### 8. *Coregonus labradoricus* Richardson.

LABRADOR WHITEFISH; MUSQUAW RIVER WHITEFISH; SAULT WHITEFISH; WHITING; LAKE CHAMPLAIN; SHAD OR SHADWAITER; WHITEFISH; GIZZARD-FISH; AITHAWMEG; POISSON POINTU.

*Coregonus labradoricus* Richardson, Fauna Bor.-Amer., III, 206, 1836, Musquaw River, Labrador.

?? *Coregonus angusticeps*, Cuvier & Valenciennes, His. Nat. Poiss., XXI, 534, 1848, Saskatchewan River; description brief and erroneous.

*Coregonus neohantoniensis* Prescott, Amer. Journ. Sci. Arts, XI, 1851, 342, Lake Winnipiseogee, New Hampshire.

*Description.*—Head, 4⅜ to 5; depth, 3¼ to 3⅜; eye, 5¼; snout, 4½ to 5. D. 11 or 12; A. 11. Scales, 10–72 to 87–9. Maxillary, 3⅜ to 4; mandible, 2⅔. Gillrakers, 9 or 10+15 to 17=25 or 26, the longest about 2 in eye.

Body long ovate, compressed, the dorsal and ventral outlines about equally arched. Head small, slender, and pointed; snout blunt, truncate, jaws subequal; maxillary rather long, reaching to vertical of anterior line of eye; the supplemental bone more than half length of maxillary, its width 2⅕ in its length; mandible long, reaching vertical of posterior edge of pupil. Eye moderate, shorter than snout, lower edge of pupil in a line with middle of upper jaw. Distance from snout to occiput 3½ in distance from snout to origin of dorsal fin, which is slightly nearer snout than base of caudal. Caudal peduncle short and deep, its least depth 2⅛ in head. Fins rather large; height of dorsal and length of pectoral about equal to length of head; base of dorsal fin not much oblique, short, 1½ in height of fin; base of anal fin very oblique, about equal to height of fin or 1½ in longest dorsal ray; adipose fin small, over posterior third of anal; ventrals shorter than pectorals, 1⅕ in head, their insertion under middle of dorsal fin. Tongue with very weak teeth. Gillrakers short and few, usually not more than 25. Scales thin and loosely imbricated; lateral line nearly straight, along axis of body. Color usually quite dark on back and sides, becoming gradually paler below; under parts pale without dark punctulations; fins all more or less black-tipped, caudal darkest. Length about 2 feet.

Specimens from Lake of the Woods are darker and much deeper in body than those from lakes Champlain and Memphremagog. There is also much variation in the length of the maxillary and in the number of scales in the lateral line. In specimen No. 63, from Lake of the Woods, and upon which our general description is chiefly based, the

maxillary scarcely reaches the eye, and is contained $3\frac{2}{5}$ times in the head; the scales are unusually large, there being but 68 in the course of the lateral line; and the body is very deep, the form being much like that of the common whitefish. No. 120, from Lake Memphremagog, has the usual more elongate form of the species, the maxillary is shorter and the scales are much smaller, there being 87 in the course of the lateral line. The examples from Lake Champlain are deeper and paler than those from Lake Memphremagog.

These variations in proportions are exhibited in the following table:

*Table of comparative measurements of specimens of Labrador whitefish (C. labradoricus).*

| No. | Locality. | Length. | Weight. | Head. | Depth. | Eye. | Snout. | Maxillary. | Mandible. | Dorsal. | Anal. | Scales. | Gillrakers. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | Number. | In eye. |
| | | *Ins.* | *Lbs.* | | | | | | | | | | | |
| 63 | Lake of the Woods | 21 | $2\frac{1}{2}$ | 5 | 3 | 5+ | 5 | $3\frac{3}{4}$ | $2\frac{3}{4}$ | 12 | 11 | 10-68-9 | 10+15; 10+15 | 2+ |
| 65 | do | 20 | ..... | $5\frac{1}{2}$ | $3\frac{1}{4}$ | $5\frac{3}{4}$ | 5 | $3\frac{3}{4}$ | $2\frac{3}{4}$ | 12 | 11 | 10-80-9 | 9+16; ..... | $1\frac{1}{2}$ |
| 67 | Lake Champlain | 15 | $1\frac{1}{4}$ | $4\frac{3}{5}$ | $3\frac{3}{4}$ | $4\frac{3}{5}$ | $4\frac{3}{5}$ | 4 | ..... | 11 | 11 | 10-72-9 | 9+17; 9+17 | 2+ |
| 68 | do | 20 | $2\frac{1}{4}$ | 5+ | $3\frac{1}{4}$ | 5 | 5 | $3\frac{3}{4}$ | ..... | 12 | 11 | 10-71-8 | 9+16; 9+16 | 2+ |
| 120 | Lake Memphremagog | 18 | ..... | $4\frac{2}{3}$ | 4— | 5+ | $4\frac{1}{2}$ | 4+ | $2\frac{3}{4}$ | 10 | 10 | 10-87-8 | 9+16; 9+16 | 2 |
| 279 | Basswood Lake, Minn | $18\frac{1}{4}$ | ..... | $4\frac{3}{4}$ | $3\frac{1}{2}$ | 5 | 5 | 4 | $2\frac{3}{4}$ | 11 | 11 | 9-80-8 | ..... | ..... |
| 382 | Ely, Minn | $15\frac{1}{2}$ | ..... | $4\frac{1}{2}$ | $3\frac{2}{3}$ | $5\frac{1}{2}$ | $4\frac{3}{4}$ | 4 | $2\frac{3}{4}$ | 12 | 13 | 10-84-8 | ..... | ..... |

*Distribution and abundance.*—This species was originally described from the Musquaw River, Labrador, in 1836. In 1851 it was redescribed as new by Prescott, under the name of *Coregonus neohantoniensis*, from Lake Winnipiseogee, New Hampshire. The specimen described in 1848 from the Saskatchewan River as *Coregonus angusticeps* by Cuvier & Valenciennes is probably identical with the Musquaw River species. It is now known from the Lake of the Woods eastward through the Great Lakes, the Adirondacks, the lakes of Vermont, New Hampshire, and Maine, and northeast through New Brunswick into Labrador. It doubtless inhabits most of the eastern Canadian lakes. We have examined specimens from the following places: Lake of the Woods; Lake Superior; Basswood Lake and Ely, Minn.; Hudson Bay; Ecorse, Mich.; Gross Water and Mississquoi bays, Lake Champlain; Cooperstown, N. Y.; Lake Memphremagog; Lake Winnipiseogee; Moosehead Lake and Grand Lake Stream, Me.; Fredericton and St. Johns River, New Brunswick; Labrador.

This species does not appear to be common in any of the Great Lakes; indeed, we have no authentic record of its ever having been taken in Lake Ontario or Lake Erie, while the few definite records for Lake Huron and Lake Michigan would indicate that it is a rare fish in those two lakes. Lake Superior seems to be the only one of the Great Lakes in which it is at all common. This is no doubt due to the fact that the waters of Lake Superior are colder than those of the other Great Lakes, thus approaching in that regard the character of the more northern lakes of Canada, where this whitefish appears to reach its greatest abundance and largest size.

As early as 1852, Mr. M. H. Perley gave the following very interesting account[1] of this species:

This fish, the celebrated *attihawmeg* of the great northern lakes, so frequently described by Arctic voyagers as the most delicious of all purely fresh-water fishes, is found in considerable numbers in Lake Temiscouata, where many are taken every autumn by the French Canadians, who come over from the St. Lawrence to fish for them, and call them *poisson pointu*. The English lumbermen call them "gizzard fish." They are taken occasionally along the Madawaska River, and the writer has caught them with rod and line below the falls of that river, at its confluence with the St. John, in the early part of summer. At these falls the inhabitants take about 40 barrels every autumn, which are cured in pickle for winter use. The whitefish abounds in all the Eagle lakes, at the head of Fish River, a tributary of the Upper St. John, and in the St. Francis lakes, at the stream's head. In these lakes it is caught abundantly every autumn, by torchlight, with dip nets. It has not been observed in any of the lakes or rivers which discharge into the Gulf of St. Lawrence, nor yet in any of the waters of Nova Scotia.

Some years since this fish was abundant in the Grand Lake, where the writer, in the month of May, saw great numbers taken out of gill nets set for gaspereau, and thrown away by the fishermen as worthless. At the same time the writer caught a number of them with rod and line in one of those small pieces of water connected with the Grand Lake, usually called "keyholes." It is occasionally taken in the Saint John throughout its whole extent. In the harbor of Saint John, in spring, it has been often caught in the seines and weirs with the gaspereau and salted with that fish because its value was not known.

It is probable that the similar fish found in the lower part of the Saint John have strayed from the great lakes at the sources of its upper tributaries and have been swept over the Grand Falls by some extraordinary flood. Once over those falls there is no possibility of return. The whitefish seen by the writer have seldom exceeded 1½ pounds in weight, but they are taken in Lake Temiscouata of the weight of 3 pounds and even more. It is an inhabitant of all the interior lakes of America, from Lake Erie to the Arctic Sea. Several Indian tribes mainly subsist upon it, and it forms the principal food at many of the fur posts for eight or nine months of the year, the supply of other articles of diet being scanty and casual. Its usual weight in the northern regions is from 2 to 3 pounds, but it has been taken in the clear, deep, and cold waters of Lake Huron of the weight of 13 pounds. The largest seen in the vicinity of Hudson Bay weighed between 4 and 5 pounds, and measured 20 inches in length and 4 in depth. One of 7 pounds' weight, caught in Lake Huron, was 27 inches long. Very recently the writer had an opportunity of seeing some fresh specimens of the whitefish of Lake Erie,[2] and was satisfied of their identity with the "gizzard-fish" of the Saint John and Lake Temiscouata.

During the summer the whitefish is not seen in Lake Temiscouata, and it is then supposed to retire to the depths of that unusually deep and cold lake. In October it draws near the shores, and ascends the Tuladi River for the purpose of spawning. It ascends the river during the night, and, having deposited its spawn, returns as quickly as possible to the lake. It is when this fish draws near the shore, prior to spawning, that the fishery is carried on, chiefly at a little bay in Lake Temiscouata,

[1] Descriptive Catalogue of the Fishes of New Brunswick and Nova Scotia, by M. H. Perley. Fredericton, 1852. This account of the *attihawmeg*, published in 1852 by Mr. Perley, was appropriated by Charles Lanman and republished verbatim as original matter in the United States Fish Commission Report for 1872–73. In this report Mr. Lanman prints three articles dealing with nine species of fishes, copying the entire amount of his articles from Perley without credit. James F. Knight, in 1866, in a descriptive catalogue of the fishes of Nova Scotia, made a similar use of much of the interesting portions of Mr. Perley's paper.

[2] The "whitefish" which Mr. Perley saw from Lake Erie were probably *C. clupeiformis*, rather than *C. labradoricus*, as he thought.

into which the Tuladi discharges its waters. At the same time the great gray trout (*Salmo ferox*)[1] follows the whitefish to the shore and preys upon it. While the nets are set for whitefish, the fishers, with torch and spear, attack and capture the *Salmo ferox*, frequently of large size; and hence this latter fish has acquired the name of *tuladi*, from the river to which it is attracted by its favorite prey.

The whitefish feeds largely on fresh-water shellfish; its stomach, in consequence, acquires an extraordinary thickness and resembles the gizzard of a fowl, hence its popular name of "gizzard-fish." The stomach, when cleaned and boiled, is a favorite morsel with the Canadian *voyageurs*.

### 9. Argyrosomus osmeriformis (H. M. Smith).

SMELT OF THE NEW YORK LAKES.

*Coregonus osmeriformis* Hugh M. Smith, Bull. U. S. Fish Comm., XIV, 1894, pl. 1, 2, Seneca Lake and Skaneateles Lake, New York. (Types, Nos. 32162 and 32165.)

Head, 4; depth, 5 to 6; eye, 4. D. 9; A. 13; scales, 9–83–10. Body elongate, slender, back not elevated. Head rather large, its width equal to half its length. Length of top of head $2\frac{1}{4}$ in distance from occiput to dorsal; greatest depth considerably less than length of head. Eye large, equal to snout. Gillrakers very long and slender, as long as eye, 20 + 35. Dorsal fin rather high, its height equal to four-fifths depth of body and $1\frac{1}{2}$ times length of base of fin; its origin nearer base of caudal than snout; its free margin nearly vertical, straight. Longest anal ray, four-fifths length of base of fin. Ventral long, equal to height of dorsal, its length equal to three-fourths of distance from ventral origin to vent; ventral origin midway between base of caudal and pupil. Adipose dorsal long and slender, of same width throughout, its width one-third its length. Mouth large, lower jaw projecting; snout straight; maxillary contained 3 times in length of head; its posterior edge extending to line drawn vertically through anterior margin of pupil; mandible one-half length of head, its angle under pupil. Teeth present on the tongue. Color above, grayish silvery; sides, bright silvery; below, white; tips of dorsal and caudal, dark. Length, 10 inches.

This fish has been recorded from Seneca and Skaneateles lakes, New York, where it is known as smelt. It doubtless inhabits most of the deep-water lakes of the northern part of the State. Nothing is known of its habits, and its small size renders it of little value as food.

### 10. Argyrosomus artedi (Le Sueur).

HERRING; LAKE HERRING; CISCO; MICHIGAN HERRING; BLUEBACK HERRING; GRAYBACK HERRING; GREENBACK HERRING; SHORE HERRING.

*Coregonus artedi* Le Sueur, Journ. Ac. Nat. Sci. Phila., I, 1818, 231, Lake Erie; Niagara River.

*Salmo* (*Coregonus*) *harengus*, Richardson, Fauna Bor.-Amer., III, 210, 1836, Lake Huron.

*Description.*—Head, 4 to 5; depth, 4 to $4\frac{2}{3}$; eye, 4 to 5; snout, 4 to 5. Dorsal 9 to 11, usually 10; anal 10 to 13, usually 11 or 12. Maxillary, 3 to $3\frac{3}{5}$ in head; mandible, 2 to $2\frac{1}{4}$, usually over 2. Scales, 8 to 10–62 to

[1] The fish referred to is the lake trout, *Cristivomer namaycush*.

87–7 or 8, the most frequent number being 9–81–8. Vertebræ, 57. Gillrakers varying from 45 to 58 (15 to 19+30 to 38), long and slender, about $1\frac{1}{5}$ in eye.

Body long, slender, and somewhat compressed; dorsal and ventral outlines but little arched; head pointed; mouth large, jaws subequal or lower jaw somewhat projecting; maxillary long, usually reaching to vertical of pupil, its width $2\frac{1}{2}$ times in its length; supplemental maxillary bone broad, about half length of maxillary; mandible long, but not often reaching vertical of posterior border of orbit; middle of upper jaw on level with lower edge of orbit. Caudal peduncle slender, not much compressed, its least depth equal to distance from tip of snout to middle of eye. Distance from tip of snout to occiput $2\frac{1}{2}$ times in distance from occiput to origin of dorsal fin, which is somewhat nearer snout than base of caudal fin. Dorsal fin small, length of base about $2\frac{1}{5}$ in head, longest ray $1\frac{3}{5}$ in head; base of anal fin about equal to that of dorsal, its longest ray about $2\frac{1}{2}$ in head; pectoral $1\frac{2}{5}$ in head. Color in life: Back dull bluish-green, this color extending down the sides nearly to the lateral line; lower part of sides silvery, under parts white or silvery; dorsal fin usually blackish or bluish-black on distal third, sometimes plain, membrane often punctate with dark; caudal bluish-black at tip; anal and ventrals pure white; pectorals white, edged with dark above. Sometimes the anal has a few black specks at base and on anterior part. The snout is also often more or less dark.

It will be noticed from the numerous comparative measurements and actual counts of fin rays, scales, and gillrakers, as exhibited in the accompanying table, that the amount of variation among individuals of this species is astonishingly great. The greatest range of variation is found in the scales. While the number in the transverse series is pretty constant, the variation being only through 4 (i. e., from 15 to 18), there is no such constancy in the number in the longitudinal series. Omitting from consideration in this connection all specimens in which mutilation of any kind renders the accurate counting of the scales uncertain, we find an extreme variation of 31 in the number of scales in the lateral line. The minimum number found by us is 62 in specimen No. 56, from Lake Ontario. The maximum number is 92 in specimen No. 142, from Lake Erie. These are the extreme variations in the scales, and are exceptional. The number does not usually run lower than 74 nor higher than 83.

The variation in the gillrakers is very great. The least number found was 43 and the greatest 58. The average for 101 examples counted, excluding mutilated ones, was 47. The length of the longest gillraker varies somewhat, from 1 to $1\frac{1}{2}$ times in the diameter of the eye, the average for over 100 examples being about $1\frac{1}{4}$. The gillrakers are, however, always long and slender, and average more in number than in any other species of *Argyrosomus* except *nigripinnis* and *tullibee*.

*Table of comparative measurements of specimens of lake herring (Argyrosomus artedi).*

| Number. | Lakes where taken. | Sex and condition. | Length. | Weight. | Head. | Depth. | Eye. | Snout. | Maxillary. | Mandible. | Dorsal. | Anal. | Scales. | Gillrakers. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | Number. | In eye. |
| | | | *In.* | *Oz.* | | | | | | | | | | | |
| 10 | Ontario .... | ..... | 14½ | 12 | 4⅔ | 3⅔ | 4⅔ | 4⅔ | 3½ | 2⅝ | 10 | 12 | 9-75-7 | *14+20; 17+30 | 1⅛ |
| 54 | .....do..... | ..... | ..... | .... | 5⅓ | ... | 4⅛ | 4⅔ | 3⅝ | 2⅝ | 10 | 11 | 8-71-8 | Dressed fish. | .... |
| 55 | .....do..... | ..... | ..... | .... | 4⅝ | ... | 4¼ | 4⅔ | 3½ | 2 | 11 | 12 | 9-78-8 | .....do ..... | .... |
| 56 | .....do..... | ..... | ..... | .... | 3⅔ | 4⅛ | 4¼ | 4⅔ | 3+ | 2— | .... | 11 | 9-62-7 | 16+31; 15+30* | 1 |
| 69 | Michigan .. | ♀ ripe.. | 12⅔ | 10— | 5⅛ | 4⅛ | 4 | 4 | 3⅓ | 2⅛ | 10 | 10 | 10-83-8 | 17+30; 16+30 | .... |
| 70 | .....do..... | ...do .... | 13⅛ | 12— | 4½ | 4⅝ | 4⅛ | 4¼ | 3⅝ | 2⅛ | 10 | 11 | 9-82-8 | ..... | .... |
| 80 | .....do..... | ...do .... | 13⅛ | 11+ | 4⅔ | 4¼ | 4⅛ | 4⅛ | 3⅝ | 2⅛ | 10 | 11 | 9-82-8 | 19+39; 18+38 | 1⅛ |
| 83 | .....do..... | ...do .... | 13⅜ | 12— | 5 | 4¼ | 4⅛ | 5 | 3½ | 2⅛ | 11 | 12 | 9-81-8 | 16+32; 16+32 | 1⅛ |
| 85 | .....do..... | ♀ ..... | 14¼ | 13+ | 5 | 4⅛ | 4⅝ | 4⅛ | 3⅝ | 2+ | 10 | 11 | 9-87-8 | 17+34; 17+34 | 1¼ |
| 90 | Huron..... | ♀ ..... | 11⅛ | .... | 5 | 4⅛ | 4⅛ | 4⅝ | 3⅔ | 2⅛ | 10 | 12 | 8-82-8 | 15+33; 16+33 | 1⅛ |
| 91 | .....do..... | ♀ ..... | 12⅛ | .... | 4⅔ | 4⅝ | 4⅛ | 5 | 3⅝ | 2⅛ | 10 | 12 | 9-83-8 | *14+32; 18+33 | 1⅛ |
| 92 | .....do..... | ♀ ..... | 12 | .... | 4⅔ | 4⅛ | 4⅛ | 5 | 3⅝ | 2⅛ | 9 | 12 | 8-79-8 | 17+33; 17+32 | 1⅛ |
| 93 | .....do..... | ♂ ..... | 12 | .... | 5 | 4⅛ | 4⅛ | 4⅝ | 3⅛ | 2⅛ | 10 | 11 | 9-76-8 | 17+30; 16+29 | 1⅛ |
| 94 | .....do..... | ♂ ..... | ..... | .... | 4⅝ | ... | 4⅛ | 4⅝ | 3⅝ | 2⅛ | .... | .... | ..... | 17+34; 17+32 | 1⅛ |
| 125 | Erie..... | ♀ spent. | 13⅜ | 12— | 5 | 4⅛ | 4⅛ | 4⅛ | 3½ | 2⅛ | 11 | 13 | 9-81-8 | 16+30; 15+30 | .... |
| 126 | .....do..... | ♂ spent. | 13⅜ | 13 | 4⅔ | 4 | 4⅛ | 4⅝ | 3 | 2⅔ | 11 | 13 | 9-72-7 | 17+30; 12+30* | .... |
| 127 | .....do..... | ♀ spent. | 13¼ | 11+ | 4⅝ | 4⅔ | 4⅝ | 4⅛ | 3⅛ | 2⅛ | 10 | 10 | ..... | 16+31; 13+31* | 1⅛ |
| 128 | .....do..... | ♂ partly spent. | 14⅛ | 14 | 5 | 4⅝ | 5 | 5 | 3 | 2⅝ | 11 | 10 | 9-81-8 | 16+29; 16+30 | 1⅛ |
| 129 | .....do..... | ♀ spent. | 14½ | 13— | 5 | 4 | 4⅞ | 4⅝ | 3 | 2 | 10 | 11 | 9-74-7 | 17+33; 16+31 | 1⅛ |
| 133 | Huron ..... | ..... | ..... | .... | 4⅛ | 4 | 5 | 5 | 3⅜ | 2+ | 11 | 11 | 9-70-8 | *16+30; 15+30 | 1 |
| 134 | Erie..... | ..... | ..... | .... | 4⅓ | 3⅝ | 5 | 5 | 3⅜ | 2⅛ | 11 | 11 | 8-76-7 | 16+32; 16+32 | 1 |
| 140 | .....do..... | ..... | ..... | .... | 4⅜ | ... | 4⅜ | 5 | 3 | 2+ | .... | 11 | 9-74-8 | *11+30; 10+16* | .... |
| 141 | .....do..... | ..... | ..... | .... | 4⅛ | 4⅝ | 4⅛ | 5 | 3+ | 2+ | 10 | 12 | 9-67-8* | 17+27; 17+30 | 1⅛ |
| 142 | .....do..... | ..... | ..... | .... | 4⅛ | 4 | 4⅜ | 5 | 3⅜ | 2⅛ | 11 | 13 | 9-92-8 | 16+31; 16+31 | 1 |
| 144 | .....do..... | ..... | ..... | .... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 16+27; 16+29 | .... |
| 145 | .....do..... | ..... | ..... | .... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 16+26; 16+28 | .... |
| 146 | .....do..... | ..... | ..... | .... | ..... | ..... | 4⅛ | .... | 3⅛ | 2+ | .... | .... | ..... | 16+27; 16+30 | 1⅛ |
| 147 | .....do..... | ..... | ..... | .... | ..... | ..... | 4+ | .... | 3⅛ | 2+ | .... | .... | ..... | 18+31; 18+31 | 1⅛ |
| 148 | .....do..... | ..... | ..... | .... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 16+30; 16+30* | .... |
| 149 | .....do..... | ..... | ..... | .... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 16+30; 16+28* | .... |
| 150 | .....do..... | ..... | ..... | .... | ..... | ..... | 5 | .... | 3⅜ | 2+ | .... | .... | ..... | 17+32; 17+31 | 1⅛ |
| 151 | .....do..... | ..... | ..... | .... | ..... | ..... | 4⅛ | .... | 3⅜ | 2⅛ | .... | .... | ..... | 15+31; 17+31 | 1⅛ |
| 152 | .....do..... | ..... | ..... | .... | ..... | ..... | 4⅛ | .... | 3⅛ | 2⅛ | .... | .... | ..... | 18+32; 16+32 | 1 |
| 153 | .....do..... | ..... | ..... | .... | ..... | ..... | 4+ | .... | 3⅛ | 2+ | .... | .... | ..... | 17+30; 17+30 | 1⅛ |
| 154 | .....do..... | ..... | ..... | .... | ..... | ..... | 4⅛ | .... | 3⅛ | 2+ | .... | .... | ..... | 17+30; 16+31 | 1⅛ |
| 155 | .....do..... | ..... | ..... | .... | ..... | ..... | 4⅛ | .... | 3⅜ | 2⅛ | .... | .... | ..... | 17+31; 17+31 | 1⅛ |
| 156 | .....do..... | ..... | ..... | .... | ..... | ..... | 4 | .... | 3⅜ | 2⅛ | .... | .... | ..... | 18+30; 18+29* | 1⅛ |
| 157 | .....do..... | ..... | ..... | .... | ..... | ..... | 4 | .... | 3⅛ | 2+ | .... | .... | ..... | 16+30; 16+28* | .... |
| 160 | .....do..... | ..... | ..... | .... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 15+31; 16+30 | .... |
| 161 | .....do..... | ..... | ..... | .... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 16+30; 17+30 | .... |
| 164 | .....do..... | ..... | ..... | .... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 14+28; 14+29 | .... |
| 166 | .....do..... | ..... | ..... | .... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | *15+30; 15+31 | .... |
| 167 | .....do..... | ..... | ..... | .... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 16+28; 16+28 | .... |
| 168 | .....do..... | ..... | ..... | .... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 17+32; 17+32 | .... |
| 169 | .....do..... | ..... | ..... | .... | ..... | ..... | 5 | .... | 4 | 2⅛ | .... | .... | ..... | 17+31; 17+31 | 1⅛ |
| 170 | .....do..... | ..... | ..... | .... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | *14+26; 14+24* | .... |
| 171 | .....do..... | ..... | ..... | .... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 18+30; 17+30 | .... |
| 172 | .....do..... | ..... | ..... | .... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 16+28; 16+26* | .... |
| 173 | .....do..... | ..... | ..... | .... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 16+30; 15+31 | 1⅛ |
| 174 | .....do..... | ..... | ..... | .... | ..... | ..... | 4⅛ | .... | 3⅛ | 2+ | .... | .... | ..... | *16+30; 13+32* | .... |
| 175 | .....do..... | ..... | ..... | .... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 16+32; 16+28 | 1⅛ |
| 176 | .....do..... | ..... | ..... | .... | ..... | ..... | 4 | .... | 3⅛ | 2⅛ | .... | .... | ..... | 17+31; 18+32 | 1⅛ |
| 177 | .....do..... | ..... | ..... | .... | ..... | ..... | 4⅛ | .... | 3⅜ | 2⅛ | .... | .... | ..... | 16+30; 16+28* | .... |
| 178 | .....do..... | ..... | ..... | .... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 16+28; 17+28 | .... |
| 179 | .....do..... | ..... | ..... | .... | ..... | ..... | 4+ | .... | 3⅜ | 2⅛ | .... | .... | ..... | 16+30; 17+31 | 1⅛ |
| 180 | .....do..... | ..... | ..... | .... | ..... | ..... | 4⅛ | .... | 3⅜ | 2⅛ | .... | .... | ..... | 17+31; 16+31 | 1⅛ |
| 181 | .....do..... | ..... | ..... | .... | ..... | ..... | 4⅛ | .... | 3⅛ | 2⅛ | .... | .... | ..... | 17+32; 17+32 | 1⅛ |
| 182 | .....do..... | ..... | ..... | .... | ..... | ..... | 4⅛ | .... | 3⅛ | 2⅛ | .... | .... | ..... | 17+29; 16+30 | 1⅛ |
| 183 | .....do..... | ..... | ..... | .... | ..... | ..... | 5 | .... | 3⅛ | 2⅛ | .... | .... | ..... | 17+31; 16+31 | .... |
| 184 | .....do..... | ..... | ..... | .... | 4⅛ | 4+ | 4⅛ | 5 | 3⅜ | 2+ | 10 | 12 | 8-72-7 | 17+31; 17+31 | 1+ |
| 185 | .....do..... | ..... | ..... | .... | 4⅜ | 5⅛ | 4⅜ | 4⅜ | 3 | 2+ | 10 | 10 | 8-80-7 | 15+28; 15+29 | 1 |
| 280 | Superior ... | ..... | 15 | .... | 4⅜ | 4⅜ | 5⅛ | 4⅛ | 3⅜ | 2⅛ | 9 | 11 | 9-85-8 | *13+27; 16+28 | 1 |
| 298 | .....do..... | ..... | ..... | .... | 4⅛ | 5 | 4 | 5 | 3 | 2 | 10 | 12 | ..... | ..... | .... |
| 299 | .....do..... | ..... | ..... | .... | 4⅜ | ... | 4 | 4⅜ | 3 | 2 | 10 | 13 | ..... | ..... | .... |
| 303 | .....do..... | ..... | 7⅛ | .... | 4⅜ | 4⅛ | 3⅜ | 4+ | 2⅜ | 2 | 10 | 11 | 8-76-7 | 17+29; 16+32 | 1⅛ |
| 314 | Ontario..... | ♂ ..... | 10⅛ | .... | 4⅜ | 4 | 4⅛ | 4⅜ | 3⅛ | 2⅛ | 11 | 11 | 8-75-7 | 16+31; 16+31 | 1⅛ |
| 315 | .....do..... | ♂ ..... | 12⅛ | .... | 4⅜ | 3⅜ | 4⅜ | 4⅛ | 3⅜ | 2⅛ | 11 | 11 | 8-80-7 | 16+30; 16+30 | 1⅛ |
| 316 | .....do..... | ♀ ..... | 12⅛ | .... | 4⅜ | 4⅜ | 4⅛ | 4⅛ | 3⅛ | 2⅛ | 12 | 12 | 8-79-7 | 18+32; 18+33 | 1 |
| 317 | .....do..... | ♂ ..... | 10⅛ | .... | 4⅛ | 4⅛ | 4⅜ | 4⅛ | 3⅛ | 2⅛ | 11 | 12 | 8-76-7 | 17+33; 17+30 | 1⅛ |
| 318 | .....do..... | ♂ ..... | 11⅜ | .... | 4⅜ | 3⅜ | 4⅜ | 4⅛ | 3⅜ | 2⅛ | 11 | 12 | 8-70-7 | 17+32; 17+31 | 1⅛ |

* Gill mutilated; number uncertain.

*Abundance, distribution, etc.*—In all the Great Lakes the lake herring, or cisco, is more abundant than any other whitefish. It is taken in enormous quantities each year, and in most of the lakes is the object of a special fishery. Considering the entire basin, the quantity of lake herring taken is greater than that of all other whitefishes combined, but in value of catch and in food value it does not equal the common whitefish.

We have critically examined specimens from lakes Ontario, Erie, Huron, Superior, and Michigan. We have also examined all the specimens of this species now in the National Museum, which represent the following localities: Lake Champlain (Professor Baird); Missisquoi Bay, Lake Champlain (R. W. Marfel); Lake Champlain, Vergennes, Vt. (M. E. Hall); Labrador (L. M. Turner); Nelson River, Hudson Bay (Dr. Robert Bell); Hudson Bay (Walter Haydon); Lake Ontario (W. H. Thompson); lakes Erie, Huron, and Michigan; Moose Factory, British America (C. Drexler). The specimens from Labrador and Hudson Bay region may represent a slight variety worthy of recognition.

Mr. John W. Titcomb says this species is quite common in several of the small lakes of Vermont, particularly Bomoseen Lake in Rutland County. In October and November, they appear in large schools close to the rocky shores of the lake for the purpose of spawning.

This species is abundant in Lake Ontario; its most important spawning-grounds are in the east end of the lake, in Chaumont Bay, Three-mile Bay, and about Grenadier, Stony, and Fox islands. Farther west spawning-grounds are found along the shores and bays, more especially in Great Sodus Bay. On the Canadian side important grounds seem to be in the Bay of Quinte. The spawning-beds are usually in shallow water on hard bottom, though mud bottom is frequently used. In the American portions of Lake Ontario the spawning takes place almost entirely in the month of November. The ciscoes of Lake Ontario run from less than a pound to 1½ pounds, though it is said they are sometimes taken weighing 2½ or even 4 pounds.

In Lake Erie this species exists in greater abundance than elsewhere. Its spawning seasons and habits are not known to differ materially from those of the Lake Ontario fish.

*Common names.*—This species is known by many names. The most widely used are lake herring and cisco, either of which is, in most places, distinctive. In Lake Ontario it is commonly called the cisco. The etymology of the word is in dispute. One assigned derivation is from a fish-peddler named Cisco, who, about 1830, took the fish through the northern part of the State and sold it to farmers as "Cisco's herring." "Sisco" is only a recent variation in the orthography. Other names used by the fishermen of this lake are herring, blueback or greenback, blueback herring or greenback herring, and grayback or grayback herring. The name most widely used, however, is cisco. These different names are the fishermen's way of distinguishing individual variations

in color, sex, age, or time of run. Usually the fishermen claim that the graybacks run in the spring and that the spring or early summer is their spawning time. The greenbacks and bluebacks run in the late fall and they are a better fish than the graybacks. It is not unlikely that all the fish found spawning in early summer are bloaters (*A. prognathus*). In lakes Erie, St. Clair, Huron, and Superior the fish is generally known as herring and lake herring, which are the names in use in Canada. In Lake Michigan the names herring, Michigan herring, blueback herring, and shore herring are in use. The name herring is in places shared by another species (*A. hoyi*). A trade name for large herring in Lake Erie is ciscoette or siscowet.

### 10a. Argyrosomus artedi sisco Jordan.

SISCO OF LAKE TIPPECANOE.

*Argyrosomus sisco* Jordan, Amer. Nat., IX, 1875, 136, Lake Tippecanoe, Warsaw, Ind.

Head, $3\frac{3}{4}$ to $4\frac{3}{5}$; depth, 4 to 5; eye, 4 to 5; snout, about 5; maxillary, $3\frac{3}{5}$; mandible, $2\frac{1}{3}$. Scales, 9-74 to 89-8. Gillrakers, 15+28 to 31 (43 to 46), long and slender, 1 to $1\frac{1}{6}$ in eye. This species is not essentially different in form from that of the lake herring, but is smaller and much superior as food. It reaches a length of about 14 inches. It is known only from Geneva, La Belle, and Oconomowoc lakes in Wisconsin, and Tippecanoe, Crooked, Shriner, and Cedar lakes in northeastern Indiana. It lives in deep water except in December, when it comes into shallow water and ascends brooks to spawn. According to Professor Kirsch it spawns from about the 25th of November to the 25th of December in Shriner Lake and the other Indiana lakes.

The following table gives detailed measurements of four specimens from Crooked Lake, Whitley County, Indiana, which were obtained by Prof. P. H. Kirsch, the Indiana State fish commissioner.

*Table of comparative measurements of specimens of sisco of Lake Tippecanoe (Argyrosomus artedi sisco).*

| No. | Locality. | Head. | Depth. | Eye. | Snout. | Maxillary. | Mandible. | Dorsal. | Anal. | Scales. | Gillrakers. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Number. | In eye. |
| 136 | Crooked Lake, Indiana | $4\frac{1}{4}$ | $4\frac{1}{3}$ | $4\frac{1}{4}$ | 0 | $3\frac{1}{4}$ | $2\frac{1}{4}$ | 10 | 11 | 9-85-8 | 15+31; 15+30 | 1+ |
| 137 | do | $4\frac{1}{4}$ | 5 | 4 | 5 | $3\frac{2}{3}$ | $2\frac{1}{4}$ | 10 | 11 | 9-89-8 | 15+29; 14+28 | $1\frac{1}{6}$ |
| 138 | do | $4\frac{1}{4}$ | 4+ | 5+ | $4\frac{1}{3}$ | $3\frac{2}{3}$ | $2\frac{1}{4}$ | 10 | 11 | 9-74-8 | 15+29; 15+30 | $1\frac{1}{6}$ |
| 139 | do | $3\frac{3}{4}$ | 4— | 5— | 5+ | $3\frac{2}{3}$ | $2\frac{1}{4}$ | 10 | 11 | 9-77-8 | 15+29; 15+30 | 1 |

## 11. Argyrosomus hoyi Gill.

MOON-EYE; MOON-EYE CISCO; CISCO; KIEYE; CHUB.

*Argyrosomus hoyi* (Gill MS.) Jordan, American Naturalist, IX, March, 1875, 135, Lake Michigan, near Racine, Wis.

*Description.*—Head, $4\frac{1}{2}$; depth, $4\frac{1}{2}$; eye, $4\frac{1}{6}$ to $4\frac{2}{3}$; snout, $3\frac{2}{5}$ to $3\frac{5}{6}$; maxillary, $2\frac{3}{5}$ to 3 in head, reaching to vertical of middle of pupil. D. 10; A. 11 or 12; scales, 8 or 9-73 to 80-7. Gillrakers, 14+25 or 26, slender, about 2 in eye. Vertebræ, 56; branchiostegals, 8 or 9. Body rather elongate, compressed, the back somewhat elevated. Mouth rather large, subterminal, the lower jaw shorter than upper, even when the mouth is open; tip of muzzle rather bluntly truncate, somewhat as in a true *Coregonus*; mandible nearly reaching posterior edge of eye, $2\frac{1}{6}$ in head. Head rather long, slender, and pointed. Supraorbital and preorbital long and narrow. Distance from tip of snout to occiput, $2\frac{1}{5}$ to $2\frac{2}{5}$ in distance from occiput to origin of dorsal fin; fins low; free margin of dorsal very oblique, the length of the anterior rays $1\frac{3}{5}$ in head, that of the last ray less than half length of the first; longest anal ray, $2\frac{3}{5}$ in head and more than twice as long as the last ray. Pseudobranchiæ very large; tongue with traces of teeth.

Color light iridescent blue on back, scales with a few fine dark punctulations reaching about two scales below lateral line; sides and under parts rich silvery, brighter than in any other of our *Coregoninæ*, much as in *Hiodon* and *Albula;* top of head light olivaceous; cheeks silvery; dorsal, caudal, and pectorals with some dark on their margins; anal and ventrals white, with some dark dustings; the male, perhaps, a little richer, more iridescent blue on back, and with the scales a little thicker and less closely imbricated. Length, 13 inches. Deep waters of Lake Michigan; the smallest and handsomest of our *Coregoninæ*.

The only specimens known until recently were the two sent to Dr. Gill and the one to Dr. Jordan by Dr. Hoy; but during recent investigations by the Fish Commission this species was found to be one of the principal fishes caught in the gill nets in the western part of Lake Michigan. It is a true *Argyrosomus*, though approaching *Coregonus*.

*Table of comparative measurements of Hoy's whitefish (Argyrosomus hoyi).*

| No. | Lake where taken. | When taken. | Sex and condition. | Length. | Weight. | Head. | Depth. | Eye. | Snout. | Maxillary. | Mandible. | Dorsal. | Anal. | Scales. | Gillrakers. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Number. | In eye. |
| | | | | *In.* | *Oz.* | | | | | | | | | | | |
| 57 | Michigan | Nov. 6 | ♀ ripe | 13½ | 10+ | 4⅛ | 4⅓ | 4⅙ | 3⅔ | 3 | 2⅓ | 10 | 12 | 8-80-7 | 14+26; 14+26 | 2 |
| 58 | do | Nov. 6 | ♂ ripe | 12 | 8+ | 4⅓ | 4⅓ | 4⅔ | 3⅔ | 2⅔ | 2⅓ | 10 | 11 | *8-73-7 | 14+25; 14+25 | 1⅔ |
| 59 | do | Nov. 6 | ♀ ripe | 13 | 9+ | 4⅔ | 4⅓ | 4⅓ | 3⅔ | 2⅔ | 2⅓ | 10 | 11 | 8-78-7 | 14+25; 14+25 | 1⅔ |
| 60 | do | Nov. 6 | ♀ ripe | 12 | 9— | 4⅓ | 4⅓ | 4⅔ | 3⅔ | 2⅔ | 2⅓ | 10 | 12 | 8-78-7 | 14+25; 14+25 | 1⅔ |
| 61 | do | Nov. 6 | ♂ not ripe | 12 | 8— | 4⅔ | 4⅔ | 4⅓ | 3⅔ | 2⅔ | 2⅓ | 9 | 11 | 9-76-7 | 14+26; 14+24 | 1⅔ |
| 62 | do | Nov. 6 | ♀ partly spent. | 12 | 8— | 4⅓ | 4⅓ | 4⅓ | 3⅔ | 2⅔ | 2⅓ | 10 | 12 | 9-73-7 | 12+26; 12+25 | 1⅔ |
| 71 | do | Nov. 12 | ♂ ripe | 12⅔ | 8 | 4⅔ | 4⅔ | 4⅓ | 3⅔ | 2⅔ | 2⅓ | 9 | 11 | 9-83-8 | 14+28; 14+27 | 1⅔ |
| 72 | do | Nov. 12 | ♂ ripe | 12⅓ | 8+ | 4⅔ | 4⅓ | 4 | 3⅓ | 2⅔ | 2 | 9 | 9 | 9-81-8 | 13+26; 13+26 | 1⅔ |
| 75 | do | Nov. 12 | ♂ ripe | 12⅓ | 7+ | 4⅔ | 4⅓ | 4 | 4 | 2⅔ | 2⅓ | 9 | 11 | 9-83-8 | 13+26; 13+24 | 1⅓ |
| 107 | do | Nov. 19 | ♀ spent | 13¼ | 13— | 4⅓ | ... | 4⅔ | 4 | 3 | 2 | 10 | 12 | ..... | ..... | ..... |

* Thicker and less closely imbricated than in No. 57.

Among the collections recently made there are 8 specimens of *Argyrosomus* (5 from Lake Michigan and 3 from Lake Superior) which we refer to *A. hoyi* for the present, though they differ from typical *hoyi* in some respects. The most important of these is the number of gillrakers. In the numerous specimens of *hoyi* examined the average number of gillrakers was found to be 39, while the average for the 8 specimens here considered is but 31½. If we consider only these averages the difference is great, but the range of variation in each is so great as to render this contrast less striking. An examination of the table under *hoyi* shows the range to be from 37 to 42, and the following table shows the range in these 8 specimens to be from 29 to 34. The difference of 3, however, between the minimum for *hoyi* and the maximum for these peculiar specimens is important, and would, under ordinary circumstances, lead us to regard these 8 specimens as belonging to another and apparently undescribed species.

These specimens also resemble *A. prognathus* in general appearance, and a comparison with that species is equally interesting. The chief differences from *A. prognathus*, which can be represented numerically, are the fewer gillrakers, the longer mandible, and shorter maxillary. The average number of gillrakers in *A. prognathus* is, as shown by our material, about 39. These averages are sufficiently wide apart to justify separating the two forms specifically; and we would not hesitate to do so were it not for the fact that the recognized extremes of variation in this particular in *A. prognathus* are very great, the minimum number recognized by us in that species being as low as 32 (in specimens Nos. 23 and 25). But the other characters shown by these two specimens are not appreciably different from typical *prognathus*. They have the projecting lower jaw, the long mandible and maxillary, and the general form of muzzle of that species.

In the 8 specimens under consideration, not only are the gillrakers very few, but the mandible and maxillary are rather shorter, and the general form of the snout is different. The lower jaw projects but slightly or not at all, and the maxillary is narrower. Nos. 108 to 112 were obtained in deep water off Sheboygan, Wis., with Hoy's whitefish, from which they were not distinguished by the fishermen, all being known to them as "kieye" or "chub." While these fish were confounded with *A. hoyi* by the fishermen, they appear more different from that species than they do from *A. prognathus*, the gillrakers in *A. hoyi* being even more numerous than in *prognathus*. Externally they very closely resemble *hoyi*, while in number of gillrakers they seem more closely related to the longjaw. If further investigation should show these differences to be as great and valuable as they now appear, these specimens should be regarded as a distinct species. For the present, however, we suspend judgment and await additional evidence.

The following table shows the comparative measurements of these 8 specimens:

| No. | Lake where taken. | When taken. | Sex and condition. | Length. | Weight. | Head. | Depth. | Eye. | Snout. | Maxillary. | Mandible. | Dorsal. | Anal. | Scales. | Gillrakers. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Number. | In eye. |
| | | | | *In.* | *Oz.* | | | | | | | | | | | |
| 108 | Michigan... | Nov. 18 | ♀ partly spent. | 13⅛ | 14 | 4⅜ | 4 | 4⅜ | 4⅛ | 3+ | 2— | 10 | 13 | 9-81-8 | 11+21; 11+19 | 1⅛ |
| 109 | .....do..... | Nov. 18 | ♂ | 13⅜ | 14+ | 4 | 3⅜ | 5 | 4⅛ | 3⅛ | 2 | ..... | | 9-87-8 | 11+18; 10+19 | 1⅛ |
| 110 | .....do..... | Nov. 18 | ♀ | 13¼ | 13— | 4⅛ | 4⅛ | 4⅜ | 4⅛ | 3 | 2+ | 10 | 11 | 9-77-8 | 12+21; 11+21 | 1⅛ |
| 111 | .....do..... | Nov. 18 | ♀ spent. | 13 | 11+ | 4⅛ | 4⅛ | 5 | 4⅛ | 3 | 2+ | 10 | 11 | 9-86-8 | 10+20; 10+20 | 1⅛ |
| 112 | .....do..... | Nov. 18 | ♂ spent. | 12½ | 9+ | 4⅛ | 4⅜ | 4⅜ | 4⅛ | 3⅛ | 2⅛ | 9 | 12 | 8-85-7 | 10+19; 10+19 | 1⅛ |
| 282 | Superior.... | July 28 | ..... | 10⅛ | .... | 4⅛ | 4 | 4⅛ | 4⅛ | 3 | 2⅛ | 10 | 11 | 8-74-7 | 13+21; 12+21 | 1⅛ |
| 283 | .....do..... | July 28 | ..... | 11 | .... | 4⅛ | 4⅛ | 4⅜ | 4⅛ | 3 | 2⅛ | 11 | 10 | 8-75-7 | 11+22; 12+21 | 1⅛ |
| 284 | .....do..... | July 29 | ..... | 11 | .... | 4⅛ | 4⅛ | 4⅛ | 4⅛ | 3 | 2⅛ | 10 | 11 | 8-74-7 | 11+22; 13+21 | 1⅛ |

*Spawning habits and food value.*—Very little is known about the spawning habits of Hoy's whitefish. All the Lake Michigan specimens examined by us were taken between the 5th and 20th of November, and they were all ripe or nearly so, or partially spent. The spawning time is therefore evidently late in the fall, and probably in deeper water than is resorted to by the herring and other species. The probability that the long-jaw spawns much earlier is an interesting and important fact, and is additional evidence of the distinctness of these species.

In the original references to this fish in the writings of Milner and Hoy, it is stated that it has no food value, on account of its small size, but that it constitutes a prominent part of the food of the salmon trout. From the time of its discovery, in 1871, to a comparatively recent date, this fish attracted no attention and was not known to possess economic value. The extension of the operations of the gill-net fishermen of Lake Michigan into the deepest parts of the lake brought the fish into notice, and for fully six years or longer it has had a gradually increasing importance. The relative scarcity of the common whitefish in the fisheries of the western side of the lake has resulted in the utilization of Hoy's whitefish, notwithstanding its small size.

### 12. Argyrosomus pusillus (Bean).

SMALL WHITEFISH; LEAST WHITEFISH.

*Coregonus pusillus* Bean, Proc. U. S. Nat. Mus. 1888, 526, Kuwuk River, Alaska. (Type, No. 38366.)

Head, 5; depth, 5; eye, 4⅓; D. 10; A. 12; V. 11; scales, 10–91–9; mandible, 2⅓; maxillary, 3⅓; gillrakers very long and slender, numerous, 49 in all. Body rather elongate, compressed. Mouth as in *A. artedi*, the lower jaw projecting; maxillary broad, with rather broad supplemental bone, three times as long as wide, not quite reaching middle of the very large eye; preorbital extremely narrow. Teeth none, or reduced to slight asperities on the tongue. Dorsal much higher than long, its last rays rapidly shortened, the first ray twice length of base of fin; insertion

of dorsal midway between snout and middle of adipose fin. Caudal large, well forked; anal small; ventrals inserted under middle of dorsal, very long, five-sixths length of head and equal to pectorals. Steel blue above, with many dark points; belly white; dorsal and caudal blackish; pectorals and ventrals tipped with black.

This is one of the smallest of the American whitefishes, rarely reaching a foot in length or a half pound in weight. It has the reputation of being more bony than any other whitefish. It is little utilized for food in Alaska, but is used chiefly by native traveling parties and as food for dogs. It extends over a very large portion of Alaska and is very abundant. So far as our information goes, it is found in all parts of Alaska except the southeastern portion. The types were obtained in the Kuwuk River by the well-known collector, Charles H. Townsend.

### 13. **Argyrosomus lucidus** (Richardson).

GREAT BEAR LAKE HERRING.

*Salmo* (*Coregonus*) *lucidus* Richardson, Fauna Boreali-Americana, III, 207, 1836, Great Bear Lake.

Head small, 5 to $5\frac{1}{3}$; depth, $4\frac{1}{4}$ to $4\frac{3}{5}$; eye, 5. D. 11 or 12 developed rays; A. 11 or 12. Scales, 85 to 87, 11 or 12 in an oblique series downward and forward from front of dorsal to lateral line. Eye slightly less than length of snout, $1\frac{1}{2}$ times in interorbital width. Body slender, elongate, the curve of back and belly about equal, the greatest depth exceeding length of head. The snout narrow, almost vertically truncate when mouth is closed, the lower jaw fitting within the upper, but the mouth not inferior. Distance from snout to nape $2\frac{3}{5}$ to 3 in distance between nape and front of dorsal. The head is much smaller in one of our specimens than in the other. Mouth oblique, with rather slender maxillary, which extends to vertical midway between front and middle of pupil, its length from tip to articulation equaling distance from end of snout to front of pupil, and contained $3\frac{3}{5}$ to $3\frac{4}{5}$ in length of head. Supplemental maxillary bone probably broader than in *artedi*, from three-fifths to two-thirds greatest width of maxillary. Suborbital bone large, its width $2\frac{1}{2}$ to $2\frac{2}{3}$ in its length. Gillrakers very long and slender, the longest slightly more than two-thirds length of eye, 16 + 28 in number in each specimen. Front of dorsal slightly nearer tip of snout than base of upper rudimentary dorsal rays. The fins are mutilated, so that their length can not be given. Adipose fin large, inserted vertically above last anal rays, its height from tip to posterior end of base equaling vertical diameter of eye. Color, silvery.

This description is based on 2 specimens recently obtained in Great Bear Lake by Miss Elizabeth Taylor and donated by her to the museum of Leland Stanford Junior University. These specimens are each 16 inches long and are the only ones received by any museum since Richardson's time. These are described in detail by Dr. Gilbert in the Bulletin of the U. S. Fish Commission for 1894.

### 14. Argyrosomus laurettæ (Bean).

LAURETTA WHITEFISH.

*Coregonus laurettæ* Bean, Proc. U. S. Nat. Mus. 1881, 156, Point Barrow. (Types Nos. 27695 and 27915.)

Head, 5; depth, 4; eye, 4½ to 5. D. 12; A. 11; V. 12; scales, 10–84 to 95–10, 84 to 87 in specimens examined by us. Body robust, the back elevated; head small and slender, the small eye not longer than snout. Distance from nape to front of snout 2½ times distance of nape from dorsal. Maxillary about reaching middle of eye, 3½ in head, its supplemental bone half its length. Lower jaw very slightly longer than upper; mandible, 2⅓ in head; lingual teeth present. Gillrakers long and numerous, 10+25; ventral scale not half length of fin; pectorals short, not reaching half way to ventrals. Scales smaller than in *A. artedi*, 16 cross series under base of dorsal. Alaska, from Yukon River northward to Point Barrow; generally common. Apparently very close to *A. lucidus*, but differing in longer base of dorsal.

### 15. Argyrosomus prognathus (H. M. Smith).

BLOAT; BLOATER; BLOATER WHITEFISH; LONGJAW; SILVER WHITEFISH.

*Coregonus prognathus* Hugh M. Smith, Bull. U. S. Fish Comm., XIV, 1894, 4, pl. 1, fig. 3, Lake Ontario, at Wilson, New York. (Type, No. 45568.)

*Description:* Head, 4⅓; depth, 3½ to 4; eye, 5. D. 9 or 10; A. 10 to 12. Eye rather small; 1⅛ in snout, 1½ in interorbital space. Scales, 9–75–8. Body oblong, much compressed; back elevated, tapering rather sharply toward the narrow caudal peduncle, the adult fish having a slight nuchal hump, as in *C. clupeiformis*. Mouth large and strong; snout straight, its tip on level with lower edge of pupil. Top of head 2⅛ in distance from occiput to front of dorsal. Maxillary reaching to opposite pupil, 2½ in head; length, 3½ times its greatest width; mandible projecting beyond upper jaw when mouth is closed, very long, reaching to or beyond posterior edge of eye, 1¾ to 1⅞ in head. Head of medium size, rather short and deep, pointed; cranial ridges prominent.

Dorsal rather high, the longest ray one-third longer than base of fin and contained 1⅔ times in greatest body depth and 1⅓ times in head; free margin slightly concave; origin nearer end of snout than base of caudal. Longest anal ray equal to base of fin or two-thirds height of dorsal. Vertebræ, 55. Gillrakers slender, about 15 + 28, about length of eye. Adipose fin the length of eye, its width half its length. Narrowest part of caudal peduncle contained nearly 4 times in greatest body depth. Ventral as long as dorsal is high, its origin midway between end of snout and fork of tail. Pectoral as long as ventral. Lateral line straight except at origin, where it presents a rather marked curve. Sides of body uniformly bright silvery, with pronounced bluish reflection in life; the back dusky, the under parts pure white without silvery color; above lateral line, the upper and lower edges of scales

finely punctulated, central part unmarked, producing light longitudinal stripes extending whole length of body; fins flesh color or pinkish in life, the dorsal and caudal usually showing dusky edges; postorbital area with a bright golden reflection. Iris golden, pupil black.

The extreme variations in some of the characters of this species are remarkable, their nature and importance being apparent only upon examination of a large series of specimens. We have counted the scales and gillrakers and made comparative measurements of a great many examples, and present in the appended table the figures obtained from such a study of nearly one hundred specimens. Figures obtained from specimens examined in the field and not preserved are not included in this table. A study of the table will show that the relative length of head and depth of body are fairly constant; the same is true of the eye and snout, and the number of fin rays; the maxillary and mandible are a little more variable, while the variations in the scales and the gillrakers are unexpectedly great. Using the averages obtained from the table and putting in parentheses the extremes of variation, this species would be described as follows:

Head, $4\frac{1}{6}$ ($3\frac{1}{2}$ to $4\frac{3}{4}$); depth, $4\frac{1}{3}$ ($3\frac{1}{2}$ to $5\frac{1}{4}$); eye, $4\frac{1}{3}$ ($3\frac{1}{2}$ to 6); snout, $4\frac{1}{3}$ ($3\frac{1}{2}$ to 5); maxillary, 3 ($2\frac{3}{5}$ to $3\frac{1}{3}$); mandible, 2 ($1\frac{4}{5}$ to $2\frac{1}{4}$); dorsal, 10 (9 to 12); anal, 11 (10 to 15); scales, 8 (7 to 9)–75 (65 to 86)–7 (6 to 9); gillrakers, 14 (10 to 17) + 25 (21 to 32).

*Table of comparative measurements of specimens of longjaw whitefish (Argyrosomus prognathus).*

| No. | Lake where taken. | Sex and condition. | Length. | Weight. | Head. | Depth. | Eye. | Snout. | Maxillary. | Mandible. | Dorsal. | Anal. | Scales. | Gillrakers. Number. | Gillrakers. In eye. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | *Ins.* | *Oz.* | | | | | | | | | | | |
| 1 | Ontario | | 8½ | 4 | 4½ | 3⅜ | 4 | 4 | 2¾ | 1⅝ | 10 | 10 | 9-83-9 | *14+28; | 15+29 |
| 2 | do | | 8 | 3 | 4 | 3⅜ | 3⅜ | 3⅜ | 2⅝ | 1⅝ | 11 | 12 | 9-71-8 | *14+24; | 15+29 |
| 3 | do | | 7 | 2 | 3⅜ | 3 | 3⅜ | 4 | 2⅝ | 2 | 10 | 12 | 9-79-8 | *12+31; | 15+31 |
| 4 | do | ♀ | 11 | 8 | 4½ | 3⅜ | 4⅜ | 4 | 3 | 2 | 10 | 11 | 9-75-8 | *13+30; | 16+31 |
| 5 | do | | 12 | 8 | 4 | 3⅜ | 5 | 4 | 3 | 2 | 9 | 12 | 9-74-8 | *11+24; | 14+25 |
| 6 | do | | 13 | 9 | 4 | 4 | 5⅛ | 3⅜ | 3 | 1⅞ | 10 | 12 | 8-74-8 | *12+26; | 12+27* |
| 7 | do | | 11⅛ | 8 | 4 | 3½ | 5 | 4 | 3 | 2⅛ | 10 | 10 | 8-66-7 | *13+22; | 10+21* |
| 8 | do | | 14 | 16 | 4⅛ | 4 | 5½ | 4 | 3 | 2 | 10 | 11 | 8-65-8 | *14+26; | 14+27 |
| 9 | do | | 8½ | 2 | 3⅜ | 4⅛ | 4 | 4⅛ | 3+ | 2 | 9 | 11 | 9-70-7 | *15+26; | 16+30 |
| 10 | do | | 14⅛ | 12 | 4⅜ | 3⅜ | 4⅜ | 4⅜ | 3½ | 2½ | 10 | 12 | 9-75-7 | *14+29; | 17+30 |
| 11 | Huron | | 9½ | 3 | 4+ | 4⅛ | 4 | 4 | 3+ | 2 | 11 | 11 | 9-74-7 | *10+18; | 12+22 |
| 12 | do | | 11 | 5 | 4⅜ | 4+ | 4⅛ | 4⅛ | 3⅛ | 2⅜ | 10 | 12 | 8-79-7 | *14+23; | 13+26 |
| 13 | do | | 9½ | 4 | 4 | 4 | 4⅜ | 4⅛ | 3⅜ | 2 | 9 | 12 | 8-75-8 | *10+17; | 10+17* |
| 14 | do | | 7 | 2— | 4⅛ | 4 | 3⅜ | 4⅜ | 3+ | 2+ | 10 | 11 | 8-66-8 | 14+26; | 14+27 |
| 15 | do | | 7 | 2— | 4 | 4 | 3⅜ | 4 | 3 | 2 | 9 | 12 | 8-70-7 | 15+27; | |
| 16 | do | | 8½ | 2 | 4⅛ | 4⅛ | 4⅛ | 4⅛ | 3 | 2 | 10 | 12 | 9-70-7 | 14+27; | 14+27 |
| 17 | do | | 8⅜ | 2⅛ | 4⅛ | 4⅜ | 4 | 4⅜ | 3 | 2+ | 11 | 11 | 9-75-7 | 14+23; | 13+23 |
| 18 | do | | 8½ | 2 | 4⅛ | 4⅛ | 4 | 4⅜ | 3⅛ | 2 | 10 | 11 | 8-75-7 | *12+23; | 13+21 |
| 19 | do | | 8⅛ | | 4⅛ | 4⅛ | 3⅜ | 4⅜ | 2⅞ | 2 | 9 | 12 | 8-77-8 | *13+23; | 11+23 |
| 20 | do | | 8⅞ | | 4⅛ | 4⅛ | 4 | 4⅜ | 2⅞ | 2 | 10 | 12 | 8-73-8 | 12+23; | 13+23 |
| 21 | do | | 7⅞ | | 4⅛ | 4⅜ | 3⅝ | 4 | 3 | 2 | 9 | 11 | 7-73-8 | 14+27; | 14+27 |
| 22 | do | | 7 | | 4⅛ | 4⅛ | 4 | 4⅜ | 3 | 2 | 9 | 12 | 9-78-8 | 12+22; | 12+23 |
| 23 | do | | 7⅛ | | 4⅛ | 4⅛ | 4 | 4 | 3 | 2— | 10 | 12 | 8-79-7 | 11+21; | 11+21 |
| 24 | do | | 8 | | 4⅛ | 4⅜ | 3⅜ | 4+ | 3 | 2 | 9 | 11 | 9-73-8 | 11+22; | 11+22 |
| 25 | do | | 8½ | | 4⅛ | 4⅜ | 3⅜ | 4⅜ | 3 | 2 | 9 | 11 | 8-73-8 | 12+22; | 12+21 |
| 26 | do | | 6½ | | 4⅛ | 4⅜ | 3⅜ | 4 | 2⅝ | 2 | 10 | 11 | 7-70-6 | 13+26; | 13+19* |
| 27 | do | | 5⅞ | | 4⅛ | 4⅜ | 3⅜ | 4⅜ | 3 | 1⅝ | 10 | 11 | 8-71-7 | 14+26; | 15+26 |
| 28 | do | | 5⅜ | | 4⅛ | 4⅛ | 3⅜ | 4⅜ | 2⅛ | 1⅝ | 10 | 11 | 8-70-7 | 13+25; | 12+27 |
| 29 | do | | 7⅜ | | 4⅛ | 4⅛ | 4 | 4⅛ | 2⅝ | 2— | 10 | 12 | 8-70-7 | 13+27; | 14+27 |
| 30 | do | | 7⅛ | | 4⅜ | 4⅛ | 4— | 4⅛ | 3 | 2 | 9 | 12 | 7-78-8 | 13+24; | 13+24 |
| 31 | do | | 9⅛ | | 4⅛ | 4⅛ | 4 | 4⅜ | 3⅛ | 2⅝ | 12 | 12 | 7-74-7 | *9+30; | 6+33* |
| 32 | Michigan | | 8 | | 4⅛ | 4⅛ | 4 | 4⅛ | 3 | 2 | 10 | 12 | 7-70-7 | 12+22; | 13+23 |

* Gill mutilated; number uncertain.

*Table of comparative measurements of specimens of longjaw whitefish (Argyrosomus prognathus)*—Continued.

| No. | Lake where taken. | Sex and condition. | Length. | Weight. | Head. | Depth. | Eye. | Snout. | Maxillary. | Mandible. | Dorsal. | Anal. | Scales. | Gillrakers. Number. | Gillrakers. In eye. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | *Ins.* | *Oz.* | | | | | | | | | | | |
| 33 | Michigan | | 7¼ | | 4 | 4⅛ | 4 | 4½ | 3 | 2 | 10 | 12 | 7-72-7 | 15+20; 16+28 | 1⅜ |
| 34 | do | | 8½ | | 4 | 4 | 3⅝ | 4½ | 3 | 2⅛ | 10 | 11 | 7-78-7 | 12+24; 12+24 | 1⅛ |
| 35 | do | | 8½ | | 4⅜ | 4⅜ | 4 | 4⅜ | 2⅞ | 2— | 10 | 12 | 7-73-7 | *14+26; 14+27* | 1⅛ |
| 36 | do | | 8½ | | 4⅞ | 4⅜ | 4 | 4½ | 3 | 2⅛ | 10 | 12 | 8-70-7 | 13+22; 13+22 | 1⅛ |
| 37 | do | | 8½ | | 4⅞ | 4⅜ | 4— | 4½ | 3⅛ | 2⅛ | 9 | 12 | 8-72-7 | 12+23; 12+24 | 1⅛ |
| 38 | do | | 8 | | 4⅛ | 4⅜ | 4 – | 4⅜ | 3 | 2 | 10 | 11 | 7-70-7 | 12+22; 12+22 | 1⅛ |
| 39 | do | | 7 | | 4⅜ | 4⅛ | 3⅜ | 4 | 3 | 2⅛ | 9 | 12 | 8-70-7 | 13+24; 13+24 | 1⅛ |
| 40 | do | | 8 | | 4⅛ | 4⅛ | 4 | 4 | 3 | 2+ | 9 | 12 | 7-73-7 | 12+24; 12+24 | 1⅛ |
| 41 | do | | 7¾ | | 4¼ | 4¼ | 4 | 4⅛ | 2⅞ | 2 | 10 | 11 | 7-74-7 | 14+27; 14+26 | 1⅛ |
| 42 | do | | 8 | | 4⅛ | 4⅛ | 3⅝ | 4 | 3 | 2⅛ | 10 | 12 | 8-74-7 | 13+23; 12+23 | 1⅛ |
| 43 | do | | 8¼ | | 4⅛ | 4⅛ | 4 | 4 | 3 | 2 | 10 | 12 | 7-70-7 | 10+23; 11+23 | 1⅛ |
| 44 | do | | 8 | | 4⅛ | 4 | 4 | 4⅛ | 2⅝ | 2 | 9 | 11 | 7-71-7 | 15+29; 15+29 | 1⅛ |
| 45 | do | | 10 | | 4⅛ | 4⅛ | 4⅛ | 4⅛ | 3— | 1⅞ | 11 | 11 | 8-76-7 | 11+23; 11+23 | 1⅛ |
| 46 | do | | 9 | | 4 | 4⅛ | 4⅛ | 4⅛ | 3 | 2— | 10 | 12 | 8-76-7 | 12+24; 13+24 | 2 |
| 47 | do | | 7⅛ | | 4 | 4⅛ | 4 | 4⅛ | 3 | 2 | 11 | 12 | 8-70-7 | 13+28; 14+28 | 1⅛ |
| 48 | do | | 7¾ | | 4⅛ | 5 | 4— | 4+ | 3 | 2⅛ | 10 | 11 | 8-77-7 | 12+22; 11+23 | 1⅛ |
| 49 | Huron | | | | 4⅛ | 4⅛ | 4⅛ | 4⅛ | 3⅛ | 2⅛ | 10 | 11 | 9-80-8 | 13+26; 13+24 | 1+ |
| 50 | do | | | | 4 | | 5 | 4 | 2⅞ | 2⅛ | 10 | 11 | 8-72-8 | 13+25; 12+24 | 1 |
| 51 | Ontario | | 4⅛ | 4+ | 5⅛ | 5⅛ | 4⅛ | 3 | 2 | 11 | 12 | 9-76-7 | 14+32; 14+29* | 1 |
| 52 | do | | 4⅛ | | 5 | 4 | 2⅞ | 1⅞ | 11 | 12 | 8-75-7 | 15+25; 14+27 | 1 |
| 53 | do | | 4⅛ | | 5⅛ | 4⅛ | 3 | 2 | 10 | 12 | 8-71-7 | 13+25; 13+24 | 1 |
| 79 | Michigan | ♀ ripe. | 12⅜ | 10— | 4⅛ | 4+ | 5 | 4⅛ | 3 | 2 | 10 | 11 | 9-80-8 | 13+24; 12+22 | 1⅜ |
| 82 | do | ♀ | 15⅜ | 16+ | 4⅜ | 4⅛ | .... | 4 | 3+ | 2 | 10 | 12 | 8-77-8 | 13+23; 13+25 | 1⅛ |
| 88 | do | ♂ | 12¾ | 11+ | 4⅛ | 4 | 4⅛ | 4 | 3 | 2 | 10 | 11 | 8-72-7 | 13+27; 13+27 | 1⅛ |
| 113 | Superior | | 16 | | 4⅛ | 4⅛ | 4⅜ | 4⅜ | 3+ | 2— | 11 | 12 | 9-88-7 | Eviscerated | ..... |
| 114 | do | | 16 | | 4 | 4⅛ | 5⅛ | 4 | 3+ | 2— | 10 | 11 | 9-77-7 | Eviscerated | ..... |
| 135 | Ontario | | 3⅞ | | 4⅛ | 4⅛ | 4⅛ | 4⅛ | 2⅛ | 1⅛ | 10 | 11 | 8-67-8 | 17+28; 16+30 | 1 |
| 200 | Superior | | 4⅛ | | 4⅛ | 5⅛ | 4⅛ | 4⅛ | 3+ | 2+ | 10 | 12 | 8-74-7 | 15+27; 15+27 | 1⅛ |
| 201 | do | | 4 | | 4⅛ | 5⅛ | 4⅛ | 4⅛ | 3 | 2 | 11 | 12 | 8-82-7 | 14+27; 14+27 | ..... |
| 202 | do | | 4⅛ | | 4⅛ | 5⅛ | 4 | 4⅛ | 3 | 2 | 11 | 12 | 9-86-7 | 13+26; 14+25 | ..... |
| 203 | do | | 4⅛ | | 4⅛ | 5 | 4⅛ | 4 | 3 | 2 | 11 | 11 | 8-86-7 | 15+24; 14+25 | ..... |
| 204 | do | | 4 | | 4⅛ | 5 | 4⅛ | 4⅛ | 2⅞ | 2— | 11 | 11 | 8-76-7 | 15+25; 14+25 | 1⅛ |
| 205 | do | | 4+ | | 4⅛ | 4⅛ | 4 | 4 | 3⅛ | 2+ | 11 | 11 | 8-76-7 | 15+28; 15+29 | 1⅛ |
| 206 | do | | 4 | | 4⅛ | 4⅛ | 4— | 4⅛ | 2⅞ | 2+ | 11 | 11 | 9-73-7 | 16+27; 14+27 | 1⅜ |
| 207 | do | | 4⅛ | | 4⅛ | 5⅛ | 4⅛ | 4⅛ | 3 | 2+ | 11 | 13 | 8-80-7 | 15+26; 14+27 | 1⅛ |
| 208 | do | | 4⅛ | | 4⅛ | 4⅛ | 4⅛ | 4⅛ | 2⅞ | 2— | 10 | 11 | 8-77-7 | 13+26; 13+26 | 1⅛ |
| 209 | do | | 4 | | 4⅛ | 4⅛ | 4⅛ | 4⅛ | 3 | 2 | 11 | 11 | 8-73-7 | 13+25; 10+23* | ..... |
| 210 | do | | 4⅛ | | 4 | 3⅞ | 4⅛ | 4⅛ | 3 | 2— | 10 | 11 | 8-74-7 | 15+28; 15+30 | 1⅛ |
| 211 | do | | 4⅜ | | 4⅛ | 4⅛ | 4+ | 4⅛ | 2⅞ | 2+ | 12 | 15 | 9-78-8 | 13+24; 13+24 | 1⅛ |
| 212 | do | | 4⅛ | | 4⅛ | 5— | 4+ | 4⅛ | 2⅞ | 2 | 12 | 13 | 9-70-8 | 14+27; 14+26 | 1⅛ |
| 213 | do | | 4⅛ | | 4⅛ | 4+ | 4⅛ | 4⅛ | 3— | 2+ | 10 | 11 | 8-70-7 | 15+30; 14+29 | 1+ |
| 214 | do | | 4 | | 4⅛ | 4 | 4⅛ | 4⅛ | 2⅞ | 2 | 11 | 11 | 8-74-7 | 13+26; 14+26 | 1⅛ |
| 215 | do | | 4 | | 4⅛ | 3⅞ | 4⅛ | 4⅛ | 3 | 2 | 11 | 11 | 8-77-7 | *13+27; 15+28 | 1⅛ |
| 216 | do | | 4⅛ | | 5⅛ | 3⅞ | 5— | 3+ | 2⅞ | 2 | 11 | 11 | 8-80-7 | 13+23; 14+23 | 1⅛ |
| 217 | do | | 4⅛ | | 4⅛ | 4— | 4⅛ | 3 | 2 | 1 | 10 | 11 | 8-70-7 | 15+28; 15+28 | ..... |
| 218 | do | | 4+ | | 4⅛ | 4 | 5 | 3+ | 2 | 1 | 11 | 11 | 8-78-7 | 14+29; 14+29 | 1⅛ |
| 219 | do | | 3⅞ | | 3⅞ | 3⅞ | 3⅞ | 5— | 3+ | 2 | 10 | 10 | 8-73... | 14+26; 14+26 | 1⅛ |
| 220 | do | | 4 | | 4⅛ | 4+ | 4⅛ | 4⅛ | 3+ | 2— | 10 | 10 | 9-67-7 | 15+29; 15+29 | 1⅛ |
| 221 | do | | 3⅞ | | 4⅛ | 4 | 4⅛ | 3 | 2 | 1 | 11 | 13 | 8-78-7 | 15+25; 15+25 | 1⅛ |
| 222 | do | | 3⅞ | | 4⅛ | 3⅞ | 5 | 3— | 2 | 1 | 10 | 11 | 8-76-7 | 15+27; 15+26 | 1⅛ |
| 223 | do | | 3⅞ | | 4⅛ | 4+ | 4⅛ | 3 | 2 | 9 | 12 | 9-67-8 | 15+26; 14+25 | 2 |
| 228 | do | | 5⅛ | | 5⅛ | 5— | 4+ | 3— | 2+ | 11 | 13 | 8-79-7 | 12+26; 13+26 | ..... |
| 281 | do | | 16 | | 4 | 3⅞ | 6 | 4⅛ | 3 | 1⅝ | 10 | 11 | 8-82-8 | *14+21; 14+26 | 1 |
| 285 | do | | 11 | | 4⅛ | 4⅛ | 4⅛ | 4⅛ | 3 | 2 | 10 | 11 | 8-82-7 | 13+21; 13+21 | ..... |
| 275 | do | | 14 | | 4+ | 4+ | 5⅛ | 3⅞ | 2⅞ | 1⅝ | 11 | 11 | 8-79-8 | 15+28; 15+28 | ⅛ |
| 276 | do | | 15 | | 4⅛ | 4 | 5⅛ | 4 | 3⅛ | 2⅛ | 11 | 12 | 8-75-7 | 16+27; ..+27 | ⅛ |
| 300 | do | | 8⅛ | | 4 | 4⅛ | 4 | 4⅛ | 3 | 2 | 9 | 10 | 9-75-8 | 14+29; 15+29 | 1⅛ |
| 301 | do | | 8⅜ | | 4⅛ | 5 | 4⅛ | 4⅛ | 3 | 2 | 10 | 10 | 8-79-7 | 12+24; 12+23 | 1⅛ |
| 302 | do | | 8⅛ | | 4 | 4⅛ | 4 | 4⅛ | 2⅜ | 2 | 9 | 12 | 8-75-7 | 11+25; 14+26 | 1⅛ |
| 310 | Ontario | ♂ | 12⅛ | | 4 | 4 | 5 | 4 | 3 | 2 | 10 | 10 | 8-72-7 | 14+25; 13+25 | 1⅛ |
| 311 | do | ♀ | 14 | | 4 | 4 | 5⅛ | 4 | 2⅛ | 2— | 10 | 10 | 9-77-7 | 14+28; 14+28 | ⅛ |
| 312 | do | ♀ | 13 | | 4 | 3⅞ | 5 | 4 | 2⅞ | 2 | 10 | 11 | 8-71-7 | 13+23; 13+22 | 1⅛ |
| 313 | do | ♀ | 11⅛ | | 4 | 3⅛ | 4⅛ | 3⅛ | 3 | 2 | 9 | 11 | 9-66-8 | *11+20; 13+21 | 1⅛ |

* Gill mutilated; number uncertain.

*Food value.*—The longjaw is a fish of some commercial importance in lakes Superior, Michigan, Huron, and Ontario. It is most valuable in Lake Michigan, although a few years ago the largest catch was taken in Lake Ontario. Its edible qualities are relatively high. The flesh is firm and of very good flavor, and by many people the difference between the longjaw and the common whitefish in this respect is considered to be

only slight. It is most highly esteemed on Lake Ontario, where it often brings the same price as the common species; elsewhere it yields the fisherman several cents a pound less than *C. clupeiformis*. Mr. Charles H. Strowger, an experienced fisherman and careful observer, residing on the shores of Lake Ontario, gives the following estimate of the food value of this fish:

When properly cared for on being caught, this is a delicious fish. When salted it keeps well, and does not lose its freshness when cooked. A great deal of prejudice against the longjaw is entertained because of the soft and damaged condition in which the fish is usually sold to the consumers. It is a fish that ought to be iced as soon as it is taken from the water and left cold until used, as it easily softens and on cooking becomes too greasy for ordinary human palates to enjoy. When fresh caught it is equal, in my judgment, to any fish for delicacy of flavor. It is a splendid fish for baking when of full size, but small-sized fish are always of less value and should not be caught.

*Spawning.*—Very little is certainly known regarding the spawning habits of the longjaw. Examples taken by Mr. Charles H. Strowger in Lake Ontario, May 17, 1892, had immature spawn except in one fish, in which the eggs were fully ripe. Specimens sent us from the same lake in April, by Mr. John S. Wilson, contained very immature spawn; while other specimens forwarded by Mr. George M. Schwartz of Rochester, on June 13, 1892, had fully matured spawn. Mr. Strowger's observations lead him to believe that this species has a prolonged spawning period, extending perhaps over the entire year. Specimens examined by us on Grenadier Island June 28, 1894, were ripe, and others examined at various times in June and July were nearly or wholly ripe. From these facts it is certain that many of this species spawn in Lake Ontario in the summer. Some of the specimens obtained by Dr. Scovell in Lake Huron in July were also ripe, while others were not. The probabilities are that Mr. Strowger's view is right, and that while the summer is the principal spawning time, the season is prolonged until late in the fall. Little is known of the location of the spawning-beds, but all the evidence indicates that they are in relatively deep water.

### 16. Argyrosomus nigripinnis Gill.

BLACKFIN; BLACKFIN WHITEFISH; BLUEFIN; BLUEFIN WHITEFISH.

*Argyrosomus nigripinnis* (Gill MS.) Milner, Rept. U. S. Fish Comm. 1872–73 (1874), 87, Lake Michigan, off Racine, Wis.

*Description.*—Head, $4\frac{1}{3}$ to $4\frac{2}{5}$; depth, 4 to $4\frac{1}{2}$; eye, $4\frac{1}{3}$ to $4\frac{5}{6}$; snout, 4 to 5; mandible, 2 to $2\frac{1}{8}$; maxillary, 3 to $3\frac{2}{5}$. D. 10 or 11 (rarely 9); A. 11 or 12. Scales, 8 or 9–75 to 81–7 or 8. Vertebræ, 58; gillrakers usually 17+33=50, long and slender, about $1\frac{1}{5}$ in eye.

Body moderately stout, ventral outline more curved than the dorsal. Head large, pointed; mouth large; maxillary long and narrow, reaching middle of pupil, the supplemental maxillary long, narrowed above; mandible very long, usually reaching vertical of posterior rim of orbit; lower jaw usually projecting. Distance from snout to occiput about

2 in distance from occiput to origin of dorsal fin. Caudal peduncle rather slender, its least depth $2\frac{2}{5}$ in head. Fins all long; in No. 100, a female, they measure as follows: Pectoral $1\frac{1}{3}$ in head, reaching just half way to base of ventrals; ventrals a little shorter, $1\frac{1}{2}$ in head; dorsal high, its longest ray equal to length of pectoral; base of dorsal fin short, $1\frac{1}{5}$ in height of fin; base of anal fin about equal to that of dorsal, longest ray 2 in head; caudal fin widely forked, the lobes $2\frac{2}{5}$ times length of middle rays.

The fins of No. 96, a male, measure as follows: Pectoral, $1\frac{1}{3}$ in head, reaching slightly more than half way to base of ventral; ventrals scarcely shorter than the pectorals and just equaling length of longest dorsal ray; length of dorsal base, $1\frac{2}{5}$ in height of fin; anal base shorter than that of dorsal, about $1\frac{1}{5}$ in longest anal ray.

Color in life: Dull bluish-green above; sides silvery, with minute black specks; white below; tip of nose and mandible black; fins all rich blue-black; pale at base. In some specimens, usually females, the fins are less black, the ventrals and anal sometimes showing scarcely any black. The dorsal, caudal, and usually the pectorals, however, are always more or less black.

The specimens of this species which we have examined are from 13 to 16 inches in length and weighed, when fresh, from two-thirds of a pound to $1\frac{1}{2}$ pounds.

*Table of comparative measurements of specimens of blackfin whitefish (Argyrosomus nigripinnis).*

| No. | Lake where taken. | Date when taken. | Sex and condition. | Length. | Weight. | Head. | Depth. | Eye. | Snout. | Maxillary. | Mandible. | Dorsal. | Anal. | Scales. | Gillrakers. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Number. | In eye. |
| | | | | In. | Oz. | | | | | | | | | | | |
| 81 | Michigan | Nov. 12 | ♂ ripe | 13⅜ | 10— | 4⅛ | 4⅛ | 4⅛ | 4 | 3⅛ | 2 | 10 | 11 | 9-81-8 | 18+33; | 18+33 1 |
| 84 | do | Nov. 12 | ♂ | 12⅜ | 10— | 4⅛ | 4⅛ | 4⅛ | 5 | 3¼ | 2+ | 10 | 12 | 9-76-7 | 17+32; | 16+30 1⅛ |
| 86 | do | Nov. 12 | ♂ | 13¼ | 11— | 4⅛ | 4⅛ | 4⅛ | 4⅛ | 3⅛ | 2+ | 11 | 12 | 8-76-7 | 17+33; | 17+32 1⅛ |
| 87 | do | Nov. 12 | ♂ ripe | 13 | 11+ | 4⅛ | 4+ | 4⅛ | 4⅛ | 3+ | 2+ | 10 | 12 | 8-77-7 | 17+33; | 18+35 1⅛ |
| 89 | do | Nov. 12 | | 15⅛ | 19— | 4⅛ | 4 | 4⅛ | 4⅛ | 3 | 2 | 10 | 11 | 8-77-7 | ..... | 7+31 1⅛ |
| 95 | do | Nov. 18 | ♂ ripe | 15⅛ | 20— | 4⅛ | 4⅛ | 4⅛ | 4⅛ | 3⅛ | 2⅛ | 10 | 11 | 9-78-7 | 16+31; | 17+31 1⅛ |
| 96 | do | Nov. 18 | ♂ spent | 16⅛ | 21— | 4⅛ | 4⅛ | 4⅛ | 4⅛ | 3⅛ | 2⅛ | 10 | 11 | 9-75-8 | 18+32; | 19+34 1⅛ |
| 97 | do | Nov. 18 | ♂ nearly ripe. | 16⅛ | 23— | 4⅛ | 4⅛ | 4⅛ | 4⅛ | 3⅛ | 2+ | 10 | 11 | 8-77-8 | 16+32; | 17+32 1⅛ |
| 98 | do | Nov. 18 | ♀ nearly ripe. | 14⅛ | 18— | 4⅛ | 4 | 4⅛ | 5 | 3+ | 2+ | 11 | 12 | 9-75-8 | 17+34; | 18+31 1 |
| 99 | do | Nov. 18 | ♂ ripe. | 15⅛ | 22 | 4⅛ | 4 | 4⅛ | 4⅛ | 3 | 2 | 10 | 12 | 9-80-8 | 17+31; | 17+31 1⅛ |
| 100 | do | Nov. 18 | ♀ spent. | 14⅛ | 21— | 4⅛ | 4⅛ | 4⅛ | 4⅛ | 3⅛ | 2 | 10 | 11 | 9-76-7 | 17+32; | 17+33 1 |
| 101 | do | Nov. 18 | ♀ spent. | 14¼ | 15 | 4⅛ | 4⅛ | 4⅛ | 4⅛ | 3⅛ | 2 | 10 | 11 | 9-75-7 | 19+34; | 19+34 1⅛ |
| 102 | do | Nov. 18 | ♀ spent. | 14⅞ | 14— | 4⅛ | 4⅛ | 4⅛ | 4⅛ | 3 | 2 | 9 | 11 | 8-78-7 | 18+32; | 17+32 1⅛ |
| 103 | do | Nov. 18 | ♀ spent. | 14⅞ | 17+ | 4⅛ | 4⅛ | 4⅛ | 4⅛ | 3 | 2+ | 10 | 12 | 8-76-7 | 17+33; | 17+33 1⅛ |
| 104 | do | Nov. 18 | ♂ spent. | 14⅛ | 15+ | 4⅛ | 4⅛ | 4⅛ | 5 | 3⅛ | 2+ | 11 | 11 | 8-76-7 | 17+32; | 17+32 1⅛ |
| 105 | do | Nov. 18 | ♂ spent. | 14⅛ | 13+ | 4⅛ | 4⅛ | 4⅛ | 4⅛ | 3⅛ | 2+ | 10 | 11 | 8-75-7 | 18+33; | 18+35 1¼ |
| 106 | do | Nov. 18 | ♀ spent. | 13⅛ | 15— | 4⅛ | ... | 4⅛ | 4⅛ | 3⅛ | 2⅛ | 10 | 12 | ..... | ..... | ..... |
| 43099 | Milton | ..... | ..... | 15½ | .... | 4 | 4 | 4⅛ | .... | 3⅛ | .... | 10 | .... | 9-73-7 | —— | 18+30 1⅛ |
| 43100 | do | ..... | ..... | 16 | .... | 4 | 4 | 4⅛ | .... | 3⅛ | .... | 10 | 12 | 9-77-8 | —— | 17+31 1⅛ |

*Range, habits, etc.*—The blackfin or bluefin whitefish was first brought to public notice at the same time that *Argyrosomus hoyi* was discovered. It was first collected in Lake Michigan, in deep water off Racine, Wis., and first described by Mr. J. W. Milner in the Report of the Com-

missioner of Fish and Fisheries for 1872–73. It is not known from any of the Great Lakes except Michigan. All of the specimens of the so-called bluefin or blackfin of Lake Superior which we have seen are the longjaw (*A. prognathus*).

The only specimens of the blackfin not from Lake Michigan which we have seen, and, indeed, the only ones existing in collections, are two fine examples (Nos. 43099 and 43100, U. S. Nat. Museum) obtained by James R. B. Van Cleave in Miltona Lake, Minnesota, where the fish is reported to be abundant, and two others (Nos. 22117, U. S. Nat. Museum), secured in one of the lakes at Madison, Wis. The Miltona Lake specimens have been described by Dr. Bean (Forest and Stream, June 2, 1894), and we agree with him in regarding them as not different from the Lake Michigan blackfin. The Madison specimens also agree very well with those from Lake Michigan.

The blackfin is probably the most abundant fish of commercial importance in the deeper waters of Lake Michigan. It is found in schools, like other members of the group, and is, at times, at least, associated with lake trout (*Cristivomer namaycush*), longjaws (*A. prognathus*), chubs (*A. hoyi*), and common whitefish (*C. clupeiformis*).

Up to a comparatively recent date very little was recorded about this fish. Specimens were scarce in collections, and in the National Museum at Washington there were only the four specimens mentioned. The absence of recorded data regarding the fish and its scarcity in collections have certainly been due to no lack of abundance of the fish, but rather to the neglect of collectors. As late as 1886, Dr. Goode, in his standard work on American Game and Food Fishes, stated that "at times it comes in considerable numbers to the Chicago market, but it is in general a rare species."

The first detailed reference to the commercial value of this fish and the most complete account of its habits and distribution in Lake Michigan were contained in a report on the Great Lakes for 1885, issued by the United States Fish Commission, based on inquiries made under the direction of Mr. R. Edward Earll.

*Spawning habits.*—The spawning season of the blackfin is the same as that of the common whitefish and the lake herring. The somewhat limited observations thus far made, and the specimens available for examination, indicate a spawning period in November and December. At that time the fish are reported to gather on stony bottom for the purpose of depositing their eggs, while at other seasons they are said to prefer clay bottom. The specimens from Lake Michigan examined by us were received fresh November 15 and 21. They were taken in gill nets off Sheboygan on or about November 12 and 18, and examination showed them to be ripe or nearly ripe with spawn; indeed, some were partially spent.

The blackfin is found in the deep water at all seasons, although during part of the year it frequents relatively shallow water. About

the first part of November the fish begins to withdraw from the deepest water of the lake and may be taken at depths of 60 to 80 fathoms. The number of fish in water of that depth increases with the advance of winter, and when fishing is brought to a close by the formation of ice the fish are at the height of their abundance. When the ice breaks up between February and April the fish begin to move into deeper water, and by May fishing is done in water 100 or 110 fathoms deep. During the warmer months this is about the minimum depth at which the blackfins are regularly found.

A favorite resort for the blackfin is Mud Hole, a large depression in the bottom of the lake, located about 20 miles east of Sheboygan; it is 7 or 8 miles square and about 90 fathoms deep. Another ground that is frequented by large bodies of blackfins is Grand Traverse Bay, on the east side of Lake Michigan.

### 17. Argyrosomus tullibee (Richardson).

TULLIBEE; MONGREL WHITEFISH.

*Salmo* (*Coregonus*) *tullibee* Richardson, Fauna Bor.-Amer., III, 201, 1836, Cumberland House, Pine Island Lake.

*Description.*—Head, 4 to 4½; depth, 3 to 3⅗; eye, 4 to 5; snout, about 5. Dorsal fin with about 11 developed rays, the number varying from 10 to 12; anal, 11 or 12. Maxillary, 3½ in head; mandible, 2 to 2¼; scales, 9–68 to 71–8; gillrakers, 16 to 18+30 to 34; 1–1½ in eye.

Body short and deep, compressed, the dorsal and ventral outlines similarly curved. Head small, conic and compressed; mouth large, lower jaw projecting; middle of upper lip on a level with middle of pupil, maxillary long, moderately broad, reaching anterior edge of pupil, the width about one-third its length; supplemental maxillary bone well developed, nearly half length of maxillary, its width 2¾ times in its length; mandible long, reaching posterior edge of pupil. Distance from tip of snout to occiput half that from occiput to origin of dorsal fin, which is midway between tip of snout and base of caudal fin. Caudal peduncle short, compressed and deep, its least depth about 2¼ in head. Fins rather large; height of dorsal, 1⅕ in head; base of fin, 1⅗ in longest ray; anal base very oblique, equal to length of longest ray, which is about equal to base of dorsal fin; pectorals and ventrals long, almost equal to height of dorsal. Scales firm, considerably enlarged anteriorly; free margin of scales less convex than in other species, often emarginate, especially on anterior part of body; lateral line straight and in a line with upper rim of orbit. Tongue with a patch of fine teeth near the tip. Gillrakers numerous, long and slender, the number varying from 47 to 52. Color iridescent bluish above, sides and under parts silvery; older individuals darker above and with more golden reflection on sides; fins all more or less evidently black-tipped; upper edge of pectoral margined with black.

*Table of comparative measurements of specimens of tullibee (Argyrosomus tullibee).*

| Number. | Where taken. | Length. | Head. | Depth. | Eye. | Snout. | Maxillary. | Mandible. | Dorsal. | Anal. | Scales. | Gillrakers. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Number. | In eye. |
| | | In. | | | | | | | | | | | |
| 115 | Lake of the Woods | 12 | 4½ | 3⅛ | 4 | 5 | 3⅜ | 2½ | 11 | 12 | ..... | 18+33; 18+34 | 1½ |
| 116 | do | 8 | 4⅝ | 3⅛ | 4 | 5 | 3½ | 2⅝ | 12 | 13 | 9-71-8 | 16+34; 18+33 | 1⅜ |
| 117 | do | 8 | 4 | 3⅜ | 4— | 5 | 3½ | 2+ | 12 | 12 | 9-70-8 | 17+30; 17+31 | 1½ |
| 118 | do | 7¾ | 4 | 3+ | 4 | 5 | 3⅜ | 2+ | 10 | 11 | 9-71-8 | 16+33; 16+32 | 1⅜ |
| 119 | do | 6¾ | 4 | 3⅜ | 4— | 5 | 3½ | 2⅛ | 11 | 12 | 9-70-8 | 17+32; 17+31 | 1⅜ |
| 64 | do | 14 | 4½ | 3— | 4⅞ | 4⅝ | 3⅜ | 2+ | 12 | 12 | 9-68-8 | ..... | ..... |
| 66 | do | 16½ | 4⅝ | 3 | 5+ | 5 | 3⅜ | 2⅛ | 11 | 11 | 9-68-8 | 16+31; 16+32 | 1 |

This species was originally described in 1836 by Richardson, from Pine Island Lake, at Cumberland House, British America. Since then it has been recorded from the following places: Albany River district, Hudson Bay (Richardson, 1836); Lake Superior (Agassiz, 1850); Albany River, Günther, 1866; Lake Superior (Jordan, 1878); Lake Erie (Jordan, 1878 and 1882); Lake Michigan (Jordan & Evermann, 1886); lower end of Lake Erie (Forest and Stream, 1890); Qu'Appelle River (Forest and Stream, 1892); and North Minnesota (Blackford, U. S. N. M.). It is also known from Lake of the Woods, Lake Winnipeg, and Manitoba.

The tullibee attains a length of 18 to 20 inches and a weight of 3½ pounds. Its food value is high, but its commercial importance is as yet very limited. In none of the Great Lakes is the fish at all common, but in the Lake of the Woods it is quite abundant and considerable quantities are taken and shipped to Sandusky. In the provinces of Assiniboia and Manitoba the fish is taken in large numbers for local consumption, with gill nets and in traps made of brush and stones.

But little is definitely known of the spawning habits of the tullibee. Mr. F. C. Gilchrist, of Fort Qu'Appelle, writing in Forest and Stream concerning this fish, as observed by him in the lakes of the Western Territories of Canada, says:

> In September they will again be found gradually nearing the shoal water, feeding heavily, and plump with fat and the now swelling ovaries. Later on they appear to eat little or nothing and devote all their time to playing until about the 25th of October, when they have settled down to the business of propagation, which they have finished by November 10. They prefer shallow water close to shore with clean sand to spawn on, and during the day they may be seen in pairs and small schools, poking along the shores, but at night they come in thousands and keep up a constant loud splashing and fluttering, very strange and weird on a calm night. Two years ago I carefully counted the ova from a ripe fish 2½ pounds in weight, and found there were 23,700, closely resembling whitefish eggs in appearance, but somewhat smaller. After spawning the fish are very thin, lank, dull in color, and quite unfit for human food.

In a recent article entitled "Whitefish culture in New York," published in the New York Fishing Gazette, Dr. Bean records the taking of a specimen of tullibee in Lake Onondaga, New York, where the species is abundant but has apparently not been previously recognized. The fish was a male, 18½ inches long, and was obtained in November by

Mr. James Annin, jr., State superintendent of fish-culture, who furnished the following notes on the tullibee in this lake:

In regard to the spawning habits of the Onondaga Lake whitefish, they are spawning at present at Onondaga Lake. They generally commence running up onto the shoals about November 15, and the season extends into December. They come up to the banks or gravelly shoals and spawn in from 3 to 6 and 7 feet of water. They have never been caught with hook in this lake, and an old fisherman told me that he had tried almost every kind of bait, and had used the very finest gut and the smallest hooks baited with *Gammarus* (fresh-water shrimp) and other kinds of natural food—that is, he supposed the food was natural to them. At the same time he claims he could see them in large schools lying in the water 8 or 10 feet from the surface.

### 17a. Argyrosomus tullibee bisselli (Bollman).

BISSELL'S TULLIBEE.

*Coregonus tullibee bisselli* Bollman, Bull. U. S. Fish Comm., VIII, 1828, 223, Rawson and Howard lakes, Michigan. (Type, No. 40619.)

Similar to *A. tullibee*, but with maxillary reaching to middle of eye, and with 80 to 82 scales in lateral line. End of supplemental maxillary bone rounded. Lower jaw projecting when closed. Supraorbital bone elongate pear-shaped. Head, $4\frac{1}{3}$ to $4\frac{1}{2}$; depth, $3\frac{1}{2}$; eye, $4\frac{1}{2}$ to $4\frac{2}{3}$. Scales anteriorly scarcely larger than those on caudal peduncle. This variety of *tullibee* is known from small lakes in southern Michigan and bears the same relation to the typical *tullibee* that *A. artedi sisco* does to the lake herring. Nothing has been recorded concerning its size, abundance, and habits.

### COMMON NAMES OF THE WHITEFISHES.

A great deal of misapprehension exists among fishermen, dealers, and others regarding the identity of even the common species of whitefishes, and a large variety of common names is employed to designate the different fishes in the same and different localities. During the recent investigations of the fish and fisheries of the Great Lakes by the United States Fish Commission, a special effort was made to learn the common names by which each of the whitefishes is known to the fishermen about the different lakes. It became apparent very soon, not only that the same species is known by a great variety of names in the different parts of its range, but that in a number of places a single species is known by several common names; and, what is still more confusing, the same common name is, in different localities, applied to two or more entirely different species.

As illustrating the improper use of common names we may take the name "whitefish" or "common whitefish." In Lake Champlain "whitefish" is one of the common names applied to either *Coregonus clupeiformis* or *C. labradoricus*. In all of the Great Lakes it is correctly applied to *C. clupeiformis*, though occasionally about Lake Huron and

Lake Superior it is used for *C. labradoricus*, while in the Lake of the Woods "whitefish" may mean either *Argyrosomus tullibee* or *C. labradoricus*, or possibly *C. clupeiformis*. Again, the "cisco" of Lake Ontario is *A. artedi*, which is the "herring" of Lake Erie, or the "shore herring" or "greenback herring" of Lake Michigan. At Whitefish Bay, Lake Superior, the name "cisco" is sometimes applied to *C. quadrilateralis*. At some places in Lake Superior "cisco" means *A. prognathus*, and in Lake Michigan it may refer to *A. hoyi*. The name "herring" or "lake herring" is generally applied to *A. artedi*, but in Lake Michigan *A. hoyi* is known by the same designation. Such names as "shad," "chub," "pilot-fish," and "shiner," when given to species of whitefish, afford no clue to the identity of the fish and illustrate the confused popular nomenclature.

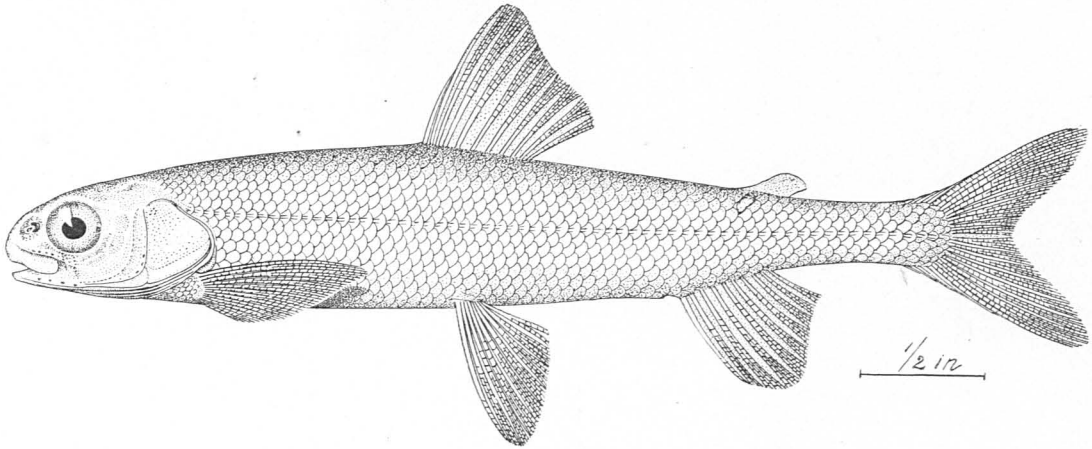
In order to facilitate to some extent the identification of the various whitefishes by persons not conversant with the subject, the common names in use have been brought together in the following list. In the first column we give the common or local name; in the second, the place where used, and in the third the scientific name. The absence of an assigned locality indicates either that the common name is not used among the fishing population (as, for instance, Nelson's whitefish), or that the common name is in more or less general use.

*Classified list of the common names applied by fishermen and others to the different species of whitefish.*

| Common name. | Where used. | Scientific name. |
|---|---|---|
| Attihawmeg | Northern lakes | Coregonus labradoricus. |
| Blackfin, or blackfin whitefish | Lake Michigan | Argyrosomus nigripinnis. |
| Blackback | do | C. quadrilateralis. |
| Bloat | Lake Huron; Lake Ontario | A. prognathus. |
| Bloater, or bloater whitefish | Lake Ontario; Lake Superior | Do. |
| Blueback, or blueback herring | Lake Ontario; Lake Michigan | A. artedi. |
| Bluefin, bluefin whitefish | Lake Michigan | A. nigripinnis. |
| Bowback, or bowback whitefish | Lake Superior | C. clupeiformis. |
| Broad whitefish | | C. kennicotti. |
| Buffalo-back whitefish | Lake Superior | C. clupeiformis. |
| Chateaugay shad | Chateaugay Lake | C. quadrilateralis. |
| Chivey | Maine | Do. |
| Chub | Lake Michigan | A. hoyi. |
| Cisco (or Sisco) | Lake Ontario; Lake Erie | A. artedi. |
| Do | Lake Michigan | A. hoyi. |
| Do | Lake Superior; Lake Ontario | A. prognathus. |
| Do | Lake Superior | C. quadrilateralis. |
| Do | Lake Tippecanoe | A. artedi sisco. |
| Ciscoette | Lake Erie (trade name for large herring). | A. artedi. |
| Do | Lake Ontario (trade name) | A. prognathus. |
| Common whitefish | | C. clupeiformis. |
| Coulter's whitefish | | C. coulterii. |
| Cross whitefish | Lake Ontario | A. prognathus. |
| Deep-water herring | Lake Michigan | A. hoyi. |
| Deep-water whitefish | Lake Superior | A. prognathus. |
| Fresh-water herring | Payette Lake, Idaho | C. williamsoni. |
| Frostfish | Adirondack Mountains; Lake Champlain. | C. quadrilateralis. |
| Gizzard-fish | St. John's River, N. B. | C. labradoricus. |
| Grayback, or grayback herring | Lake Ontario | A. artedi. |
| Greenback, or greenback herring | Lake Ontario; Lake Michigan | Do. |
| Herring | | Do. |
| Do | Idaho | C. williamsoni. |
| Do | Great Bear Lake | A. lucidus. |
| Do | Lake Michigan | A. hoyi. |

*Classified list of the common names applied by fishermen and others to the different species of whitefish*—Continued.

| Common name. | Where used. | Scientific name. |
|---|---|---|
| Highback whitefish | Lake Superior | C. clupeiformis. |
| Hoy's whitefish | | A. hoyi. |
| Humpback whitefish | | C. nelsonii. |
| Do | Lake Superior | C. clupeiformis. |
| Hybrid whitefish | Lake Superior; Lake of the Woods | C. labradoricus. |
| Kiyf or kieye | Lake Michigan | A. hoyi. |
| Kennicott's whitefish | | C. kennicotti. |
| Labrador whitefish | | C. labradoricus. |
| Lake herring | | A. artedi. |
| Lake whiting | | C. labradoricus. |
| Lauretta whitefish | | A. laurettæ. |
| Least whitefish | | A. pusillus. |
| Little whitefish | Lake Superior | A. prognathus. |
| Longjaw, or longjaw whitefish | Lake Ontario; Lake Huron; Lake Michigan; Lake Superior. | Do. |
| Longjaw | Lake Superior; Lake of the Woods | C. labradoricus. |
| Menominee, or Menominee whitefish | Lake Superior; Lake Michigan | C. quadrilateralis. |
| Michigan herring | Lake Michigan | A. artedi. |
| Mongrel whitefish | | A. tullibee. |
| Do | Lake Superior; Lake of the Woods | C. labradoricus. |
| Mooneye | Lake Michigan | A. hoyi. |
| Mooneye cisco | do | Do. |
| Mountain herring | Utah; Idaho | C. williamsoni. |
| Musquaw River whitefish | | C. labradoricus. |
| Nelson's whitefish | | C. nelsonii. |
| Onondaga Lake whitefish | Onondaga Lake, N. Y | A. tullibee. |
| Ontario whitefish | Lake Ontario | A. prognathus. |
| Otsego bass | Otsego Lake; New York | C. clupeiformis. |
| Pilot-fish | Lake Champlain | C. quadrilateralis. |
| Poisson pointu | French Canadians | C. labradoricus. |
| Richardson's whitefish | | C. richardsonii. |
| Rocky Mountain whitefish | | C. williamsoni. |
| Round whitefish | | C. quadrilateralis. |
| Sault whitefish | | C. labradoricus. |
| Shad | Lake Champlain | C. quadrilateralis. |
| Do | Lake Champlain; Lake Memphremagog. | C. labradoricus. |
| Shadwaiter | Lake Winnipiseogee | C. quadrilateralis. |
| Do | Lake Champlain; Lake Memphremagog. | C. labradoricus. |
| Shiner | Lake Michigan | A. hoyi. |
| Shore herring | do | A. artedi. |
| Silver whitefish | Lake Ontario | A. prognathus. |
| Sisco (see Cisco) | Lake Tippecanoe | A. artedi sisco. |
| Siscowet | Lake Erie (trade name for large herring). | A. artedi. |
| Do | Lake Ontario (trade name) | A. prognathus. |
| Small whitefish | | A. pusillus. |
| Smelt | New York lakes | A. osmeriformis. |
| Tullibee | Lake Superior; Lake of the Woods; Lake Winnepeg, Assinniboia. | A. tullibee. |
| Whitefish | Idaho | C. williamsoni. |
| Do | Lake of the Woods | A. tullibee. |
| Do | | C. clupeiformis. |
| Do | Lake of the Woods; Grand lakes, Maine; Lake Champlain. | C. labradoricus. |
| Do | Maine; New Hampshire | Do. |




COREGONUS COULTERII Eigenmann & Eigenmann. *Coulter's Whitefish.*

From a specimen, 4⅛ inches long, one of the types, collected in Kicking Horse River, at Field, British Columbia.

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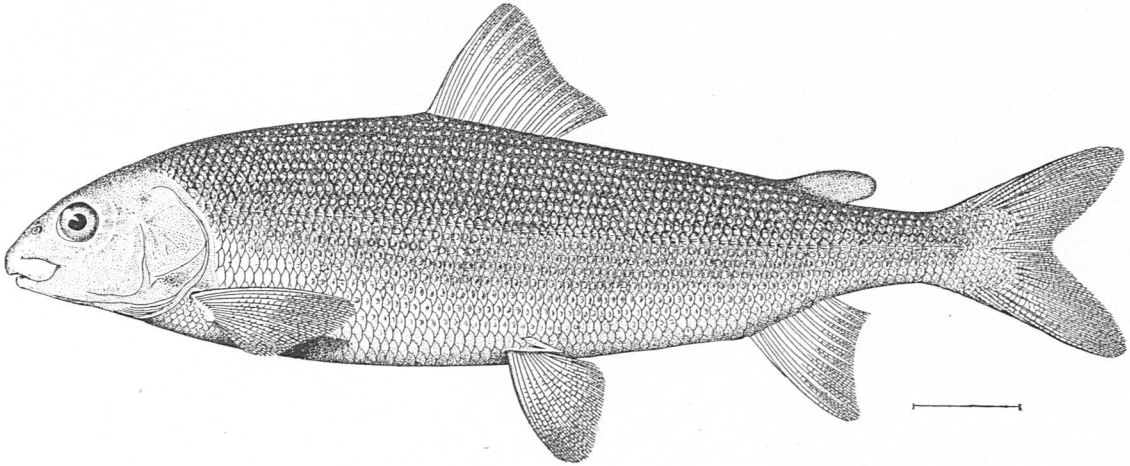
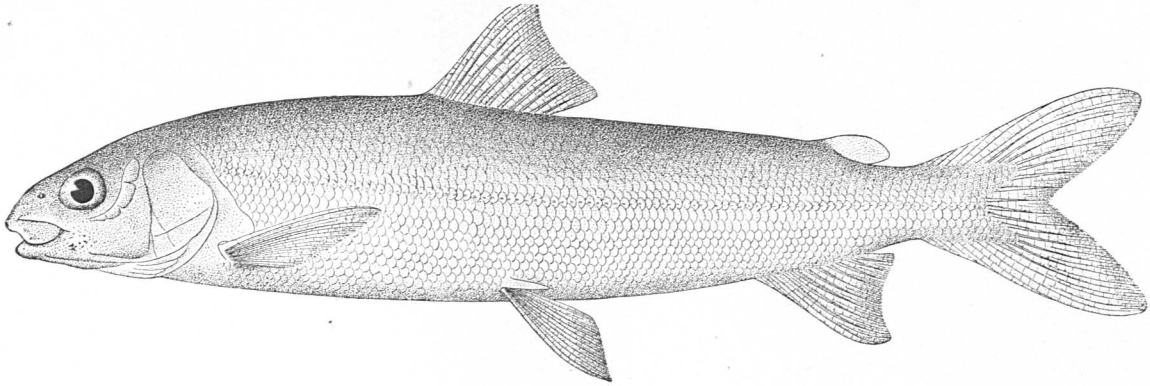


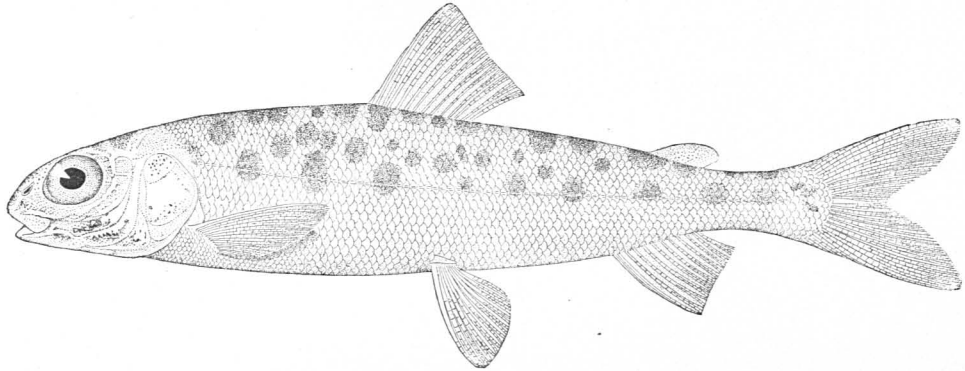
COREGONUS WILLIAMSONI Girard. *Williamson's Whitefish.*

From a breeding male, 11 inches long, collected in Little Spokane River, Washington.



COREGONUS WILLIAMSONI CISMONTANUS Jordan. *Mountain Whitefish.*

From a specimen, about 11 inches long, collected in Horsethief Springs Creek, Montana.



COREGONUS WILLIAMSONI Girard. *Williamson's Whitefish.*

*From a young specimen, 3 inches long, showing parr-marks, collected in Little Blackfoot River, Elliston, Montana.*

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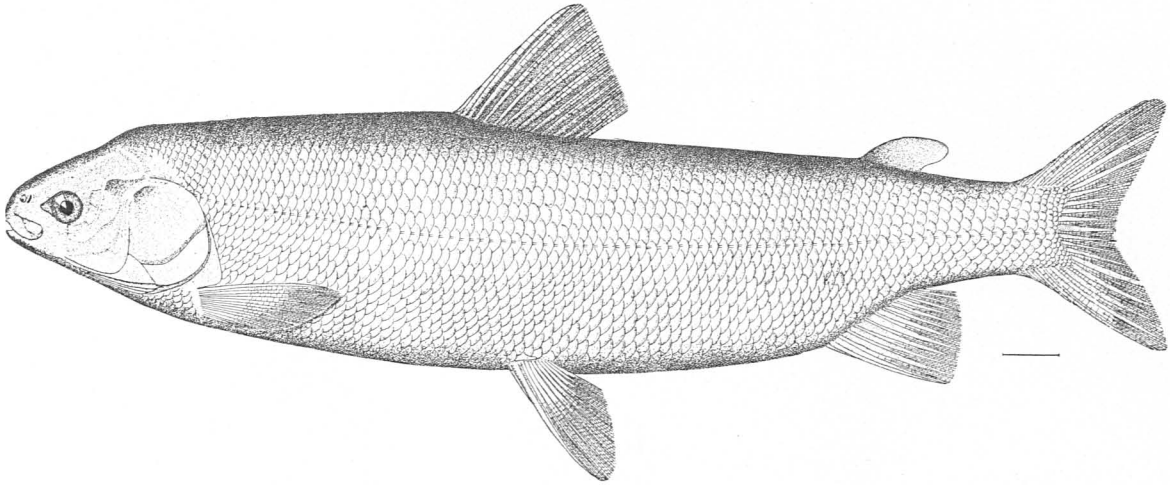

COREGONUS KENNICOTTI Milner. *Kennicott's Whitefish.*

From a specimen, 20 inches long, collected in Meade River, Alaska.

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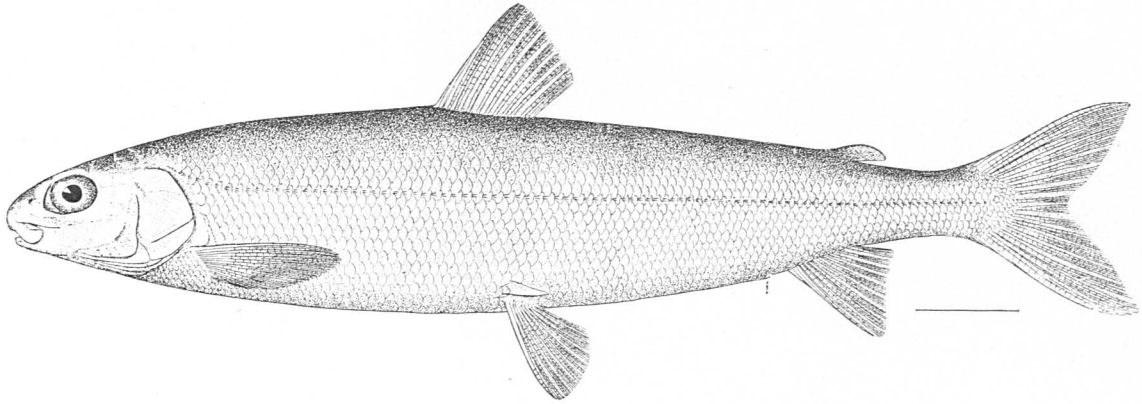

COREGONUS QUADRILATERALIS Richardson. *Round Whitefish.*

From a specimen, 11 inches long, collected in Lake Winnipiseogee, New Hampshire.

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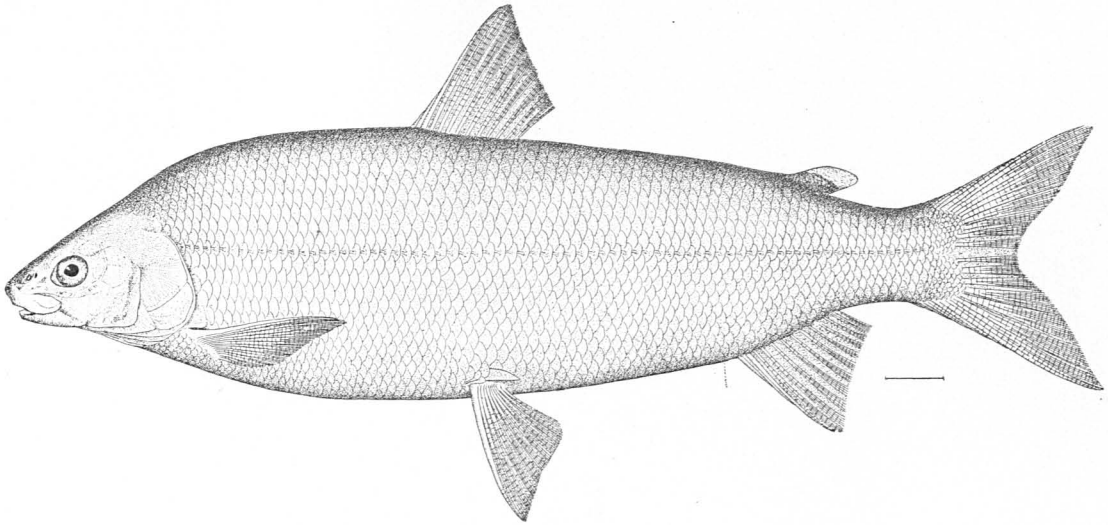

COREGONUS CLUPEIFORMIS (Mitchill). *Common Whitefish.*

From a specimen, 19 inches long, collected in Detroit River, near Ecorse, Michigan.

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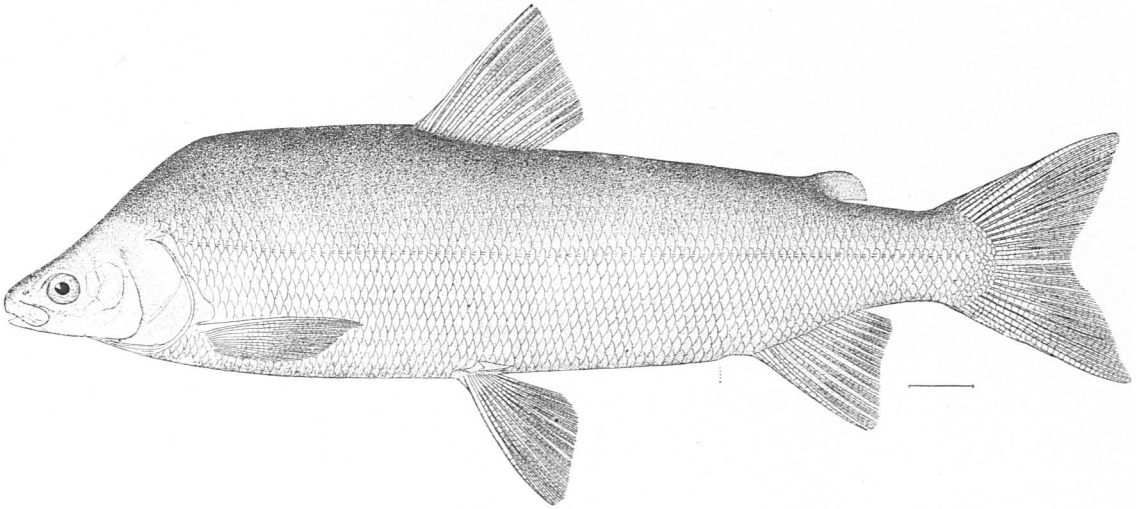

COREGONUS NELSONII Bean. *Nelson's Whitefish.*

From the type, a specimen 18 inches long, collected at Nulato, Alaska.

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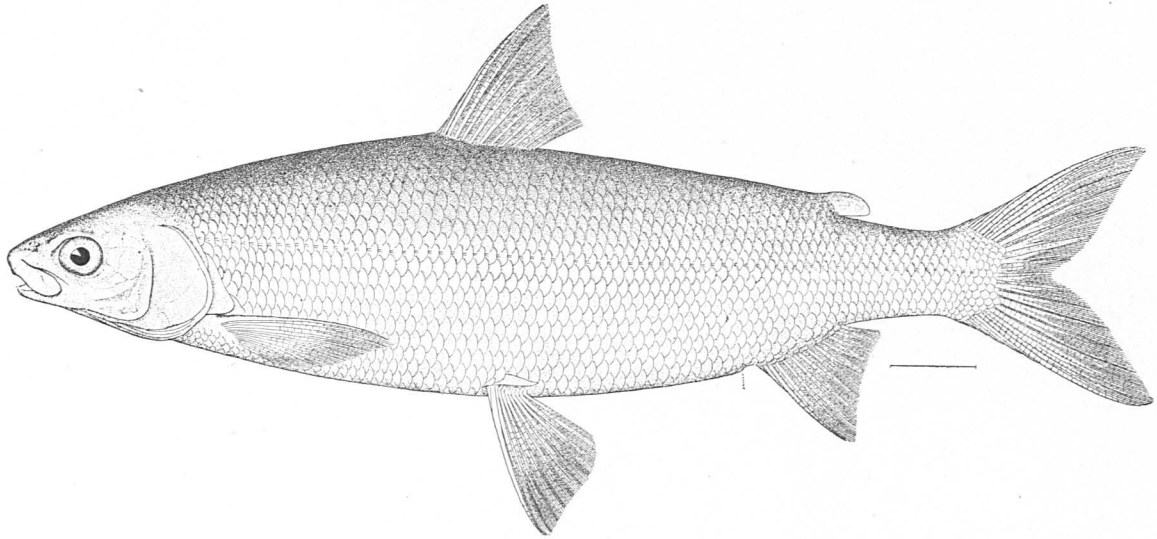
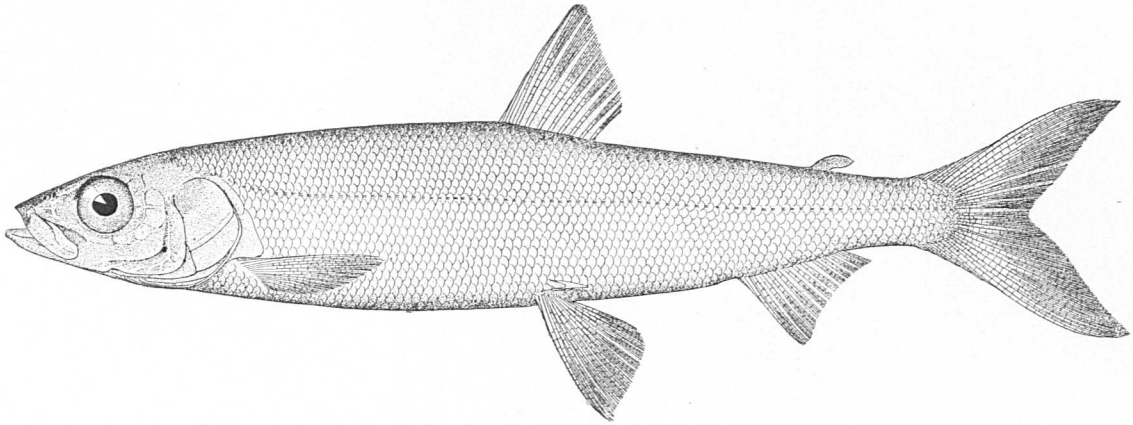


COREGONUS LABRADORICUS Richardson. *Labrador Whitefish.*

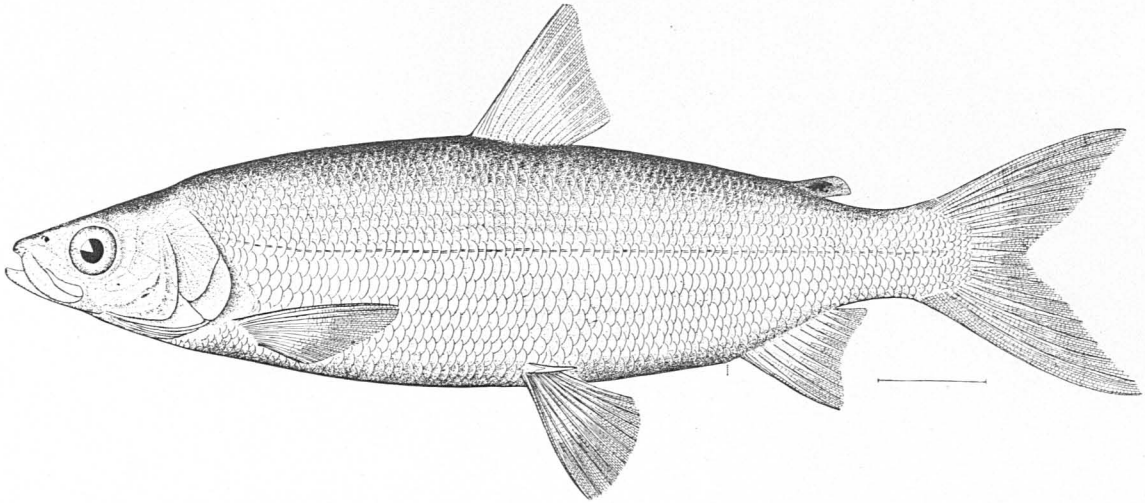
From a specimen, 13½ inches long, collected in Grand Lake Stream, Maine.



ARGYROSOMUS OSMERIFORMIS (H. M. Smith). *Smelt.*

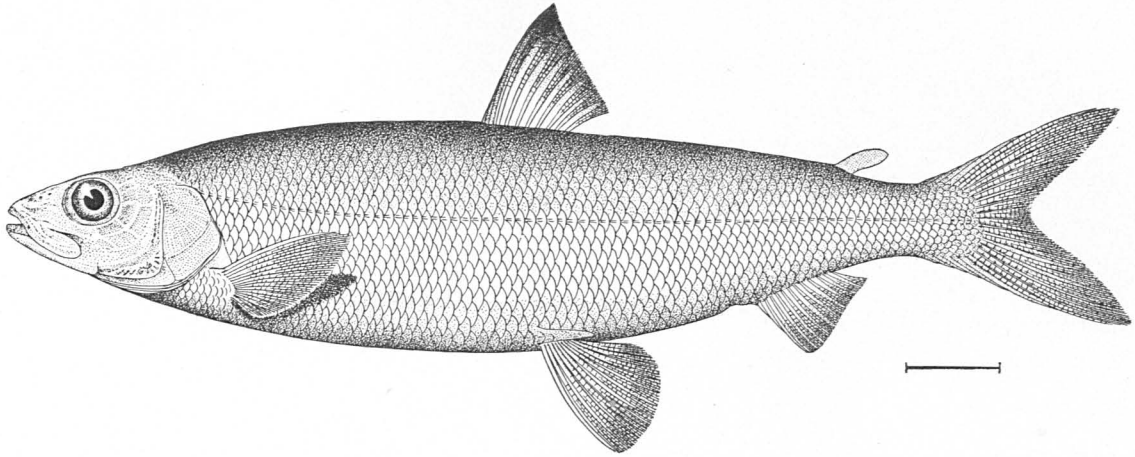
From the type, a specimen 10 inches long, taken in Seneca Lake, New York.

Report U. S. F. C. 1894. (To face page 324.)



ARGYROSOMUS ARTEDI (Le Sueur). *Lake Herring.*

From a specimen, 11 inches long, collected in Lake Superior, near Bayfield, Wisconsin.



ARGYROSOMUS HOYI Gill. *Hoy's Whitefish; Kiyi.*

From a nearly ripe male, 12 inches long, collected in deep water in Lake Michigan, off Kenosha, Wisconsin.

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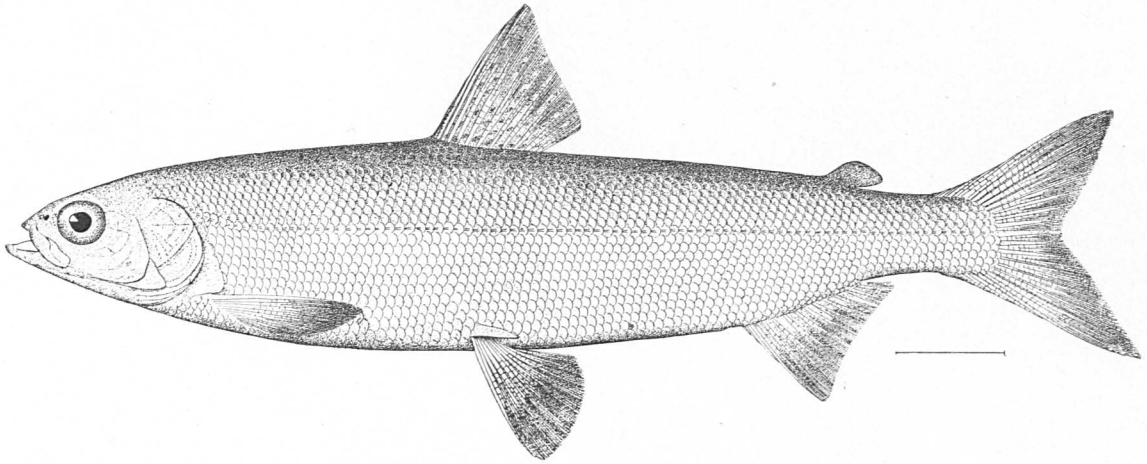
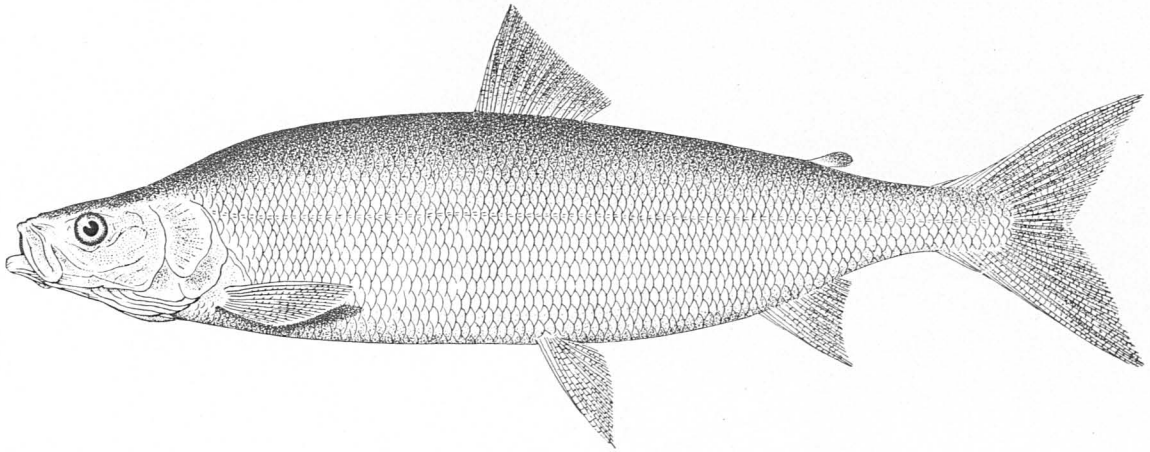


ARGYROSOMUS PUSILLUS (Bean). *Least Whitefish.*

From a specimen, 10 inches long, collected in northern Alaska.



ARGYROSOMUS LUCIDUS (Richardson). *Great Bear Lake Herring.*

Adapted from Richardson's figure of the type, collected in Great Bear Lake.

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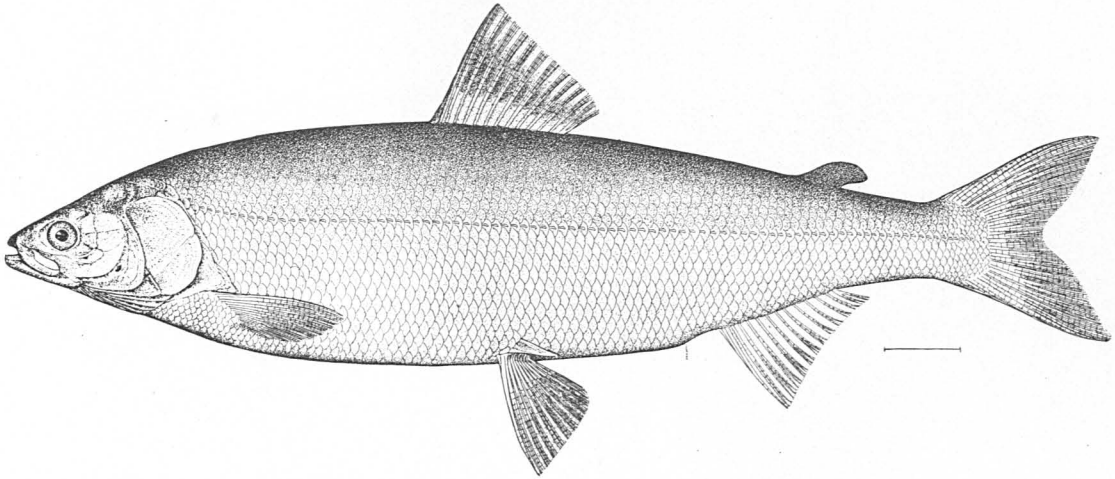
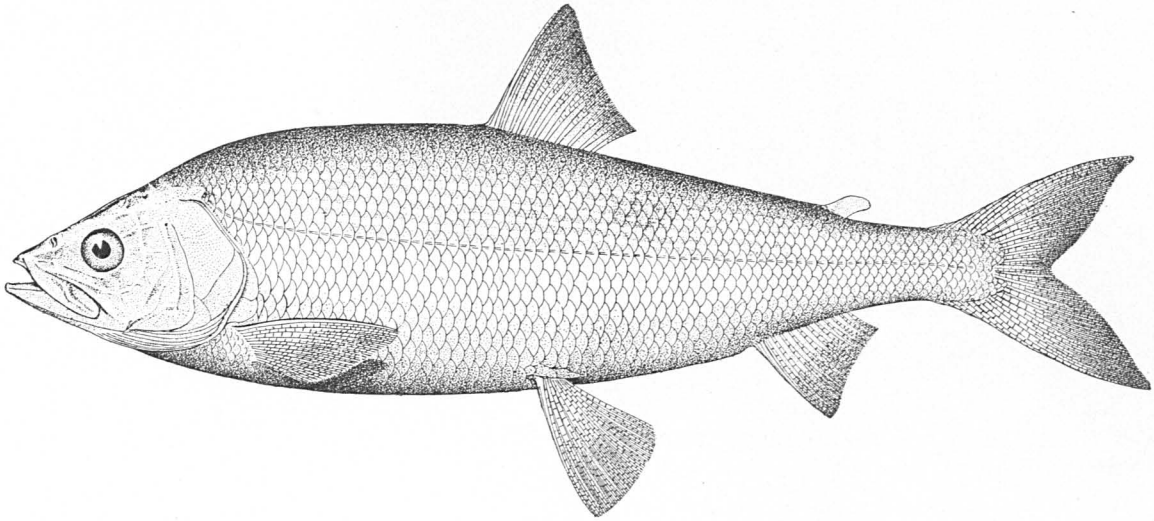


ARGYROSOMUS LAURETTÆ (Bean). *Lauretta Whitefish.*

From the type, a specimen 15 inches long, collected at Point Barrow, Alaska.



ARGYROSOMUS PROGNATHUS (H. M. Smith). *Longjaw Whitefish.*

From the type, a specimen 15 inches long, taken in Lake Ontario in 40 fathoms of water, off Wilson, New York.

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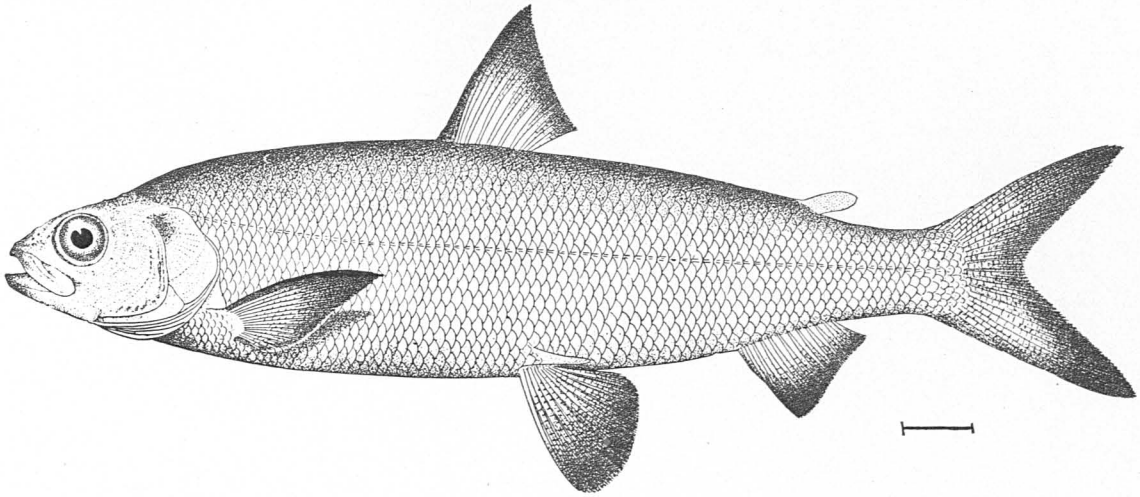

ARGYROSOMUS NIGRIPINNIS Gill. *Blackfin.*

From a nearly ripe male, 16¼ inches long, caught in Lake Michigan in 90 fathoms of water, off Sheboygan, Wisconsin.

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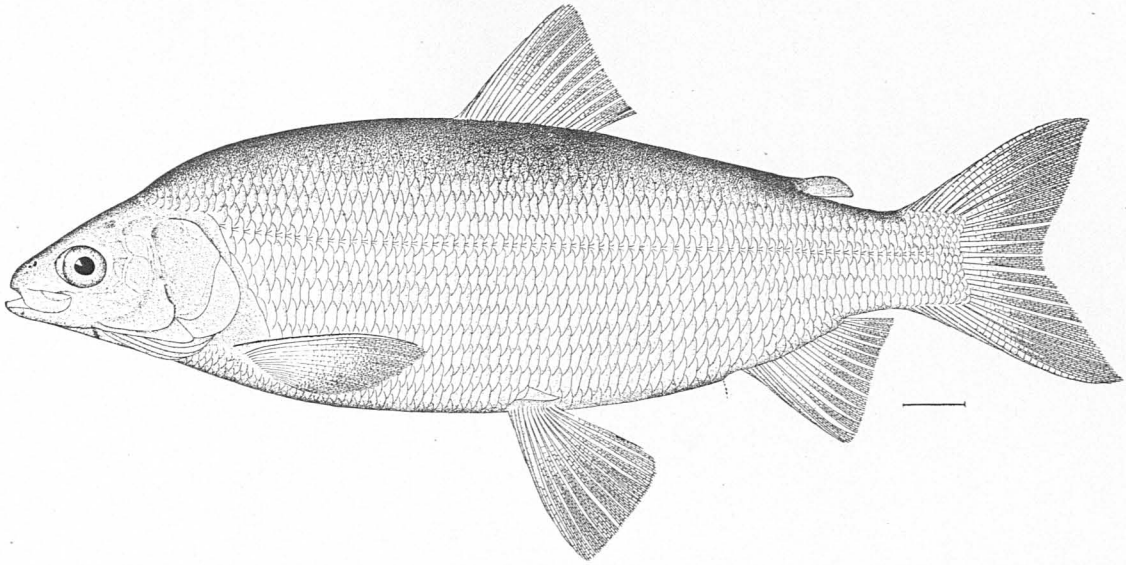

ARGYROSOMUS TULLIBEE (Richardson). *Tullibee.*

From a specimen 18 inches long, probably from Minnesota.

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# 5.—A REPORT UPON THE FISHES OF THE MISSOURI RIVER BASIN.

By Barton W. Evermann and Ulysses O. Cox.

## INTRODUCTION.

The investigations upon which this report is primarily based were provided for by two items in the sundry civil bill approved August 5, 1892. First, "for investigation and report respecting the advisability of establishing fish-hatching stations at suitable points in the States of South Dakota, Iowa, and Nebraska, $1,000, or as much thereof as may be necessary"; and second, "for investigation and report respecting the advisability of establishing a fish-hatching station at some suitable point in Wyoming, $400."

The conditions which determine the desirability of locating one or more fish-hatcheries in these States made it expedient to conduct each investigation as being a part of one general inquiry. It was wholly impracticable to separate them or to consider their results as pertaining alone to Wyoming on the one hand, or to Iowa, South Dakota, and Nebraska, on the other. They were, therefore, conducted with reference to the general fish-cultural needs of the entire group of north-central States west of the Mississippi River.

It became apparent, early in the consideration of the matter, that the greatest need of this region, so far as fish-culture is concerned, is a station for the hatching and rearing of the various pond and river fishes. With the exception of a few streams in northeastern Iowa, two or three small creeks in northern Nebraska, and the Black Hills streams in South Dakota, the waters of these three States are not adapted to trout. The streams of Wyoming which are suitable for trout are, with few unimportant exceptions, confined to that portion west of the Powder River and north of the Sweetwater. This is a region which can probably be best reached and stocked with trout from the station now being established at Bozeman, Montana.

It therefore appears that if but one station is established for these States it should be chiefly devoted to the hatching and rearing of the species of fishes which are indigenous to the waters of this region, and that the best location, geographically, would be somewhere in South Dakota, Nebraska, or Iowa. If it should be regarded as desirable to establish at any time a second station in these States it might very well be a trout station, and should be located in or near the Black Hills. If

but one station is established it should be a composite station, or one which, though chiefly devoted to pond and river fishes, could also engage in trout culture to some extent.

## SUMMARY OF REPORT.

These investigations were begun in the fall of 1892 (October 6 to November 2), but owing to cold weather the work was suspended the first week in November, and was not taken up again until June, 1893. The work done in 1892 was carried on by Professor Evermann, assisted by Mr. Lewis M. McCormick, formerly of Oberlin College, now of the Glen Island Museum, New York.

### ITINERARY, 1892.

Oct. 6. Began work at Deadwood, S. Dak.
7. Drove to Spearfish and examined Spearfish Creek and numerous springs in vicinity.
8. Drove from Spearfish to Boulah, Wyo.; examined Cook's Pond, Chicken and Crow creeks, Cox and Montana lakes, and Sand and Redwater creeks.
9. Returned to Deadwood.
10. Went to Lead City and examined Whitewood Creek and Gold Run.
11. Went to Belle Fourche, examined the waters in that vicinity, and seined Belle Fourche River.
12. Seined Redwater and Middle creeks and returned to Deadwood.
13. Went to Crystal Cave, S. Dak.
14. Examined Elk Creek, then went to Rapid City, S. Dak.
15. Examined Rapid Creek, Cleghorn's and Miller's springs, and went to Hot Springs.
16. At Hot Springs.
17. Drove to Cheyenne Falls.
18. Examined Fall River and various springs about Hot Springs and went to Edgemont.
19. Examined Cottonwood Creek and Cheyenne River.
Oct. 20. Went to Newcastle, Wyo., and examined Salt and Beaver creeks.
21. Went to Ardmore, S. Dak., where we seined Hat Creek; took night train for Ravenna, Nebr.
22. Seined Mud Creek and South Loup River at Ravenna.
23. Took train for Lincoln.
24. Spent at Lincoln and vicinity.
25. Went to South Bend and examined Nebraska fish-hatchery there. Returned to Lincoln in the evening.
26. Went to Crete and examined Blue River. Took night train for Albia, Iowa.
27. Went to Lovilla, Iowa, where we examined Bluff Creek.
28. Went to Ames, Iowa.
29. Examined springs and streams near Ames.
30. At Ames. Went to Cedar Rapids, Iowa, at night.
31. Examined springs in the vicinity of Cedar Rapids.
Nov. 1. Went to Spirit Lake, Iowa.
2. Cold weather having set in, we decided to close the work here, and returned to Washington.

The work was resumed June 16, 1893, and carried on for several weeks, under the immediate direction of Professor Evermann, who was assisted by Prof. U. O. Cox, teacher of biology in the State Normal School at Mankato, Minn., Mr. Cloudsley Rutter, then of Long Pine, Nebr., now a student at Stanford University, and Prof. Robert G. Gillum, professor of chemistry and physics in the Indiana State Normal School. During the time that Professor Evermann was unable to remain with the party Mr. Cox was placed in charge.

The examination and determination of the physical and biological features of the streams of these States was made an important part of these investigations, and it was this phase of the work to which Mr. Cox and his assistants chiefly directed their attention. The work in Iowa was done by Professor Evermann alone, and was in most part devoted to the examination of springs and the smaller streams.

ITINERARY, 1893.

June 16. Messrs. Cox and Rutter began the work at Mitchell, S. Dak.
17. Examined the Dakota River, Rock Creek, and Firesteel Creek, near Mitchell.
18. Made collections in Enemy Creek, near Mitchell.
19 to 21. Spent in making further investigations on Dakota River and Rock Creek.
22. Professor Evermann joined the party. Went to Chamberlain, S. Dak.
23. Drove north of Chamberlain and examined Crow and Smith creeks.
24. Drove 15 miles southwest of Chamberlain and examined White River.
25. Sunday. Spent the day at Chamberlain.
26. Went from Chamberlain to Scotland, S. Dak., where we examined Prairie Creek; went to Springfield, S. Dak., in the evening.
27. Drove northwest of Springfield and examined Emanuel and Choteau creeks; then to Running Water, S. Dak., where we crossed the Missouri River and went to Niobrara, Nebr.
28. Went 3 miles west of Niobrara to Ponca Creek; examined it and Niobrara River, then drove east to Bazile Creek, which we examined; went to Verdigris, Nebr., in the evening.
29. Examined the Verdigris River and a small creek near Verdigris, and in the afternoon went to Creighton, Nebr., where we examined a large pond.
30. Drove to Bazile Mills, where we examined Spring Creek; then took train to Norfolk Junction, and fished Elkhorn River and Norfolk Creek.

July 1. Messrs. Cox and Rutter went to Ewing, Nebr., where they examined the Elkhorn River and other waters in that vicinity. In the evening they went to Long Pine, Nebr. Prof. Evermann examined springs near Council Bluffs, Iowa.
3 and 4. Messrs. Cox and Rutter examined streams about Long Pine, and were rejoined on the 4th by Messrs. Evermann and Gillum.
5 and 6. Examined various streams and springs about Long Pine.
7. Professor Evermann left the party here and went to Lake Erie; the others drove south of Long Pine and examined Lake George and Carp Lake, returning to Long Pine on evening of the 8th.
9. Went from Long Pine to Valentine, Nebr.
10. Fished the Niobrara River, Minnechaduza Creek, and another small creek near Valentine. Left in the evening for Chadron, Nebr.
11. Examined White River, Chadron Creek, and Lone Tree Creek near Chadron.
12. Went by rail to Casper, Wyo.
13. Examined the North Platte and a small creek at Casper.
14. Went from Casper to Glenrock, Wyo., and examined Deer Creek and North Platte River.
15. Went to Douglas, Wyo., and examined the North Platte at that place.
16. Sunday, spent at Douglas.
17. Went to Crawford, Nebr.
18. Went to Sheridan, Wyo.
19. Examined Big Goose Creek at Sheridan, and left in the afternoon for a three days' wagon trip to the mountains.

ITINERARY, 1893—Continued.

July 20. Investigated Tongue River.
21. Investigated Big Goose Creek.
22. Went to Little Goose Creek and returned to Sheridan.
23. Sunday, spent at Sheridan.
24. Left for Arvada, Wyo., Mr. Rutter stopping at Clermont to fish Clear Creek; fished Powder River at Arvada.
25. Went to Newcastle, Wyo.
26. Examined Salt and Beaver creeks near Newcastle, and went to Edgemont, S. Dak., in the evening.
27. Fished Cheyenne River and went to Hot Springs, S. Dak., where Prof. Evermann rejoined the party.
28. Examined Fall and Cheyenne rivers. Messrs. Evermann and Rutter left the party here and went to Cheyenne, Wyo., then to Idaho to take up work in Columbia River basin. Messrs. Cox and Gillum went to Buffalo Gap, S. Dak.
29. Fished Beaver Creek at Buffalo Gap and returned to Hot Springs at night.
30. Sunday, spent at Hot Springs.
31. Went from Hot Springs to Custer, S. Dak., and examined French Creek.

Aug. 1. Went to Hill City, S. Dak., and examined a small stream there.
2. Went from Hill City to Deadwood, S. Dak.
3. Went by stage to Spearfish, S. Dak., where examined Spearfish Creek.
4. Drove northwest of Spearfish and examined Cox, Hopkins, and Montana lakes and Redwater Creek.
5. Returned to Deadwood
6. Went to Crawford, Nebr.
7. Fished White River and then went to Marsland, Nebr.
8. Examined the Niobrara River at Marsland, and then went to Dunning, Nebr.
9. Examined Dismal River and the North Loup, and then went to Ravenna, Nebr.
10. Examined Mud Creek and the South Loup at Ravenna.
11. Went to Grand Island, where we fished the Platte River.
12. Went to York, Nebr., and fished Lincoln and Beaver creeks.
13. Sunday, spent at York.
14. Went to Seward, Nebr., and examined Lincoln Creek and Blue River.
15. Went from Seward to Lincoln, Nebr., where the work was brought to a close, and Mr. Cox and Mr. Gillum returned home.

Professor Evermann's examinations for the selection of a hatchery site in Iowa were made on the following dates: July 17, at Manchester; July 18, at Waterloo; July 19, at Marshalltown; July 20, at Cedar Rapids; July 21, at Ames; July 22, at Des Moines; October 23 and 24, at Spirit Lake; October 25, at Decorah; October 26, at McGregor; October 27, at Jesup.

As already stated, these investigations were not limited to the examination of proposed hatchery sites, but included an examination and study of the physical and biological features of the waters of the region, with especial reference to the species of fish and other animal life they already contain, and their suitability for stocking with other species of food-fishes not indigenous to them.

A report has already been made to the Commissioner, in which were given the details of the investigations bearing directly upon the selection of a hatchery site. In this particular work more than 100 springs were examined, their temperatures taken, their volume measured or approximately estimated, and the topographic features surrounding each noted and recorded.

After a careful consideration of the advantages and disadvantages of each place, the Commissioner selected a site on Spring Branch, near Manchester, Iowa, and the station is now under construction there.

In the present paper are given the results of the examination of the various streams visited in South Dakota, Nebraska, and Wyoming, together with our report upon the large collections of fishes obtained.

## ACKNOWLEDGMENTS.

During the progress of our work in 1892, and again in 1893, numerous courtesies of one kind or another were shown us by various gentlemen who are interested in the work of the Commission, and we desire here to express our thanks to all these gentlemen for their many kindnesses. Especial mention should be made of Hon. George W. Holdredge, general manager of the Burlington and Missouri River Railroad; Hon. C. J. Ives, president of the Burlington, Cedar Rapids and Northern Railroad, and Hon. Roswell Miller, president of the Chicago, Milwaukee and St. Paul Railroad, all of whom took an active interest in our work and furnished facilities in the way of transportation which enabled us to greatly extend the field of our investigations.

Capt. Frank A. Whittemore, of Long Pine; Mr. Fred Ingalls and Mr. and Mrs. Blodgett, of Brown County, Nebr.; Dr. John Dixon and Messrs. John Harlow and John Johnson, of Spearfish; Mr. J. R. Brennan, of Rapid City; Major Wolcott, of Glenrock, Wyo.; Hon. Joseph M. Carey, Hon. Henry A. Coffeen, and Mr. Charles L. Decker, of Wyoming, all rendered us valuable assistance in various ways.

The following gentlemen in Iowa showed us many courtesies: Col. B. F. Shaw, ex-State fish commissioner, Cedar Rapids; Mr. T. J. Griggs, of Spirit Lake, then State fish commissioner; William Mynster, esq., Council Bluffs; Mr. J. A. Laird, Jesup; Mr. J. H. Larson, McGregor; Mr. Frank S. Landers, Decorah; Mr. A. M. Sherwood, Manchester; Mr. O. L. F. Browne, Des Moines; Prof. Herbert Osborn, Ames, and E. T. Cowin, esq., Waterloo.

## THE MISSOURI RIVER BASIN.

The Missouri is the longest river in North America. Its headwaters are among the Rocky Mountains of Montana, Wyoming, and Colorado. At numerous places its sources are but a few miles from those of the Saskatchewan, the Columbia, and the Colorado. In northwestern Montana are the sources of Milk River, which are said to be connected directly with those of the Saskatchewan, while only a few miles to the westward the drainage is into Flathead River and thence into the Columbia. In southwestern Montana the headwaters of the Big Hole, Beaverhead, Red Rock, and Madison, on one hand, closely approach those of the Bitter Root, Salmon, and Snake on the other. In northwestern Wyoming, just south of the Yellowstone National Park, the headwaters of the Columbia and Missouri actually unite in Two-Ocean Pass, forming a continuous waterway from the mouth of the Columbia to that of the Mississippi.

In Wyoming the Sweetwater, a tributary of the North Platte, and in Colorado the South Platte, rise within a few miles of streams which are tributary to the Colorado of the West.

The headwaters of these various tributary streams are 8,000 to 14,000 feet above sea level. Gallatin, Mont., where the Jefferson, Madison, and Gallatin rivers unite to form the Missouri proper, is 4,132 feet in altitude; the sources of the Madison River are over 8,300 feet above the sea, while Two-Ocean Pass is about 8,200 feet.

The mouth of the Missouri River is about 400 feet above sea level; the total fall of this river is therefore over 7,000 feet, or 3,732 feet between Gallatin and the Mississippi. The length of the Missouri proper is given as 3,000 miles; add to this the length of Madison River and we have 3,230 miles, which may properly be regarded as the total length of the Missouri. Among the important tributaries may be named Milk River; Jefferson Fork, 140 miles; Gallatin Fork, 170 miles; Yellowstone River, 1,100 miles; Platte River, 1,250 miles (including the North Platte); and the Kansas River, 900 miles (including the Smoky Hill Fork). The area drained by this great river is given as 518,000 square miles. This includes the entire State of Nebraska, all of South Dakota except a few square miles in the northeast corner, nearly all of Montana, North Dakota, and Wyoming, about half of Kansas, more than half of Missouri, and large parts of Iowa and Colorado.

In the mountains at the headwaters of the various tributary streams there is an abundance of rainfall in summer and snow in winter. As a rule, the mountains were naturally heavily timbered, and the moisture was therefore conserved and fed out slowly during the season of drought. This is still true in general, but the reckless destruction of the forests in many places is having its effect upon the streams.

After leaving the mountains the tributaries of the Missouri, with scarcely an exception, enter a broad plain almost entirely devoid of trees except along the water-courses. This plain extends over eastern Montana, the two Dakotas, eastern Wyoming, Nebraska, Kansas, and Iowa. The western portion is barren, in some places even desolate. This is particularly true of the Bad Lands, or Mauvaises Terres, of South Dakota, and parts of North Dakota, Montana, Wyoming, and Nebraska. These are Miocene beds of great thickness. The White River Tertiary beds of parts of Wyoming, Nebraska, and South Dakota are several hundred feet thick, full of alkali, and in most places easily eroded.

The eastern part of South Dakota, nearly all of Nebraska and Kansas, and those parts of Colorado and Iowa in the Missouri basin constitute a more or less gently undulating prairie country, becoming dry, almost arid to the westward, but receiving an abundance of moisture and being very rich and productive in the eastern parts. In the State of Missouri there is more timber and plenty of moisture. The Missouri basin as a whole, however, is a country whose soils erode with unusual ease, and after getting out of the mountains and upon the plains few of the streams are ever really clear. The Missouri River always carries

vast amounts of solid matter in suspension, and justly deserves the name "Big Muddy." The channels of the Missouri and all the larger tributaries are constantly changing and shifting the beds of the streams. All this, of course, has its effect upon the fishes.

*Classified list of streams examined in the Missouri River Basin in 1892 and 1893.*

Missouri River at Chamberlain and Running Water, S. D.
  Yellowstone River:
    Tongue River at Sheridan, Wyo.
      South Fork of Tongue River at Sheridan.
      Big Goose Creek at Sheridan.
      Wolf Creek at Sheridan.
      Little Goose Creek at Sheridan.
    Powder River at Arvada, Wyo.
      Clear Creek at Clermont, Wyo.
  Big Cheyenne:
    North Fork or Belle Fourche at Belle Fourche, S. D.
      Redwater Creek at Spearfish, S. D.
      Montana Lake at Spearfish, S. D.
      Cox Lake at Spearfish, S. D.
      Spearfish Creek at Spearfish, S. D.
      Crow Creek near Spearfish.
      Chicken Creek near Spearfish.
      Sand Creek near Beulah, Wyo.
      Whitewood Creek at Deadwood.
      Rapid Creek at Rapid City, S. D.
    South Fork at Hot Springs and Edgemont, S. D.
      Fall River at Hot Springs, S. D.
      Beaver Creek at New Castle, Wyo.
      Salt Creek at New Castle, Wyo.
      Hat Creek at Ardmore, S. D.
      Beaver Creek at Buffalo Gap, S. D.
      French Creek at Custer, S. D.
      Spring Creek at Hill City, S. D.
  Crow Creek at Chamberlain, S. D.
    Smith Creek at Chamberlain, S. D.
  White River at Chadron and Crawford, Neb., and Chamberlain, S. D.
    Chadron Creek at Chadron, Nebr.
    Lone Tree Creek at Chadron, Nebr.
  Choteau Creek at Springfield, S. D.
  Ponca Creek at Niobrara, Nebr.
  Niobrara River at Marsland, Valentine, Long Pine, and Niobrara.
    Schlegel Creek at Valentine, Nebr.
    Minnechaduza Creek at Valentine.

Missouri River—Continued.
  Niobrara River—Continued.
    Long Pine Creek at Long Pine.
      Bone Creek at Long Pine, Nebr.
      Ponds along creek at Long Pine.
    Verdigris River and a small creek at Verdigris, Nebr.
  Emanuel Creek at Springfield, S. D.
  Bazile Creek at Niobrara, Nebr.
    Ponds at Creighton, Nebr.
    Spring Creek at Bazile Mills, Nebr.
  James or Dakota River at Mitchell, S. D.
    Rock, Firesteel, and Enemy creeks at Mitchell, S. D.
    Prairie Creek at Scotland, S. D.
  Platte River at Grand Island and South Bend, Nebr.
    North Fork of Platte River at Casper, Glenrock and Douglas, Wyo.
      Garden Creek at Casper, Wyo.
      Deer Creek at Glenrock, Wyo.
      Little Deer Creek at Glenrock.
    Wood River at Grand Island, Nebr.
    Loup River at Grand Island, Nebr.
      Middle Loup and Dismal rivers at Dunning, Nebr.
      South Loup River and Mud Creek at Ravenna, Nebr.
      Calamus River:
      Isolated lakes near Long Pine.
      Carp Lake and Lake George near Long Pine, Nebr.
    Elkhorn River at Ewing and Norfolk, Nebr.
      Bayous, south fork of Elkhorn, and pond, at Ewing, Nebr.
      Ponds and Norfolk Creek at Norfolk, Nebr.
  Kansas River:
    Big Blue River at Seward and Creto, Nebr.
      Lincoln Creek at York and Seward.
      Beaver Creek at York, Nebr.

The Missouri River itself was examined at Chamberlain, S. Dak., where the stream is divided into two channels by an island, the west channel being 1,200 feet wide and the east 1,436 feet. At the time of the visit the water was higher than usual, "the June rise," as the people call it, and the current was swift, in some places averaging 3 feet per second. Owing to the high water it was impossible to do successful seining, although we attempted it at the north end of the island. As is usually the case with this river, the water was exceedingly muddy. At places the recently deposited silt was so deep that it was dangerous to attempt to wade in the water over it. Where the water had receded enough to allow a light crust to form on top of the mud it was possible to stand and shake the whole mass for a distance of 10 feet or more in all directions. The Missouri was also examined at Running Water, opposite Niobrara, but no specimens were obtained.

The larger and more important river fishes, such as sturgeon, cat, and buffalo are said to be abundant in this portion of the river and to furnish a considerable food supply.

*Tongue River* rises in the Big Horn Mountains west of Sheridan, Wyo., flows northeast, and empties into the Yellowstone River in southeastern Montana. We examined the Tongue River at the mouth of the canyon where it leaves the mountains. At this place it is a very swiftly flowing stream, current 3½ feet per second, discharging about 127,200 gallons of water a minute. The bed of the stream is everywhere strewn with bowlders, which made it next to impossible to seine in it. Considerable pine timber is found along the banks, which are composed in most part of granite, enough having been disintegrated and collected in places to allow the growth of a scanty vegetation. The source of the water supply is the melting snow on the mountains, and since there is barely any limestone with which it can come in contact the water is very pure and soft. The temperature of the water in the canyon was 54°, air 90°. While our fishing was done under many unfavorable circumstances, we secured one fine specimen of mountain trout (*Salmo mykiss lewisii*) 20 inches long, a black-nosed dace (*Rhinichthys cataractæ dulcis*), and from a fisherman a specimen of whitefish (*Coregonus williamsoni cismontanus*). The whitefish is said to be quite common there. Many persons were seen along the river fishing for trout. Taking everything into consideration, it would certainly be hard to find a more ideal trout stream. Small parties have reported as many as 800 fish taken with hook and line in a few days. There is so much fishing done now in that region that most residents are of the opinion that if something is not done to stock the stream its fame as a fishing resort will soon be lost.

*South Fork of Tongue River.*—Not far from where the Tongue River leaves the canyon it is joined by a small stream from the south called the south fork of Tongue River. We fished it a few miles from its mouth on Mr. Dinwiddie's ranch. At this place it averaged 8 inches deep and 5 to 20 feet wide, with a current of 2 feet per second. The

water was clear and pure and the bottom was covered with gravel and bowlders. We seined it very carefully and secured several specimens of *Pantosteus jordani*, several mountain trout, and a number of dace. The water was not cold, being 70°. The banks were lined with box-elders and a few low shrubs.

*Big Goose Creek*, a stream similar to Tongue River and one of its tributaries, flows from the mountains about 12 miles south of Tongue River. Big Goose Creek is a stream nearly as large as Tongue River, has a swift current, bottom covered with bowlders, and water clear and very pure. All the streams in this region have irrigation ditches connected with them, consequently the volume is much reduced outside the canyon. Goose Creek was fished in two places, at Beck's ranch about 3 miles from the mouth of the canyon, and at Sheridan. At the former place we took several mountain trout, one dace, and a sucker. At Sheridan we found the temperature of the water 62°, current 2 feet per second, stream 35 feet wide and ranging 2 to 5 feet deep. The bottom was gravelly, but in many places there were bowlders in addition. At this place we took one species of sucker and two species of minnows.

On Mr. Decker's ranch, about 10 miles northwest of Sheridan, we examined a small brook which was fed partially by springs. The largest spring we found discharged about 945 gallons per minute, and when this amount of water was flowing the temperature was 65°. The spring did not originate in any one place, but the water seemed to seep from the banks along the spring brook. We did not take any fish from either of these streams.

*Little Goose Creek* flows from the mountains some 7 or 8 miles south of Big Goose and is very much smaller than the latter. We did not fish in it, but found it a characteristic mountain stream similar to the other except in size. At the town of Bighorn we visited an artificial fish pond whose outlet is Little Goose Creek. The pond was fed by a spring whose temperature was 51°. The temperature of the water at the surface in the pond was 72°. At one edge of the pond there were considerable algæ and a very great amount of white water-crowfoot (*Batrachium trichophyllum*). The owner of the pond was trying to cultivate trout, but had not been successful. From appearances it is possible that black bass would do much better than trout. From the overflow stream we took two species of minnows and one species of sucker.

The streams about Sheridan are the finest of any that we visited in Wyoming, and were the most numerous for the region over which they were distributed. They are nearly all fed by melting snow, and since the snow does not entirely leave during the year, they never go dry. They are all filled with bowlders and the currents of all were swift. Big Goose and Tongue rivers are the longest, and have probably the most picturesque canyons.

*Powder River* was fished at Arvada, a watering station on the Burlington and Missouri road. The bed of the river at this place was 250

feet wide, but the water, simply running in a few shallow channels, did not fill it. At no place was the water more than 2½ feet deep. It was milky in color and strongly alkaline. The current was about 2 feet per second. We took five species of minnows, two species of suckers, and one catfish (*Noturus flavus*). The channel cat was reported by fishermen. The temperature of the water was 75°, air 90°. The country is very poor, there being but little vegetation except buffalo grass and sage brush. A few cottonwood trees grow on the river banks.

*Clear Creek*, a tributary of the Powder River, rises in the Bighorn Mountains and flows northeast until it joins the river about 15 miles south of the northern boundary line of the State. Mr. Rutter, of our party, examined this at the small station of Clermont. The depth of the water varied from 4 inches to 6 feet, and the width from 15 to 40 feet, with a very sluggish current. Temperature of water, 67.5°; air, 72°. A spring near by registered 54.5°. The bottom was covered with sand, pebbles, and large rocks, and the water was clear. There was very little woody vegetation along the banks. The following fishes were taken: Redhorse sucker (*Moxostoma aureolum*), 5¼ inches long; *Pantosteus jordani*, 12½ inches long; wall-eyed pike (*Stizostedion vitreum*); catfish (*Ictalurus punctatus*); also a number of minnows.

*Belle Fourche River* was examined at the little town of Belle Fourche, where it is a stream of some size, except during dry weather. The water is fairly pure, and a good many fishes, chiefly suckers, minnows, and catfishes, are found here. We also examined the Redwater Creek and a small creek called Middle Creek at this place.

*Redwater Creek* was examined 14 miles northwest of Spearfish, where it is a stream 30 feet wide, 2 feet deep, and discharged, when we were there, about 27,000 gallons of water per minute. The water was clear at this time, but ordinarily it contains red clay in suspension, and this gives the name to the stream. We fished it carefully, and took *Notropis blennius*, *Rhinichthys cataractæ dulcis*, *Pantosteus jordani*, *Catostomus commersonii*, *Platygobio gracilis*, and *Semotilus atromaculatus*. Near this stream is Cox Lake, which contains 4 acres or more, and whose depth we could not measure on account of not having a boat. The shores were grown up with *Chara*, which had become so incrusted with calcareous deposits that it would hold a person's weight, but when you ventured too far you would break through and sink to your waist. The outlet to the lake was in the same condition, and this hindered us very much in seining. We secured from the lake, however, two species of fish, *Rhinichthys cataractæ dulcis* and *Leuciscus neogæus*, the latter being very abundant. The outlet of this lake, measured just below the lake, October 8, was 14 feet wide, 16 inches deep, and flowed 2 feet per second. The temperature of the water was 58°.

About 3 miles west of Cox Lake is Montana Lake, which contains 5 acres or more, with shores filled with *Chara* similar to Cox Lake, but, in addition, other vegetation. We found it impossible to seine, but by

getting into an old boat we dipped out a few examples of *Leuciscus neogæus*. This fish swarmed by thousands around the mouth of a little spring that helped to feed the lake. We saw no other fish, but were told that suckers had been taken from it. The owner was contemplating stocking it with carp. The lake has an outlet, but at the time of our visit there was no overflow water.

*Spearfish Creek.*—This is by far the most picturesque of all the streams of the Black Hills seen by us. It has its source on the limestone divide between Crook Tower and Custer Peak, and after cutting a rough and interesting canyon through a belt of quartzite, shale, and igneous rocks, enters the limestone formation encircling the Hills, and unites its waters with those of Redwater Creek not far from Belle Fourche. We examined Spearfish Creek at the town of Spearfish, where it was 30 feet wide, 1 foot or more deep, and with a swift current. The temperature was 68° in one place and 70° in another, August 3. On October 7, at 11 a. m., it was 45° when the air was 64°. The bottom was gravelly and there was considerable vegetation along the banks. From it we took *Salvelinus fontinalis* (planted), *Pantosteus jordani*, and *Rhinichthys cataractæ dulcis*. The stream is a very fine one, indeed. The bulk of its water comes fresh from the hills, but even at Spearfish there are some fine springs. One in particular had a temperature of 52° and discharged 2,250 gallons per minute. The gentleman who owned it had a number of brook trout in a small pool formed by the spring. The bottom is in most places moderately coarse gravel of sandstone, chert, and quartz. There is but little vegetation except in the deeper holes, where there is some *Chara* and where the bottom is of stiff white clay. The banks are from 1 to 5 feet high in the little valley. The immediate banks are in most places pretty well covered with a growth of cottonwood, ash, elm, oak, etc. Further back and on the hills were a few pines.

About 12 miles above the town of Spearfish are Spearfish Falls, where the stream descends several feet in a series of very beautiful cascades. Below these falls 5 or 6 miles are two considerable and picturesque rapids; the more important one, known as Dickson Rapids, is about 2,200 feet long and falls 96 feet in that distance. Just above the town are several important springs. One of these, which may be designated as the upper spring, flows about 375 gallons per minute and has a temperature of 49° to 50°. The outlet of this spring soon receives the water from a number of smaller springs and the total flow amounts to about 1,100 gallons. Above the mill some distance from the town is Kroll's Spring, which has a temperature of 47° and flows about 500 gallons. A little further up is the Randall Spring, with a temperature of 47° and flowing about 800 gallons per minute. If fish-cultural work should ever be undertaken at any place in the Black Hills, the most satisfactory natural conditions could probably be found here.

*Crow Creek.*—This was visited at Gammon's ranch, not far from Beulah. It is a small, sluggish stream, excessively full of suckers and minnows.

*Whitewood Creek*, at Deadwood, is ruined by the tailings from the numerous stamp mills. No fish are now found in it, but in pools along the creek we found many young suckers.

*Chicken Creek* is a small stream rising north of Crow Peak and after flowing north about 4 miles empties into Redwater Creek near Gammon's ranch. It is a small stream that has cut out a narrow channel 6 to 10 feet deep in the loose soil through which it flows. The bottom is very muddy in most places. Average width near Gammon's ranch 2 feet, depth 10 inches, current 1½ feet per second, temperature, October 8, 57°.

*Sand Creek* rises about 8 miles southwest of Beulah, Wyo., and flows northeast, joining the Redwater a few rods below Beulah. The bed of this creek is of coarse gravel, the banks are 1 to 15 feet high and are composed chiefly of very red clay. Along the banks are a few willows and cottonwoods. Near Beulah the stream measured 17 feet wide, 14 inches deep, and flowed nearly 4 feet per second. The temperature at 3.30 p. m., October 8, was 55°. No vegetation was seen in the stream except in the quiet water above a dam.

The *South Fork* of the *Cheyenne River* rises in east-central Wyoming, flows east through southwestern South Dakota until it joins the North Fork, or Belle Fourche, then northeast and joins the Missouri. This river was examined at Cheyenne Falls, October 17, 1892, and again July 28, 1893; and at Edgemont, October 19, 1892, and again July 27, 1893. Measured at the ford, just below the mouth of Fall River, October 17, Cheyenne River was 100 feet wide, 2 feet deep, and flowed 3¼ feet per second. There had been recent rains and there was a much larger volume of water than usual. At Cheyenne Falls the river forms two separate falls, the upper and the lower, the distance between them being about 250 feet. These falls are formed by ledges extending obliquely across the river, and the vertical descent in each is about 10 feet. At the time of our visit, in October, considerable water was flowing over, on account of recent rains. The ledges are quite irregular and the water pours over at several disconnected places. The temperature October 17 was 47° at noon, when the air was 58°. On July 28 the water temperature was 75°. The water was very muddy and strongly alkaline. All the fishes obtained were so bleached as to be almost colorless. The characteristic fishes of this place were found to be *Noturus flavus*, *Moxostoma*, *Hybognathus*, and *Platygobio*.

At Edgemont, on October 19, this river was less than 20 feet wide and 5 inches deep, with a current of 1 foot per second. At 9 a. m., when the air was 49°, the water was 39°. The channel of the stream here, as elsewhere, is much wider than the stream itself. The bed is of sand and yellowish or whitish clay, and is constantly shifting. The changes that had taken place since 1892 were very noticeable. The banks of Cheyenne River are usually of pale-colored clay and are ordinarily but a few feet high. The flood-plain is here from a few rods to a mile in width. The region through which the stream flows is a prairie country

with soil so charged with alkali as to be, in many places, almost without vegetation; indeed, a considerable portion of the Mauvaises Terres or Bad Lands lies in the drainage basin of the Cheyenne. This soil erodes with great ease, and, as a consequence, the water of the river is never clear. The only trees seen along the Cheyenne were a few cottonwoods. At Edgemont a small stream known as Cottonwood Creek flows into the Cheyenne. This is a muddy creek with only a few species of fishes, chief among which are *Platygobio gracilis*, *Hybognathus nuchale evansi*, and *Catostomus griseus*. The temperature of the water was 46° at noon, October 19, when the air was 59°.

*Fall River.*—This is a considerable stream, formed just above the town of Hot Springs by the union of Warm Creek and Cold Creek, the first of these deriving its water from numerous warm or hot springs. The larger warm springs at the town pour their waters into the creek there and the water is quite warm for some distance below. On October 18, when the air was 50° at noon, the water was 65° at a point 2 miles below the town. At the town the temperature of the water in the creek was 80°. This water is strongly impregnated with lime, and as a result the *Chara* which fills the stream grows very rank and forms thick deposits along the banks and in the bed of the stream. In places it has become quite hard, but upon attempting to walk over it one will frequently break through the crust and sink into the soft mud beneath. Besides the *Chara*, there are several species of algæ growing luxuriantly, and in this mass of vegetation the smaller crustaceans and other minute forms of animal life abound. The only species of fish which we found living in this warm water was the western dace (*Rhinichthys cataractæ dulcis*).

*Hat Creek.*—This stream was examined October 21 at Ardmore, S. Dak., about 1½ miles from the Nebraska line. It is a small alkali stream about 10 feet wide, 6 inches in average depth, and flowing about a foot in 2 seconds. At the time examined it was flowing more water and was muddier than usual, owing to recent rains. The bed is in most places of very soft mud; the banks are rather high and of blue or white adobe clay, which is sticky in the extreme when wet. There are occasional deeper holes in the stream, where the characteristic fishes of the region are found in considerable numbers. This stream is subject to sudden floods and dries up to mere isolated pools in the summer and early fall. The headwaters of the stream are said not to dry up so much as does the lower course. The country is prairie, easily eroded, and the water is always muddy or milky in appearance. At 5 p. m., when the temperature of the air was 52°, that of the water was 46°. The principal fishes found here were the flatheaded minnow and the silvery minnow (*Hybognathus nuchale evansi*), both of which were abundant. There were also a few western dace and suckers.

*Beaver Creek* rises in the western part of the Black Hills, flows south and empties into the South Fork of the Cheyenne River. We examined it near the L. A. K. ranch, 5 miles from Newcastle, Wyo., October 20,

and again on July 26, about 6 miles east of Newcastle. At the first place we found it to be a clear, cold, swift creek about 7 feet wide, 1½ feet deep, with a 4-foot current, and a temperature at 10 a. m. of 43°, when the air was 51°. The bottom was of large gravel in most places, mud-coated rocks with much *Chara*, and other aquatic vegetation in other places where the water was less swift. The banks were usually of mud, 1 to 5 feet high, and were covered with a good growth of willows, box-elders, buffalo berry, and cottonwood. The hills near by were covered with pines. No fish were seen here. At the place where it was visited July 26 it was about 10 feet wide and 2 feet deep, with a current flowing 2½ feet per second. The temperature of the water at this time was 58°, while that in some of the springs was 54°. One set of springs on Mr. Hanson's ranch near by discharges about 700 gallons per minute, while another furnishes about 300 gallons per minute.

We saw a number of fine brook trout and rainbow trout in the irrigating ditches on Mr. Hanson's ranch. These all seemed to be doing well, but Mr. Hanson did not think that they increased in numbers very rapidly. The water was thoroughly saturated with gypsum. From the brook we took one species of sucker and two species of minnows.

*Salt Creek* is a very small western tributary of Beaver Creek. We saw it east of Newcastle, Wyo., where it contained very little running water and no fish. The water was strongly saturated with common salt. On October 20, this creek was about 7 feet wide, 3 inches deep, and flowed about 9 inches per second. The temperature was 45° at 11 a. m., when the air was 52°.

*Beaver Creek.*—At Buffalo Gap, a small station on the Elkhorn Road east of Hot Springs, we examined a little stream called Beaver Creek. In places it was 10 feet wide and 3 feet deep, while at others it was narrowed down to a small, shallow ripple. The water contained much vegetation, principally algæ and *Chara*. The latter was incrusted with calcareous deposits from the water. We found suckers very abundant and took two species (*Pantosteus jordani* and *Catostomus commersonii*), besides three species of minnows and one species of catfish (*Noturus flavus*).

*French Creek* is a small stream which rises in the central part of the Black Hills and flows east to the south fork of the Cheyenne. We examined it at Custer, S. Dak. There is no creek worth mentioning, and at the time of our visit it consisted of a few stagnant pools. We took *Semotilus atromaculatus*, *Rhinichthys cataractæ dulcis*, *Pimephales promelas*, *Pantosteus jordani*, and *Catostomus commersonii*, all thickly covered with trematodes. Some of the fish were about dead from the effects of these parasites. Near Custer there is an interesting artificial lake, but it contained no fish.

*Spring Creek*, a western tributary of the Cheyenne, was examined at Hill City, S. Dak. It was not over 10 feet wide and contained very little running water. From it we took *Pantosteus jordani*, *Catostomus commersonii*, *Rhinichthys cataractæ dulcis*, and *Semotilus atromaculatus*.

*Crow Creek* rises northeast of Chamberlain, S. Dak., and, flowing west, empties into the Missouri some 16 miles south of the above-named town. The stream ranges from 15 to 20 feet wide, and from 6 inches to 3 feet deep. The current was moderate and the banks of the stream were covered with trees and shrubs. The quiet water contained some plant life, but much of it was free from this, and the creek bed was covered with gravel and bowlders. From the creek we took three species of suckers, a wall-eyed pike, a mooneye, a few darters, and several species of minnows. The next day after we were there a fisherman caught an 18-inch gar in the same creek, which we examined.

*Smith Creek* flows into Crow Creek near where we fished the latter. It is a small stream, with very little running water, but a few pools range from 2 to 4 feet deep and from 8 to 30 feet wide. These pools contain stagnant water, great mats of aquatic vegetation, and the bottom is covered with soft mud ranging in depth from 1 to 2 feet. Much marsh gas bubbled up through the water when the mud was disturbed. In some places a few trees and shrubs lined the banks.

It is worthy of notice that all these streams, as was the case with those at Mitchell and Scotland, are made up of more or less disconnected pools.

*White River* rises in the northwestern county of Nebraska, flows through southwestern South Dakota, and empties into the Missouri River near Chamberlain, S. Dak. In its entire course this river flows through a dry, barren, and worthless country, some of it—the Bad Lands—being among the most desolate regions found in the United States. The soil and the water are of such a nature as will support but few forms of plant life and the condition of the water limits the forms of animal life. The so-called alkali is found in the water, even up to the very head of the river, in small quantities. We examined White River at Crawford and Chadron, Nebr., and at Chamberlain, S. Dak. At Crawford the stream was 15 feet wide, 1½ feet deep, and discharged 9,450 gallons per minute. The water was clear, and in places there was considerable plant life. The banks had at this place a few bushes. We fished it here and took at least four species of fishes. At Chadron the stream was about the same size as at Crawford, and flowed through a similar country, but the water was more milky in color, which is a characteristic of the water of this region. There was no visible vegetation in the water here, but the banks supported a few small trees and shrubs. The fishes were not numerous, and all were white in color, bleached by the action of the alkaline water. Near Chamberlain, at the mouth of the river, the stream was 273 feet wide, averaged 10 inches deep, and discharged 153,500 gallons per minute. The banks supported but little vegetation, consisting of a few bushes; the bottom was gravelly in places, of quicksand in others, and in still others it was covered with a layer of fine mud. This fine mud was so near the same specific gravity as the water that where undisturbed it was held in suspension

in great quantities. Water that appeared to be 6 inches deep was found to be 12, the lower part being completely filled with the fine mud particles. In the mouth of this river we found such species as *Leptops olivaris* and *Polyodon spathula*, which had run in from the Missouri. We were told that spoonbill cat as long as 5 feet and buffalo weighing 30 pounds or more are often caught here.

*Chadron Creek* is a small stream, some 15 miles long, which empties into White River 3 miles west of Chadron, Nebr. We fished it not far from the mouth, where it was 4 to 6 feet wide and 2 to 3 feet deep, with a very sluggish current. There was no vegetation along the banks except grass.

*Lone Tree Creek*, 20 miles in length, flows from the northwest and empties into White River, near the mouth of Chadron Creek. Near its mouth, where we examined it, the stream was 40 to 50 feet wide and from 4 to 8 feet deep. The banks below the surface of the water were almost perpendicular, and the water so deep that we could do but little seining. The water was muddy and the current very sluggish. While the creek seemed to discharge but little water, the portion examined was a continuous pool. The banks were bare, with the exception of a very few small shrubs and some grass.

*Choteau Creek* is a small creek flowing into the Missouri from the north, 15 miles west of Springfield, S. Dak. At the place examined it was 50 feet wide and ranged from 1 to 8 feet deep, but averaging about 3 feet. The bottom was covered with soft, black mud, 15 inches deep in places, which gave forth large quantities of marsh gas when stirred. The bank on one side was well wooded, some of the trees being quite large. The trees and shrubs noted were ash, cottonwood, box-elder, oak, elm, willow, sumac, and plum. The temperature of the water at noon June 27 was 73°.

Much algæ, *Potamogeton*, and other aquatic plant life were found in the water. We fished the stream in several places and took as many as 10 different species of fishes. Among the valuable fishes were the wall-eyed pike, bullhead, channel cat, black sucker, redhorse sucker, and buffalo. Several other species of less importance were taken.

*Ponca Creek* rises in the southern part of Tripp County, S. Dak., flows a little southeast, and empties into the Missouri River in the northwestern part of Knox County, Nebr. It is more than 100 miles long, flows through a prairie country, and at its mouth is 41 feet wide, 4 to 8 feet deep, with a sluggish current and, at the time examined, muddy water. The sluggish current, depth of the water, and its muddiness were in part due to backwater from the Missouri River. Only two species of fish were taken, *Hiodon alosoides* and *Hybognathus nuchale evansi*. Temperature of water 72°, air 70°. The banks of the stream were heavily wooded.

*Niobrara River.*—The Niobrara River rises in eastern Wyoming, flows east through northern Nebraska, and empties into the Missouri River at the northeastern boundary of Nebraska. At Marsland, the

farthest western station made on it by us, the stream was 20 feet wide and 6 inches deep. The bottom was sandy, as is the case with the bottom at every station made. In some places this sand is very loose quicksand. The whole course of the river is through a dry, sandy country, known as the sand-hill region of Nebraska.

At Valentine, Nebr., the stream was 150 feet wide, 1 to 4 feet deep, and with a very swift current, 2½ feet per second, at least. We found it very difficult to seine, on account of the velocity of the current.

The temperature July 10 was 81½°. There was much quicksand in the bottom. The region at Valentine is a typical sand-hill country. Very little vegetation other than grass and small shrubs was found along the banks of the river. The water was clear and free from vegetation. Only a few cyprinoids were found here.

We fished the Niobrara again 15 miles north of Long Pine, Nebr., and found still more quicksand than at either Marsland or Valentine. The bed of the stream here was 800 feet wide. The current averaged about 3 feet per second, and the stream ranged in depth from 1 to 6 feet. The velocity and the quicksand bottom made it impossible to fish in some places. The banks of the river at this place are quite heavily timbered for a few rods on each side. The temperature of the water was 80°. Only minnows and a few suckers were found.

At Niobrara the Niobrara River is 1,000 feet wide, the water running in many small channels over the sandy bottom at the time examined, and averaging 10 inches in depth. The same characteristics that have been given above apply to the river here. A narrow timbered strip lines its banks, but the water is free from vegetation and is clear wherever running. A few rods from the river we fished a small pond and secured a few species of minnows. The pond was simply an old bend in the river that had been cut off by a change in the direction of the current. Some of the trees and shrubs of this region are cottonwood, elm, ash, cedar, two species of oak, wild cherry, willow, box-elder, grapevine, sumac, rose, poison ivy, *Euonymus*, prickly ash, elder, lead plant, and basswood.

*Schlegel Creek* is the tributary farthest up the Niobrara River which we examined. It is a small creek, 15 feet wide and 2 feet deep, which flows from the south and empties into the river about 4½ miles south of Valentine. Near the mouth the banks are broken and hilly and are covered with shrubs. The stream itself was dammed in many places by snags, which made seining very difficult. The bed of the creek was sandy. Fishermen reported that trout had been taken in this brook, and that it had been stocked up toward its head, where there are several springs. The temperature of the water was 71°.

*Minnechaduza Creek* flows from the west and empties into the north side of the Niobrara River at Valentine. It is a fine stream, averaging 20 feet wide, 1 foot deep, and having a velocity of 3 feet per second. The bottom is covered with rocks and gravel, and several springs flow

into it in the vicinity of Valentine. The banks are lined with various kinds of trees and shrubs, and the water was free from vegetable life of any importance. There are several fine small springs near Valentine. We took sunfish from this creek, the farthest west they have been recorded along the Niobrara River. Below the milldam, at Valentine, in Minnechaduza Creek there was a great abundance of fish, principally minnows, all trying, no doubt, to go upstream. The temperature of the water below the dam was 76°. A little spring running into the creek at this place had a temperature of 54°.

*Long Pine Creek*, which is something more than 20 miles in length, rises in the east-central part of Brown County, Nebr., and flows directly north, emptying into the Niobrara River. This stream is a characteristic spring creek. Near the town of Long Pine there are many fine springs, some of them discharging large quantities of water. The bed is sandy and the water clear and almost entirely free from lime and other impurities. Seven miles south of Long Pine, near the head of the creek, the stream was 15 feet wide and 1 to 3 feet deep, with a swift current. Temperature 65° At various places between the head of this creek and the town of Long Pine are numerous springs; indeed, the creek is fed almost entirely by springs. About 4 miles above the town is a spring creek about 2 feet wide and 5 inches deep, possessing a 2-foot current and a temperature of 53° to 55°. This was the temperature of all the springs along this creek except those at the extreme head. In them the water was more stagnant and warmer by several degrees. The temperature of the main stream was found to range from 61° to 75° near noon, July 5.

We secured some sunfish, a few sticklebacks, and some minnows. We fished the creek 10 miles north of Long Pine, where we found it 35 to 40 feet wide, 2 to 4 feet deep, and a current averaging 3 feet per second. We attempted to fish below a dam, but found it difficult on account of the swift current and the numerous snags. The banks along this portion of the creek were covered with small trees, principally ash. The temperature of the water was 79°. Half a mile above the dam Bone Creek enters Long Pine Creek from the west. It is small, 10 feet wide, 8 inches deep, and has a rather swift current. Its bottom is sandy and the water clear, with a temperature of 79°.

Between the mouth of Bone Creek and the dam in Long Pine Creek there are some ponds that have been made by a change of channel of Long Pine Creek. When we visited them there was no connection between them and the creek, and since Long Pine Creek depends upon springs and does not have high water, the ponds have not been connected with the stream for some time. The water in the ponds was almost completely filled with aquatic vegetation, ranged from 2 to 4 feet in depth, and had a temperature of 77°. From these ponds we took sunfish (*Apomotis cyanellus*), darters, and minnows.

Of the many streams of Nebraska which we have examined, Long Pine Creek is by far the most beautiful and best adapted to trout. In

volume of water, clearness, purity, and low temperature, it surpasses any other stream in the State, of which we know. Natural food of the trout is found in abundance; besides insect larvæ, the smaller crustaceans and mollusks abound, and several species of minnows are abundant as to individuals and doubtless furnish excellent food to better fishes.

The numerous beautiful groves of hardwood trees and shrubs covering the little park-like tracts of bottom land found along the stream, or scattered over the hillsides and in the narrow flanking canyons, make this region one of surprising beauty and picturesqueness. The trout that were planted in this creek a few years ago have done unusually well, and now Long Pine Creek affords excellent fishing to the anglers of Nebraska and neighboring States.

*Verdigris River* rises in the northwest corner of Antelope County, Nebr., flows northeast and then north, and empties into the Niobrara River about 5 miles from its mouth. We examined it at the town of Verdigris, where the stream below the mill-dam was 58 feet wide and 1 foot deep, with a current of 2½ feet per second. The temperature of the air was 77° and that of the water 67°. The bottom was covered with rather large rocks and the water was clear.

The small unnamed creek which emptied into Verdigris River at Verdigris had a very little muddy water standing in pools and consequently very few fish were found in it.

*Emanuel Creek* was fished 3 miles northwest of Springfield, S. Dak. It is quite a small stream, a tributary of the Missouri, with very muddy water which was not more than 3 feet deep at any place, and ranged from 4 to 30 feet wide. There were some bushes on the banks, principally ash, and a great amount of algæ in the bed of the stream.

*Bazile or Creighton Creek* is small, rises in northern Nebraska, flows north, and empties into the Missouri about 5 miles east of the town of Niobrara. The current is swift, flowing a stream 30 to 40 feet wide and 18 inches deep over a fine gravelly bottom. Shrubs and small trees, principally ash, are found along the banks. As many as 8 species of fishes were taken, but none in great abundance. A pond which has connection with Bazile Creek was fished at Creighton, Nebr. This pond is at the edge of the town and contains 10 or 15 acres. On one side there were a few shrubs, but, for the most part, the banks were grassy. The water was deep except at the edges and here it was almost completely filled with the algæ and other aquatic vegetation. In some places it was almost impossible to land the seine on account of this mass of plant life. Twelve species of fish, at least, were taken here, among them *Notropis topeka*, *Notropis cayuga*, *Apomotis cyanellus*, *Etheostoma iowæ*, and *Fundulus sciadicus*.

*Spring Creek*, a very small tributary of Bazile Creek, was fished at Bazile Mills. This brook was interesting on account of the fact that the water was cold, 54° at 8 a. m., when the air was 68°, and that trout had been planted there and were doing well. The only fish taken were

the trout and *Catostomus commersonii*. The water is clear and pure; the bottom is of sand and gravel. Though this stream is scarcely more than a mile long, it is so well suited to trout that it affords excellent trout fishing and large catches are made in it every season.

*Dakota* or *James River* rises near the central part of North Dakota and flows a little southeast until it empties into the Missouri River on the southeastern boundary of South Dakota. The country through which it flows is comparatively level prairie, hence the course of the river, while in general straight, has very many crooks and bends which make it many times longer than it would otherwise be. The current is sluggish and as a result the water becomes somewhat stagnant in summer and contains much aquatic vegetation and lower forms of aquatic life peculiar to such conditions. On account of the loose prairie soil through which the river flows, the water is muddy, even when only slightly disturbed.

The tributaries to the Dakota River are small and short, consequently the region drained, while long from north to south, is not wide.

We examined the Dakota River at Mitchell, S. Dak., about 80 miles from its mouth, where we found it 110 feet wide and averaging 6¼ feet in depth, with a current having a velocity of 1 foot per second, thus discharging about 300,000 gallons per minute. Owing to rains in the Dakota Valley a few days previous to our examination, the water was probably 1 foot higher than usual at this time of year, June 19. The temperature at this time was 74°. The nature of the stream shows at once its suitability for suckers, catfish, sunfish, and yellow perch, which is further proved by our taking numerous specimens of each, either in the river itself or from the mouths of creeks which empty into the river. The banks of the stream are covered with low shrubs and a few trees, principally ash.

*Rock Creek* flows from the northeast and enters the Dakota River near Mitchell. It averages 30 feet wide and 2½ feet deep, although it is very irregular, being made up apparently of a series of holes connected by a small stream of running water, probably formed partly by erosion and partly by glacial action. The same may be said of Enemy and Firesteel creeks. We examined Rock Creek near its mouth, where the banks are covered with small bushes, principally ash and willow, and took specimens of pike (*Lucius lucius*), yellow perch, sunfish, catfish, darters, and a few minnows. The water was clear, and contained so much algæ that seining was difficult in places. Much of the bottom was covered with bowlders. Crawfish, frogs, and toads were abundant.

*Firesteel Creek* flows from the northwest and empties into the Dakota River about 2 miles below the mouth of Rock Creek. It is, like that creek, tortuous and sluggish, and is about 30 feet wide, 4 feet deep, and has a current of ½ foot per second. The temperature was 79°. The bottom was covered with mud, the water contained much algæ and other aquatic vegetation, and about the same species of fish were taken here as in Rock Creek.

*Enemy Creek*, which empties into the Dakota River 6 miles southeast of Mitchell, is a small stream made up of connected pools and just enough running water through the narrow connecting channels to allow small fish to pass from one pool to another. The bottom in that part examined was gravelly, and the water did not contain as much plant life as was found in the others. We did not find as great a variety of fishes here as in the other streams, the principal species being suckers, yellow perch, sunfish, and catfish.

*Prairie Creek*, a western tributary of the Dakota River, was examined about 4 miles east of Scotland, S. Dak. The creek was nearly dry, with the exception of a few small pools, but these were deep and contained so much plant life that seining was difficult. No trees or shrubs were found on the banks. The country about Scotland is of the same general character as that around Mitchell. The aquatic animals that we found, other than fish, were crawfish, clams, and frogs.

*Platte River.*—The North Fork of the Platte River rises in western Wyoming, and flows a little southeast through Wyoming and Nebraska until it joins the South Fork in the southwestern part of the latter State. Platte River proper, formed by the joining of the two forks, flows east through Nebraska and empties into Missouri River. The point nearest its head, at which the North Fork was examined, was Casper, Wyo. The stream at this place varied from 150 to 200 feet in width, has a very swift current, and was in some places from 6 to 7 feet deep. The temperature was 66½°, and the water was clear. Along the banks were a few scattered cottonwood, willow, and box-elder trees.

We next examined the North Platte at Glenrock, Wyo., where we found the temperature, current, size, and general appearance about the same as at Casper.

At Douglas, Wyo., we found the North Platte the same swift, sandy stream, and not any larger than before, owing to the dry region through which it flows.

Our next station was on the Platte River proper, at Grand Island. At the time of our visit, August 11, the water was very low and ran in several small and shallow channels, the depth at no place being more than 2½ feet, consequently only very small fish could live in it. The temperature of the water was 79°. Several minnows were taken, as well as young wall-eyed pike, yellow catfish, a buffalo, a moon-eye, and a sturgeon.

On October 23, 1892, we examined the Platte at South Bend, Nebr., but made no collections except specimens of *Etheostoma iowæ* from the State fish-hatchery waters near South Bend, where this small darter is very abundant.

*Garden Creek*, a little mountain stream discharging 250 gallons of water per minute at the mouth of the canyon, is the tributary farthest up the North Platte that we examined. In fact, it is a tributary only during high water, for during the dry season all the water is used in irrigation and not a drop of it reaches the river. At the mouth of the

canyon is a pretty little fall, 70 feet in height. Only two species of fish were found, *Semotilus* and *Rhinichthys*. Trout would probably live in this stream, since the temperature in the canyon was 53½°.

*Deer Creek* rises in the Laramie Mountains and flows northeast into the North Platte at Glenrock, Wyo. It is a small stream, not over 15 feet in width at its mouth at the time examined, but this was during the dry season and much of the water was used above for irrigating purposes. The stream did not average more than 6 inches deep at the mouth; the water was clear, and the temperature 61½°.

*Little Deer Creek*, a tributary of Deer Creek, flows out of a canyon in the Laramie Mountains on the ranch of Major Wolcott, about 7 miles south of Glenrock. It is a very pretty little mountain stream, discharging about 1,600 gallons of water per minute at the mouth of the canyon and registering a temperature of 50°.

*Wood River* flows first in a southeasterly direction, until it gets within 4 or 5 miles of the Platte, when it takes a northwesterly course, following alongside the latter river until it joins it about 10 miles east of Grand Island. We fished it at Grand Island, where it was not more than 15 feet wide, the water muddy, and standing principally in holes. The banks were lined with small trees. The fishes taken were *Hybognathus nuchale evansi*, *Notropis lutrensis*, *Notropis blennius*, *Catostomus commersonii*, and *Carpiodes carpio*.

*Middle Loup River* rises in Cherry County, in northwestern Nebraska, and joins the South Loup about the center of the State. We examined it at Dunning, where it was 200 to 250 feet wide, averaged 6 inches deep, and had a current of 2 feet per second, thus discharging 112,500 gallons per minute. The bottom was sandy and the water clear, with a temperature of 65°. From it we took *Platygobio gracilis*, *Hybopsis æstivalis*, *Rhinichthys cataractæ dulcis*, *Notropis lutrensis*, *Noturus flavus*, *Hybognathus nuchale evansi*, *Fundulus sciadicus*, *Notropis blennius*, and *Carpiodes carpio*. The country about Dunning is prairie with but a few small bushes along the banks of the river.

*Dismal River*, a tributary which joins the Middle Loup at Dunning, was also examined. It is 100 feet wide, averages 10 inches deep, and has a current of 2 feet per second, thus discharging 75,000 gallons per minute. Like the Loup River, the water was clear and the bottom sandy. In two or three shallow ponds near by, containing much *Lemna* and other aquatic vegetation, we found the green sunfish (*Apomotis cyanellus*). This was the farthest west in central Nebraska that we took sunfish. From the ponds and river we took, also, *Pimephales promelas*, *Notropis lutrensis*, *Catostomus commersonii*, and *Fundulus sciadicus*. The temperature of the water was 66°.

*South Loup* and the mouth of *Mud Creek* were examined, October 22 and August 10, at Ravenna, where they join. The South Loup River here is 150 feet wide, but the water at the times of our visits was very shallow and flowed in several channels over the sandy bottom. Mud Creek is a very sluggish stream, being 40 to 60 feet wide and from 2 to

8 feet deep. The bottom is covered with a thick deposit of black mud, and at the edge of the water there was considerable vegetation. The temperature October 22 was 46° when the air was 62°. Owing to a milldam in the stream at the town, the fish from the river have free access to only about a mile of Mud Creek. The water was considerably colder than that in Loup River, and this, with the great amount of food matter and the quietness and depth of the water, accounted for the abundance of fishes found in it. No doubt many of them had been driven in here on account of low water in Loup River.

We examined Mud Creek from the railroad bridge down to its mouth, a distance of nearly a mile, and then seined the river at several places near the mouth of Mud Creek. The abundance of fishes here, both as to species and individuals, was unusually great. We obtained not fewer than 15 species, among which were the following:

| | | |
|---|---|---|
| Moxostoma aureolum. | Carpiodes velifer. | Platygobio gracilis. |
| Notropis jejunus. | Notropis lutrensis. | Stizostedion vitreum. |
| Hiodon alosoides. | Fundulus sciadicus. | Hybognathus nuchale evansi. |
| Apomotis cyanellus. | Hybopsis æstivalis. | Micropterus salmoides (planted). |
| Ictalurus punctatus. | Hybopsis storerianus. | Pimephales promelas. |

The black bass had been planted and seemed to be doing well. We saw two which a fisherman had taken, that were each 12 inches long. There is certainly much need of a fishway in Mud Creek, so that fish may pass to the water above the dam. The banks of both streams are well covered with trees. In Mud Creek 2 species of turtles were seen, *Chelydra serpentina* and *Aspidonectes spinifer*.

*Lakes Carp and George.*—Seventeen miles south and a little west of Long Pine, Nebr., lie two isolated lakes of considerable size, and a few small ones. There is no record of any outlet for these lakes, but the slope is toward the south, and since there is but one neighboring river, the Calamus, in this direction, it is likely that these lakes were once drained by that stream.

*Carp Lake* contains about 160 acres and ranges in depth from 3 to 7 feet. There is open water in the center, but the edges of the lake are grown up with various species of aquatic plants. We seined the lake on the south side and secured a large number of *Ameiurus melas* and *Apomotis cyanellus*. At one haul we took 65 specimens of *Ameiurus*, 4 of them ranging from 11 to 13 inches in length. No other species of fish were seen, and Mr. Blodgett, who lives near the lake, said that no native fish had ever been taken there. The catfish and sunfish he planted in the lake himself. In 1887 he planted 2,000 young carp, but never saw any afterwards. In 1888 he planted 512 sunfish and 6 bullheads, and it was from these that the fish we caught had grown. We also tried catching sunfish with a hook and were very successful. Those we caught were not very large, but Mr. Blodgett said he had caught some that measured 8 inches in length.

*Lake George* lies about 3 miles southeast of Carp Lake, covers 200 acres, and is from 3 to 7 feet deep. It has more open water than Carp

Lake and not so much vegetation around the shores. We made several hauls in it and secured nothing but *Apomotis cyanellus*, all young, many of them but one-half inch long. Eight carp were planted in this lake at the same time the 2,000 were put in Carp Lake, but they have never been seen since. A few sunfish and a few bullheads were planted in this lake at the time those were put in Carp Lake. Both lakes abound in fish food, and the conditions are very favorable for the black bass. The water in both lakes is quite pure and the temperature at the time of our visit was 70°.

A little lake of about 20 acres, north of Carp Lake, was visited, but no fish were found. The water was not more than 1 foot deep and was very warm. In one haul of the seine we took a large number of tadpoles and about 150 larval salamanders.

In addition to the lakes mentioned, there are other small ponds and marshes throughout the region, but all are shallow and contain no fish.

*Elkhorn River* rises in the central part of Rock County, in northern Nebraska, flows southeast and finally south, and empties into Platte River about 30 miles above its mouth. We examined it at Ewing and at Norfolk, Nebr. At Ewing the stream was about 100 feet wide and 6 inches to 5 feet deep, averaging 18 inches, and the current was moderate. The bottom was sandy in most places, but occasionally there was a bunch of aquatic vegetation, in which we found sunfish (*Apomotis cyanellus*) and black bass (*Micropterus salmoides*). We also took two species of suckers, a catfish, two darters, and several species of minnows. Near the river are some old bayous that are probably connected with the river during high water, but at the time of our visit were isolated. These contain thousands of young black bass, most of them about one-fourth inch long.

Elkhorn River, 2 miles southeast of Norfolk Junction, is 150 feet wide, averages 2 feet in depth, and has a swift current. The bottom is sandy and trees line the south bank. Among the fish taken here were the pickerel (*Lucius lucius*), large-mouthed black bass, redhorse sucker, a darter, and a number of minnows.

Near the river are some bayous that furnish excellent fishing for the people of Norfolk, the principal fish being black bass and sunfish. There are two of these bayous located in a nicely wooded grove. The water was quiet and in the shallow places completely matted with aquatic vegetation. From the banks the sunfish could be seen quietly swimming around looking for food, while farther along, perhaps, numerous fish were jumping out of the water to catch the unwary insects that had ventured too near the surface. Many frogs were seen along the banks and the aquatic vegetation was well loaded with numerous forms of animal life. One noticeable fact was the scarcity of minnows, yet this is not remarkable when we consider the abundance of bass.

*South Fork of Elkhorn River.*—The tributary of Elkhorn River nearest its head, which we examined, was the south fork of the Elkhorn at Ewing, Nebr. The stream was 30 feet wide, 1 foot deep, current

swift, and water with a temperature of 79½°. The bottom was sandy, the water clear, and there were no trees on the banks, only a few willows. We secured two species of minnows, one darter, and one sucker. From a small pond near by we took a few catfish (*Ameiurus melas*).

*Norfolk Creek* flows into Elkhorn River about 3 miles southeast of Norfolk Junction, and near its mouth averages 35 feet wide and 1¾ feet deep, but a few holes were as much as 6 feet. The current was rather sluggish and the water somewhat muddy. The banks were well wooded in places with cottonwood, box-elder, willow, and ash. From this stream we secured at least five species of minnows, two species of darters, one species of black bass, two species of catfish, and a redhorse sucker.

*Big Blue River* rises in southeastern Nebraska, flows south, and empties into the Kansas River. We fished the Big Blue at Seward, Nebr., where it was 30 feet wide, 2 to 4 feet deep, and very muddy. From it we secured *Lepomis humilis*, *Ameiurus melas*, *Notropis lutrensis*, and *Pimephales promelas*. This stream was also examined at Crete in 1892, and by Mr. Rutter at Crete in 1891.

*Lincoln Creek*, a tributary of the Big Blue River, was 10 feet wide, 10 inches deep, had a current of 1 foot per second at York, was very muddy, and registered a temperature of 68°. From it we took the following species: *Noturus flavus*, *Pimephales promelas*, *Ameiurus melas*, *Notropis lutrensis*, and *Notropis blennius*.

At Seward, Nebr., Lincoln Creek was 40 to 50 feet wide, 4 to 6 feet deep, and very muddy. We found but one species of fish here, *Notropis lutrensis*. The place fished was just above a dam, consequently the water was much deeper than at other places.

*Beaver Creek*, a tributary of the Big Blue River, was fished at York, Nebr. We found it a little larger than Lincoln Creek at the same place, but the same kind of a stream, and with a temperature of 71°. We took from it *Ameiurus melas*, *Noturus flavus*, *Notropis lutrensis*, *Pimephales promelas*, *Notropis blennius*, and *Semotilus atromaculatus*.

## HISTORICAL AND BIBLIOGRAPHICAL.

In the following pages we give the bibliography of the ichthyology of the Missouri River basin. We have meant to include all faunal lists and such other papers as throw light upon the geographic distribution of the species of fishes in the drainage basin of that river. The titles are arranged in chronologic order, thus enabling one to see at a glance the progress of ichthyological investigations in that region. Following the title of each paper will be found a brief statement of the character of the paper, and then a summary of its contents, including (1) the page upon which the species is mentioned, (2) the name under which recorded, (3) our identification of the nominal species, (4) the locality from which the specimens were obtained, and (5) the name of the col-

lector. Whenever the character of the paper permits it, the summary is given in briefer form.

The first printed references to fishes of the Missouri River basin that have come under our notice are those by Lewis and Clark in the journal of their famous expedition to the mouth of the Columbia River in 1803–1806. The original edition of the history of this expedition was published in 1814.

In 1893 appeared the elegant and splendidly annotated new edition by Dr. Elliott Coues. In this edition all the fishes mentioned in the original journals and note books of the expedition are identified when the reference is sufficiently full.

The fishes mentioned are, as would be expected, those which they were able to catch for food, and we find the following noted with sufficient detail to render identification possible: *Ictalurus punctatus*, *Leptops olivaris* or *Ameiurus lacustris*, *Stizostedion canadense boreum*, *Moxostoma aureolum*, *Pantosteus jordani*, and *Salmo mykiss lewisi*.

The following are the more important notes on the fishes seen. The references are to the new edition of Lewis and Clark, in four volumes, by Dr. Elliott Coues (New York, 1893):

Vol. I, p. 54: "White catfish [*Ictalurus punctatus*], the eyes of which were small, and its tail resembling that of a dolphin"; Missouri River near mouth of Papillion Creek, near present site of Omaha.

Vol. I, p. 76: "August 16. * * * A party had gone out yesterday to the Maha Creek [and] a second went to-day. They made a kind of drag with small willows and bark, and swept the creek. The first company brought 318 fish, the second upward of 800, consisting of pike [probably *Lucius lucius*], bass [*Micropterus salmoides?*], fish resembling salmon trout, red-horse [*Moxostoma aureolum*], buffalo fish [*Ictiobus sp.?*], rockfish, one flat-back, perch, catfish, a small species of perch called on the Ohio silver-fish, a shrimp of the same size, shape, and flavor of those about New Orleans and the lower part of the Mississippi. We also found very fat mussels." Few, if any, of these are certainly identifiable. This locality is in the present Dakota County, Nebraska, a little south of Dakota City. They called the place "Fishing Camp."

Vol. I, p. 88: "Some large catfish, nine that would together weigh 300 pounds." Nine miles below mouth of Bow Creek, Cedar County, Nebraska. These may have been *Leptops olivaris* or *Ameiurus lacustris*.

Vol. I, p. 320: "We have caught very few fish on this side of the Mandans, and these were the white catfish of two to five pounds"; Missouri River near mouth of Beauchamp Creek, Mont., longitude about 108° W.

Vol. II, p. 363: "The white cat [-fish] continues as high as Marias River, but they are scarce in this part of the Missouri, nor have we caught any of them since leaving the Mandans which weighed more than six pounds."

Vol. II, p. 364: "I amused myself catching those white [cat-] fish yesterday. I caught upward of a dozen in a few minutes; they bite most freely at the melt of a deer which Goodrich brought with him for the purpose of fishing." (Lewis.) This locality was near the mouth of Marias River, longitude about 110° 30′ W.

Vol. II, p. 367: "Both kinds of white fish" [*I. punctatus* and *Stizostedion canadense boreum*]. Falls of Missouri.

Vol. III, p. 1159: "Some catfish and soft-shelled turtles were procured"; near mouth of Tongue River.

Vol. II, p. 362: "June 11. One of the men caught several dozen fish of two species. The first is about nine inches long, of a white color, round in shape; the mouth is beset both above and below with a rim of fine, sharp teeth, the eye moderately large, the pupil dark, the iris narrow, and of a yellowish brown. In form and size it resembles the white chub of the Potomac, though its head is proportionally smaller. These readily bite at meat or grasshoppers; the flesh, though soft and of a fine white color, is not highly flavored. The second species is precisely of the form and about the size of the fish known by the name of hickory-shad or old-wife, though it differs from it in having the outer edge of both the upper and lower jaw set with a rim of teeth, and the tongue and palate also defended by long, sharp teeth bending inward; the eye is very large, the iris wide, and of a silvery color. These do not inhabit muddy water, and the flavor is much superior to that of the former species. Of the first kind we have seen a few before we reached Marias River; but had found none of the last before we caught them in the Missouri above its junction with that river." This locality was near the mouth of Marias River. The first species is *Stizostedion canadense boreum*, and the other either *Hiodon alosoides* or *Hiodon tergisus*.

Vol. II, p. 367: "June 13. In the afternoon they caught in the falls some of both kinds of the white fish, and half a dozen trout from 16 to 23 inches long, precisely resembling in form and in the position of the fins the mountain or speckled trout of the United States, except that the specks of the former are of a deep black while those of the latter are of a red or gold color. They have long, sharp teeth on the palate and tongue, and generally a small speck of red on each side behind the front ventral fins; the flesh is of a pale yellowish red, or when in good order of a rose-colored red." This locality is the lower or Crooked Falls of the Missouri, below the present town of Great Falls, Montana. The two kinds of "white fish" were probably *Ictalurus punctatus* and *Hiodon alosoides*, and the trout, of course, was *Salmo mykiss lewisi*.

Vol. II, p. 373: The next day and at the same place they "obtained a number of fine trout and several small catfish, weighing about four pounds and differing from the white catfish lower down the Missouri." These were probably not different from the other white catfish.

Vol. II, p. 431: "July 20. Since the river has become shallow we have caught a number of trout and a fish white on the belly and sides, but of a bluish cast on the back, with a long, pointed mouth opening somewhat like that of a shad." This was in the Missouri nearly due east of Helena. The fish were *Salmo mykiss lewisi* and probably *Hiodon alosoides*.

Vol. II, p. 458: "August 3. The only fish observed in this part of the river were the trout and a species of white fish with a remarkably long, small mouth, which one of our men recognized as the fish called in the Eastern States the 'bottlenose.'" This was in Jefferson Fork of the Missouri, near the mouth of Whitetail Deer Creek, south of Helena. The trout was *Salmo mykiss lewisi*; the "bottlenose" is not identifiable; it may have been *Coregonus williamsoni cismontanus* or *Pantosteus jordani*.

Vol. II, p. 495: "August 13. Some very fine trout [*Salmo mykiss lewisi*] were caught, as also for several days past." This was in Beaverhead River near the mouth of Grasshopper Creek, south of Dillon, Mont.

Vol. III, p. 1138: "July 16. One of the men caught a fish which they had not seen before. It was eight inches long, and resembled a trout in form, but its mouth was like that of a sturgeon, and it had a red streak passing on each side from the gills to the tail." This locality was in the Yellowstone River near the mouth of Little Timber Creek, some 30 miles below Livingston, Mont. The fish was undoubtedly a sucker, and almost certainly the species named *Pantosteus jordani* 87 years afterward. There is, of course, a possibility of its having been *Catostomus catostomus*.

The papers whose titles follow are each more or less faunal in character and each contains references to fishes from definite Missouri Basin localities.

**1854.** LOUIS AGASSIZ. Notice of a collection of fishes from the southern bend of the Tennessee River, in the State of Alabama. <Amer. Journ. Science and Arts, 2d series, vol. XVII, No. 50, March, 1854, 297-308, and No. 51, May, 1854, 353-365.

In a footnote on page 304 of this paper Professor Agassiz described as new two darters collected in the Osage River, Missouri, by Mr. George Stolley. These are *Pœcilichthys spectabilis* (=*Etheostoma cœruleum spectabile*) and *Pœcilichthys punctulatus* (=*Etheostoma punctulatum*).

**1856.** CHARLES GIRARD. Researches upon the cyprinoid fishes inhabiting the fresh waters of the United States west of the Mississippi Valley, from specimens in the museum of the Smithsonian Institution. <Proc. Ac. Nat. Sci. Phila. 1856, 165-218.

This is the first of the several papers based wholly or partly upon the collections made by the naturalists connected with the Pacific Railroad Survey parties which traversed portions of the Missouri Basin. The localities from which the specimens of these collections came are seldom given with any definiteness, as will appear from an examination of the following table. In this table, and in all others of like character in the present paper, the names of new species are printed in italics.

| Page. | Nominal species. | Identification. | Locality. | Collector. |
|---|---|---|---|---|
| 170 | Carpiodes *damalis* | Carpiodes velifer | Milk River | Suckley. |
| 172 | Ptychostomus *haydeni* | Minytrema melanops | Missouri River at Fort Pierro. | Evans and Hayden. |
| | | | Yellowstone River. | Do. |
| 174 | Catostomus (Acomus) *lactarius.* | Catostomus griseus | Milk River | Suckley. |
| 174 | Catostomus (Acomus) *griseus.* | ....do | Sweetwater River | Bowman. |
| 175 | Catostomus *sucklii* | Catostomus commersonii | Milk River | Suckley. |
| 180 | Pimephales *fasciatus* | Pimephales promelas | Yellowstone River. | Hayden. |
| 182 | Hybognathus *argyritis* | Hybognathus argyrite | Milk River | Suckley. |
| 182 | Hybognathus *evansi* | Hybognathus nuchale evansi. | Fort Pierro, Nebr | Evans. |
| 185 | Argyreus *dulcis* | Rhinichthys cataractæ dulcis. | Sweetwater River | Bowman. |
| 188 | Pogonichthys *communis* | Platygobio gracilis | Fort Pierro, Nebr. | Evans. |
| | | | Fort Union | Denig. |
| | | | Above Fort Union. | Suckley. |
| | | | Milk River | Do. |
| | | | Yellowstone River. | Hayden. |
| | | | Sweetwater River | Bowman. |
| 188 | Gobio *gelidus* | Hybopsis gelidus | Milk River | Suckley. |
| 189 | Leucosomus *dissimilis* | Couesius dissimilis | Milk and Little Muddy rivers. | Do. |
| 190 | Nocomis *nebracensis* | Hybopsis kentuckiensis | Sweetwater River | Bowma. |
| 190 | Plagyrus *bowmani* | Notropis cornutus | ....do | Do. |
| 204 | Semotilus *macrocephalus* | Semotilus atromaculatus. | Fort Pierro, Nebr. | Evans. |
| 204 | Semotilus *speciosus* | ....do | Sweetwater River | Bowman. |

**1858.** CHARLES GIRARD. The fishes [of the Pacific Railroad Surveys]; Pacific Railroad Report, vol. x, 1–400, numerous plates, 1858; vol. vi, part iv, No. 1, 9–34, 11 plates.

The reports of the Pacific Railroad Survey credit but 23 nominal species to the Missouri Basin.

| Page. | Nominal species. | Identification. | Locality. | Collector. |
|---|---|---|---|---|
| 17 | Calliurus longulus | Apomotis cyanellus | Platte River | Captain Pope. |
| 32 | Stizostedion boreus | Stizostedion canadense boreum. | Fort Sarpy, Nebr.. | Dr. Hayden. |
| | | | Milk River, Mont.. | Dr. Suckley. |
| | | | Fort Union, Mont.. | Dr. Hayden. |
| 98 | Amblodon grunniens | Aplodinotus grunniens | Milk River, Mont.. | Dr. Suckley. |
| 212 | Pimelodus *olivaceus* | Ictalurus punctatus | Fort Pierre, Nebr.. | Dr. Evans. |
| | | | Milk River, Mont.. | Dr. Suckley. |
| | | | Yellowstone River, Nebr. | Mr. Walker, Dr. Hayden. |
| 219 | Carpiodes damalis | Carpiodes velifer | Milk River | Dr. Suckley. |
| | | | Fort Pierre, Nebr.. | Dr. Evans. |
| 221 | Ptychostomus hayden | Minytrema melanops | Yellowstone River | Dr. Hayden. |
| 21 | | | Missouri River at Fort Pierre, Nebr. | Dr. Evans. |
| 222 | Acomus griseus | Catostomus griseus | Sweetwater River.. | J. S. Bowman. |
| 22 | | | | |
| 223 | Acomus lactarius | do | Milk River | Dr. Suckley. |
| 226 | Catostomus sucklii | Catostomus commersonii | do | Do. |
| 234 | Pimephales fasciatus | Pimephales promelas | Yellowstone River. | Dr. Hayden. |
| | | | Milk River | Dr. Suckley. |
| 236 | Hybognathus argyritis | Hybognathus argyrite | do | Do. |
| 22 | | | | |
| 237 | Hybognathus evansi | Hybognathus nuchale evansi. | Fort Pierre, Nebr.. | Dr. Evans. |
| | | | Sweetwater River.. | J. S. Bowman. |
| 243 | Argyreus dulcis | Rhinichthys cataractæ dulcis. | do | Do. |
| 248 | Pogonichthys communis | Platygobio gracilis | Milk River | Dr. Suckley. |
| | | | Sweetwater River.. | J. S. Bowman. |
| | | | Missouri River at Fort Union. | E. J. Denig. |
| | | | Milk River above Fort Union. | Dr. Suckley. |
| | | | Fort Pierre, Nebr.. | Dr. Evans. |
| | | | Yellowstone River. | Dr. Hayden. |
| 249 | Gobio gelidus | Hybopsis gelidus | Milk River | Dr. Suckley |
| 251 | Leucosomus dissimilis | Couesius dissimilis | do | Do. |
| | | | Little Muddy River | Do. |
| 253 | Leucosomus macrocephalus. | Semotilus atromaculatus | Fort Pierre, Nebr.. | Dr. Evans. |
| 254 | Nocomus nebrascensis | Hybopsis kentuckiensis | Sweetwater River.. | J. S. Bowman. |
| 23 | | | | |
| 264 | Plagyrus bowmani | Notropis cornutus | do | Do. |
| 284 | Semotilus speciosus | Semotilus atromaculatus | Tributary of Platte River, Nebr. | Do. |
| 25 | | | | |
| 320 | Salar lewisi | Salmo mykiss lewisi | Falls of Missouri River. | Dr. Suckley. |
| 357 | Scaphirhynchus platirhynchus. | Scaphirhynchus platorhynchus. | Missouri River | Dr. Shumard. |
| 59 | | | | |
| 358 | Polyodon folium | Polyodon spathula | Fort Pierre, Nebr.. | Dr. Evans. |

**1859.** CHARLES GIRARD. Ichthyological Notices. <Proc. Ac. Nat. Sci. Phila. 1859, 100–104.

In these "notices" Dr. Girard described as new two species of darters from the Missouri Basin, viz: In Notice XXXVII, p. 103, *Boleichthys exilis*, obtained by Dr. George Suckley in the Little Muddy River, and in Notice XL, p. 104, *Boleichthys warreni* (=*Boleichthys exilis*), obtained by Dr. F. V. Hayden in the Cannon Ball River September, 1856. The Cannon Ball flows into the Missouri just below Bismarck, N. Dak., in long. 100° 30′, lat. 46° 30′. The stream called Little Muddy River is probably near Bismarck.

**1860.** CHARLES C. ABBOTT. Descriptions of two new species of *Pimelodus* from Kansas. <Proc. Ac. Nat. Sci. Phila. 1860, 568-569.

In this paper are given descriptions of the two nominal species, *Pimelodus hammondii* (=*Ictalurus punctatus*) and *Pimelodus notatus* (=*Ictalurus punctatus*). The types of each were collected at Fort Riley, Kans., by Dr. W. A. Hammond, presumably from the Kansas River.

**1860.** Dr. GEORGE SUCKLEY. Report upon the fishes collected on the [Pacific Railroad] Survey; chapter 1, Report upon the *Salmonidæ;* chapter 2, Report upon the fishes exclusive of the *Salmonidæ*. Pacific Railroad Report, vol. XII, part III, No. 5, pp. 307-368, with 21 plates, 1860; and in Natural History of Washington Territory, same pagination, plates, and date.

All of the dozen Missouri Basin fishes mentioned in this paper were collected by Dr. Suckley.

| Page. | Nominal species. | Identification. | Locality. |
|---|---|---|---|
| 348 | (Salmo) Salar lewisi | Salmo mykiss lewisi | Falls of Missouri River. |
| 351 | Stizostedion boreus | Stizostedion canadense boreum | Milk River. |
| 355 | Amblodon grunniens | Aplodinotus grunniens | Do. |
| 359 | Pimelodus olivaceus | Ictalurus punctatus | Do. |
| 360 | Carpiodes damalis | Carpiodes velifer | Do. |
| 360 | Acomus lactarius | Catostomus griseus | Do. |
| 360 | Catostomus sucklii | Catostomus commersonii | Upper Missouri and its tributaries. |
| 360 | Pimephales fasciatus | Pimephales promelas | Milk River. |
| 361 | Hybognathus argyritis | Hybognathus argyrite | Do. |
| 361 | Pogonichthys communis | Platygobio gracilis | Do. |
| 361 | Gobio gelidus | Hybopsis gelidus | Do. |
| 364 | Hyodon tergisus | Hiodon tergisus | West of Fort Union. |

**1862.** THEODORE GILL. Observations on the genus *Cottus*, and descriptions of two new species (abridged from the forthcoming report of Capt. J. H. Simpson.) <Proc. Bost. Soc. Nat. Hist., VIII, 1862, 40-42.

In this paper, page 40, is given the original description of *Potamocottus punctulatus* (=*Cottus bairdi punctulatus*), the type a single specimen obtained by Dr. George Suckley in 1859, "between Bridger's Pass and Fort Bridger." This is probably in the Missouri Basin.

**1862a.** THEODORE GILL. Descriptions of new species of *Pimelodinæ* (abridged from the forthcoming report of Capt. J. H. Simpson). <Proc. Bost Soc Nat. Hist., VIII, 1862, 42-46.

In this paper Dr. Gill described as new 3 species of catfishes, viz. *Ictalurus simpsonii* (=*I. punctatus*), from the "Big Sandy River of Kansas" (probably the Kansas River); *Amiurus obesus* (=*Ameiurus melas*), "supposed to be from Nebraska" (collected by Mr. McCarthy); and *Noturus occidentalis* (=*N. flavus*) from Platte River. The first and third were collected by Dr. Suckley.

**1863.** F. W. PUTNAM. List of the fishes sent by the Museum to different institutions in exchange for other specimens, with annotations. <Bull. Mus. Comp. Zool., vol. 1, No. 1, 2-16, 1863.

In this paper are described 2 species supposed to be new. The types of each were collected by Mr. Stolley in the Osage River, Missouri. They are *Alburnus lineolatus* Agassiz MS., 1854, and *Alburnus zonatus* Agassiz MS., 1854 (=*Notropis zonatus*). The first of these is unidentifiable; it may be *Notropis scylla.*

**1864.** THEODORE GILL. A new species of *Percopsis* (*Percopsis hammondii*) from Kansas. <Proc. Ac. Nat. Sci. Phila. 1864, 151.

In this note Dr. Gill describes *Percopsis hammondii* (=*Percopsis guttattus*), the specimen said to have been obtained in Kansas by Dr. W. A. Hammond.

**1864.** E. D. COPE. On a blind Silurid from Pennsylvania. <Proc. Ac. Nat. Sci. Phila. 1864, 231-233.

In the paper bearing this inadequate title Professor Cope describes not only the blind catfish from Pennsylvania and a new darter from New Jersey, but a new darter (as *Pœcilichthys mesœus* = *Boleosoma nigrum*) from Platte River, near Fort Kearney, Nebr. The type was collected by Dr. Hammond.

**1864a.** EDWARD D. COPE. Partial catalogue of the cold-blooded Vertebrata of Michigan. Part I. <Proc. Ac. Nat. Sci. Phila. 1864, 276-285.

In this paper Professor Cope records 5 species of fishes from the Missouri Basin, 4 of which he describes as new. All were collected by Dr. W. A. Hammond.

| Page. | Species. | Present identification. | Locality. |
|---|---|---|---|
| 277 | Pogonichthys (Platygobio) *gulonellus.* | Platygobio gracilis..... | Near Bridger Pass. |
| 278 | Rhinichthys *marillosus*..... | Rhinichthys cataractæ dulcis.. | Kansas. |
| 282 | Alburnus *oligaspis*..... | Notropis dilectus..... | Do |
| 283 | Hybognathus evansi..... | Hybognathus nuchale evansi... | Upper Platte River. |
| 284 | Campostoma *hippops*..... | Campostoma anomalum..... | Platte River at Fort Kearney, Kans. |

**1865.** EDWARD D. COPE. Partial catalogue of the cold-blooded Vertebrata of Michigan. Part II. <Proc. Ac. Nat. Sci. Phila. 1865, 78-88.

In this paper Professor Cope incorporates a "Note on fishes brought from the Platte [Kansas] River, near Fort Riley, by Dr. W. A. Hammond." Twenty-four species are mentioned, three of which (*Gasterosteus micropus*, *Fundulus sciadicus*, and *Lepidosteus otarius*) are described as new. The localities assigned to some of these species seem to be erroneous. *Gila affinis* certainly did not come from any Missouri Basin locality, and the trout mentioned as *Trutta lewisi* probably came from some point in the headwaters of the South Platte rather than

from Fort Riley. Fort Riley was on the Kansas River, in what is now Davis County, Kans., near the present town of Junction City. It is very doubtful if trout ever occurred so far east in Kansas.

| Page. | Nominal species. | Identification. |
|---|---|---|
| 85 | Bryttus longulus | Apomotis cyanellus. |
| 85 | Stizostedium americanum | Stizostedion canadense. |
| 85 | Pœcilichthys mesæus | Boleosoma nigrum. |
| 81 | Gasterosteus *microps* | Eucalia inconstans. |
| 85 | Trutta lewisi | Salmo mykiss stomias. |
| 85 | Hyodon tergisus | Hiodon tergisus. |
| 85 | Percopsis hammondii | Percopsis guttatus. |
| 78 | Fundulus *sciadicus* | Fundulus sciadicus. |
| 85 | Carpiodes damalis | Carpiodes velifer. |
| 85 | Catostomus chloropterum | Catostomus commersonii. |
| 85 | Campostoma hippops | Campostoma anomalum. |
| 85 | Hybognathus evansi | Hybognathus nuchalo evansi. |
| 85 | Pimephales promelas | Pimephales promelas. |
| 85 | Alburnus oligaspis | Notropis dilectus. |
| 85 | Gila affinis | Gila robusta (locality erroneous). |
| 85 | Semotilus corporalis | Semotilus atromaculatus. |
| 85 | Semotilus pallidus | Do. |
| 85 | Platygobio gulonellus | Platygobio gracilis. |
| 85 | Ceratichthys cyclotis | Hybopsis kentuckiensis. |
| 85 | Rhinichthys maxillosus | Rhinichthys cataractæ dulcis. |
| 85 | Ictalurus cærulescens | Ictalurus punctatus. |
| 86 | Ictalurus notatus | Do. |
| 86 | Amia calva | Amia calva. |
| 86 | Lepidosteus *otarius* | Lepisosteus osseus. |

**1870.** EDWARD D. COPE. A partial synopsis of the fishes of the fresh waters of North Carolina. <Proc. Amer. Philos. Soc. 1869–70 (June 7, 1870), 448–495.

In this paper, page 482, *Carpiodes grayi* (=*Carpiodes velifer*) is described as new. The definite locality is not known, but Prof. Cope says "it is probably from one of the Western States."

**1870.** AUG. DUMÉRIL. Histoire naturelle des poissons, ou ichthyologie générale, vol. II, 1870.

In this work the common sturgeon of the Great Lakes and the Mississippi Valley is described as new no fewer than sixteen times. The types of three of these nominal species are reputed to have come from the Missouri Basin. They are the following: *Acipenser* (*Huso*) *copei*, Upper Missouri; *Acipenser* (*Huso*) *rauchii*, Osage River, Missouri, and *Acipenser* (*Huso*) *anasimos*, Missouri River, near St. Louis.

**1871.** EDWARD D. COPE. Recent reptiles and fishes. Report on the reptiles and fishes obtained by the naturalists of the expedition. <Preliminary Report U. S. Geological Survey of Wyoming and portions of contiguous territory, being a second annual report of progress, 432–442, 1870 (1871).

This paper is a report upon the fishes collected by the naturalists of the Hayden Survey during the season of 1870. Most of the specimens were probably collected by C. P. Carrington, zoologist, and Henry D. Schmidt, naturalist, of the expedition. Some were obtained by Dr. W. A. Hammond, and others by Dr. William Stimpson.

| Page. | Nominal species. | Present name. | Locality. |
|---|---|---|---|
| 433 | Salmo (Salar) *stomias*..... | Salmo mykiss stomias..... | Platte [Kansas] River near Fort Riley. |
| 434 | Catostomus sucklii ..... | Catostomus commersonii... | Platte River. |
| 434 | Catostomus griseum..... | Catostomus griseus ..... | Horse Creek, Red Cloud Creek, Platte River. |
| 437 | Ptychostomus *bucco* ..... | Moxostoma bucco..... | St. Joseph, Mo. |
| 437 | Campostoma anomalum..... | Campostoma anomalum.... | Probably headwaters of Platte River. |
| 437 | Coliscus *parietalis*..... | Pimephales promelas..... | Missouri River near St. Joseph. |
| 437 | Hybopsis *missuriensis*..... | Notropis blennius..... | Near St. Joseph, Mo. |
| 438 | Hybopsis *scylla*..... | Notropis scylla..... | Red Cloud Creek. |
| 438 | Photogenis *piptolepis*..... | Notropis piptolepis..... | North Platte River and Red Cloud Creek. |
| 439 | Hypsilepis cornutus..... | Notropis cornutus ..... | Red Cloud Creek. |
| 439 | Cyprinella *lillingsiana* ..... | Notropis lutrensis..... | St. Joseph, Mo. |
| 439 | Moniana *jugalis* ..... | ....do..... | Do. |
| 440 | Alburnellus *percobromus*... | Notropis rubrifrons..... | Do. |
| 440 | Sarcidium *scopiferum*..... | Phenacobius scopifer..... | Missouri River near St. Joseph, Mo. |
| 442 | Rhinichthys maxillosus .... | Rhinichthys cataractæ dulcis. | Red Cloud Creek and Platte River. |
| 442 | Noturus flavus..... | Noturus flavus..... | Platte River. |

**1872.** EDWARD D. COPE. Report on the recent reptiles and fishes of the survey, collected by Campbell Carrington and C. M. Dawes. <Preliminary Report U. S. Geological Survey of Montana and portions of adjacent territory, being a fifth annual report of progress, 467–476, 1872.

Only three or four species from the Missouri Basin are mentioned in this paper.

| Page. | Nominal species. | Present name. | Locality. |
|---|---|---|---|
| 469 | Thymallus tricolor ... | Thymallus signifer ontariensis. | Yellow Creek and the Gallatin Fork of the Missouri in Montana; headwaters of Yellowstone. |
| 471 | Salmo *pleuriticus* ..... | Salmo mykiss stomias and Salmo mykiss lewisi. | Platte River and Yellowstone River; Yellow Creek and Gallatin Fork of Missouri, Montana; Yellowstone Lake. |
| 476 | Uranidea punctulata. | Cottus bairdi punctulatus. | Gallatin Fork of the Missouri River. |

**1874.** EDWARD D. COPE. On the *Plagopterinæ* and the ichthyology of Utah. <Proc. Amer. Philos. Soc. Phila. 1874, 129–139, 1–11 of reprint.

In this paper one species is recorded from the Missouri Basin, viz: *Fundulus floripinnis*, which is described as new (as *Haplochilus floripinnis*, on page 10 of reprint). The specimens were obtained by Mr. J. M. Keasbey from the South Platte River near Denver.

**1874.** GEORGE SUCKLEY. On the North American species of salmon and trout. <Report U. S. Fish Comm. 1872–73 (1874), 91–160.

This paper was written by Dr. Suckley in 1861, but was not printed and published until 1874. Only one species is mentioned from the Missouri Basin, viz: *Salmo mykiss lewisi* (as *Salmo lewisi*), on page 139, from headwaters of the Missouri (Dr. Suckley; Dr. Cooper); southern tributaries of the Yellowstone; Black Hills, Nebr. (Dr. Hayden); on page 140, "Falls of the Missouri in Nebraska" (Dr. Cooper); "Great Falls of the Missouri" (the types; Dr. Suckley).

**1874.** JAMES W. MILNER. Notes on the grayling of North America. <Report U. S. Fish Comm. 1872–73 (1874), 729–742.

In this paper, p. 741, Professor Milner describes the grayling of the headwaters of the Missouri as a new species, to which he gives the name *Thymallus montanus*. The type came from Camp Baker, Montana.

**1876.** E. D. COPE and H. C. YARROW. Report upon the collections of fishes made in portions of Nevada, Utah, California, Colorado, New Mexico, and Arizona, during the years 1871, 1872, 1873, and 1874. <U. S. Geographical Surveys west of the one hundredth meridian, in charge of First Lieut. G. M. Wheeler, Corps of Engineers, U. S. Army, vol. v, Zoology, Fishes, 635–703, pls. XXVI–XXXII, 1875 (1876).

The only species mentioned in this report from the Missouri Basin is *Fundulus floripinnis* (as *Haplochilus floripinnis*, p. 695, pl. XXVIII, figs. 4, 4*a*, 4*b*), from Denver, Colo.

**1876.** THEODORE GILL. Report on [the] ichthyology [of Captain Simpson's explorations across the Great Basin of the Territory of Utah in 1859]. Appendix L, 385–431, pls. I–IX, 1876.

In this report the following species are mentioned as having been obtained from Missouri Basin localities:

| Page. | Nominal species. | Present name. | Locality. |
|---|---|---|---|
| 408 | Platygobio communis..... | Platygobio gracilis..... | Platte Valley.* |
| 417 | Ictalurus simpsoni..... | Ictalurus punctatus ..... | Big Sandy River of Kansas. |
| 420 | Amiurus obesus ..... | Ameiurus melas..... | Probably Nebraska. |
| 423 | Noturus occidentalis..... | Noturus flavus..... | Platte River. |

*The specimens of this species which Dr. Gill records from "Green River, Utah," almost certainly came from some point in the Missouri Basin. It is not known to occur in the Green River Basin. This is not the Big Sandy Fork of Green River, but probably the Platte, or possibly the Arkansas.

**1878.** DAVID STARR JORDAN. Report on the collection of fishes made by Dr. Elliott Coues, U. S. A., in Dakota and Montana during the seasons of 1873 and 1874. <Bull. U. S. Geol. and Geog. Surv. Terr., IV, 1878.

The fishes reported upon in this paper were collected by Dr. Elliott Coues, naturalist of the United States Northern Boundary Survey. The localities are not, in most cases, stated with such definiteness as is desirable. The following 9 species are reported from the Missouri Basin:

| Page. | Nominal species. | Present name. | Locality. |
|---|---|---|---|
| 777 | Scaphyrynchus platyrhynchus. | Scaphirhynchus platorynchus.. | Fort Buford, N. Dak. |
| 777, 778 | Ichthælurus punctatus..... | Ictalurus punctatus ..... | Big Muddy River. |
| 777, 792 | Hyodon chrysopsis..... | Hiodon alosoides..... | Quaking Ash River. |
| 777 | Catostomus teres..... | Catostomus commersonii..... | Five Forks of Milk River; headwaters of Milk River. |
| 777, 780 | Pantosteus virescens..... | Pantosteus jordani ..... | Sweet Grass Hills. |
| 777, 797 | Salmo clarki..... | Salmo mykiss lewisi ..... | St. Marys River. |
| 777 | Polyodon folium (?)..... | Polyodon spathula..... | Do. |
| 778, 798 | Esox lucius..... | Lucius lucius..... | Do. |
| 791 | Cliola chlora..... | Notropis scylla ..... | Upper Missouri. |

**1879.** E. D. COPE. A contribution to the zoology of Montana. <American Naturalist, XIII, July, 1879, 432–441.

In the summer and autumn of 1876 Professor Cope made an expedition into Montana and South Dakota, the special object of which was the investigation of the beds of the Judith River lignite formation and the extraction of their fossils. Some attention was given to the present fauna of the region, and this paper contains his notes on the fishes and other animals observed. The fishes mentioned were seen chiefly in the vicinity of Fort Benton, on the Missouri River, in longitude 110° 40′ west, latitude 47° 50′ north, and near the mouth of Battle Creek, which empties into the Missouri a short distance north of the mouth of the Moreau River, South Dakota, longitude 100° 30′ west, latitude 45° 25′ north. The streams from which fishes are recorded in this paper are: Missouri River at Fort Benton and near mouth of Battle Creek; lower portion of Battle Creek, South Dakota; Judith River, Montana, and headwaters of the Upper Missouri.

| Page. | Nominal species. | Present name. | Locality. |
|---|---|---|---|
| 439, 440 | Lucioperca borea..... | Stizostedion canadense boreum. | Missouri River at Fort Benton and elsewhere, abundant. |
| 440 | Lota maculosa..... | Lota lota maculosa..... | Battle Creek. |
| 440 | Ichthaelurus punctatus... | Ictalurus punctatus ..... | Pools left by river near Battle Creek. |
| 440 | Semotilus corporalis..... | Semotilus atromaculatus ..... | Battle Creek. |
| 440 | Pogonichthys communis . | Platygobio gracilis ..... | Fort Benton, Judith River. |
| 440 | Rhinichthys maxillosus.. | Rhinichthys cataractæ dulcis. | Battle Creek. |
| 440 | Phoxinus *milnerianus*.... | Leuciscus milnerianus..... | Battle Creek, probably. |
| 440 | Chrosomus sp. (?) ..... | Chrosomus dakotensis?..... | Battle Creek. |
| 440 | Hybognathus evansi ..... | Hybognathus nuchale evansi. | Do. |
| 440 | Hyborhynchus nigellus.. | Pimephales promelas..... | Do. |
| 441 | Hyodon tergisus ..... | Hiodon tergisus ..... | Judith River and river pools near Battle Creek. |
| 441 | Coregonus williamsonii .. | Coregonus williamsoni cismontanus. | Heads of tributaries of the Upper Missouri. |
| 441 | Lepidosteus productus... | Lepisosteus platostomus..... | River pools near Battle Creek. |
| 441 | Lepidosteus otarius..... | Lepisosteus osseus..... | Do. |
| 441 | Scaphirhynchops platyrhynchus. | Scaphirhynchus platorynchus. | Missouri River at Fort Benton. |

**1881.** SAMUEL GARMAN. New and little-known reptiles and fishes in the Museum collections. Bull. Mus. Comp. Zool., VIII, No. 3, 85–93, February, 1881.

This paper contains a single reference to the Missouri Basin. On page 88 *Fundulus lineatus* is described as new (as *Zygonectes lineatus*), and "northeastern Wyoming" is given as the type locality.

**1881a.** SAMUEL GARMAN. North American fresh-water fishes (1). Science Observer, vol. III, No. 8, 1881, 57–63.

In this paper is given a synopsis of the species of *Rhinichthys*. The western dace (*Rhinichthys cataractæ dulcis*) is recorded from Missouri Basin localities as follows: Northeast Wyoming and Montana (as *R. ocella* sp. nov.); Cheyenne, Wyo. (as *R. dulcis*); and from Kansas (as *R. maxillosus*).

**1883.** DAVID S. JORDAN and CHARLES H. GILBERT. Synopsis of the fishes of North America. Bull. U. S. Nat. Mus., 16, 1882 (1883).

In the Synopsis are several references to Missouri Basin localities, none of them, however, being original references.

**1884.** SETH E. MEEK. Description of a new species of *Hybopsis* (*Hybopsis montanus*).

This species was described from three specimens (No. 36882, U. S. N. M.) collected by Dr. F. V. Hayden. The exact locality is not known, but it is presumably somewhere in the Upper Missouri region.

**1884.** DAVID S. JORDAN. Descriptions of four new species of *Pœcilichthys* in the United States National Museum. <Proc. U. S. Nat. Mus., VII, 1884, 477–480.

On page 479 of this paper *Pœcilichthys beani* (=*Bolcosoma nigrum*) is described as new. The type (No. 35754, U. S. N. M.) came from Tabo Creek, Lafayette County, Mo.

**1884.** CHARLES H. GILBERT. Notes on the fishes of Kansas. <Bulletin Washburn Laboratory of Natural History, vol. I, No. 1, 10–16, September, 1884.

In 1883 the Washburn College laboratory of natural history (Topeka, Kans.) began a biological survey of the State of Kansas, under Prof. Francis W. Cragin, director, at that time professor of natural history in Washburn College. The fishes, which were collected chiefly by Professor Cragin and his students and by Dr. Watson, of Ellis, Kans., were studied by Dr. Gilbert. This paper and three others published in 1885, 1886, and 1889, respectively, contain the results of his examination of the different collections.

| Page. | Nominal species. | Identification. | Locality. |
|---|---|---|---|
| 10 | Amiurus melas | Ameiurus melas | Kansas River, Topeka. |
| 10 | Ictiobus carpio | Carpiodes carpio | Manhattan, Riley County, Ward Creek. |
| 10 | Catostomus teres | Catostomus commersonii | Shunganunga Creek and Kansas River, Topeka. |
| 11 | Campostoma anomalum | Campostoma anomalum | Alma, Wabaunsee County; Kansas River, Topeka; Ellis, Ellis County. |
| 11 | Hybognathus nuchalis | Hybognathus nuchale | Ward Creek, Menoken; Kansas River, Topeka. |
| 11 | Pimephales confertus | Pimephales promelas | Ellis, Ellis County. |
| 12 | Pimephales notatus | Pimephales notatus | Ward Creek. |
| 12 | Cliola straminea | Notropis blennius | Do. |
| 13 | Cliola (Hybopsis) *topeka* | Notropis topeka | Shunganunga Creek, Topeka. |
| 13 | Cliola (?) gibbosa | Notropis lutrensis | Ward Creek. |
| 14 | Minnilus cornutus | Notropis cornutus | Ellis, Ellis County. |
| 14 | Minnilus (Lythrurus) *nigripinnis*. | Notropis umbratilis umbratilis. | Shunganunga Creek, Topeka. |
| 14 | Phenacobius mirabilis | Phenacobius mirabilis | Ward Creek. |
| 15 | Semotilus corporalis | Semotilus atromaculatus | Shunganunga Creek, Topeka. |
| 15 | Fundulus zebrinus | Fundulus zebrinus | Ellis, Ellis County. |
| 16 | Lepomis humilis | Lepomis humilis | Ward and Shunganunga creeks, Topeka. |
| 16 | Pœcilichthys cœruleus | Etheostoma lepidum | Ellis, Ellis County. |

**1885.** CHARLES H. GILBERT. Description of three new fishes from Kansas. <Proc. U. S. Nat. Mus., VII, 1884 (January 19, 1885), 512–514.

Two of these three species are from Missouri Basin localities, viz: *Cliola* (*Hybopsis*) *topeka* (=*Notropis topeka*) from Shunganunga Creek, Topeka (type, No. 36609, U. S. N. M., coll. Prof. F. W. Cragin), and *Minnilus* (*Lythrurus*) *nigripinnis* (=*Notropis umbratilis umbratilis*), also from Shunganunga Creek, Topeka (type, No. 36613, coll. Prof. Cragin). The first publication of these names was really in the preceding paper.

**1885.** DAVID STARR JORDAN and SETH E. MEEK. List of fishes collected in Iowa and Missouri in August, 1884, with descriptions of three new species. <Proc. U. S. Nat. Mus. 1885, 1–17.

The explorations upon which this paper was based were carried on during August, 1884, under the auspices of the United States National Museum and the United States Fish Commission. The field work was under the direction of Dr. Jordan, assisted by Mr. Meek.

Collections were made in the Missouri Basin at the following places:

(*a*) At Bedford, Taylor County, Iowa, from the east fork of Hundred and Two River, and at Marysville, Nodaway County, Mo., from Hundred and Two River.

(*b*) At St. Joseph, Mo., from Missouri River on the Kansas shore opposite the city.

(*c*) About 6 miles east of Lexington, Lafayette County, Mo., from Tabo Creek, a small tributary of the Missouri.

(*d*) At Brownsville, Saline County, Mo., from Blackwater Creek, and near Sedalia, Pettis County, Mo., from Flat Creek. Both of these creeks are small tributaries of La Mine River, which flows into the Missouri northeast of Sedalia.

(*e*) At Clinton, Henry County, Mo., from Grand River, and at Calhoun, in the same county, from Tabo Creek, a small tributary of Grand River. Grand River flows into the Osage River at Warsaw, a few miles southeast of Clinton, and the latter stream unites with the Missouri just below Jefferson City.

Nineteen species were obtained from Hundred and Two River:

Noturus flavus.
Ameiurus melas.
Ictalurus punctatus.
Carpiodes velifer (as Ictiobus velifer).
Catostomus commersonii (as C. teres).
Hybognathus nuchale.
Pimephales promelas.
Pimephales notatus.
Notropis blennius (as N. deliciosus).
Notropis topeka (only at Bedford, from an abandoned stone quarry).
Notropis lutrensis.
Notropis umbratilis.
Notropis cornutus (as N. megalops).
Phenacobius mirabilis.
Hybopsis kentuckiensis (as H. biguttatus).
Semotilus atromaculatus.
Lepomis humilis.
Apomotis cyanellus (as Lepomis cyanellus).
Boleosoma nigrum (as Boleosoma olmstedi maculatum).

From the Missouri River, opposite St. Joseph, the following 22 species were collected:

Lepisosteus osseus.
Leptops olivaris.
Ameiurus melas.
Ameiurus natalis.
Ictalurus punctatus.
Ictalurus furcatus.
Ictiobus cyprinella.
Ictiobus urus.
Ictiobus bubalus.
Ictiobus carpio.
Hybognathus nuchale.
Notropis blennius (as N. deliciosus).
Platygobio gracilis.
Hybopsis meeki (as H. gelidus).
Dorosoma cepedianum.
Hiodon alosoides.
Micropterus salmoides.
Apomotis cyanellus (as Lepomis cyanellus).
Lepomis pallidus.
Pomoxis annularis.
Stizostedion canadense.
Aplodinotus grunniens.

From Tabo Creek, near Lexington, 9 species were obtained, viz:

Ameiurus melas.
Ictalurus punctatus.
Notropis blennius (as N. deliciosus).
Notropis lutrensis.
Phenacobius mirabilis.
Semotilus atromaculatus.
Hiodon alosoides.
Dorosoma cepedianum.
Apomotis cyanellus (as Lepomis cyanellus).

From the tributaries (Blackwater and Flat creeks) of La Mine River 24 species were obtained, viz:

Noturus flavus.
Ameiurus melas.
Carpiodes velifer (as Ictiobus velifer).
Catostomus commersonii (as C. teres).
Moxostoma aureolum (as M. macrolepidotum duquesnii).
Campostoma anomalum.
Pimephales notatus.
Notropis blennius (as N. deliciosus).
Notropis lutrensis.
Notropis umbratilis.
Notropis cornutus (as N. megalops).
Notropis rubrifrons.
Abramis crysoleucas (as Notemigonus americanus chrysoleucus; from Blackwater Creek only).
Phenacobius mirabilis.
Hybopsis kentuckiensis (as H. biguttatus).
Semotilus atromaculatus.
Labidesthes sicculus.
Micropterus salmoides.
Apomotis cyanellus (as Lepomis cyanellus).
Lepomis humilis.
Pomoxis annularis.
Boleosoma nigrum (as Boleosoma olmstedi maculatum).
Etheostoma cæruleum spectabile (as E. variatum spectabile).
Aplodinotus grunniens.

From the tributaries (Grand River and Tabo Creek) of Osage River the following 27 species were secured:

Lepisosteus osseus.
Noturus flavus.
Ameiurus melas.
Leptops olivaris.
Ictalurus punctatus.
Carpiodes velifer (as Ictiobus velifer).
Catostomus commersonii (as C. teres).
Campostoma anomalum.
Pimephales notatus.
Cliola vigilax.
Notropis blennius (as N. deliciosus).
Notropis gilberti.
Notropis dilectus.
Notropis umbratilis.
Notropis cornutus (as N. megalops).
Notropis lutrensis.
Phenacobius mirabilis.
Hybopsis storerianus.
Semotilus atromaculatus.
Micropterus salmoides.
Dorosoma cepedianum.
Apomotis cyanellus (as Lepomis cyanellus).
Lepomis humilis.
Hadropterus phoxocephalus.
Boleosoma nigrum (as B. olmstedi maculatum).
Etheostoma cæruleum spectabile (as E. variatum spectabile).
Aplodinotus grunniens.

**1885a.** CHARLES H. GILBERT. Second series of notes on the fishes of Kansas. <Bull. Washburn Lab. Nat. Hist., vol. 1, No. 3, 97-99.

This is the second of the four papers of Dr. Gilbert based upon the collections made by Prof. F. W. Cragin in connection with the biological survey of Kansas conducted by the Washburn College laboratory of natural history.

Specimens were obtained from the following streams:

(*a*) Ward Creek, Shunganunga Creek, and Kansas River, in Shawnee County, near Topeka; collectors, Messrs. Ralph McCampbell and Dana McVicar. Menoken, Shawnee County; collector, Mr. L. T. Matthews.
(*b*) Manhattan, Riley County; collector, Prof. E. A. Popenoe.
(*c*) Mill Creek, at Alma, Wabaunsee County; collectors, Professor Cragin and Mr. Jerry Fields.
(*d*) Ellis, Ellis County; collector, Dr. L. Watson.

| Page. | Nominal species. | Identification. | Locality. |
|---|---|---|---|
| 97 | Ictalurus punctatus | Ictalurus punctatus | Ward Creek. |
| 97 | Amiurus melas | Ameiurus melas | Shunganunga and Ward creeks. |
| 97 | Ictiobus carpio | Carpiodes carpio | Manhattan and Ward Creek. |
| 98 | Catostomus teres | Catostomus commersonii | Shunganunga Creek and Kansas River. |
| 98 | Moxostoma macrolepidotum | Moxostoma aureolum | Shunganunga Creek. |
| 98 | Campostoma anomalum | Campostoma anomalum | Shunganunga Creek, Kansas River, Ellis, and Mill Creek. |
| 98 | Hybognathus nuchalis | Hybognathus nuchale | Ward Creek, Menoken, and Kansas River. |
| 98 | Pimephales promelas | Pimephales promelas | Shunganunga Creek, Kansas River, Ward and Mill creeks and Ellis. |
| 98 | Pimephales notatus | Pimephales notatus | Shunganunga and Ward creeks. |
| 98 | Notropis topeka | Notropis topeka | Shunganunga Creek and Ellis. |
| 98 | Notropis lutrensis | Notropis lutrensis | Ward and Shunganunga creeks. |
| 98 | Notropis megalops | Notropis cornutus | Ellis; Shunganunga, Ward, and Mill creeks. |
| 98 | Notropis nigripinnis | Notropis umbratilis umbratilis. | Shunganunga Creek. |
| 98 | Phenacobius mirabilis | Phenacobius mirabilis | Shunganunga and Ward creeks. |
| 98 | Hybopsis biguttatus | Hybopsis kentuckiensis | Mill Creek. |
| 99 | Semotilus atromaculatus | Semotilus atromaculatus | Mill and Shunganunga creeks. |
| 99 | Fundulus zebrinus | Fundulus zebrinus | Ellis. |
| 99 | Lepomis humilis | Lepomis humilis | Ellis; Ward and Shunganunga creeks. |
| 99 | Lepomis cyanellus | Apomotis cyanellus | Ward and Shunganunga creeks. |
| 99 | Etheostoma variatum | Etheostoma cæruleum spectabile. | Ellis. |

**1885.** F. W. CRAGIN. Note on the chestnut lamprey. <Bull. Washburn Lab. Nat. Hist., vol. 1, No. 3, 99–100.

In this note Professor Cragin records the occurrence of the chestnut lamprey (*Ichthyomyzon castaneus*) in Mill Creek, Shawnee County, Kans.

**1885a.** F. W. CRAGIN. Preliminary list of Kansas fishes. <Bull. Wash. Coll. Lab. Nat. Hist., vol. 1, No. 3, 105–111.

This is a list of 91 nominal species thought to inhabit the waters of Kansas. Of this number 69 are credited to that portion of the State lying in the Missouri basin. These are given in the following tabular list:

| Page. | Nominal species. | Identification. | Locality. |
|---|---|---|---|
| 106 | Ammocœtes nigor | Lampetra wilderi | Kansas River at Lawrence (Snow). |
| 106 | Petromyzon argenteus | Ichthyomyzon concolor | Osage River (Prof. Wheeler). |
| 106 | Petromyzon castaneus | Ichthyomyzon castaneus | Mill Creek, Wabaunsee County (Cragin). |
| 106 | Polyodon spathula | Polyodon spathula | Kansas River at Lawrence (Snow). |
| 106 | Acipenser rubicundus | Acipenser rubicundus | Do. |
| 106 | Scaphirhynchops platyrhynchus. | Scaphirhynchus platorynchus. | Kansas River at Topeka (Cragin) and Lawrence (Snow). |
| 106 | Lepidosteus osseus | Lepisosteus osseus | Kansas River (Cragin) and Osage River (Wheeler). |
| 106 | Lepidosteus platystomus | Lepisosteus platostomus | Kansas River at Topeka (Cragin), and Osage River (Wheeler). |
| 106 | Litholepis tristœchus | Lepisosteus osseus(?) | Kansas River at Junction City (Cragin). |
| 107 | Leptops olivaris | Leptops olivaris | Kansas River (Cragin), Lawrence (Snow), and Osage River (Wheeler). |
| 107 | Amiurus nebulosus | Ameiurus nebulosus | Topeka (Cragin), Lawrence (Snow), and Ottawa (Wheeler). |

| Page. | Nominal species. | Identification. | Locality. |
|---|---|---|---|
| 107 | Amiurus natalis | Ameiurus natalis | Kansas River (Snow). |
| 107 | Ictalurus albidus | Ictalurus punctatus (?) | Osage River (Wheeler). |
| 107 | Ictalurus lacustris | Ictalurus furcatus (?) | Kansas River (Snow) and Osage River (Wheeler). |
| 107 | Ictalurus punctatus | Ictalurus punctatus | Kansas River, Silver Lake, Ward Creek, and Mill Creek (Cragin); Manhattan (Prof. Popenoe); Blue River (Graham). |
| 107 | Ictalurus furcatus | Ictalurus furcatus | Kansas River (Snow). |
| 107 | Ictiobus cyprinella | Ictiobus cyprinella | Soldier Creek in Shawnee County (Cragin); Osage River (Wheeler). |
| 107 | Ictiobus urus | Ictiobus urus | Silver Lake and Soldier Creek in Shawnee County (Cragin). |
| 107 | Ictiobus bubalus | Ictiobus bubalus | Kansas River (Snow). |
| 107 | Ictiobus carpio | Carpiodes carpio | Silver Lake and Ward Creek in Shawnee County (Cragin); Fort Riley (Cope). |
| 107 | Ictiobus bison | Carpiodes velifer | Ottawa (Wheeler). |
| 107 | Ictiobus velifer | ....do | Eureka Lake (Graham). |
| 107 | Cycleptus elongatus | Cycleptus elongatus | Kansas River between Manhattan and Topeka (Cragin). |
| 107 | Catostomus teres | Catostomus commersonii | Shunganunga Creek and Kansas River (Cragin); Wild Cat Creek (Graham); Osage River (Wheeler); Fort Riley (Abbott). |
| 108 | Catostomus nigricans | Catostomus nigricans | Osage River (Wheeler). |
| 108 | Erimyzon sucetta | Erimyzon sucetta | Kansas River (Snow). |
| 108 | Minytrema melanops | Minytrema melanops | Osage River (Wheeler); Mill Creek (Cragin). |
| 108 | Moxostoma macrolepidotum. | Moxostoma aureolum | Soldier Creek, Shunganunga Creek and Silver Lake (Cragin); Osage River (Wheeler); Blue River (Graham). |
| 108 | Moxostoma aureolum | ....do | Kansas River (Snow). |
| 108 | Campostoma anomalum | Campostoma anomalum | Kansas River, Shunganunga Creek, Mill Creek, and Ellis (Cragin); Wild Cat Creek (Graham). |
| 108 | Hybognathus nuchalis | Hybognathus nuchale | Kansas River and Ward Creek (Cragin); Fort Riley (Cope). |
| 108 | Pimephales promelas | Pimephales promelas | Kansas River at Topeka and small streams in Shawnee, Wabaunsee, and Ellis counties (Cragin). |
| 108 | Pimephales notatus | Pimephales notatus | Shunganunga and Ward creeks (Cragin). |
| 108 | Notropis hudsonius | Notropis hudsonius | Wild Cat Creek (Graham). |
| 108 | Notropis topeka | Notropis topeka | Shunganunga Creek and Ellis (Cragin). |
| 108 | Notropis lutrensis | Notropis lutrensis | Shunganunga and Ward creeks (Cragin). |
| 108 | Notropis billingsiana | ....do | Missouri River at St. Joseph (Cope). |
| 108 | Notropis megalops | Notropis cornutus | Shawnee, Wabaunsee, and Ellis counties (Cragin). |
| 109 | Notropis atripinnis | Notropis umbratilis umbratilis. | Shunganunga Creek (Cragin). |
| 109 | Notropis percobromus | Notropis rubrifrons | St. Joseph, Mo. (Cope). |
| 109 | Phenacobius mirabilis | Phenacobius mirabilis | Shunganunga and Ward creeks (Cragin). |
| 109 | Rhinichthys maxillosus | Rhinichthys cataractæ dulcis. | Fort Riley (Cope). |
| 109 | Hybopsis biguttatus | Hybopsis kentuckiensis | Mill Creek (Cragin); Fort Riley (Cope). |
| 109 | Platygobio gracilis | Platygobio gracilis | Fort Riley (Cope). |

| Page. | Nominal species. | Identification. | Locality. |
|---|---|---|---|
| 109 | Semotilus atromaculatus ... | Semotilus atromaculatus ... | Shunganunga and Mill creeks (Cragin); Fort Riley (Cope). |
| 109 | Hyodon tergisus..... | Hiodon tergisus ..... | Kansas River at Topeka (Cragin). |
| 109 | Hyodon alveoides ..... | Hiodon alosoides ..... | Silver Lake (Cragin). |
| 109 | Dorosoma cepedianum ..... | Dorosoma cepedianum..... | Shunganunga and Ward creeks (Cragin). |
| 109 | Salmo purpuratus stomias.. | Salmo mykiss stomias ..... | Kansas River (Cope). |
| 109 | Percopsis hammondi..... | Percopsis guttatus..... | Kansas (Gill). |
| 110 | Fundulus zebrinus..... | Fundulus zebrinus..... | Ellis (Cragin). |
| 110 | Anguilla rostrata..... | Anguilla chrysypa ..... | Kansas River at Lawrence (Snow) and at Topeka (Cragin). |
| 110 | Pomoxys annularis ..... | Pomoxis annularis..... | Soldier Creek (Cragin). |
| 110 | Pomoxys sparoides ..... | Pomoxis sparoides..... | Osage River (Wheeler). |
| 110 | Ambloplites rupestris ..... | Ambloplites rupestris ..... | Kansas River (Snow). |
| 110 | Lepomis cyanellus..... | Apomotis cyanellus ..... | Shunganunga and Ward creeks (Cragin). |
| 110 | Lepomis humilis..... | Lepomis humilis..... | Shunganunga and Ward creeks and Ellis (Cragin). |
| 110 | Lepomis gibbosus ..... | Eupomotis gibbosus ..... | Osage River at Ottawa (Wheeler). |
| 110 | Micropterus salmoides ..... | Micropterus salmoides ..... | Soldier Creek (Cragin). |
| 110 | Ammocrypta pellucida ..... | Ammocrypta pellucida ..... | Kansas River (Snow). |
| 110 | Boleosoma nigrum..... | Boleosoma nigrum..... | Near Fort Riley (Cope). |
| 110 | Diplesion blennioides..... | Diplesion blennioides..... | Wild Cat Creek (Graham). |
| 111 | Etheostoma variatum..... | Etheostoma cæruleum spectabile. | Ellis (Cragin). |
| 111 | Stizostedion vitreum ..... | Stizostedion vitreum ..... | Soldier Creek (Cragin). |
| 111 | Stizostedion canadense ..... | Stizostedion canadense boreum. | Mill Creek (Graham). |
| 111 | Roccus chrysops..... | Roccus chrysops..... | Do. |
| 111 | Roccus interruptus..... | Morone interrupta..... | Kansas River (Snow). |
| 111 | Aplodinotus grunniens..... | Aplodinotus grunniens ..... | Kansas River (Cragin). |
| 111 | Lota maculosa ..... | Lota lota maculosa..... | Missouri River at Wyandotte (Snow; Bean). |

**1885.** I. D. GRAHAM. Preliminary list of Kansas fishes. <Trans. Kans. Ac. Sci., vol. IX, 1883-84 (1885), 69-78.

This paper seems to be merely a compilation and contains no definite original locality references. Several of the references need verification

| Page. | Nominal species. | Identification. | Locality.* |
|---|---|---|---|
| 70 | Ammocœtes niger..... | Lampetra wilderi..... | Wild Cat Creek near Manhattan. |
| 70 | Petromyzon argenteus..... | Ichthyomyzon concolor..... | Cottonwood River. |
| 70 | Polyodon spathula..... | Polyodon spathula..... | Kansas River, Manhattan. |
| 70 | Scaphirhynchops platyrrhynchus. | Scaphirhynchus platorynchus. | Kansas, common over the State. |
| 70 | Acipenser rubicundus..... | Acipenser rubicundus..... | Kansas River. |
| 70 | Lepidosteus osseus..... | Lepisosteus osseus..... | Common in all streams in Kansas. |
| 71 | Lepidosteus platystomus... | Lepisosteus platostomus... | Kansas River. |
| 71 | Amia calva..... | Amia calva..... | Branches of Missouri River, Osage River, etc. |
| 71 | Noturus miurus..... | Schilbeodes miurus..... | Branches of Missouri River. |
| 71 | Noturus exilis..... | Schilbeodes exilis..... | Osage River, etc. |
| 71 | Leptops olivaris..... | Leptops olivaris..... | Kansas River. |
| 71 | Amiurus melas..... | Ameiurus melas..... | Common over the State. |
| 71 | Amiurus natalis..... | Ameiurus natalis..... | Kansas River. |
| 71 | Amiurus nebulosus..... | Ameiurus nebulosus..... | Plentiful. |
| 71 | Ictalurus punctatus..... | Ictalurus punctatus..... | Quite common. |
| 71 | Ictalurus furcatus..... | Ictalurus furcatus..... | Large streams. |
| 71 | Ictiobus carpio..... | Carpiodes carpio..... | Kansas River. |
| 72 | Ictiobus velifer..... | Carpiodes velifer..... | Do. |
| 72 | Ictiobus velifer bison..... | ....do ..... | Do. |
| 72 | Ictiobus urus..... | Ictiobus urus..... | Kansas River and branches of the Missouri. |

*Some of the locality references given in this column seem somewhat vague, but we have used the phraseology of Mr. Graham.

| Page. | Nominal species. | Identification. | Locality. |
|---|---|---|---|
| 72 | Ictiobus bubalus | Ictiobus bubalus | Plentiful over State. |
| 72 | Ictiobus cyprinella | Ictiobus cyprinella | Eastern Kansas. |
| 72 | Cycleptus elongatus | Cycleptus elongatus | Kansas River. |
| 72 | Catostomus teres | Catostomus commersonii | Common over State. |
| 72 | Catostomus nigricans | Catostomus nigricans | Kansas River. |
| 72 | Moxostoma macrolepidotum. | Moxostoma aureolum | Plentiful. |
| 72 | Campostoma anomalum | Campostoma anomalum | Common in small streams. |
| 72 | Chrosomus erythrogaster | Chrosomus erythrogaster | Marais des Cygnes. |
| 72 | Hybognathus placita | Hybognathus nuchalo evansi. | Kansas River and other branches of the Missouri. |
| 73 | Pimephales promelas | Pimephales promelas | Kansas River. |
| 73 | Notropis hudsonius | Notropis hudsonius | Kansas River branches. |
| 73 | Notropis billingsiana | Notropis lutrensis | Kansas River and Missouri River at St. Joseph. |
| 73 | Notropis lutrensis | do | Very abundant. |
| 73 | Notropis lineolatus | Notropis scylla | Marais des Cygnes. |
| 73 | Notropis deliciosa | Notropis blennius | Kansas River branches. |
| 73 | Notropis topeka | Notropis topeka | Missouri River, St. Joseph. |
| 73 | Notropis rubifrons | Notropis rubifrons | Kansas and Missouri rivers. |
| 74 | Phenacobius mirabilis | Phenacobius mirabilis | Common throughout the State. |
| 74 | Hybopsis biguttatus | Hybopsis kentuckiensis | Very common. |
| 74 | Hybopsis gelidus | ?Hybopsis meeki | Branches of Missouri River. |
| 74 | Hybopsis storerianus | Hybopsis storerianus | Osage River and branches. |
| 74 | Platygobio gracilis | Platygobio gracilis | Kansas River. |
| 74 | Gila affinis | Gila robusta | Kansas River (erroneous). |
| 74 | Notemigonus chrysoleucus | Abramis crysoleucas | Eastern Kansas. |
| 74 | Hyodon alosoides | Hiodon alosoides | Kansas, Marais des Cygnes, and Missouri rivers. |
| 74 | Hyodon tergisus | Hiodon tergisus | Common. |
| 75 | Dorosoma cepedianum | Dorosoma cepedianum | Very common. |
| 75 | Fundulus zebrinus | Fundulus zebrinus | Kansas River and branches. |
| 75 | Fundulus diaphanus | Fundulus diaphanus | Kansas River. |
| 75 | Anguilla rostrata | Anguilla chrysypa | Believed to be common throughout the State. |
| 75 | Pomoxys annularis | Pomoxis annularis | Kansas River at Lawrence. |
| 75 | Chænobryttus gulosus | Chænobryttus gulosus | Kansas River. |
| 75 | Lepomis cyanellus | Apomotis cyanellus | Common. |
| 75 | Lepomis humilis | Lepomis humilis | Locally abundant. |
| 76 | Micropterus salmoides | Micropterus salmoides | Kansas River at Lawrence. |
| 76 | Micropterus dolomieu | Micropterus dolomieu | Marais des Cygnes. |
| 76 | Percina caprodes | Percina caprodes | Eastern Kansas. |
| 76 | Boleosoma olmstedi maculatum. | Boleosoma nigrum | Kansas River. |
| 76 | Diplesion blennioides | Diplesion blennioides | Wild Cat Creek, Manhattan. |
| 76 | Hadropterus phoxocephalus | Hadropterus phoxocephalus | Marais des Cygnes. |
| 76 | Etheostoma variatum | Etheostoma cæruleum | Kansas River. |
| 76 | Etheostoma fusiforme | Boleichthys fusiformis | Marais des Cygnes. |
| 77 | Stizostedion vitreum | Stizostedion vitreum | Kansas River. |
| 77 | Stizostedion canadense | Stizostedion canadense | Kansas River and Mill Creek. |
| 77 | Roccus chrysops | Roccus chrysops | Kansas River. |
| 77 | Aplodonatus (Aplodinotus) grunniens | Aplodinotus grunniens | Do. |
| 77 | Clupea chrysochloris | Pomolobus chrysochloris | Abundant in large streams. |

**1886.** CHARLES H. GILBERT. Third series of notes on Kansas fishes. <Bull. Washburn Laboratory of Natural History, vol. 1, No. 7, 207-211.

This is the third series of notes upon the collections made by the Washburn College Laboratory biological survey of Kansas. The Missouri Basin specimens reported upon in this paper came from the following places:

(*a*) Mission Creek, Shawnee County; collectors, Messrs. H. J. Adams and Ralph McCampbell.
(*b*) Snokomo Creek, Wabaunsee County; collector, Mr. Aaron Myers.
(*c*) Missouri River, Leavenworth; collectors, Professors Cragin and Kelly, and Messrs. Poston, Lange, and Johnston.
(*d*) Shunganunga Creek, Shawnee County; collectors, Professor Cragin and Mr. Myers.
(*e*) Blacksmith Creek, Shawnee County; collectors, Messrs. Adams and McCampbell.
(*f*) Spring near Maple Hill, Wabaunsee County.

| Page. | Nominal species. | Identification. | Locality. |
|---|---|---|---|
| 207 | Noturus flavus | Noturus flavus | Mission Creek, Snokomo Creek, Leavenworth. |
| 207 | Amiurus natalis | Ameiurus natalis | Shunganunga, Blacksmith, and Mission creeks. |
| 207 | Ictalurus furcatus | Ictalurus furcatus | Leavenworth. |
| 208 | Notropis rubrifrons | Notropis rubrifrons | Blacksmith and Snokomo creeks. |
| 209 | Hybopsis gelidus | Hybopsis meeki | Leavenworth. |
| 209 | Hadropterus aspro | Hadropterus aspro | Snokomo Creek. |
| 209 | Percina caprodes | Percina caprodes | Do. |
| 209 | Etheostoma cæruleum lepidum. | Etheostoma lepidum | Shunganunga Creek and Maple Hill. |
| 210 | Boleosoma olmstedi maculatum. | Boleosoma nigrum | Shunganunga, Blacksmith, and Snokomo creeks. |
| 210 | Lota lota maculosa | Lota lota maculosa | Leavenworth. |
| 210 | Amiurus melas | Ameiurus melas | Blacksmith Creek. |
| 210 | Ictalurus punctatus | Ictalurus punctatus | Blacksmith and Mission creeks. |
| 210 | Catostomus teres | Catostomus commersonii | Blacksmith Creek. |
| 210 | Campostoma anomalum | Campostoma anomalum | Do. |
| 210 | Pimephales promelas | Pimephales promelas | Do. |
| 210 | Notropis topeka | Notropis topeka | Do. |
| 210 | Notropis lutrensis | Notropis lutrensis | Do. |
| 210 | Notropis megalops | Notropis cornutus | Do. |
| 210 | Hybopsis biguttatus | Hybopsis kentuckiensis | Mission and Blacksmith creeks. |
| 211 | Semotilus atromaculatus | Semotilus atromaculatus | Do. |
| 211 | Lepomis cyanellus | Apomotis cyanellus | Blacksmith Creek. |
| 211 | Lepomis humilis | Lepomis humilis | Do. |

**1887.** R. ELLSWORTH CALL. Memoranda on a collection of fishes from the Ozark region of Missouri. <Proc. Davenport Ac. Nat. Sci., vol. v, 1887, 73-80.

The collections upon which this paper was based were made by Professor Call in June and July, 1886. The majority of the specimens came from the west fork of Black River and its smaller tributaries in Reynolds County, and from Jacks Fork and its tributaries in Shannon County. These streams are in southeastern Missouri and drain southward by way of the Black River, being no part of the Missouri system. A small collection was made in Texas County, in Piney River, a tributary of the Gasconade, which flows northeastward into the Missouri. In October and November of the same year Professor Call made some collections

in Bear and Hickson creeks, near Columbia, Boone County, which lies on the north side of the Missouri. In this paper 11 species are credited to Piney River, viz:

Ictalurus punctatus.
Catostomus nigricans (as Hypentelium nigricans).
Campostoma anomalum.
Hybognathus nubilum (as Dionda nubila).
Hybognathus nuchale.
Notropis blennius (as N. deliciosus).
Notropis whipplii (as N. notatus).
Notropis zonatus.
Notropis cornutus (as N. megalops).
Micropterus dolomieu.
Cottus bairdi (as Uranidea richardsoni).

In the same paper 5 species are reported from Hickson Creek, near Columbia, Boone County, viz:

Catostomus commersonii (as C. teres).
Schilbeodes exilis (as Noturus exilis).
Campostoma anomalum.
Apomotis cyanellus (as Lepomis cyanellus).
Moxostoma aureolum (as M. macrolepidotum.)

From Bear Creek, near Columbia, Boone County, the 10 following species are recorded:

Apomotis cyanellus (as Lepomis cyanellus).
Lepomis humilis.
Boleosoma nigrum (as B. olmstedi ozarcanum).
Campostoma anomalum.
Pimephales notatus.
Pimephales promelas.
Notropis blennius (as N. deliciosus missuriensis).
Semotilus atromaculatus.
Phenacobius scopifer (as P. mirabilis scopifer).
Pomoxis annularis.

**1887.** O. P. HAY. A contribution to the knowledge of the fishes of Kansas. <Proc. U. S. Nat. Mus. 1887, 242–253.

The fishes on which this paper was based were collected in July, 1885, by Prof. Hay, assisted by Prof. M. J. Thompson, of Bethany College.

Collections were made from the following streams:

(*a*) Republican River, Concordia, Cloud County, Kans.
(*b*) Small tributary of Solomon River, Beloit, Mitchell County, Kans.
(*c*) North fork of Solomon River, Kirwin, Phillips County, Kans.
(*d*) North fork of Solomon River, Lenora, Norton County, Kans.
(*e*) Saline River, north of Wakeeney, Trego County, Kans.
(*f*) Smoky Hill River, Wallace, Wallace County, Kans.

The following species were obtained:

| Page. | Nominal species. | Identification. | Locality. |
|---|---|---|---|
| 242 | Hyodon alosoides | Hiodon alosoides | Republican River. |
| 242 | Notropis lutrensis | Notropis lutrensis | Do. |
| 242 | Ictiobus velifer | Carpiodes velifer | Do. |
| 242 | Ictalurus punctatus | Ictalurus punctatus | Do. |
| 242 | Ameiurus melas | Ameiurus melas | Do. |
| 243 | Boleosoma olmstedi | Boleosoma nigrum | Solomon River at Beloit. |
| 243 | Lepomis humilis | Lepomis humilis | Do. |
| 243 | Lepomis cyanellus | Apomotis cyanellus | Do. |
| 243 | Semotilus atromaculatus | Semotilus atromaculatus | Do. |
| 243 | Phenacobius mirabilis | Phenacobius mirabilis | Do. |
| 243 | Notropis megalops | Notropis cornutus | Do. |
| 243 | Notropis lutrensis | Notropis lutrensis | Do. |
| 244 | Notropis macrostoma | do | Do. |
| 245 | Notropis *æneolus* | Notropis topeka | Do. |
| 246 | Notropis deliciosus | Notropis blennius | Do. |
| 246 | Notropis topeka | Notropis topeka | Do. |
| 246 | Pimephales notatus | Pimephales notatus | Do. |
| 247 | Pimephales promelas confertus. | Pimephales promelas | Do. |

| Page. | Nominal species. | Identification. | Locality. |
|---|---|---|---|
| 247 | Campostoma anomalum..... | Campostoma anomalum .... | Solomon River at Beloit. |
| 247 | Moxostoma macrolepidotum. | Moxostoma aureolum..... | Do. |
| 247 | Catostomus teres ..... | Catostomus commersonii.... | Do. |
| 247 | Ictiobus velifer ..... | Carpiodes velifer ..... | Do. |
| 247 | Ictalurus punctatus ..... | Ictalurus punctatus..... | Do. |
| 247 | Amiurus melas ..... | Ameiurus melas..... | Do. |
| 247 | Lepidosteus osseus ..... | Lepisosteus osseus ..... | Do. |
| 247 | Lepomis humilis..... | Lepomis humilis..... | North fork of Solomon River at Kirwin. |
| 247 | Semotilus atromaculatus ... | Semotilus atromaculatus ... | Do. |
| 247 | *Notropis megalops*..... | *Notropis cornutus*..... | Do. |
| 247 | Notropis deliciosus ..... | Notropis blennius ..... | Do. |
| 248 | Notropis lutrensis ..... | Notropis lutrensis..... | Do. |
| 248 | Notropis æneolus..... | Notropis topeka ..... | Do. |
| 248 | Pimephales promelas confertus. | Pimephales promelas ..... | Do. |
| 248 | Pimephales notatus ..... | Pimephales notatus..... | Do. |
| 248 | Amiurus melas ..... | Ameiurus melas..... | Do. |
| 248 | Etheostoma lepidum..... | Etheostoma lepidum..... | North fork of Solomon River at Lenora. |
| 249 | Boleosoma olmstedi..... | Boleosoma nigrum..... | Do. |
| 249 | Lepomis cyanellus..... | Apomotis cyanellus..... | Do. |
| 249 | Fundulus zebrinus ..... | Fundulus zebrinus ..... | Do. |
| 249 | Squalius elongatus..... | Leuciscus elongatus..... | Do. |
| 249 | Semotilus atromaculatus... | Semotilus atromaculatus.... | Do. |
| 249 | Phenacobius mirabilis..... | Phenacobius mirabilis..... | Do. |
| 249 | *Notropis megalops* ..... | *Notropis cornutus* ..... | Do. |
| 249 | Notropis umbratilis ..... | Notropis umbratilis ..... | Do. |
| 249 | Notropis deliciosus ..... | *Notropis blennius* ..... | Do. |
| 249 | Notropis lutrensis ..... | Notropis lutrensis ..... | Do. |
| 249 | Pimephales promelas confertus. | Pimephales promelas ..... | Do. |
| 249 | Pimephales notatus ..... | Pimephales notatus..... | Do. |
| 249 | Chrosomus erythrogaster... | Chrosomus erythrogaster... | Do. |
| 250 | Campostoma anomalum..... | Campostoma anomalum..... | Do. |
| 250 | *Catostomus teres* ..... | *Catostomus commersonii*... | Do. |
| 250 | Noturus flavus ..... | Noturus flavus..... | Do. |
| 250 | Etheostoma lepidum..... | Etheostoma lepidum..... | Saline River near Wakeeney. |
| 250 | Boleosoma olmstedi..... | Boleosoma nigrum..... | Do. |
| 250 | Lepomis humilis..... | Lepomis humilis..... | Do. |
| 250 | Lepomis cyanellus..... | Apomotis cyanellus..... | Do. |
| 250 | Fundulus zebrinus..... | Fundulus zebrinus..... | Do. |
| 250 | Hyodon alosoides ..... | Hiodon alosoides ..... | Do. |
| 250 | *Semotilus atromaculatus*.... | *Semotilus atromaculatus*.... | Do. |
| 250 | Hybopsis biguttatus..... | Hybopsis kentuckiensis.... | Do. |
| 250 | Hybopsis storerianus..... | Hybopsis storerianus..... | Do. |
| 250 | Phenacobius mirabilis..... | Phenacobius mirabilis..... | Do. |
| 250 | Notropis megalops..... | Notropis cornutus ..... | Do. |
| 250 | Notropis deliciosus..... | Notropis blennius ..... | Do. |
| 250 | Notropis lutrensis ..... | Notropis lutrensis..... | Do. |
| 251 | *Notropis æneolus*..... | Notropis topeka ..... | Do. |
| 251 | Pimephales promelas confertus. | Pimephales promelas..... | Do. |
| 251 | Pimephales notatus..... | Pimephales notatus..... | Do. |
| 251 | Hybognathus nuchalis ..... | Hybognathus nuchale..... | Do. |
| 251 | Campostoma anomalum .... | Campostoma anomalum..... | Do. |
| 251 | Catostomus teres ..... | Catostomus commersonii ... | Do. |
| 251 | Ictiobus velifer..... | Carpiodes velifer..... | Do. |
| 251 | Ictalurus punctatus..... | Ictalurus punctatus..... | Do. |
| 251 | *Amiurus melas* ..... | *Ameiurus melas*..... | Do. |
| 252 | Etheostoma lepidum..... | Etheostoma lepidum..... | Smoky Hill River at Wallace. |
| 252 | Lepomis humilis..... | Lepomis humilis..... | Do. |
| 252 | Lepomis cyanellus..... | Apomotis cyanellus..... | Do. |
| 252 | Fundulus zebrinus..... | Fundulus zebrinus..... | Do. |
| 252 | Semotilus atromaculatus ... | Semotilus atromaculatus.... | Do. |
| 252 | Hybopsis biguttatus..... | *Hybopsis kentuckiensis*.... | Do. |
| 252 | Phenacobius mirabilis..... | Phenacobius mirabilis..... | Do. |
| 252 | *Notropis megalops*..... | *Notropis cornutus* ..... | Do. |
| 252 | Notropis deliciosus ..... | Notropis blennius ..... | Do. |
| 252 | Notropis lutrensis ..... | Notropis lutrensis ..... | Do. |
| 252 | Notropis æneolus ..... | Notropis topeka ..... | Do. |
| 252 | Notropis *germanus* ..... | Notropis heterodon ..... | Do. |
| 253 | Pimephales promelas confertus. | Pimephales *promelas* ..... | Do. |
| 253 | Hybognathus nuchalis ..... | Hybognathus nuchale..... | Do. |
| 253 | Campostoma anomalum..... | Campostoma anomalum..... | Do. |
| 253 | Catostomus teres ..... | Catostomus commersonii... | Do. |
| 253 | Amiurus melas ..... | Ameiurus melas ..... | Do. |
| 253 | Noturus flavus ..... | Noturus flavus ..... | Do. |

**1889.** CHARLES H. GILBERT. Fourth series of notes on the fishes of Kansas. <Bull. Washburn Laboratory of Natural History, vol. II, No. 9, 38–43, January, 1889.

These collections also were made by Professor Cragin and his students (James L. Poston and Dana McVicar) during the summer of 1887 for the Washburn College Laboratory of Natural History. The Missouri Basin localities are the following:

(*a*) Republican River, near Wano, Cheyenne County.
(*b*) Sappa Creek, a tributary of Republican River, Oberlin, Decatur County.
(*c*) North fork of Solomon River, Logan, Phillips County.
(*d*) North fork of Solomon River, Harlan, Smith County.
(*e*) Middle Beaver Creek, a tributary of North fork of Solomon River, Smith County.
(*f*) A spring branch of Spring Creek, near Smith Center, Smith County.
(*g*) Osage River, La Cygne, Linn County.

Localities *a* to *f* are in the northwestern part of the State, while *g* is near the middle of the eastern boundary.

| Page. | Nominal species. | Identification. | Locality. |
|---|---|---|---|
| 38 | Amiurus melas | Ameiurus melas | Sappa Creek. |
| 38 | Notropis deliciosus lineolatus. | Notropis blennius | Republican River; Logan and Harlan; Ward Creek, Shawnee County. |
| 39 | Notropis topeka | Notropis topeka | Sappa Creek. |
| 39 | Notropis lutrensis | Notropis lutrensis | Do. |
| 39 | Notropis jejunus | Notropis jejunus | Do. |
| 39 | Phenacobius mirabilis | Phenacobius mirabilis | Do. |
| 39 | Semotilus atromaculatus | Semotilus atromaculatus | Republican River. |
| 39 | Fundulus zebrinus | Fundulus zebrinus | Do. |
| 39 | Lepomis humilis | Lepomis humilis | Sappa Creek. |
| 39 | Etheostoma olmstedi maculatum. | Boleosoma nigrum | Do. |
| 40 | Amiurus melas | Ameiurus melas | Logan and Harlan; Middle Beaver Creek. |
| 40 | *Ictalurus punctatus* | *Ictalurus punctatus* | Harlan. |
| 40 | Noturus flavus | Noturus flavus | Logan and Harlan. |
| 40 | Catostomus teres | Catostomus commersonii | Middle Beaver Creek and Logan. |
| 40 | Campostoma anomalum | Campostoma anomalum | Middle Beaver Creek and spring branch of Spring Creek. |
| 40 | *Hybognathus nuchalis* | *Hybognathus nuchale* | Logan. |
| 40 | Pimephales promelas | Pimephales promelas | Middle Beaver Creek and Logan. |
| 40 | Notropis deliciosus lineolatus. | Notropis blennius | Middle Beaver and Spring creeks and Logan. |
| 40 | Notropis lutrensis | Notropis lutrensis | Do. |
| 40 | Notropis megalops | Notropis cornutus | Logan. |
| 40 | Phenacobius mirabilis | Phenacobius mirabilis | Do. |
| 40 | *Semotilus atromaculatus* | *Semotilus atromaculatus* | Middle Beaver and Spring Creeks. |
| 40 | Fundulus zebrinus | Fundulus zebrinus | Logan and in a spring branch of Sand Creek 5 miles southwest of Logan. |
| 40 | Lepomis humilis | Lepomis humilis | Smith County. ? |
| 40 | Ictalurus punctatus | Ictalurus punctatus | Osage River at La Cygne, Linn County, Kans. |
| 40 | Noturus flavus | Noturus flavus | Do. |
| 40 | Notropis deliciosus | Notropis blennius | Do. |
| 40 | Notropis lutrensis | Notropis lutrensis | Do. |
| 40 | Notropis rubrifrons | Notropis rubrifrons | Do. |
| 40 | Phenacobius mirabilis | Phenacobius mirabilis | Do. |
| 40 | Hybopsis biguttatus | Hybopsis kentuckiensis | Do. |
| 40 | Dorosoma cepedianum | Dorosoma cepedianum | Do. |
| 40 | Lepomis humilis | Lepomis humilis | Do. |
| 40 | *Lepomis cyanellus* | *Apomotis cyanellus* | Do. |
| 40 | Etheostoma phoxocephalus | Hadropterus phoxocephalus | Do. |

**1891.** DAVID STARR JORDAN. *Report of explorations in Colorado and Utah during the summer of 1889, with an account of the fishes found in each of the river basins examined.* <Bull. U. S. Fish Comm., IX, 1889 (May 29, 1891), 1-40, plates 1-5.

During July and August, 1889, these collections were made under the direction of the United States Fish Commission. In making them Dr. Jordan was assisted by Messrs. Barton W. Evermann, Bert Fesler, and Bradley M. Davis. Specimens from the Missouri Basin were obtained at the following places:

(*a*) South Platte River near Denver.
(*b*) South Platte River at Hartsel Hot Springs.
(*c*) Bear Creek near Morrison, Jefferson County, Colo. This creek is a small tributary of South Platte. The specimens from this place were obtained by Messrs. Fesler and Davis.
(*d*) Middle Boulder Creek near Boulder, Boulder County, Colo. This is also a tributary of the South Platte. The collecting here was done by Messrs. Jordan and Evermann.

The following species were obtained:

| Page. | Nominal species. | Identification. | Locality. |
|---|---|---|---|
| 7 | *Catostomus teres sucklii*.... | *Catostomus commersonii* | Denver. |
| 7 | Catostomus griseus..... | Catostomus griseus..... | Denver, Hartsel Hot Springs, Morrison, and Boulder. |
| 8 | Hybognathus nuchalis (? var. placita). | Hybognathus nuchalo evansi. | Denver. |
| 8 | Notropis scylla..... | Notropis scylla..... | Do. |
| 8 | Notropis gilberti..... | Notropis gilberti ..... | Do. |
| 8 | Notropis megalops..... | Notropis cornutus..... | Do. |
| 8 | *Notropis lutrensis*..... | *Notropis lutrensis*..... | Do. |
| 8 | Semotilus atromaculatus ... | Semotilus atromaculatus | Do. |
| 8 | Rhinichthys dulcis ..... | Rhinichthys cataractæ dulcis. | Denver, Hartsel Hot Springs, and Morrison. |
| 8 | Zygonectes floripinnis..... | Fundulus floripinnis... | Denver. |
| 8 | Etheostoma nigrum ..... | Boleosoma nigrum..... | Do. |
| 8 | Salmo mykiss stomias ..... | Salmo mykiss stomias .. | Morrison. |

**1891a.** DAVID STARR JORDAN. *A reconnoissance of the streams and lakes of the Yellowstone National Park, Wyoming, in the interest of the United States Fish Commission.* <Bull. U. S. Fish Comm., IX, 1889 (July 11, 1891), 41-63, plates 7-22, and map.

The investigations upon which this paper was based were made under the direction of the United States Fish Commissioner in October, 1889, by Dr. Jordan, assisted by Dr. C. H. Gilbert. The following streams in the Missouri Basin were examined:

(*a*) Yellowstone and Gardiner rivers near Mammoth Hot Springs, and Yellowstone River at Livingston, Mont.
(*b*) Madison River, Yellowstone Park.
(*c*) Horsethief Springs, Gallatin County, Mont.
(*d*) Gallatin River west of Yellowstone Park.
(*e*) Riddle Lake and Solution Creek, Yellowstone Park.
(*f*) Canyon Creek, Yellowstone Park.

The following species were found in the Missouri Basin:

| Page. | Nominal species. | Identification. | Locality. |
|---|---|---|---|
| 46 | Catostomus griseus..... | Catostomus griseus..... | Yellowstone and Gardiner rivers. |
| 48 | Rhinichthys dulcis..... | Rhinichthys cataractæ dulcis. | Gardiner River. |
| 49 | Coregonus williamsoni *cismontanus.* | Coregonus williamsoni cismontanus. | Madison, Yellowstone, and Gardiner rivers, and Horsethief Springs. |
| 49 | Thymallus signifer ontariensis. | Thymallus signifer ontariensis. | Madison River, Horsethief Springs, and Gallatin River. |
| 50 | Salmo mykiss..... | Salmo mykiss lewisi..... | Livingston, Gardiner River below the falls, Solution Creek, Riddle Lake, Canyon Creek, and Madison River. |
| 53 | Cottus bairdi punctulatus.. | Cottus bairdi punctulatus | Gibbon and Madison rivers, and Canyon Creek. |

**1891.** SETH EUGENE MEEK. Report of explorations made in Missouri and Arkansas during 1889, with an account of the fishes observed in each of the river basins examined. <Bull. U. S. Fish Comm., IX, 1889 (1891), 113–141.

The collections reported upon in this paper were made between July 17 and August 21, 1889, for the United States Fish Commission, by Professor Meek, assisted by Messrs. Frank M. Drew and Louis J. Rettger. Collections were made in Missouri in the Missouri Basin at the following places: Gasconade River at Arlington, Phelps County, and at a point 5 miles above Arlington; Little Piney River, an eastern tributary of the Gasconade at Arlington, and also at Newburg, Phelps County; Osage Fork of Gasconade River, 6 miles southeast of Marshfield, Webster County; Lock Fork of Gasconade River, Mansfield-Wright County; Big Piney River, a southern tributary of the Gasconade, near Cabool, Texas County; Jones Creek, a small western tributary of the Gasconade, near Dixon, Pulaski County; Marais River, near Dixon; Niangua River, near Marshfield; and Sac River, near Springfield, Greene County. The last three streams mentioned are tributaries of Osage River, the most important southern tributary of the Missouri in Missouri.

The following 16 species were obtained from the Gasconade River at or near Arlington:

Leptops olivaris.
Ictalurus punctatus.
Catostomus nigricans.
Moxostoma aureolum (as M. duquesnei).
Notropis shumardi (as N. boops).
Notropis zonatus.
Hybopsis kentuckiensis.
Hybopsis dissimilis.
Semotilus atromaculatus.
Fundulus catenatus.
Apomotis cyanellus (as Lepomis cyanellus).
Lepomis pallidus.
Micropterus dolomieu.
Diplesion blennioides (as Etheostoma blennioides).
Cottogaster uranidea (as Etheostoma uranidea).
Etheostoma cœruleum spectabile.

From Little Piney River at Arlington and Newburg 25 species were obtained, as follows:

Schilbeodes exilis (as Noturus exilis).
Catostomus nigricans.
Moxostoma aureolum (as M. duquesnei).
Hybognathus nubilum.
Pimephales notatus.
Notropis shumardi (as N. boops).
Notropis lutrensis.
Notropis whipplii.
Notropis zonatus.
Hybopsis kentuckiensis.
Hybopsis dissimilis.
Semotilus atromaculatus.
Dorosoma cepedianum.
Fundulus catenatus.
Apomotis cyanellus (as Lepomis cyanellus).
Lepomis pallidus.
Micropterus dolomieu.
Micropterus salmoides.
Diplesion blennioides (as Etheostoma blennioides).
Cottogaster uranidea (as Etheostoma uranidea).
Hadropterus aspro (as Etheostoma aspro).
Hypohomus cymatotænia (as Etheostoma cymatotænia).
Etheostoma flabellare.
Etheostoma cœruleum spectabile.
Cottus bairdi.

From Osage Fork of the Gasconade the following 27 species were taken:

Ameiurus nebulosus.
Catostomus nigricans.
Moxostoma aureolum (as M. duquesnei).
Campostoma anomalum.
Chrosomus erythrogaster.
Hybognathus nubilum.
Pimephales notatus
Notropis cayuga.
Notropis whipplii.
Notropis umbratilis cyanocephalus.
Notropis zonatus.
Notropis rubrifrons.
Hybopsis kentuckiensis.
Semotilus atromaculatus.
Fundulus macdonaldi (as Zygonectes macdonaldi).
Labidesthes sicculus.
Lepomis macrochirus.
Lepomis pallidus.
Lepomis megalotis.
Micropterus dolomieu.
Micropterus salmoides.
Percina caprodes (as Etheostoma caprodes).
Diplesion blennioides (as Etheostoma blennioides).
Hypohomus cymatotaenia (as Etheostoma cymatotaenia).
Etheostoma flabellare.
Etheostoma punctulatum.
Etheostoma cœruleum spectabile.
Cottus bairdi.

The following 20 species were found in Lock Fork of the Gasconade:

Catostomus nigricans.
Moxostoma aureolum (as M. duquesnei).
Campostoma anomalum.
Hybognathus nubilum.
Pimephales notatus.
Notropis cayuga.
Notropis umbratilis cyanocephalus.
Notropis zonatus.
Notropis cornutus (as N. megalops).
Notropis rubrifrons.
Hybopsis kentuckiensis.
Semotilus atromaculatus.
Lepomis macrochirus.
Micropterus salmoides.
Etheostoma punctulatum.
Etheostoma cœruleum spectabile.
Boleosoma nigrum (as Etheostoma nigrum).
Diplesion blennioides (as Etheostoma blennioides).
Percina caprodes (as Etheostoma caprodes).
Cottus bairdi.

The collection from Big Piney River contained 16 species, as follows:

Ameiurus melas.
Catostomus commersonii (as C. teres).
Moxostoma aureolum (as M. duquesnei).
Campostoma anomalum.
Chrosomus erythrogaster.
Pimephales notatus.
Notropis cayuga.
Notropis zonatus.
Notropis cornutus (as N. megalops).
Hybopsis kentuckiensis.
Semotilus atromaculatus.
Labidesthes sicculus.
Apomotis cyanellus (as Lepomis cyanellus).
Lepomis pallidus.
Micropterus salmoides.
Etheostoma cœruleum spectabile.

From Jones Creek, near Dixon, the following 17 species were taken:

Schilbeodes exilis (as Noturus exilis).
Catostomus nigricans.
Campostoma anomalum.
Chrosomus erythrogaster.
Hybognathus nubilum.
Notropis shumardi (as N. boops).
Notropis zonatus.
Hybopsis kentuckiensis.
Semotilus atromaculatus.
Fundulus catenatus.
Fundulus macdonaldi (as Zygonectes macdonaldi, types).
Etheostoma flabellare.
Etheostoma punctulatum.
Etheostoma cœruleum spectabile.
Microperca punctulata (as Etheostoma microperca).
Apomotis cyanellus (as Lepomis cyanellus).
Cottus bairdi.

The following 10 species were found in each of the three tributaries of the Osage River—the Marais, the Niangua, and the Sac:

Catostomus nigricans.
Campostoma anomalum.
Chrosomus erythrogaster.
Hybognathus nubilum.
Pimephales notatus.
Notropis zonatus.
Hybopsis kentuckiensis.
Semotilus atromaculatus.
Etheostoma cœruleum spectabile.
Cottus bairdi.

The following 7 species were found in both the Marais and Niangua, but not in the Sac:

Catostomus commersonii (as C. teres).
Moxostoma aureolum (as M. macrolepidotum duquesnei).
Campostoma anomalum.
Labidesthes sicculus.
Apomotis cyanellus (as Lepomis cyanellus).
Boleosoma nigrum (as Etheostoma nigrum).
Etheostoma flabellare.

The following 2 species were found in the Marais and Sac, but not in the Niangua:

Diplesion blennioides (as Etheostoma blennioides).
Notropis umbratilis.

In the Niangua were found 4 species not found in either of the two other streams, viz:

Schilbeodes exilis (as Noturus exilis).
Notropis cayuga.
Etheostoma punctulatum.
Etheostoma nianguæ.

The Marais contained 7 species not found in either of the other streams, viz:

Ameiurus melas.
Ictiobus cyprinella.
Ictiobus bubalus.
Abramis crysoleucas (as Notemigonus chrysoleucus).
Notropis lutrensis.
Lepomis humilis.
Micropterus dolomieu.
Hypohomus cymatotænia (as Etheostoma cymatotænia).

In the Sac River only 2 species were found which were not obtained from the Marais or the Niangua, viz:

Notropis blennius (as N. deliciosus).
Notropis rubrifrons.

**1892.** SETH EUGENE MEEK. Report upon the fishes of Iowa, based upon observations and collections made during 1889, 1890, and 1891. <Bull. U. S. Fish Comm., x, 1890 (1892), 217-248.

The Missouri Basin localities mentioned in this paper are as follows:

(*a*) Missouri River at Sioux City, Woodbury County, Iowa.
(*b*) Big Sioux River at Sioux City and at Sioux Falls, Minnehaha County, S. Dak.
(*c*) Silver Lake, Dickinson County, Iowa, at the head of the north fork of Little Sioux River.
(*d*) East Fork of Soldier River at Charter Oak, Crawford County, Iowa.
(*e*) Boyer River at Arion, Crawford County, Iowa.

All of these localities (except Sioux Falls) are in the northwestern part of Iowa, in which region all the streams flow southwestward, in courses nearly parallel to the Missouri. In this report upon the fishes of Iowa, Prof. Meek records the following species from that portion of the State lying in the Missouri River basin:

| Page. | Species. | Locality. |
|---|---|---|
| 245 | *Polyodon spathula* | Missouri River, Harrison County, Iowa. |
| 245 | Scaphirhynchus platorynchus | Missouri River. |
| 245, 246 | Ictalurus punctatus | Missouri River; Big Sioux River at Sioux City. |
| 245, 246 | Noturus flavus | Missouri River; Big Sioux River at Sioux Falls and Sioux City. |
| 246 | Schilbeodes gyrinus | Big Sioux River. |
| 247, 248 | Ameiurus melas | Silver Lake; Soldier River at Charter Oak; Boyer River at Arion. |
| 245, 246 | Carpiodes velifer | Missouri River; Big Sioux River at Sioux City. |
| 246, 248 | Catostomus commersonii | Big Sioux River at Sioux City; Boyer River at Arion. |
| 246 | Moxostoma aureolum (as duquesnei). | Big Sioux River at Sioux Falls and Sioux City. |
| 245, 246, 247 | Hybognathus nuchale | Missouri River; Big Sioux River at Sioux City; Soldier River at Charter Oak. |
| 246, 247 | Pimephales notatus | Big Sioux River at Sioux City and Sioux Falls; Silver Lake. |
| 247, 248 | Pimephales promelas | Silver Lake; Soldier River at Charter Oak; Boyer River at Arion. |
| 245, 246 | Notropis dilectus | Missouri River; Big Sioux River at Sioux Falls. |
| 246 | Notropis cayuga | Big Sioux River at Sioux City. |
| 246, 248 | Notropis blennius | Big Sioux River; Boyer River. |
| 246, 248 | Notropis topeka | Big Sioux River at Sioux City; Boyer River. |
| 246 | Notropis heterodon | Silver Lake. |
| 246 | Notropis hudsonius | Big Sioux River at Sioux City. |
| 246 | Notropis whipplii | Do. |
| 246 | Notropis atherinoides | Do. |
| 246, 247, 248 | Notropis cornutus (as megalops). | Big Sioux River; Silver Lake; Boyer River. |
| 247, 248 | Notropis gilberti | Soldier River; Boyer River. |
| 248 | Notropis lutrensis | Boyer River. |
| 245 | Hybopsis meeki (as gelidus) | Missouri River. |
| 246 | Hybopsis kentuckiensis | Big Sioux River at Sioux Falls. |
| 245 | Platygobio gracilis | Missouri River. |
| 246, 247 | Abramis crysoleucas | Big Sioux River at Sioux Falls; Silver Lake. |
| 247, 248 | Semotilus atromaculatus | Soldier River; Boyer River. |
| 248 | Phenacobius mirabilis | Boyer River. |
| 245, 246 | Dorosoma cepedianum | Missouri River; Big Sioux River at Sioux City. |
| 245, 246 | Hiodon alosoides | Do. |
| 246, 247 | Fundulus zebrinus | Big Sioux River at Sioux City; Silver Lake. |
| 246, 248 | Percopsis guttatus | Big Sioux River at Sioux City; Boyer River. |
| 248 | Lucius lucius | Boyer River. |
| 246 | Ambloplites rupestris | Big Sioux River at Sioux City and Sioux Falls. |
| 246, 247, 248 | Apomotis cyanellus | Big Sioux River at Sioux City and Sioux Falls; Soldier River; Boyer River. |
| 246, 248 | Lepomis humilis | Big Sioux River at Sioux City and Sioux Falls; Boyer River. |
| 247 | Lepomis megalotis | Silver Lake. |
| 246, 248 | Boleosoma nigrum | Big Sioux River at Sioux City and Sioux Falls; Boyer River. |
| 246 | Etheostoma zonale | Big Sioux River at Sioux City. |
| 246 | Hadropterus aspro | Big Sioux River. |
| 247 | Etheostoma iowæ | Silver Lake. |
| 246, 247 | Perca flavescens | Big Sioux River at Sioux City and Sioux Falls; Silver Lake. |
| 246 | Stizostedion vitreum | Big Sioux River. |
| 246 | Stizostedion canadense | Do. |
| 246, 247 | Roccus chrysops | Big Sioux River; Silver Lake. |
| 246 | Aplodinotus grunniens | Big Sioux River at Sioux City. |

**1892.** BARTON W. EVERMANN. A reconnaissance of the streams and lakes of western Montana and northwestern Wyoming, in Report of the Commissioner of Fish and Fisheries respecting the establishment of fish-cultural stations in the Rocky Mountain region and Gulf States. Senate Mis. Doc. 65, Fifty-second Congress, first session, 1–90, plates 1–36, May 25, 1892.

These investigations were carried on during July and August, 1891, by Professor Evermann, assisted by Prof. O. P. Jenkins, of Stanford University, and Mr. B. Clapham, of Monroeville, Ind.

The Missouri Basin localities from which specimens were obtained are the following:

(*a*) Red Rock River, near Red Rock, Beaverhead County, Mont.
(*b*) Beaverhead River, near Dillon, Beaverhead County, Mont.
(*c*) Junction of Firehole and Gibbon rivers, Yellowstone Park.
(*d*) Horsethief Springs, Gallatin County, Mont.
(*e*) Atlantic Creek, in and below Two-Ocean Pass, Wyoming.
(*f*) Mouth of Upper Yellowstone River, Yellowstone Park.
(*g*) Meadow Creek at its mouth on east side of Yellowstone Lake.
(*h*) East Fork of Gardiner River, below the falls, Yellowstone Park.
(*i*) McClellan Creek, near Helena, Mont.
(*j*) Canyon Creek, Yellowstone Park.

From these localities only 7 species were obtained, viz:

| Page. | Species. | Identification. | Locality. |
|---|---|---|---|
| 41 | Catostomus discobolus.... | Pantosteus jordani..... | Red Rock and Beaverhead rivers. |
| 42 | Rhinichthys dulcis..... | Rhinichthys cataractæ dulcis. | Beaverhead River, Red Rock River, and junction of Firehole and Gibbon rivers. |
| 47 | Coregonus williamsoni.... | Coregonus williamsoni oismontanus. | Do. |
| 47 | Thymallus signifer..... | Thymallus signifer montanus. | Red Rock and Beaverhead rivers; junction of Firehole and Gibbon Rivers; Horsethief Springs. |
| 48 | Salmo mykiss..... | Salmo mykiss lewisi..... | Atlantic Creek in Two-Ocean Pass and one mile above its mouth; mouth of Upper Yellowstone River; Meadow Creek; east fork of Gardiner River; McClellan Creek. |
| 51 | Cottus bairdi punctulatus. | Cottus bairdi punctulatus. | Beaverhead and Red Rock rivers; Canyon Creek and junction of Firehole and Gibbon rivers. |
| 52 | Lota lota maculosa..... | Lota lota maculosa..... | Red Rock River. |

**1892a.** BARTON W. EVERMANN. Report on the establishment of fish-cultural stations in the Rocky Mountain region and Gulf States. <Bull. U. S. Fish Comm., XI, 1891 (1892), 1–90, plates 1–36.

This is the Fish Commission edition of the above report, and contains no additional species.

**1893** BARTON W. EVERMANN. Description of a new sucker, *Pantosteus jordani*, from the Upper Missouri Basin. <Bull. U. S. Fish Comm., XII, 1892 (January 27, 1893), 51–56, with figure.

This paper contains the original description of *Pantosteus jordani*. The type locality and all others from which specimens were obtained are given under this species in the general list and need not be repeated.

**1893a.** BARTON W. EVERMANN. The ichthyologic features of the Black Hills. <Proc. Indiana Ac. Sci. 1892 (1893), 73-78.

This was a preliminary paper upon the work done in the Black Hills and gives the Black Hills localities for the 15 species collected there in October, 1892, by Evermann and McCormick. All these localities are clearly given in the present report, and need not be repeated here.

**1894.** CARL H. EIGENMANN. Results of explorations in western Canada and the northwestern United States. <Bull. U. S. Fish Comm., XIV, 1894 (July 7), 101-132, plates 5-8.

During these explorations (summer of 1892) Dr. Eigenmann made two stations in the Missouri River basin—at Craig, Mont. (long. 112° W., lat. 47° N.), where collections were made from Missouri River, and at Poplar, Mont. (long. 105° W., lat. 48° N.), where Poplar River was examined. The following species are recorded by Dr. Eigenmann:

| Page. | Species. | Locality. |
|---|---|---|
| 107 | Noturus flavus | Missouri River at Craig, Mont. |
| 107 | Carpiodes velifer | Poplar River at Poplar, Mont. |
| 108 | Catostomus griseus | Missouri River at Craig. |
| 108 | Catostomus commersonii | Poplar River at Poplar. |
| 108 | Moxostoma aureolum | Poplar River. |
| 108 | Hybognathus nuchale evansi (as placita) | Do. |
| 110 | Notropis atherinoides | Do. |
| 111 | Rhinichthys cataractæ dulcis | Poplar River; Missouri River. |
| 111 | Couesius dissimilis | Poplar River. |
| 111 | Platygobio gracilis | Missouri River; Poplar River |
| 114 | Hiodon alosoides | Poplar River at Poplar. |
| 115 | Coregonus williamsoni | Missouri River at Craig. |
| 115 | Thymallus signifer ontariensis | Do. |
| 116 | Encalia inconstans | Poplar River at Poplar. |
| 118 | Stizostedion canadense boreum (as griseum) | Do. |
| 118 | Cottus bairdi punctulatus | Missouri River at Craig. |
| 118 | Lota lota maculosa | Do. |

**1894.** SETH EUGENE MEEK. Notes on the fishes of western Iowa and eastern Nebraska. <Bull. U. S. Fish Comm., XIV, 1894, 133-138.

The localities from which were obtained the specimens mentioned in this paper are the following:

(*a*) Spirit Lake, Dickinson County, Iowa.
(*b*) East and West Okoboji lakes, Dickinson County, Iowa.
(*c*) Little Sioux River, the outlet of Spirit and the Okoboji lakes, was examined at Cherokee, Cherokee County, Iowa.
(*d*) Floyd River was examined at Lemars, Plymouth County, and Sioux City, Woodbury County, Iowa.

Collections were made from these Iowa localities by Professor Meek in 1890. A few specimens from Spirit and East Okoboji lakes obtained by Professor Evermann, October 31, 1892, are also included.

(*e*) Platte River at Fremont, Dodge County, Nebr.
(*f*) Elkhorn River near Fremont, Nebr.
(*g*) Salt Creek near Lincoln, Nebr.
(*h*) Blue River at Crete, Saline County, Nebr.

The specimens from these four places were obtained in the summer of 1891 by Professor Meek and Prof. P. B. Burnett, then of Cotner College, now of Nebraska State University.

(*i*) Nebraska State fish commission ponds in Sarpy County, near the mouth of Platte River.

The few specimens recorded by Professor Meek from this locality were obtained by Messrs. Evermann and McCormick, October 25, 1892.

In this paper Dr. Meek records the following species from Missouri Basin localities:

| Page. | Species. | Locality. |
|---|---|---|
| 135 | Lepisosteus osseus | Spirit Lake, Iowa. |
| 135 | Schilbeodes gyrinus | Platte River at Fremont; Floyd River at Lemars and Sioux City. |
| 135 | Noturus flavus | Salt Creek near Lincoln. |
| 135 | Ameiurus melas | Platte and Elkhorn Rivers at Fremont; Salt Creek near Lincoln; Floyd River at Lemars; Spirit Lake. |
| 135 | Ictalurus punctatus | Blue River at Crete; Platte and Elkhorn rivers at Fremont; Salt Creek near Lincoln. |
| 135 | Ictiobus cyprinella | Elkhorn River at Fremont. |
| 135 | Ictiobus bubalus | Floyd River at Sioux City; East Okoboji Lake. |
| 135 | Carpiodes velifer | Blue, Platte, Elkhorn, and Floyd rivers. |
| 135 | Catostomus commersonii | Floyd River at Lemars and Sioux City. |
| 136 | Moxostoma aureolum | Floyd and Blue rivers. |
| 136 | Placopharynx duquesnei | Floyd River. |
| 136 | Campostoma anomalum | Floyd River at Sioux City. |
| 136 | Hybognathus nuchale | Platte, Elkhorn, and Floyd rivers; Salt Creek. |
| 136 | Pimephales promelas | Blue, Platte, Elkhorn, and Floyd rivers; Salt Creek. |
| 136 | Pimephales notatus | Blue, Elkhorn, and Floyd rivers. |
| 136 | Notropis cayuga | Floyd River. |
| 136 | Notropis blennius | Platte, Elkhorn, Blue, and Floyd rivers; Salt Creek. |
| 136 | Notropis gilberti | Floyd River. |
| 136 | Notropis topeka | Blue and Floyd rivers; Salt Creek. |
| 136 | Notropis hudsonius | Floyd River; Spirit Lake, and East and West Okoboji lakes. |
| 136 | Notropis lutrensis | Blue, Platte, Elkhorn, and Floyd rivers; Salt Creek. |
| 136 | Notropis cornutus | Floyd and Elkhorn rivers. |
| 136 | Notropis jejunus | Platte and Elkhorn rivers. |
| 136 | Notropis dilectus | Floyd and Elkhorn rivers. |
| 136 | Phenacobius mirabilis | Blue River. |
| 137 | Hybopsis kentuckiensis | Elkhorn River. |
| 137 | Hybopsis storerianus | Floyd and Elkhorn rivers. |
| 137 | Hybopsis hyostomus | Blue, Platte, and Elkhorn rivers. |
| 137 | Platygobio gracilis | Platte River. |
| 137 | Semotilus atromaculatus | Floyd River. |
| 137 | Abramis chrysoleucas | Platte and Floyd rivers; Spirit Lake. |
| 137 | Hiodon alosoides | Floyd and Platte rivers. |
| 137 | Dorosoma cepedianum | Floyd and Elkhorn rivers. |
| 137 | Percopsis guttatus | Floyd River; East Okoboji Lake. |
| 137 | Fundulus zebrinus | East Okoboji Lake. |
| 137 | Fundulus sciadicus | Floyd, Platte, and Elkhorn rivers. |
| 137 | Lucius lucius | Floyd River; East Okoboji, West Okoboji, and Spirit lakes. |
| 137 | Pomoxis sparoides | East Okoboji Lake. |
| 137 | Ambloplites rupestris | Floyd River. |
| 137 | Apomotis cyanellus | Platte River at South Bend and Fremont; Elkhorn and Floyd rivers. |
| 137 | Lepomis humilis | Platte River at South Bend and Fremont; Elkhorn, Blue, and Floyd rivers; Salt Creek. |
| 137 | Lepomis pallidus | Spirit Lake. |
| 137 | Eupomotis gibbosus | Do. |
| 138 | Micropterus salmoides | Floyd, Platte, and Elkhorn rivers; Spirit Lake. |
| 138 | Micropterus dolomieu | Spirit Lake. |
| 138 | Boleosoma nigrum | Floyd and Elkhorn rivers; Spirit and East Okoboji lakes. |
| 138 | Hadropterus aspro | Floyd River. |
| 138 | Etheostoma iowæ | Platte and Elkhorn rivers at Fremont; State fish commission ponds at South Bend; Floyd River at Lemars and Sioux City; Spirit Lake. |
| 138 | Perca flavescens | East Okoboji and Spirit lakes. |
| 138 | Stizostedion vitreum | West Okoboji and Spirit lakes. |
| 138 | Stizostedion canadense | Floyd and Platte rivers; Spirit Lake. |
| 138 | Aplodinotus grunniens | Elkhorn River. |

**1896.** ALBERT J. WOOLMAN. A report upon ichthyological investigations in western Minnesota and eastern North Dakota. < Report U. S. Fish Comm., 1893 (1896), 343-373.

During the months of July and August, 1892, Mr. Woolman made extensive collections of fishes in western Minnesota and eastern North Dakota, in the interests of the United States Fish Commission. He was assisted by Mr. Ulysses O. Cox, instructor in biology in the State Normal School, Mankato, Minn. The work was confined chiefly to the basins of the Minnesota River and the Red River of the North, but some work was done in the Dakota or James River, which is a tributary of the Missouri.

Collections were made in this river basin at the following places:

(*a*) Dakota River at Lamoure, about 100 miles southwest from Fargo.
(*b*) Dakota River at Jamestown, about 55 miles northeast from Lamoure.
(*c*) Pipestem Creek near Jamestown.

The total number of species obtained at these stations was 20. The following is the list:

| Page. | Name under which recorded. | Name adopted. | Locality. |
|---|---|---|---|
| 359 | Ameiurus nebulosus | Ameiurus nebulosus | Lamoure; Jamestown. |
| 359 | Ameiurus natalis | Ameiurus natalis | Lamoure. |
| 359 | Ameiurus melas | Ameiurus melas | Dakota River; Pipestem Creek. |
| 359 | Catostomus teres | Catostomus commersonii | Lamoure; Jamestown. |
| 359 | Moxostoma macrolepidotum duquesnei. | Moxostoma aureolum | Jamestown. |
| 359 | Campostoma anomalum | Campostoma anomalum | Do. |
| 359 | Pimephales notatus | Pimephales notatus | Lamoure; Jamestown. |
| 359 | Pimephales promelas | Pimephales promelas | Lamoure. |
| 360 | Hybognathus nuchalis | Hybognathus nuchalo | Jamestown. |
| 360 | Notropis megalops | Notropis cornutus | Lamoure; Jamestown. |
| 360 | Notropis deliciosus | Notropis blennius | Do. |
| 360 | Notropis cayuga | Notropis cayuga | Jamestown, in the river. |
| 360 | Hybopsis kentuckiensis | Hybopsis kentuckiensis | James River; Pipestem Creek. |
| 360 | Semotilus atromaculatus | Semotilus atromaculatus | Do. |
| 360 | Rhinichthys atronasus | Rhinichthys atronasus | Lamoure; Jamestown. |
| 360 | Lucius lucius | Lucius lucius | Jamestown. |
| 360 | Etheostoma nigrum | Boleosoma nigrum | Do. |
| 360 | Etheostoma aspro | Hadropterus aspro | Do. |
| 360 | Etheostoma iowæ | Etheostoma iowæ | Do. |
| 360 | Perca flavescens | Perca flavescens | Do. |

## CHARACTER OF THE FISH FAUNA OF THE MISSOURI RIVER BASIN.

The total number of species and subspecies of fishes at present known from the Missouri Basin is 143. These are distributed among 24 families and 68 genera, as may be seen from the table on pages 426–428. This table also shows the distribution of the species among the 9 different States of the Missouri Basin. It will be seen that the great majority of the species do not extend westward beyond the eastern counties of Kansas, Nebraska, and South Dakota. Only 55 of the 143 species are known from North Dakota, Montana, Wyoming, and Colorado, and but 10 of these are limited to those 4 States. On the other hand Missouri and the small part of Iowa drained by the Missouri furnish 94 species, or, if we include the narrow-timbered and abundantly-watered strip of eastern Kansas, Nebraska, and South Dakota, we have about 100 species occurring in this eastern or lower belt of the Missouri Basin.

The middle belt, or that portion lying between the one hundredth and the one hundred and fifth meridians, has such characteristic species as *Platygobio gracilis*, *Hybopsis gelidus*, *Rhinichthys cataractæ dulcis*, *Hybognathus nuchale evansi*, and the like. Few if any of these are confined to this belt, but they probably all extend more or less into the lower and upper belts.

The upper belt comprises the elevated mountain region where the water is comparatively clear and cold. The characteristic species here are the trout, whitefish, grayling, two or three species of suckers (*P. jordani*, *C. catostomus*, and *C. griseus*), and the western blob. These are all practically limited to this belt.

In the lower belt is found the limit in the westward extension of spiny-rayed fishes. West of the ninety-sixth meridian, which is approximately the eastern boundary of Nebraska and the Dakotas, not over a dozen species of spiny-rayed fishes are known to occur. This fact becomes interesting when we recall that a single small creek in Indiana (Bean Blossom Creek, Monroe County) is known to contain not fewer than 18 species of spiny-rayed fishes, and from the streams of Indiana alone we know at least 51 species of that group, nearly as many as the total number of species found in the entire fish fauna of the Missouri Basin west of the ninety-eighth meridian.

In the Missouri itself and in its larger tributaries are found such large river species as *Polyodon spathula*, *Scaphirhynchus platorynchus*, *Leptops olivaris*, *Ictalurus punctatus*, species of *Ictiobus*, and the like; but in the smaller streams *Catostomus*, *Hybognathus*, and *Notropis* are the principal genera represented. *Micropterus*, *Perca*, *Lepomis*, and *Etheostoma* are not rare on the eastern edge of this region, but they become more and more rare as we go westward and very soon disappear altogether. *Perca* has not been found west of Dakota River (98°30′ W.);

*Micropterus* has not been found west of Ravenna, Nebr. (98° 30′ W.), and it is not likely that it occurs naturally even that far west.

Of the four darters whose range extends farthest west in this basin, *Boleosoma nigrum* reaches only to Dakota River, *Hadropterus aspro* to Ewing, Nebr. (98° 20′ W.), and to Jamestown, N. Dak. (98° 30′ W.). *Etheostoma iowæ* extends still farther west, it having been found by us at Valentine, Nebr. (100° 30′ W.), while *Boleichthys exilis*, a somewhat doubtful species, was found by Dr. Suckley even a little farther west in North Dakota.

## THE ICHTHYOLOGIC PECULIARITIES OF THE BLACK HILLS.

The fish fauna of that portion of the Missouri system lying in and about the Black Hills is peculiarly restricted in its character, and presents a number of interesting problems in geographic distribution. The physical conditions of the region are briefly these:

(1) An isolated, mountainous region, approximately 75 by 100 miles in extent, covered with heavy pine forests and drained by more than a dozen good-sized creeks, whose waters are naturally cold, clear, and pure, and all flowing east, northeast, or southeast to the north or south fork of the Cheyenne.

(2) Surrounding this region on all sides is a broad plain 100 to 200 miles wide, in which the soil is full of alkali, where the rainfall is not great, where there are no forests, and where even herbaceous vegetation is very scant, where the soil is eroded with great ease, the streams are shallow, their beds constantly shifting, the water warm in the summer time and always strongly alkaline and full of solid matter in suspension. To the east and northeast, country of this character extends from the base of the Hills to the Missouri River at least, a distance of not less than 150 to 200 miles. To the southward is a broad strip almost equally uninviting, while on the west, extending from the base of the Hills to the Powder River, the country is barren in the main and the streams are of the same general character. Among the low hills on the east of the Powder River Valley are the headwaters of two streams; one of these is the Belle Fourche or north fork of the Cheyenne, which flows to the northeast and sweeps around the north base of the Black Hills; the other is the south fork of the Cheyenne, which, flowing east and south, hugs the south base of the Hills a little less closely, and then turning northeast unites with the north fork 30 or 40 miles east of the Hills, thereby forming the Big Cheyenne, which, after a course of more than 100 miles in a northeasterly direction, flows into the Missouri. Into one or the other of these two forks flow all the streams of the Hills.

Most of these streams were examined by us and collections made from them at many different places. Only 15 species of fishes were secured, and no other species has ever been reported from any definite locality of this region. The 15 species known from the Black Hills represent

but 4 families, viz: 2 catfishes, 4 suckers, 8 cyprinoids, and one member of the codfish family. Eight of the 15 species belong to one family, the *Cyprinidæ*. Not a single species of spiny-rayed fish has ever been found in any of the streams in or about the Hills and it is not probable that any will be found there. Many of the streams in or near the Hills would apparently furnish congenial homes for sunfishes, bass, and even several of the different species of darters. That these are not there must be due to the nature of the lower courses of the streams draining the Hills, and that of the Cheyenne to which they are all tributary. The Cheyenne is ordinarily a shallow stream whose waters are always more or less alkaline and filled with solid matter in suspension from the extremely easily eroded country through which it flows; and fishes would not ascend such streams from choice.

The lower courses of the streams flowing from the Hills are through the same Cretaceous beds and partake of the same character. Only those species with which the struggle has become most severe will be driven to seek protection and food in the muddy, alkaline streams, and they alone would eventually find their way into purer, clearer waters above. This, of course, means the soft-rayed, non-rapacious fishes, the suckers and minnows and other mud-loving forms.

The spiny-rayed species are aggressive, extending their attacks to all weaker forms about them, while the soft-rayed species are defensive and seek protection in retreat. A spiny-rayed fish has no occasion to ascend into the muddy, alkaline, and uncongenial portions of these streams; the only thing which would cause him to do so would be a quest for food, but he finds it easier and more agreeable to get food of sufficient quantity and quality where he is.

Not so with the soft-rayed fish; he must not only search for suitable food but he must also see that his enemy, the spiny-rayed fish, does not catch him. The attacks of his enemies were probably the first cause impelling him to take refuge in the turbid water. Finding suitable and sufficient food in this new environment, and total relief from the persecutions of his old enemies, he finds the struggle for existence easy, the surroundings in time become bearable and perhaps agreeable, and he moves about at will through all parts of the muddy stream and even into the headwaters where, still finding an abundant food supply and none of his old enemies, he is content to make his home.

Before mining began in the Hills in 1875 and 1876, nearly every stream possessed all the natural conditions necessary to make it an excellent trout stream. The waters were clear and cold, not subject to contamination from any source, and suitable food, such as insects and insect larvæ, and the smaller crustacea and mollusca, was undoubtedly found then, as now, in abundance. With the exception of a few streams which are now ruined by mining operations, the creeks of this region are yet excellent for trout.

The explanation of their absence is practically the same as that which accounts for the absence of spiny-rayed fishes. Land barriers have evidently proved competent to prevent trout getting in from the headwaters of the trout streams to the westward, and the mud and alkali which they encountered in the lower portion of the Yellowstone, the Missouri, and the Big Cheyenne have as certainly proved an impassable barrier from that direction. Among the many regions of the United States which possess the necessary natural conditions for trout, the Black Hills district is the only one of any considerable area, if we except portions of the Yellowstone National Park, in which one or more specimens of *Salmonidæ* are not or have not been indigenous. The absence of trout and all other species of fish from the various lakes and streams of Yellowstone National Park (i. e., Lewis and Shoshone lakes, Gibbon, Firehole, and Little Firehole rivers, and Indian, Glen, Nez Perce, and Sentinel creeks) is undoubtedly accounted for by the presence of impassable falls where these waters leave the great rhyolite sheet which covers the park, as shown by the investigations made by Dr. Jordan in 1889. The presence of trout in Yellowstone Lake and tributary streams, notwithstanding the fact that the outlet of Yellowstone Lake (Yellowstone River) has two enormous falls which wholly prevent the ascent of fish, is quite evidently due to the most interesting and curious fact that there is a continuous waterway furnishing easy passage for trout from the upper tributaries of Snake River by way of Two-Ocean Pass into the Upper Yellowstone River. That Yellowstone Lake could have been, and almost certainly was, stocked in this way from the Columbia Basin was demonstrated by the investigations which were made by Professor Evermann during a visit to Two-Ocean Pass in August, 1891.[1]

The presence of trout in the upper tributaries of the Colorado, Rio Grande, Arkansas, and South Platte, whose lower courses are, in some cases at least, not unlike those of the Cheyenne and Missouri, is a matter whose explanation is not without some difficulties. The relationships of the various species or subspecies of *Salmo* found in those different basins are very close and indicate a common origin at no remote date. It is certain that they are all descended from a form which came up from the Pacific Coast and that the headwaters of the Columbia, Colorado, Rio Grande, Arkansas, and South Platte have been connected in some way at some time or other, thus permitting the trout to spread into these various basins.[2]

That there are no trout in the Cheyenne Basin would seem to indicate that the streams of this system became separated and differentiated as a distinct drainage system earlier than did those of the South Platte, Arkansas, Rio Grande, Colorado, and Columbia; or else that they are

[1] See Bull. U. S. Fish Comm., XI, 1891, 24-28; also, Popular Science Monthly for June, 1895.

[2] For an interesting discussion of the origin of the varieties of *Salmo* of our western waters see "How the trout came to California," by Dr. Jordan, in Recreation, for October, 1894.

streams of more recent origin and have never been connected at any time with any of the streams containing trout. Such a history as this for the Cheyenne, together with the shallow, muddy, alkaline character of its lower portion, seems to be a reasonable explanation of the absence of trout from the Black Hills.[1]

The effect of the peculiar alkaline water of the Cheyenne and the lower courses of the streams flowing from the Black Hills has been to reduce the fishes to a nearly uniform pale, faded, or bleached appearance. Except those found above the alkali water, they are apparently almost wholly without pigment cells of any kind. Perhaps the most extreme case of bleaching is that of the flat-headed minnow, *Platygobio gracilis*, which, of all American fishes, seems to be the one most perfectly adapted to these alkali streams.

## ANNOTATED LIST OF THE FISHES FOUND IN THE MISSOURI RIVER BASIN.

In this list we give under each species all the localities in this basin from which it has been recorded. The references are arranged in chronological order, and the localities are given in the terms of the original record, except when a modification of the wording seemed desirable for sake of clearness. When in the original reference the fish was designated by some name different from the one by which it is now recognized, the name employed in the original reference is given in parenthesis. The name of the authority and the date of each reference are also given in parenthesis, thus enabling the reference to be connected with the appropriate title in the bibliography given on pages 350–379.

The nomenclature and sequence of species adopted in this paper agree essentially with the forthcoming "Fishes of North and Middle America," by Jordan & Evermann.

1. **Ichthyomyzon concolor** (Kirtland). *Silver Lamprey.* One small specimen, 4½ inches long, from Crow Creek, Chamberlain, South Dakota. This is the most western point from which this species has been reported. It has also been recorded from Kansas by Professor Snow, and from Cottonwood Creek, Kans. (as *Petromyzon argenteus*, Graham, 1885); Osage River (Cragin, 1885*a*).

2. **Ichthyomyzon castaneus** Girard. *Chestnut-colored Lamprey.* The only reference to the occurrence of this lamprey in the Missouri Basin is by Prof. F. W. Cragin (1885), who obtained four specimens at the mouth of Mill Creek, Shawnee County, Kans. These specimens were found attached to buffalo-fish.

[1] In his paper "On the North American species of salmon and trout," printed in the U. S. Fish Commission Report for 1872–73, Dr. Suckley, in giving the habitat of *Salmo lewisi*, credits it to the "Black Hills, Nebraska (Dr. Hayden)." We have been unable to verify this reference, and believe it to be erroneous. It is possible the specimen came from the headwaters of the North Platte, in what is now known as the Laramie Range. In that case the trout was *Salmo mykiss stomias*.

3. **Lampetra wilderi** Gage. *Brook Lamprey.* Wild Cat Creek, near Manhattan (as *Ammocœtus niger*, Graham, 1885); Kansas River at Lawrence (Cragin, 1885*a*).

4. **Polyodon spathula** (Walbaum). *Spoonbill Cat; Paddle-fish.* Fort Pierre, Nebr. (as *P. folium*, Girard, 1858); St. Mary River (Jordan, 1878); Kansas River (Graham, 1885); Kansas River at Lawrence (Cragin, 1885*a*); Missouri River, Harrison County, Iowa (Meek, 1891).

   A large male fish of this species was caught in White River, at the ford 12 miles from Chamberlain, S. Dak., June 24. Total length, 4 feet 5 inches; length to base of caudal fin, 3 feet 10 inches; tip of paddle to edge of gill flap, 2 feet 7 inches; to origin of dorsal fin, 2 feet 10½ inches; stretch of caudal fin, 1 foot; weight, 18 pounds.

   The water was not over 18 inches deep where this fish was caught. This species has not hitherto been reported from any point so far west, but it is probably not uncommon in the Missouri and its large tributaries even farther west than this place. Mr. Walker, who lives near the mouth of White River, says the spoonbill cat is occasionally seen there in the spring, and that one was taken near this same place, about the 1st of June of this year, which was about 5 feet long.

   While this curious and interesting fish is probably common in all the larger streams and bayous of the Mississippi Valley, especially in the lowland waters, it is very rarely caught or seen. During several years collecting in the Mississippi Valley, we have taken not more than 6 or 8 examples, all of which were rather large, the smallest being at least 15 inches long. Special search for the young has been made by us in the ponds and bayous along the lower Wabash River, but without finding any. Prof. Harrison Garman, who has made a careful study of the fauna of the waters of the Mississippi bottoms near Quincy, Ill., took but a single example, which was about 14 inches long. "The adults," he says, "are common in the Mississippi River, where they were occasionally seen leaping about the water."

5. **Acipenser rubicundus** Le Sueur. *Red Sturgeon; Common Sturgeon.* Upper Missouri River (as *Acipenser copei* type, Duméril, 1870); Osage River (as *Acipenser rauchi* type, Duméril, 1870); and Missouri River (as *Acipenser anasimos* type, Duméril, 1870); Kansas River (Graham, 1885); Kansas River at Lawrence (Cragin, 1885*a*).

   Not seen by us, but Mr. Walker informs us that sturgeon are often taken in White and Missouri rivers, near Chamberlain, in the spring, and we have learned from others that this species is of considerable importance as a food-fish in this portion of the Missouri River. In the vicinity of Yankton considerable numbers were formerly caught, but the fish is less abundant during the last few years.

6. **Scaphirhynchus platorynchus** (Rafinesque). *Shovel-nose Sturgeon.* Missouri River (Girard, 1858); Missouri River, at Fort Buford, N. Dak. (Jordan, 1878); Missouri River, at Fort Benton (Cope, 1879); "Common over the State of Kansas" (Graham, 1885); Kansas River at Lawrence and Topeka (Cragin, 1885*a*); Missouri River, Iowa (Meek, 1892).

   Specimens of this species were obtained from North Platte River at Casper and Douglas. The single specimen in the collection from Casper is 18 inches long. At Douglas numerous specimens were taken, the largest being about 2 feet long. Armed plates before the dorsal, 16; lateral plates, 42. A very small specimen from North Platte, at Grand Island, measures 4¾ inches in total length. Smaller individuals than this are not often taken in miscellaneous collecting. While at Creighton we were told of the capture of a shovel-nosed sturgeon 2 feet long in Bazile Creek, 15 miles from that place, a few weeks before our visit.

7. **Lepisosteus osseus** (Linnæus). *Long-nosed Gar.* Kansas River near Fort Riley (as *L. otarius* type, Cope, 1865); pools of the Missouri near mouth of Battle Creek, S. Dak. (as *L. otarius*, Cope, 1879); Osage River and tributaries and Missouri River at St. Joseph (Jordan & Meek, 1885); common in all streams of Kansas (Graham, 1885); Kansas and Osage rivers (Cragin, 1885*a*); Solomon River at Beloit (Hay, 1887); Spirit Lake (Meek, 1894). It was reported to us as being seen frequently in the Missouri at Niobrara and Chamberlain, and in the White River near the latter place. We examined one large example, 2½ feet long, which was taken in Crow Creek, near Chamberlain, while we were there. The distance from the tip of the bill to the eye was 6½ inches, or about one-fifth total length. There were no dark spots except on the caudal and one on the dorsal fin.

8. **Lepisosteus platostomus** Rafinesque. *Short-nosed Gar.* Pools of the Missouri River near Battle Creek, S. Dak. (as *Lepidosteus productus*, Cope, 1879); Kansas River (Graham, 1885); Kansas River at Topeka and Osage River (Cragin, 1885*a*). Not seen by us.

9. **Amia calva** Linnæus. *Mudfish; Dogfish.* Not seen by us. The only record for the upper Missouri is that of Cope in 1865, who reports it from "Platte [Kansas] River, Fort Riley." It is also recorded from the branches of Missouri River, Osage River, etc. (Graham, 1885). This species doubtless occurs in all the bayous along the lower Missouri.

10. **Ictalurus furcatus** (Le Sueur). *Chuckle-head Cat.* Missouri River, Leavenworth, Kans. (Gilbert, 1885); Missouri River, St. Joseph (Jordan & Meek, 1885); "Large streams" [in Kansas] (Graham, 1885); Kansas River and Osage River (Cragin, 1885*a*).

11. **Ictalurus punctatus** (Rafinesque). *Channel Cat; Blue Cat.* Fort Pierre, Nebr.; Milk and Yellowstone rivers; and Nebraska (as *Pimelodus olivaceus* types, Girard, 1858); Fort Riley, Kans. (as *Pimelodus hammondii* and *Pimelodus notatus* types, Abbott, 1860); Milk River (as *Pimelodus olivaceus*, Suckley, 1860); "Big Sandy River of Kansas" [Platte River] (as *Ictalurus simpsonii* type, Gill, 1862 and 1876); Kansas River near Fort Riley (as *I. cæruleus* and *I. notatus*, Cope, 1865); Big Muddy River (Jordan, 1878); Missouri River pools near mouth of Battle Creek, S. Dak. (Cope, 1879); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Missouri River at St. Joseph; Tabo Creek at Lexington, Mo.; Grand and Osage rivers at Clinton, Mo. (Jordan & Meek, 1885); "quite common" [in Kansas] (Graham, 1885); Ward Creek, Shawnee County, Kans. (Gilbert, 1885); Kansas River, Silver Lake, Ward Creek, Mill Creek, Manhattan, Blue River, and Osage River (Cragin, 1885*a*); Blacksmith and Mission creeks, Shawnee County, Kans. (Gilbert, 1886); Republican River at Concordia, Saline River at Wakeeney, and Solomon River at Beloit (Hay, 1887); Piney River, Texas County, Mo. (Call, 1887); Osage River at La Cygne, Kans.; Solomon River at Harlan, Kans. (Gilbert, 1889); Gasconade River, Mo. (Meek, 1891); Missouri River at St. Joseph and Big Sioux River at Sioux City (Meek, 1892).

Obtained by us at the following localities: White River at Chamberlain; Choteau Creek at Springfield; Bazile Creek at Niobrara; South Loup River and Mud Creek at Ravenna, and Clear Creek at Clermont, Wyo. It was also obtained by Professor Meek in Blue River at Crete, Salt Creek at Lincoln, and at Fremont in the Elkhorn and Platte rivers (Meek, 1894). In most of the streams where we found this fish at all it was rather abundant, but not many specimens were saved. It was especially abundant in White River near Chamberlain and in the channel of South Loup River. Most of the individuals seen were young fish. The largest were a 15-inch specimen at Ravenna and one 16 inches long at Clermont. One of the best and most valuable food-fishes of the lower and middle Missouri Basin.

12. **Ameiurus natalis** (Le Sueur). *Yellow Cat.* Missouri River, St. Joseph (Jordan & Meek, 1885); Kansas River (Graham, 1885); Kansas River (Cragin, 1885*a*); Shunganunga Creek, Topeka, and Blacksmith and Mission creeks, Shawnee County, Kans. (Gilbert, 1886); Dakota River at Lamoure (Woolman, 1896).

13. **Ameiurus nebulosus** (Le Sueur). *Common Bullhead.* "Plentiful" [in Kansas] (Graham, 1885); Topeka, Lawrence, and Ottawa (Cragin, 1885*a*); Osage Fork of Gasconade River, Mo. (Meek, 1891); Dakota River at Lamoure and Jamestown, N. Dak. (Woolman, 1896).

14. **Ameiurus melas** (Rafinesque). *Black Bullhead.* Nebraska (as *A. obesus* type, Gill, 1862 and 1876); Kansas River at Topeka (Gilbert, 1884); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Missouri River at St. Joseph; Tabo Creek, Lexington, Mo.; La Mine River and tributaries at Sedalia, Mo; Osage River at Clinton, Mo.; Grand River and Tabo Creek at Calhoun, Mo. (Jordan & Meek, 1885); "common over the State" [of Kansas] (Graham, 1885); Shunganunga and Ward creeks, Shawnee County, Kans. (Gilbert, 1885); Smoky Hill River at Wallace, Republican River at Concordia, Solomon River at Beloit, Saline River at Wakeeney, north fork of Solomon River at Kirwin (Hay, 1887); Sappa Creek at Oberlin, Middle Beaver Creek, Smith County, Kans., Solomon River at Logan and Harlan, Kans. (Gilbert, 1889); Big Piney River near Cabool and Marais River at Dixon, Mo. (Meek, 1891); Silver Lake, Iowa; Soldier River at Charter Oak, and Boyer River at Arion, Iowa (Meek, 1892); Platte and Elkhorn rivers at Fremont, Salt Creek at Lincoln, Floyd River at Lemars, and Spirit Lake (Meek, 1894); Dakota River and Pipestem Creek at Jamestown, N. Dak. (Woolman, 1896).

Found by us at the following places: Blue River, Seward; Ingalls Lake, Long Pine; Bazile Creek, Niobrara; Long Pine Creek, Long Pine; pond at Creighton; pond at Norfolk Junction; pond at Ewing; canal at Niobrara; Lincoln and Beaver creeks, York; Carp Lake near Long Pine; Big Blue River at Seward; Lone Tree Creek, Chadron; Rock and Enemy creeks, Mitchell; Firesteel, Choteau, and Emanuel creeks, Springfield; Crow Creek, Chamberlain; and Prairie Creek, Scotland. The western limit in the range of this species seems to be near the western boundaries of Kansas and Nebraska, and is marked by the western limit of the small prairie lakes and stagnant ponds. It was not found in any of the alkaline streams, nor in any of the clear, cold streams of the Black Hills; but in the ponds in eastern Nebraska and South Dakota it was very abundant, particularly at Scotland, Mitchell, Chamberlain, Creighton, and Long Pine. It grows to a size which makes it of considerable value in those States as a pan-fish.

15. **Leptops olivaris** (Rafinesque). *Mud Cat.* Osage River, Mo., and Missouri River, St. Joseph (Jordan & Meek, 1885); Kansas River (Graham, 1885); Topeka, Lawrence, and Ottawa (Cragin, 1885*a*); Gasconade River, Mo. (Meek, 1891). A single specimen of this species was caught with the seine in the White River near Chamberlain. It was a female measuring 3 feet 6 inches in total length, and weighing 32 pounds. The following additional measurements were taken: Tip of nose to origin of dorsal fin, 15 inches; to adipose fin, 28 inches; distance over head between pectorals, 15¼ inches; distance between posterior nostrils, 3¼ inches; distance between eyes, 6¼ inches; length of maxillary barbel, 7¼ inches. This fish was very sluggish, and made no effort to escape until we began lifting it out of the water, when it became greatly excited and hard to handle. The mud cat probably occurs in all the larger streams of the Missouri Basin, but we have not seen any record of its occurrence west of Omaha, except the general statement of Graham cited above.

16. **Noturus flavus** Rafinesque. *Stone Cat; Yellow Cat.* Platte River (as *Noturus occidentalis* type, Gill, 1862 and 1876); Platte River (Cope, 1871); Osage River., Mo., La Mine River, Mo., and Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Osage River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (Jordan & Meek, 1885); Mission Creek, Shawnee County, Kans. (Gilbert, 1886); Smoky Hill River, Wallace, Kans., and North Fork of Solomon River, Lenora, Kans. (Hay, 1887); Mission Creek, Shawnee County, Kans.; Snokomo Creek, Wabaunsee County, Kans., and Missouri River, Leavenworth, Kans. (Gilbert, 1886); Solomon River at Harlan and Logan, Kans., and Osage River at La Cygne, Kans. (Gilbert, 1889); Missouri River, St. Joseph; Big Sioux River, Sioux Falls, S. Dak., and Sioux City, Iowa (Meek, 1892); Missouri River, Craig, Mo. (Eigenmann, 1894); Salt Creek, Lincoln, Nebr. (Meek, 1894). It was found by us at the following places: Emanuel Creek, Springfield; Norfolk Creek, Norfolk Junction; Elkhorn River, Ewing; Beaver Creek, York; Lincoln Creek, York; Platte River, Grand Island; Middle Loup River, Dunning; Chadron Creek, Chadron; White River, Chadron; Cheyenne Falls; Belle Fourche River, Belle Fourche; Beaver Creek, Buffalo Gap; Platte River, Douglas; Beaver Creek near Newcastle; Powder River, Arvada; Big Goose Creek, Sheridan, and Salt Creek, Lincoln. Quite abundant in the south fork of the Cheyenne at Cheyenne Falls, where numerous specimens, 5 to 10 inches long, were taken. It is said to be a common fish in the Cheyenne and is of some importance as a food-fish. The specimens from Cheyenne Falls are all extremely pale.

17. **Schilbeodes gyrinus** (Mitchill). Big Sioux River, Sioux Falls, S. Dak. (Meek, 1892); Platte River, Fremont, Nebr.; Floyd River, Lemars and Sioux City, Iowa (Meek, 1894); Choteau Creek, Springfield; Prairie Creek, Scotland; Enemy, Firesteel, and Rock creeks, Mitchell; Norfolk Creek, Norfolk Junction.

    This small catfish appears to be not uncommon about Mitchell and Scotland, but we did not find it elsewhere except at Norfolk Junction, where a single specimen was obtained. The largest specimens secured by us are 4 inches long, and are very plump. The head is very broad and heavy. The interorbital region is concave, especially posteriorly, the postocular region being quite fleshy and prominently rounded. The pectoral spine is equal to one-third of the distance from the tip of the snout to the origin of dorsal fin. Most of these specimens are very dark, but the dark lateral lines show plainly on all. These lines are three in number, one following the axis of the body from just back of the pectoral to the middle of the base of the caudal fin, another above from the dorsal fin to the caudal; the median line of the back also is dark.

18. **Schilbeodes exilis** (Nelson). Osage River, etc. (Graham, 1885); Jones Creek, Dixon, Mo., and Little Piney River, Cabool, Mo. (Meek, 1891).

19. **Schilbeodes miurus** (Jordan). Branches of Missouri River (Graham, 1885).

20. **Ictiobus cyprinella** (Cuvier & Valenciennes). *Common Buffalo-fish.* Missouri River, St. Joseph, Mo. (Jordan & Meek, 1885); eastern Kansas (Graham, 1885); Soldier Creek and Osage River (Cragin, 1885*a*); Marais River, Dixon, Mo. (Meek, 1891); Elkhorn River, Fremont, Nebr. (Meek, 1894). Small specimens were obtained in Platte River at Grand Island, in the Elkhorn at Ewing, and in the Middle Loup River at Dunning. The confusion which exists among the species of *Ictiobus* and *Carpiodes* is very great and it is doubtful if any of the descriptions given in the books is correct. The species as now understood are certainly hard to distinguish, and the confusion can only be removed by an exhaustive study of a very large amount of material.

**21. Ictiobus urus** (Agassiz). *Mongrel Buffalo.* Missouri River, St. Joseph (Jordan & Meek, 1885); Kansas River and branches of the Missouri (Graham, 1885); Silver Lake and Soldier Creek (Cragin, 1885*a*).

**22. Ictiobus bubalus** (Rafinesque). *Small-mouth Buffalo.* Missouri River, St. Joseph, Mo. (Jordan & Meek, 1885); plentiful over Kansas (Graham, 1885); Kansas River (Cragin, 1885*a*); Marais River, Dixon, Mo. (Meek, 1891); Floyd River, Sioux City, Iowa, and East Okoboji Lake, Iowa (Meek, 1894). Found by us only in Crow Creek near Chamberlain, S. Dak. The two small specimens in the collection give the following measurements: Head 4; depth 2¾ and 3; eye 4; snout 4; scales 7-37-5 and 7-38-5. D. 23 and 26; A. 8. The number of dorsal rays is fewer than the usual number for this species, and the axis of the body is scarcely below the lateral line. These are the only dark-colored specimens of buffalo-fish that we secured, and they are paler than more eastern examples.

Either this or the following species is said to be very abundant in Okoboji Lake and the other lakes of northwestern Iowa and southern Minnesota. We were unable to secure specimens, and can not be sure which species it is. Some species of buffalo-fish, probably this one, is said to be excessively abundant in most of the small lakes of South Dakota, where it is of much importance as an article of food.

**23. Carpiodes carpio** (Rafinesque). *Carp Sucker.* Osage River, Mo. (as *Carpiodes bison* type, Agassiz, 1855); Manhattan, Kans., and Ward Creek, Shawnee County, Kans. (Gilbert, 1884); Silver Lake, Ward Creek, and Fort Riley (Cragin, 1885*a*); Belle Fourche River, Belle Fourche, S. Dak. (Evermann, 1893); Niobrara River north of Long Pine; Mud Creek at Ravenna; Wood Creek at Grand Island; Middle Loup River at Dunning and Emanuel Creek near Springfield. Only young specimens were obtained. These seemed to differ from typical *carpio* in being more slender and in having fewer rays in dorsal fin. The depth is 3 to 3¼ and the dorsal 25.

**24. Carpiodes velifer** (Rafinesque). *Quillback.* Milk River (as *Carpiodes damalis* type, Girard, 1856); Fort Pierre (Girard, 1858); Milk River (as *Carpiodes damalis*, Suckley, 1860); Kansas River near Fort Riley (as *Carpiodes damalis*, Cope, 1865); "Probably from one of the Western States" (as *Carpiodes grayi* type, Cope, 1870); Hundred and Two River, Bedford, Iowa, and Maryville, Mo.; Blackwater Creek, Brownsville, Saline County, and Flat Creek, near Sedalia, Mo.; Osage River, Clinton, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (as *Ictiobus velifer*, Jordan & Meek, 1885); Kansas River (as *Ictiobus velifer* and *Ictiobus velifer bison*, Graham, 1885); Ottawa and Eureka Lake (Cragin, 1885*a*); Republican River, Concordia, Kans.; Solomon River, Beloit, Kans.; Saline River, Wakeeney, Kans. (Hay, 1887); Missouri River, Iowa; Big Sioux River, Sioux City, Iowa (Meek, 1892); Poplar River, Poplar, Mont. (Eigenmann, 1894); Blue River, Crete, Nebr.; Platte and Elkhorn rivers, Fremont, Nebr., and Floyd River, Sioux City, Iowa (Meek, 1894). Found by us in the South Loup at Ravenna, which is the most western point from which this species has been reported.

**25. Cycleptus elongatus** (Le Sueur). *Gourd-seed Sucker; Missouri Sucker; Black Sucker.* Kansas River (Graham, 1885; Cragin, 1885*a*). This interesting sucker does not seem to have been taken often in the Missouri Basin, and how it came by the name "Missouri sucker" is not apparent.

**26. Pantosteus jordani** Evermann.

*Pantosteus virescens* Jordan, Bull. 4, vol. IV., U. S. Geol. and Geogr. Survey of Territories, 780, 1878, Sweet Grass Hills, Montana (specimens collected by Dr. Elliott Coues).

*Catostomus discobolus* Evermann, Bull. U. S. Fish Comm., XI, 1892, pl. XVIII, fig. 1, 41, Red Rock and Beaverhead rivers, Mont.

*Pantosteus jordani* Evermann, Bull. U. S. Fish Comm., XII, 1892, January 27, 1893, art. 2, 51–56, Red Rock and Beaverhead rivers, Mont., and various Black Hills localities, types; Gilbert & Evermann, Bull. U. S. Fish Comm., XIV, 1894, 189, various places in the Columbia River basin.

*Pantosteus columbianus* Eigenmann & Eigenmann, American Naturalist, February 4, 1893, 151, Boise River, Caldwell, Idaho; types.

In the third paper referred to above will be found the description of this species, together with a discussion of the relationships of the various known species of *Pantosteus* and the closely related species of *Catostomus*. In the paper is also given the complete synonymy of each species of *Pantosteus*. In October, 1892, numerous specimens of this species were obtained as follows: Whitewood Creek, Deadwood; Spearfish Creek, Spearfish; Chicken Creek near Spearfish; Crow Creek, Gammon's Ranch; Belle Fourche River, Belle Fourche; Rapid Creek, Rapid, and Hat Creek, Ardmore.

All the specimens found in Whitewood and Spearfish creeks were young individuals. In all the other streams named, good-sized specimens were found, the largest and finest one being about 7 inches in length and from Rapid Creek. During the investigation in South Dakota, Nebraska, and Wyoming, carried on in 1893, it was found in the following places: Chadron Creek, Chadron; Cheyenne River, Edgemont; Cheyenne River near Hot Springs; Beaver Creek, Buffalo Gap; Spearfish Creek, Spearfish; Redwater Creek near Spearfish; creek at Hill City; French Creek, Custer; Beaver Creek, Newcastle; Powder River, Arvada; Clear Creek at Clermont; south fork of Tongue River, Sheridan; Big Goose Creek, Sheridan. This small sucker is abundant in most of the smaller, clearer streams in and about the Black Hills. It seems most abundant in the streams tributary to the Cheyenne. South of the Cheyenne it was found in only one place, this being at Chadron in the basin of White River, which, however, is separated from the south fork of Cheyenne River by a distance of less than 20 miles. This is the most eastern and southern point from which it has yet been obtained. The only other place outside of the Cheyenne basin where we found it was in the streams about Sheridan. It probably does not occur in the North or South Platte, but will doubtless be found to inhabit all suitable streams of the upper Missouri Basin.

The recent finding of this fish at many places in the Columbia Basin shows it to be a species of wide distribution, and, as is usually the case with such species, it is subject to great variations in some of its characters. This is true particularly as regards the squamation. The specimens from Spearfish and Hill City are noticed to have very small scales, the number in the course of the lateral line ranging from 94 to 108 in the several specimens counted; the usual number seems to be 17–104–13. Those from Sheridan, Chadron, and Hot Springs have larger scales, the number in the lateral line running from 77 to 89 in numerous examples counted. From Big Goose Creek the usual formula was found to be 14–80–11 or 12. In the Newcastle specimens the scales are a little smaller, the number being about 88 or 89, thus approximating the fine-scaled Hill City form. There is not much variation among the individuals from any one place. The fine-scaled specimens were found in very cold water, and it may be that they represent a slight geographic variety inhabiting the smaller and colder mountain streams of the Black Hills. The Hill City specimens have the mouth unusually broad and 3 or 4 rows of papillæ upon the upper lip. The Chadron specimens have the mouth narrower and more numerous papillæ upon the upper lip. The color is somewhat darker. This species evidently does not reach a large size. We have examined about 500 specimens, and the largest individual measures less than 10 inches in the total length.

**27. Catostomus griseus** (Girard). *Milk River Sucker.* Sweetwater River (as *Catostomus* (*Acomus*) *griseus* type, Girard, 1856 and 1858); Milk River (as *Catostomus* (*Acomus*) *lactarius* type, Girard, 1856 and 1858); Milk River, Mont. (as *Catostomus retropinnis* type, Jordan, 1878); Horse Creek, Red Cloud Creek, and Platte River (as *C. griseum*, Cope, 1871); South Platte River, Denver and Hartsel Hot Springs, Colo.; Bear Creek, Morrison, Colo.; Middle Boulder Creek, Boulder, Colo. (Jordan, 1891); Yellowstone and Gardiner rivers (Jordan, 1891*a*); Missouri River, Craig, Mont. (Eigenmann, 1894). Two specimens were taken from the North Platte River at Douglas, Wyo. They give the following measurements:

| Total length. | Head. | Depth. | Eye. | Snout. | Dorsal. | Anal. | Scales. |
|---|---|---|---|---|---|---|---|
| *Inches.* | | | | | | | |
| 7 | 4⅛ | 4⅞ | 5 | 2¼ | 10 | 7 | 15-88-10 |
| 5 | 3⅞ | 4⅝ | 5 | 2¼ | 10 | 7 | 15-95-10 |

Compared with specimens of *C. commersonii sucklii* of the same size, the following differences are noted: Body rather heavier or stouter; caudal peduncle shorter and deeper, the least depth being 2¼ in head, while in *C. commersonii sucklii* it is more than 3; the top of the head is less arched and the snout more prominent; the mouth is a little narrower and the lobes of the lower lip are longer; the scales are very small, particularly on the anterior part of the body; the color is much paler, the three dark spots usually present on younger specimens of var. *sucklii* not being present on *griseus* at all. Compared with smaller specimens of *C. catostomus*, the distinguishing characters are found to be very slight. In *C. griseus* the top of the head is flatter and the snout is less decurved; the upper lip is larger and more pendant, and has more papillæ; the lobes of the lower lip are rather longer, and the cartilaginous sheath is less developed; the dorsal fin is smaller, it having but 10 rays.

**28. Catostomus catostomus** (Forster). *Long-nosed Sucker.* This sucker was obtained at the following places: North Platte River; Deer Creek, Glenrock; Clear Creek, Clermont; Powder River, Arvada; Big Goose Creek, Sheridan, and south fork of Tongue River, Sheridan. It was not found anywhere in Nebraska or South Dakota, and probably does not occur in the Missouri Basin east of Wyoming. It was obtained in 1892 by Dr. Eigenmann in the Red River of the North at Winnipeg, Swift Current Creek, and Bow, Elbow, Vermillion, and Saskatchewan rivers, all in the Saskatchewan Basin. The important characters of the larger specimens collected by us are given in the following table:

| Locality. | Total length in inches. | Head in length. | Depth in length. | Eye in head. | Eye in snout | Dorsal. | Anal. | Rows of papillæ on upper lip. | Scales. |
|---|---|---|---|---|---|---|---|---|---|
| Arvada, Wyo.... | 11 | 4⅛ | 6 | 6 | 3 | 10 | 7 | 3 | 17- 95-13 |
| Sheridan, Wyo... | 8 | 4⅜ | 5½ | 6 | 2¾ | 10 | 7 | 4 | 15-105-12 |
| Clermont, Wyo.. | 7⅛ | 4⅛ | 5⅞ | 6 | 2¾ | 10 | 7 | 3 | 17-102-12 |
| Do..... | 7⅛ | 4⅛ | 5 | 6 | 2¾ | 10 | 7 | 2 | 16- 96-13 |
| Douglas, Wyo.... | 7 | 4¼ | 5 | 5¾ | 2⅝ | 10 | 7 | 3 | 15- 89-12 |
| Sheridan, Wyo... | 11 | 4⅜ | 4⅜ | 6⅜ | 3¼ | 10 | 7 | 3 | 17-100-13 |
| Do..... | ..... | ..... | ..... | 6½ | 3¼ | 10 | 7 | 4 | 14-100-16 |
| Do..... | ..... | ..... | ..... | 6¼ | 3⅛ | 10 | 7 | 4 | 17-100-13 |

The Sheridan specimens are badly decayed and accurate measurements can not be taken. In all of these specimens the scales are considerably smaller than the examples of *C. griseus* from Douglas, the top of the head is more curved, and the snout less prominent. The upper lip is incised nearly to the base, there being but a single row of papillæ across the base.

**29. Catostomus commersonii** (Lacépède). *Common White Sucker.* Milk River (as *Catostomus sucklii* type, Girard, 1856 and 1858); upper Missouri and tributaries (as *Catostomus sucklii*, Suckley, 1860); Kansas (as *Catostomus chloropteron* type, Abbott, 1860); Kansas River near Fort Riley (as *Catostomus chloropteron*, Cope, 1865); Platte River (as *C. sucklii*, Cope, 1871); Five Forks and headwaters of Milk River (as *C. teres*, Jordan, 1878); Shunganunga Creek and Kansas River, Topeka (as *C. teres*, Gilbert, 1884); Hundred and Two River, Bedford, Iowa, and Maryville, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; and Flat Creek, Sedalia, Mo.; Osage River, Clinton, Mo.; Grand River, Clinton, Mo., and Tabo Creek, Calhoun, Mo. (as *C. teres*, Jordan & Meek, 1885); common over the State [of Kansas] (as *C. teres*, Graham, 1885); Shunganunga Creek and Kansas River, Topeka (as *C. teres*, Gilbert, 1885); Shunganunga and Wild Cat creeks, and Kansas and Osage rivers (Cragin, 1885*a*); Blacksmith Creek, Shawnee County, Kans. (as *C. teres*, Gilbert, 1886); Solomon River, Beloit, Kans.; north fork of Solomon River, Lenora, Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (Hay, 1887); north fork of Solomon River, Logan, Kans.; Middle Beaver Creek, Smith County, Kans. (as *C. teres*, Gilbert, 1889); Big Piney River, Cabool, Mo.; Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo. (as *C. teres*, Meek, 1891); South Platte River, Denver (as *C. teres sucklii*, Jordan, 1891); Big Sioux River, Sioux City, Iowa; Boyer River, Arion, Iowa (Meek, 1892); Middle, Crow, Chicken, Cottonwood, and Hat creeks, S. Dak., and Belle Fourche River, Belle Fourche, S. Dak. (Evermann, 1893); Poplar River, Poplar, Mont. (Eigenmann, 1894); Floyd River at Lemars and Sioux City, Iowa (Meek, 1894); Dakota River at La Moure and Jamestown (Woolman, 1896).

This is apparently the most abundant sucker in the region covered by these investigations, as may be seen from the following list of localities from which we obtained it: Enemy Creek, Mitchell; Dakota River, Mitchell; Firesteel Creek, Mitchell; Rock Creek, Mitchell; Crow Creek, Chamberlain; Prairie Creek, Scotland; Emanuel Creek, Springfield; Choteau Creek, Springfield; canal at Niobrara; Bazile Creek, Niobrara; Verdigris Creek, Verdigris; pond at Creighton; Spring Creek at Bazile Mills; Elkhorn River at Ewing; Long Pine Creek, Long Pine; Niobrara River, Marsland; Chadron Creek, Chadron; Lone Tree Creek, Chadron; Wood Creek, Grand Island; Dismal River, Dunning; Deer Creek, Glenrock; North Platte River, Glenrock; North Platte River, Douglas; French Creek, Custer; small creek at Hill City; Beaver Creek, Buffalo Gap; Cheyenne River, Hot Springs; Cheyenne River, Edgemont; Redwater Creek, Spearfish; Beaver Creek, Newcastle; Clear Creek, Clermont; Powder River, Arvada; south fork of Tongue River, Sheridan; Big Goose Creek, Sheridan. In October, 1892, it was found at the following places: Middle Creek and Belle Fourche River at Belle Fourche; Crow Creek at Gammon's ranch, near Spearfish; Chicken Creek, near Spearfish; Rapid Creek, Rapid City, S. Dak.; Cottonwood Creek, Edgemont, and Hat Creek, Ardmore, S. Dak.

We have spent a good deal of time in studying this large amount of material and have found it extremely difficult to reach any satisfactory conclusion regarding the status of this and the other species of *Catostominæ* of the Missouri Basin. Among the individuals which we refer to this species there is great variation, particularly in the size and arrangement of the scales, the number of dorsal fin rays, and in the mouth. Such of these variations as can be well presented in tabular form are given in the following table. The localities are arranged approximately, beginning with those farthest east and ending with those farthest west at which this species was found:

| Locality. | Head. | Depth. | Eye. | Snout. | Dorsal. | Anal. | Scales. | Rows of papillæ on upper lip. |
|---|---|---|---|---|---|---|---|---|
| Mitchell, S. Dak | 4 | 4⅓ | 5 | 2¼ | 11 | 7 | 10-64-8, crowded anteriorly | 3 |
| Do | 3⅞ | 4⅓ | 4½ | 1¾ | 11 | 7 | 10-60-7, crowded anteriorly | 3 |
| Do | 3⅝ | 4½ | 4⅝ | 2 | 11 | 7 | 10-59-7, crowded anteriorly | 3 |
| Do | 3⅝ | 5 | 5 | 2⅛ | 13 | 7 | 9-60-8, somewhat crowded | 3 |
| Ewing, Nebr | 4 | 4½ | 5 | 2⅜ | 12 | 7 | 10-58-9 | 3 |
| Do | 4⅛ | 5 | 5½ | 2¼ | 11 | 7 | 10-62-8 | 3 |
| Bazile Mills, Nebr | 4⅛ | 6 | 5 | 2¼ | 11 | 7 | 10-62-9, crowded anteriorly | |
| Niobrara, Nebr | 3⅞ | 5 | 4½ | 2 | 11 | 7 | 9-60-8, crowded anteriorly | 3 |
| Do | 4¼ | 5 | 5 | 2⅛ | 11 | 7 | 10-62-8, crowded anteriorly | |
| Scotland, S. Dak | 4 | 5 | 5⅛ | 2⅜ | 11 | 7 | 9-61-7, not much crowded | 4 |
| Chamberlain, S. Dak | 4 | 5⅛ | 5⅜ | 2¼ | 11 | 7 | 9-59-7, crowded anteriorly | |
| Creighton, Nebr | 4 | 4⅞ | 4⅞ | 2 | 11 | 7 | 10-60-8, crowded anteriorly | 3 |
| Long Pine, Nebr | 4 | 5⅛ | 6 | 2¼ | 10 | 7 | 10-63-7, crowded anteriorly | |
| Do | 4 | 4⅝ | 4⅜ | 2⅛ | 10 | 7 | 10-62-9, not much crowded | 3 |
| Do | 4 | 5 | 4 | 1⅝ | 11 | 7 | 9-60-8, not much crowded | 3 |
| Do | 4 | 5⅛ | 4⅜ | 2⅛ | 10 | 7 | 10-60-8, not much crowded | 3 |
| Dunning, Nebr | 4 | 4⅝ | 4⅝ | 2 | 11 | 7 | 9-59-8 | 3 |
| Grand Island, Nebr | 4 | 4⅜ | 4⅝ | 2¼ | 10 | 7 | 9-62-7, scarcely reduced anteriorly. | 3 |
| Chadron, Nebr | 4 | 4⅜ | 5⅛ | 2⅛ | 11 | 7 | 10-60-8, not much crowded | 4 |
| Do | 4⅛ | 5 | 5 | 2 | 12 | 7 | 10-63-9, not much crowded | 3 |
| Do | | | | | | | 10-60-7 | |
| Cheyenne Falls, S. Dak | 3⅝ | 5 | 5 | 2¼ | 11 | 7 | 9-56-7 | 2 or 3 |
| Do | 3⅝ | 4⅝ | 4⅜ | 2⅛ | 9 | 7 | 9-56-7 | 2 or 3 |
| Custer, S. Dak | 3⅝ | 4⅜ | 5 | 2⅛ | 11 | 7 | 11-63-9, somewhat crowded | 3 |
| Do | 3⅝ | 4⅛ | 4⅜ | 2 | 11 | 7 | 10-62-8 | 3 |
| Do | 3¼ | 5 | 4¼ | 2 | 12 | 7 | 10-64-9 | 4 |
| Hill City, S Dak | 3⅝ | 4⅛ | 5⅛ | 2⅛ | 11 | 7 | 10-62-7, rather crowded | 3 |
| Redwater Creek, S. Dak | 4 | 4⅛ | 5 | 2¼ | 10 | 7 | 9-60-7, not much crowded | 3 |
| Do | 3⅞ | 4⅜ | 4⅜ | 2⅛ | 10 | 7 | 9-58-7, not much crowded | 4 |
| Do | 4 | 4⅝ | 5 | 2¼ | 11 | 7 | 10-62-7, not much crowded | 3 |
| Do | 4 | 5 | 5 | 2¼ | 11 | 7 | 9-58-8, not much crowded | 3 |
| Glenrock, Wyo | 3⅜ | 5 | 4⅛ | 2⅛ | 11 | 7 | 58-19, no lateral line | 2 or 3 |
| Do | 3⅜ | 4⅜ | 4⅜ | 2⅛ | 10 | 7 | 9-60-8 | 3 |
| Do | 3⅜ | 4⅛ | 4⅜ | 2⅛ | 10 | 7 | 10-61-8, somewhat crowded | 3 |
| Do | | | | | 11 | | 10-58-7 | |
| Douglas, Wyo | 3⅜ | 5 | 5 | 2⅜ | 11 | 7 | 9-61-7, somewhat crowded | 3 |
| Newcastle, Wyo | 4 | 5 | 4⅜ | 2⅛ | 10 | 7 | 9-54-6, somewhat crowded | 3 |
| Do | 3⅝ | 5⅛ | 4⅜ | 2⅛ | 10 | 7 | 9-54-6, somewhat crowded | 3 |
| Do | | | | | 11 | 7 | 9-58-6, somewhat crowded | 3 |
| Marsland, Nebr | 4 | 4⅛ | 5 | 2 | 11 | 7 | 10-61-9, not much crowded | 4 |
| Buffalo Gap, S. Dak | | | | | 12 | | 9-64-8 | |
| Do | | | | | 11 | | 9-59-8 | 4 |
| Arvada, Wyo | 3⅛ | 4⅜ | 5⅛ | 2⅜ | 11 | | 9-59-7, not much crowded | 4 or 5 |
| Do | 3⅛ | 4⅜ | 5⅛ | 2⅛ | 11 | 7 | 9-58-8, crowded, but regular | 4 or 5 |
| Do | 3⅜ | 5 | 5 | 2⅛ | 11 | 7 | 10-57-6, crowded, but regular | 2 |
| Clermont, Wyo | 3⅜ | 4 | 5⅜ | 2⅛ | 13 | 7 | 11-61-9, much crowded and irregular. | 2 |
| Do | 3⅜ | 4⅜ | 6 | 2 1/16 | 11 | 7 | 10-56-7, crowded and irregular | 3 |
| Do | 3⅜ | 5 | 4⅜ | 2⅛ | 11 | 7 | 10-60-8, crowded, but regular | 3 |
| Sheridan, Wyo | 3⅝ | 5 | 5 | 2⅛ | 12 | 7 | 9-59-7, not much crowded | |

An inspection of this table shows that the variation in the length of head is from 3⅜ to 4¼, and in depth from 4 to 6; the usual length of head and depth of body is about 4 and 5, respectively. These variations, however, are not unusual, and need give us no trouble. The same may be said of the eye and snout; these differences are no greater than can be accounted for as due to differences in age. The range of the dorsal fin rays is through 5, i. e., from 9 to 13, the usual number being 10 or 11. This is a larger range than has hitherto been noticed in this species and is, of course, independent of age. The variation in the scales is rather remarkable, the number in a transverse series ranging from 15 to 20, and those in the course of the lateral line from 54 to 64, the most usual formula being 9 or 10-59 to 61-7 or 8. The scale formula for *Catostomus commersonii* has usually been given as 10-64 to 70-9. In the original description of *Catostomus sucklii* the dorsal rays are given as 14 (including rudimentary ones), but Girard does not give the number of scales, merely remarking that "the scales are large and but little smaller anteriorly than posteriorly." The two figures which he gives in the Pacific Railroad report show the scales as 10-64-8 and 9-55-9, the latter being a young specimen. The specimens in our collection which we have examined

from Mitchell, Bazile Mills, Niobrara, Chamberlain, Long Pine, and Clermont, have the scales decidedly crowded and irregular on the anterior part of the body; this is especially so in the two large specimens from Clermont. Those from Chadron, Custer, Hill City, Redwater Creek, Douglas, and Newcastle are not much crowded, but they are irregular in arrangement.

Five of the eight small specimens from Glenrock are peculiar in that there is no trace of the lateral line. In the three others the lateral line is normally developed. The number of rows of papillæ upon the upper lip varies from 2 to 5, the usual number being 3 or 4. These differences do not possess any geographic significance; specimens from the same stream or from the same sub-basin show both extremes of variation in this regard. Nor have we been able to discover that these variations in lip characters are coordinated with any other characters. Upon comparing these Missouri specimens with others from Ohio and Pennsylvania, it appears that in the western specimens the scales average somewhat larger and the papillæ on the upper lip are arranged in more rows. The eye is somewhat smaller in the western specimens. The two forms may be diagnosed as follows:

*a.* Scales small, 60 to 70 in lateral line, much crowded anteriorly; eye less than 5 in head; upper lip with 2 or 3 rows of papillæ ..... *commersonii.*

*aa.* Scales large, 54 to 64 in lateral line, less crowded anteriorly; eye smaller, usually more than 5 in head; upper lip with 3 or 4 rows of papillæ ..... *sucklii.*

We doubt, however, if *sucklii* should be recognized even as a subspecies, and for the present we combine the two.

In nearly all the young western specimens the dark spot at base of caudal fin is quite distinct; there is often a similar dark spot above the ventral and one just above the middle of the pectoral. All these disappear with age.

30. **Catostomus nigricans** Le Sueur. *Hog Sucker; Stone-lugger.* Kansas River (Graham, 1885); Osage River (Cragin, 1885*a*); Little Piney River, Osage Fork, Lock Fork, and Jones Creek, Mo.; Marais, Niangua, and Sac rivers, at Dixon, Marshfield, and Springfield, Mo. (Meek, 1891). This common eastern species seems not to occur in Nebraska, South Dakota, or Wyoming, but reaches its western limit in the lower Missouri Basin.

31. **Erimyzon sucetta oblongus** (Mitchill). *Chub Sucker.* Professor Snow reports this fish from the Kansas River at Lawrence (Cragin, 1885*a*).

32. **Minytrema melanops** (Rafinesque). *Spotted Sucker; Striped Sucker.* Missouri River at Fort Pierre and Yellowstone River (as *Ptychostomus haydeni* type, Girard, 1856 and 1858); Osage River and Mill Creek (Cragin, 1885*a*). The fact that this species has not been taken west of Missouri by any recent collector makes its occurrence in the upper Missouri region questionable.

33. **Moxostoma bucco** (Cope). St. Joseph, Mo. (as *Ptychostomus bucco* type, Cope, 1871). Only the type known; a doubtful species.

34. **Moxostoma aureolum** (Le Sueur). *Common Redhorse.* Blackwater Creek at Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo. (as *Moxostoma macrolepidotum duquesnei*, Jordan & Meek, 1885); plentiful in Kansas (Graham, 1885); Soldier and Shunganunga creeks, Silver Lake, Osage River, Blue River, and Kansas River (Cragin, 1885*a*); La Mine River, Mo. (Jordan & Meek, 1885); Shunganunga Creek, Topeka (as *M. macrolepidotum*, Gilbert, 1885); Solomon River, Beloit, Kans. (Hay, 1887); Osage River, Marshfield, Mo.; Lock Fork, Mansfield, Mo.; Big Piney River, Cabool, Mo.; Little Piney River, Newburg, and Arlington, Mo.; Gasconade River, Arlington, Mo.; Marais River, Dixon, Mo.; Niangua River, Marshfield (as *M. macrolepidotum duquesnei*, Meek, 1891); Big Sioux River at Sioux Falls and Sioux City (Meek, 1892); Belle Fourche River, Belle Fourche, S. Dak.; Redwater Creek, Belle Fourche, S. Dak.; and south fork of Cheyenne River, Cheyenne Falls, S. Dak.

(Evermann, 1893); Poplar River, Poplar, Mont. (Eigenmann, 1894); Floyd River, Lemars, Iowa, and Blue River, Crete, Nebr. (as *M. macrolepidotum duquesnei*, Meek, 1894); Dakota River at Jamestown (Woolman, 1896).

Many good-sized examples were obtained in 1892 at Belle Fourche from the Redwater and the Belle Fourche. The collection of 1893 contains specimens from the following places: Dakota River, Mitchell; Emanuel Creek, Springfield; Choteau Creek, Springfield; Crow Creek, Chamberlain; canal at Niobrara; Verdigris Creek, Verdigris; Elkhorn River, Norfolk Junction; Elkhorn River, Ewing; South Loup River, Ravenna; Long Pine Creek, Long Pine; Niobrara River, Long Pine; North Platte River, Douglas; North Platte River, Casper; Deer Creek, Glenrock; Clear Creek, Clermont. There is but little variation among the specimens from different localities, either in number of fin rays, size of scales, or proportion of parts. The scales are, in many specimens counted, 6 or 7–42 to 45–4 or 5. D. 12 or 13; head 4¼ to 4⅖; depth 3⅔ to 4. In large specimens the upper caudal lobe is the longer. This species is of sufficient size and abundance to make it of considerable value as a food fish in this region.

35. **Placopharynx duquesnii** (Le Sueur). *Big-jawed Sucker.* Floyd River at Sioux City and Lemars, Iowa (as *P. carinatus*, Meek, 1894).

36. **Campostoma anomalum** (Rafinesque). *Stone-roller.* Platte River at Fort Kearney (as *C. hippops* type, Cope, 1864 and 1865); Alma, Wabaunsee County, Kans.; Kansas River, Topeka; Ellis, Ellis County, Kans. (Gilbert, 1884); Blackwater Creek, Brownsville, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (Jordan & Meek, 1885); common in small streams in Kansas (Graham, 1885); Shunganunga Creek and Kansas River at Topeka; Ward Creek, Shawnee County, Kans.; Alma and Ellis, Kans. (Gilbert, 1885); Kansas River, Shunganunga, Mill, and Wild Cat creeks, and Ellis (Cragin, 1885*a*); Blacksmith Creek, Shawnee County, Kans. (Gilbert, 1886); Solomon River, Beloit, Kans.; north fork of Solomon River, Lenora, Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (Hay, 1887); Middle Beaver Creek and Spring branch of Spring Creek, Smith County, Kans. (Gilbert, 1889); Jones Creek, Dixon, Mo.; Big Piney River, Cabool, Mo.; Osage Fork, Marshfield, Mo.; Lock Fork, Mansfield, Mo.; Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo.; Sac River, Springfield, Mo. (Meek, 1891); Floyd River, Sioux City, Iowa (Meek, 1894); Dakota River at Jamestown (Woolman, 1896).

Obtained by us as follows: Floyd River, Sioux City; Emanuel Creek, Springfield; Enemy Creek, Mitchell; Prairie Creek, Scotland; Firesteel Creek, Mitchell; Crow Creek, Chamberlain; Wood Creek, Grand Island; Chadron Creek, Chadron; Deer Creek, Glenrock. Not found in any of the streams in or about the Black Hills; nor was it found in any of the streams that are strongly alkaline in character. The largest specimens are those from Chadron, some of which are about 5 inches long. No differences between these and eastern specimens are apparent. Head 4⅕; depth 4⅓; eye 5¼; snout 2½; D. 8; A. 7; scales 8–52–7. The black band in the dorsal and anal fins distinct in males; those from Glenrock paler. Glenrock, Wyo., is the most western point from which this fish is known.

37. **Chrosomus erythrogaster** Rafinesque. *Red-bellied Dace.* Marais des Cygnes, Kans. (Graham, 1885); north fork of Solomon River, Lenora, Kans. (Hay, 1887); Jones Creek, Dixon, Mo.; Big Piney River, Cabool, Mo.; Osage Fork, Marshfield, Mo.; Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo.; Sac River, Springfield, Mo. (Meek, 1891).

38. **Chrosomus dakotensis** sp. nov. Type locality: Crow Creek, Chamberlain, S. Dak., where 11 specimens were collected June 22, 1893. (Type, No. 45680, U. S. Nat. Mus.)

Closely related to *Chrosomus erythrogaster*. Head 3⅝; depth 4½; eye 3½; snout 4½; D. 8; A. 8; scales about 80, 24 in cross series. Teeth 4–4, hooked, and with a slight grinding surface. Body moderately stout, head heavy, caudal peduncle shorter than in related species. Eye moderate, interorbital width 3 in head; mouth small and oblique, maxillary short, not nearly reaching vertical at front of eye, its length 1½ in eye; lower jaw projecting. Fins moderate; height of dorsal 1½ in head, its origin behind the base of the ventrals a distance greater than length of snout; anal similar to dorsal; pectorals short, 1½ in head; ventrals very short, not reaching anal. Color as in *C. erythrogaster*, except that the back is darker and the upper dark line is continuous and not broken up into spots; the lower black line is also more distinct. Besides the 11 specimens obtained in Crow Creek we have two from a pond at Niobrara and one from Minnechaduza Creek at Valentine, Nebr. The specimens from Battle Creek, S. Dak., referred by Professor Cope (1879) to *Chrosomus* sp., probably belong to this species.

**39. Hybognathus nuchale** Agassiz. Ward Creek, Menoken, Kans., and Kansas River, Topeka (Gilbert, 1884); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Missouri River, St. Joseph (Jordan & Meek, 1885); Kansas River, Ward Creek, and Fort Riley (Cragin, 1885*a*); Piney Creek, Texas County, Mo. (Call, 1887); Smoky Hill River, Wallace, Kans. (Hay, 1887); north fork of Solomon River, Logan, Kans. (Gilbert, 1889); Missouri River, Iowa; Big Sioux River, Sioux City, Iowa; Soldier River, Charter Oak, Iowa (Meek, 1892); Platte and Elkhorn rivers, Fremont, Nebr.; Salt Creek, Lincoln, Nebr.; Floyd River at Sioux City and Lemars, Iowa (Meek, 1894); Dakota River at Jamestown (Woolman, 1896).

**40. Hybognathus nuchale evansi** (Girard). Missouri River at Fort Pierre, Nebr. (as *H. evansi* type, Girard, 1856); Fort Pierre and Sweetwater River (Girard, 1858); upper Platte River (Cope, 1864*a*); Kansas River near Fort Riley (Cope, 1865); Battle Creek, S. Dak. (Cope, 1879); Kansas River and other branches of the Missouri (as *H. placita*, Graham, 1885); South Platte River, Denver (as *H. nuchalis placita*, Jordan, 1891); Cottonwood, Hat, and Middle creeks, and south fork of Cheyenne and Belle Fourche rivers, Black Hills (as *H. nuchalis placita*, Evermann, 1893); Poplar River, Poplar, Mont. (as *H. placita*, Eigenmann, 1894).

Our collections contain specimens from the following localities: Ponca Creek near Niobrara; Bazile Creek, Niobrara; Platte River, Grand Island; Wood Creek, Grand Island; Middle Loup River, Dunning; Niobrara River north of Long Pine; South Loup River, Ravenna; Mud Creek, Ravenna; Platte River, Fremont; White River, Chadron; Lone Tree Creek, Chadron; Choteau Creek, Springfield; Cheyenne River near Hot Springs; Hat Creek, Ardmore; Cottonwood Creek, Edgemont; Crow Creek, Chamberlain; Emanuel Creek, Springfield; Belle Fourche River, Belle Fourche; Cheyenne River, Edgemont; White River, Chamberlain; Middle Creek, Belle Fourche; Powder River, Arvada; Beaver Creek, Newcastle; Platte River, Douglas; Platte River, Casper.

The following notes are from a specimen 5 inches long, from Belle Fourche River: Head 5; depth 4⅛; eye 5; snout 3⅛; D. I, 8; A. I, 9; scales 6–40–7, 18 before dorsal; mouth small, slightly oblique, lower jaw included; maxillary short, not reaching eye. Origin of dorsal a little in front of ventral, and nearer snout than base of caudal; height of dorsal nearly equal to length of head; interorbital width equal to length of snout to middle of pupil. In a specimen from Ravenna the scales count 6–43–5, 16 before the dorsal. There is considerable variation in the snout, it being much more blunt in some than in others, those from Ardmore being especially blunt. This minnow seems to be peculiarly liable to be affected by parasites, a considerable percentage of the specimens from Belle Fourche, Ravenna, and Cheyenne Falls showing psorosperms embedded among the scales over different parts

of the body. Girard's types of *H. evansi* came from Fort Pierre, Nebr., and if identical with *placitus* the name *evansi* has precedence, and the form may stand as *Hybognathus nuchale evansi* Girard.

41. **Hybognathus argyrite** Girard. Milk River (as *H. argyritis* type, Girard, 1856 and 1858, and Suckley, 1860). This is a doubtful species, probably identical with *H. evansi*.

42. **Hybognathus nubilum** (Forbes). Piney Creek, Texas County, Mo. (Call, 1887); Jones Creek and Marais River, Dixon, Mo.; Little Piney River at Arlington and Newburg, Mo.; Osage Fork, Marshfield, Mo.; Lock Fork, Mansfield, Mo.; Niangua River, Marshfield, Mo.; Sac River, Springfield, Mo. (Meek, 1891). Obtained by us at the following places: Floyd River, Sioux City; Bazile Creek, Niobrara; Verdigris Creek, Verdigris; Elkhorn River, Norfolk Junction; Norfolk Creek, Norfolk; pond at Long Pine; Ponca Creek, Niobrara; canal at Niobrara; pond at Creighton; Niobrara River north of Long Pine; Emanuel Creek, Springfield; Choteau Creek, Springfield; Crow Creek, Chamberlain; White River, Chamberlain; Platte River, Casper; Powder River, Arvada.

A very large series of specimens of *Hybognathus* was collected, but we find it extremely difficult to decide just how many and what species are represented. For the present it seems best to recognize *nubila*, *argyrite nuchalis*, and var. *evansi*. The range of variation in each is great. *H. nubila* is the more common form in eastern Nebraska and southwestern South Dakota, and is distinguished by the much larger eye (less than 4 in head), the larger mouth, more pointed snout, and the plumbeous lateral stripe; ordinarily this lateral stripe is quite distinct and characteristic. This species is found chiefly in the clearer, colder streams. Typical *nuchale* was found in Salt Creek at Havelock, and Fremont, Nebr., and by Dr. Gilbert at several places in Kansas. It is not unlikely that some of the specimens from middle Nebraska, that we have identified with *evansi*, are really *nuchale*. The two forms are very close and can be distinguished with difficulty. We identify with *evansi* that form with a small eye (4⅓ to 5½ in head), short, blunt snout, small mouth, and very pale coloration; it is perhaps more slender, also. The specimens of *H. nuchale* have a somewhat larger eye (about 4 in head), rather larger, sharper snout, and slightly darker coloration, in these respects approaching *nubilum*.

43. **Pimephales promelas** Rafinesque. *Fat-head; Black-head Minnow.* Yellowstone River (as *P. fasciatus* type, Girard, 1856); Yellowstone River and Milk River (as *P. fasciatus*, Girard, 1858); Milk River (as *P. fasciatus*, Suckley, 1860); Kansas River near Fort Riley (Cope, 1865); Missouri River near St. Joseph (as *Colisous parietalis* type, Cope, 1871); Battle Creek, S. Dak. (as *Hyborhynchus nigellus*, Cope, 1879); Ward Creek, Menoken, Kans.; Shunganunga Creek and Kansas River, Topeka; Ellis, Kans. (as *P. confertus*, Gilbert, 1884); Hundred and Two River at Bedford, Iowa, and Maryville, Mo. (Jordan & Meek, 1885); Kansas River (Graham, 1885); Kansas River at Topeka, and small streams in Shawnee, Wabaunsee, and Ellis Counties, Kans. (Cragin, 1885*a*); Blacksmith Creek, Shawnee County, Kans. (Gilbert, 1885); Solomon River, Beloit, Kans.; north fork of Solomon River at Kirwin and Lenora, Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (as *P. promelas confertus*, Hay, 1887); north fork of Solomon River at Logan, Kans., and Middle Beaver Creek, Smith County, Kans. (Gilbert, 1889); Silver Lake, Iowa; Soldier River, Charter Oak, Iowa; Boyer River, Arion, Iowa (Meek, 1892); Blue River, Crete, Nebr.; Platte and Elkhorn rivers, Fremont, Nebr.; Salt Creek, Lincoln, Nebr.; Floyd River at Sioux City and Lemars, Iowa (Meek, 1894); Dakota River at Lamoure (Woolman, 1896); Dover, S. Dak. (Butler, 1896).

Numerous specimens obtained by us at the following places: Enemy Creek, Mitchell; Rock Creek, Mitchell; Dakota River, Mitchell; Choteau Creek, Springfield; Emanuel Creek, Springfield; Prairie Creek, Scotland; Crow Creek, Chamberlain; Rapid Creek, Rapid City; Hat Creek, Ardmore; Cottonwood Creek, Edgemont; Middle Creek, Belle Fourche; French Creek at Custer; Bazile Creek, Niobrara; pond at Niobrara; pond at Creighton; Elkhorn River, Fremont; Elkhorn River, Norfolk Junction; Elkhorn River, Ewing; Spring Creek, Bazile Mills; Salt Creek, Havelock; Mud Creek, Ravenna; Long Pine Creek and ponds, Long Pine; Bone Creek, Long Pine; Ingalls Lake, Long Pine; Chadron Creek, Chadron; South Loup River, Ravenna; Dismal River, Dunning; Platte River, Fremont; Beaver Creek, York; Niobrara River, Marsland; Blue River, Seward; Lincoln and Beaver creeks, York; Minnechaduza Creek, Valentine; Clear Creek, Clermont.

In all the warmer, sluggish creeks with muddy bottom, and in all the warmer ponds and stagnant pools of the prairie region from Illinois to Wyoming, this, the fat-head or black-head minnow, is one of the most abundant species. During the dry season many of the small streams are reduced to isolated pools, mere mudholes, which are kept stirred up and rendered filthy by the cattle which visit them to slake their thirst. In these pools, however shallow and filthy they might be, we never failed to find this hardy, little fish. There is no doubt that all the nominal species cited in the above synonymy belong to a single species. There is considerable variation in the development of the lateral line, the position of the dorsal, the shape of the head, and the color; all of these, except the variation in the lateral line, are accessory sexual characters. In breeding males the head is short, the snout very blunt, and the origin of dorsal fin nearer tip of snout than base of caudal; the males are very dark, sometimes the upper parts and entire head being blue-black, while the females are much paler. The females are more elongate, head larger, snout less blunt, and correlated with this is the more posterior portion of the dorsal. Among two dozen examples studied, all the females have the dorsal midway between the snout and base of caudal, while in all the males the dorsal was nearer snout than base of caudal. The lateral line is usually better developed on the females than on the males.

On a number of male examples we find from 9 to 28 pores and these are often scattered (*parietalis*.) In several females we find the number of pores varying from 20 to 46, or complete. A female 2⅞ inches long, from Ingalls Lake, is described as follows: Head 3½; depth 3½; eye 4; snout 4⅔; D. 1, 8; A. 7; scales 9–47–3, lateral line developed on 9 scales on one side and 2 on the other. Body short and stout; snout blunt; caudal peduncle compressed, deep, its least depth 2 in head. Origin of dorsal nearer snout than base of anal, directly opposite ventrals. Entire head, except preopercle and free edge of opercle, and upper parts blue-black, middle of side with a broad plumbeous band; lower parts pale; fins all more or less thickly dusted with fine dark spots; a long dark blotch on anterior rays of dorsal; snout with about 25 large tubercles, about 7 on tip of lower jaw. A female about 3 inches long from Lincoln Creek has the following characters: Head 4⅓; depth 4⅓; eye 4⅔; snout 3⅔; D. 1, 8; A. 7; scales 9–46–4, the lateral line nearly complete, 2 or 3 isolated scales without pores. Body more slender; snout and head less blunt; caudal peduncle more slender, its least depth more than 2 in head. Color pale; back and upper part of sides dusted with fine dark specks; plumbeous lateral band faint; under parts pale; few fine punctulations on fins; dorsal with a long black blotch on anterior rays.

The specimens from Hat Creek, 1½ to 2 inches long, present the following characters: Head 3⅔, = depth; eye 3½, = snout; dorsal 1, 8; anal 1, 7; scales 10–55–5; lateral line decurved and incomplete; scales small and crowded anteriorly, about 30 before the dorsal; origin of dorsal in front of

ventrals, nearer snout than caudal. Snout blunt, mouth terminal, small, oblique; head broad, interorbital width 2½ in length of head. Teeth 4–4, with rather broad grinding surface. Intestine more than twice the length of body; peritoneum black. Color very pale; upper part of body with numerous very small dark specks, a few narrow, indistinct lines on anterior half, running from median line upward and backward; a dark line from occiput to origin of dorsal; a rather distinct plumbeous band along lateral line; base of caudal dark. The specimens from Middle and Beaver creeks are considerably paler, the lateral plumbeous band being evident on caudal peduncle.

**44. Pimephales notatus** (Rafinesque). *Blunt-nosed Minnow.* Ward Creek, Menoken, Kans. (Gilbert, 1884); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo., and Tabo Creek, Calhoun, Mo. (Jordan & Meek, 1885); Shunganunga and Ward creeks, Topeka (Gilbert, 1885); Shunganunga and Ward creeks, Kans. (Cragin, 1885*a*); Solomon River, Beloit, Kans.; north fork of Solomon River, Kirwin and Lenora, Kans.; Saline River, Wakeeney, Kans. (Hay, 1887); Big Piney River, Cabool, Mo.; Little Piney River, Arlington and Newburg, Mo.; Osage Fork, Marshfield, Mo.; Lock Fork, Mansfield, Mo.; Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo.; Sac River, Springfield, Mo. (Meek, 1891); Big Sioux River at Sioux City and Sioux Falls; Silver Lake, Iowa (Meek, 1892); Blue River, Crete, Nebr.; Elkhorn River, Fremont, Nebr.; Floyd River at Sioux City and Lemars, Iowa (Meek, 1894); Dakota River at Lamoure and Jamestown (Woolman, 1896).

**45. Semotilus atromaculatus** (Mitchill). *Creek Chub.* Fort Pierre, Nebr. (as *S. macrocephalus* type, Girard, 1856 and 1858); Sweetwater River (as *S. speciosus* type, Girard, 1856); tributary of Platte River (as *S. speciosus*, Girard, 1858); Kansas River near Fort Riley (as *S. hammondii* type, Abbott, 1860); Platte River (Cope, 1865); Kansas River near Fort Riley (as *S. corporalis* and *S. pallidus*, Cope, 1865); Red Cloud Creek (Cope, 1870); Battle Creek, S. Dak. (as *S. corporalis*, Cope, 1879); Shunganunga Creek, Topeka (as *S. corporalis*, Gilbert, 1884); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Tabo Creek, Lexington and Calhoun, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo. (Jordan & Meek, 1885); Mill Creek, Wabaunsee County, Kans. (Gilbert, 1885); Shunganunga and Mill Creeks and Fort Riley, Kans. (Cragin, 1885*a*); Mission and Blacksmith creeks, Shawnee County, Kans. (Gilbert, 1886); Bear Creek, Boone County, Mo. (Call, 1887); Solomon River, Beloit, Kans.; north fork of Solomon River, Kirwin and Lenora, Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (Hay, 1887); Republican River, Wano, Kans.; Middle Beaver Creek, Smith County, Kans.; Spring Creek, Smith Center, Kans. (Gilbert, 1889); Big Piney River, Cabool, Mo.; Little Piney River at Newburg and Arlington, Mo.; Jones Creek, Dixon, Mo.; Gasconade River, Arlington, Mo.; Lock Fork, Mansfield, Mo.; Osage Fork, Marshfield, Mo.; Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo.; Sac River, Springfield, Mo. (Meek, 1891); South Platte River, Denver (Jordan, 1891*a*); Soldier River at Charter Oak and Boyer River at Arion, Iowa (Meek, 1892); Floyd River at Sioux City (Meek, 1894); Dakota River and Pipestem Creek at Jamestown (Woolman, 1896).

Obtained by us at the following places: Floyd River, Sioux City; Bazile Creek, Niobrara; Norfolk Creek, Norfolk Junction; Verdigris Creek, Verdigris; Long Pine Creek, Long Pine; Bone Creek, Long Pine; Minnechaduza Creek, Valentine; Chadron Creek, Chadron; Lone Tree Creek, Chadron; White River, Crawford; Beaver Creek at York; Emanuel Creek, Springfield; Crow Creek, Chamberlain; Beaver Creek, Buffalo Gap; Rapid Creek, Rapid

City; Redwater Creek, Spearfish; Spring Creek, Hill City; Crow Creek, Gammon's ranch; Chicken Creek, Spearfish; Belle Fourche River, Belle Fourche; French Creek at Custer; Deer Creek, Glenrock; Big Goose Creek, Sheridan. At most of these places it was quite abundant, especially in the clear and moderately cold streams with gravelly bottoms. The largest specimens obtained are from the Belle Fourche and from Rapid Creek, some of which are over 8 inches in total length. Head $3\frac{2}{3}$; depth $4\frac{1}{2}$; eye $7\frac{1}{2}$; snout 3; D. 8; A. 8; scales 11-56 to 59-6. These western specimens do not differ appreciably from eastern specimens of this species.

**46. Leuciscus elongatus** (Kirtland). North fork of Solomon River, Lenora, Kans. (as *Squalius elongatus*, Hay, 1887). This reference to the occurrence of this fish in the Missouri Basin needs verification.

**47. Leuciscus neogæus** (Cope). Fifteen specimens from Cox Lake and 10 from Montana Lake. These examples vary in length from 2 to $3\frac{1}{2}$ inches, the average being about $2\frac{3}{4}$ inches. Head $3\frac{1}{4}$ to 4; depth 4 to 5; eye $3\frac{1}{4}$ to 4; D. 1, 8; A. 1, 8; scales about 80, 20 to 26 in transverse series, very small, embedded and hard to count. Body stout, not compressed; head very broad and heavy; snout moderate, oblique, the maxillary reaching orbit. Color dark olive above, sides paler, under parts straw color, median line of back black; middle of side with a narrow plumbeous band, ending in a small black caudal spot. The band greenish posteriorly.

**48. Leuciscus milnerianus** (Cope). Probably Battle Creek, S. Dak. (as *Phoxinus milnerianus* type, Cope, 1879). A species of doubtful validity.

**49. Abramis chrysoleucas** (Mitchill). *Golden Shiner; Roach.* Blackwater Creek, Brownsville, Saline, County, Mo.; Flat Creek, Sedalia, Mo. (as *Notemigonus americanus chrysoleucus*, Jordan & Meek, 1885); eastern Kansas (as *Notemigonus chrysoleucus*, Graham, 1885); Marais River, Dixon, Mo. (Meek, 1891); Big Sioux River at Sioux Falls and Silver Lake, Iowa (Meek, 1892); Platte River at Fremont; Floyd River at Sioux City, and Spirit Lake (Meek, 1894). Not obtained by us except in ponds near Long Pine Creek, 10 miles north of Long Pine, where it was common, and in bayous of Elkhorn River near Ewing.

**50. Cliola vigilax** (Baird & Girard). Grand River at Clinton, Mo., and Tabo Creek at Calhoun, Mo. (Jordan & Meek, 1885); Norfolk Creek, Norfolk Junction; Floyd River, Sioux City; Elkhorn River at Fremont, Norfolk Junction, and Ewing. This species was, contrary to what we had expected, found to be rather uncommon in this region. Eastern Nebraska seems to be the limit of its range northwestward. The largest specimens are $2\frac{3}{4}$ inches in total length. A typical example from Ewing shows the following characters: Head $4\frac{1}{4}$; depth $4\frac{1}{4}$; eye 4; snout 4; D. 1, 8; A. 1, 7; scales 7-46-3, 21 before dorsal; lateral line complete, decurved. Body rather slender; snout, blunt; top of head, flat; back, little arched; caudal peduncle, long; mouth small, subinferior, nearly horizontal, maxillary barely reaching eye; color, pale; back and upper parts of sides with small black specks on borders of the scales forming cross-hatching on back; lower parts pale; black caudal spot, not large; fins all plain, except a dark spot on front of dorsal. On some specimens the caudal and dorsal spots were quite indistinct.

**51. Cliola smithii** sp. nov. Type locality: Prairie Creek near Scotland, S. Dak., where 5 specimens were obtained June 26, 1893 (collectors, Evermann, Cox, and Rutter). Associate type localities: Pond near Niobrara, Nebr., 1 specimen, June 28, 1893 (collectors, Evermann, Cox, and Rutter); Dismal River, Dunning, Nebr., August 9, 1 specimen (collectors, Cox and Gillum). (Type, No. 45681, U. S. Nat. Mus. Co-type, No. 3136, L. S. Jr. Univ. Mus.)

Head 4; depth $3\frac{2}{3}$; eye 4; snout 4; interorbital width 3; D. 1, 8; A. 7; scales 9-47-6, 27 before the dorsal. Teeth 4-4, not hooked, grinding surface slightly developed. Intestine not long. Body short and stout, compressed;

head moderate; mouth small, terminal, slightly oblique; maxillary not reaching eye; preorbital broad. Back considerably arched, caudal peduncle deep, its least depth 2 in head. Origin of dorsal fin over ventrals, nearer snout than base of caudal. Color, above densely covered with fine, black specks, giving a general blue-black appearance; sides with a broad plumbeous band two-thirds as broad as eye, darkest and best defined on caudal peduncle; sides below this band with a few scattered specks anteriorly; lower part of caudal peduncle pale; top and upper parts of sides of head bluish-black; dorsal, anal, and pectorals with a few dark specks; other fins plain. Length, 2¼ inches.

Named for Dr. Hugh M. Smith, chief of the Statistical Division of the United States Fish Commission.

**52. Notropis cayuga** Meek. Big Piney River, Cabool, Mo.; Osage River and Lock Fork, Mansfield, Mo.; Niangua River, Marshfield, Mo. (Meek, 1891); Big Sioux River, Sioux City, Iowa (Meek, 1892); Floyd River, Sioux City and Lemars, Iowa (Meek, 1894); Dakota River at Jamestown (Woolman, 1896); Floyd River, Sioux City; Dakota River and Enemy, Firesteel and Rock creeks, Mitchell; Prairie Creek, Scotland; Choteau and Emanuel creeks, Springfield; pond at Niobrara; Bazile Creek, Niobrara; pond at Verdigris; pond at Creighton; Norfolk Creek, Norfolk Junction; Elkhorn River at Ewing; creek at Ewing; ponds and creeks, Long Pine; Minnechaduza Creek, Valentine; Chadron Creek, Chadron; Mud Creek, Ravenna.

From the above it will be seen that this small minnow is one of the most abundant species in eastern South Dakota and Nebraska. The most westerly point at which we obtained it is Chadron, Nebr., and as but a single specimen was found there, its occurrence at that place is probably exceptional. At Valentine, about 130 miles east of Chadron, it was found in considerable numbers, and eastward from Valentine it was abundant in all suitable places.

This is preeminently a species of the pools, ponds, and small lakes. While we might not find it, even with careful seining, in the clear running streams, we seldom failed to take it in abundance in any overflown pond or small lake that we found along the streams. It was very abundant in the ponds at Creighton and Long Pine. Choteau Creek, in which it was also abundant, is a slow, sluggish creek, much like a pond in many respects. In such waters as these, when the bottom was of mud, or mud and coarse gravel, and where there was considerable vegetation, *Potamogeton*, *Chara*, and various species of *Algæ*, would we find *Notropis cayuga* in greatest numbers. The last week of June seems to be its spawning season in this region; many of the specimens taken at Creighton, June 29, were full of ripe spawn.

Considerable variation in the intensity of the coloration is shown by these collections, the specimens from the cooler, clearer ponds being much darker than those from warmer streams.

The following description is drawn up from a typical specimen, 2¼ inches long, from Prairie Creek: No. 1745. Head 3⅝; depth 4⅓; eye 3⅓; snout 4; D. I, 8; A. 8; scales 6-35-3, 15 before dorsal; lateral line incomplete, irregularly broken. Body slender, head moderate, back little arched, peduncle long and slender, mouth moderate, somewhat oblique, terminal; maxillary not reaching eye; eye large. Origin of dorsal slightly behind ventrals, midway between snout and base of caudal; pectorals short; 1½ in head, not reaching ventrals; ventrals shorter than pectorals, reaching vent; caudal deeply forked. Color of back dark, covered with fine brownish points, thickest on edges of scales, forming cross-hatching on entire length of back; middle of sides with a broad dark band from base of caudal fin along course of lateral line across opercle, and meeting its fellow around snout, not on lower lip; under parts pale, except a dark line from anus along base of anal fin and

under side of caudal peduncle and on to caudal fin; fins all more or less dusted with fine dark points. The only species with which this fish is likely to be confused are the closely related species *N. heterodon* and *N. anogenus*.

These three species bear a very close superficial resemblance to each other. They were first critically compared and their differential characters pointed out by Dr. Meek in his Fishes of the Cayuga Lake Basin. The following key will enable one to distinguish them:

*a.* Black of nose not extending to lower lip; snout blunt, mouth small, subinferior, little oblique ..... *cayuga.*
*aa.* Black of nose upon lower lip as well as upon upper.
*b.* Snout sharp; mouth large, oblique, the lower jaw scarcely included ..... *heterodon.*
*bb.* Snout more blunt; mouth very small, very oblique ..... *anogenus.*

A comparison of our specimens of *cayuga* with others from northern Indiana shows no marked differences.

**53. Notropis heterodon** (Cope). Smoky Hill River, Wallace, Kans. (as *N. germanus* type, Hay, 1887); Silver Lake, Iowa (Meek, 1892).

**54. Notropis blennius** (Girard). Missouri River at St. Joseph (as *Hybopsis missuriensis* type, Cope, 1874); Ward Creek, Shawnee County, Kans. (as *Cliola straminea*, Gilbert, 1884); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Missouri River, St. Joseph; Tabo Creek, Lexington, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (as *N. deliciosus*, Jordan & Meek, 1885); Kansas River branches (as *N. deliciosa*, Graham, 1885); Piney River, Texas County, Mo. (as *N. deliciosus*, Call, 1887); Solomon River, Beloit, Kans.; north fork of Solomon River at Kirwin and Lenora, Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (as *N. deliciosus*, Hay, 1887); Republican River, Wano, Kans.; Sappa Creek, Oberlin Kans.; Logan, Kans.; Middle Beaver Creek, Smith County, Kans.; Spring Creek, Smith Center, Kans.; Osage River, La Cygne, Kans. (as *N. deliciosus lineolatus*, Gilbert, 1889); Sac River, Springfield, Mo. (as *N. deliciosus*, Meek, 1891); Big Sioux River at Sioux Falls and Sioux City; Boyer River at Arion, Iowa (as *N. deliciosus*, Meek, 1892); Platte and Elkhorn rivers at Fremont; Blue River at Crete; Salt Creek at Lincoln; and Floyd River at Sioux City and Lemars (Meek, 1894); Dakota River at Lamoure and Jamestown (Woolman, 1896).

Found by us at the following places: Floyd River, Sioux City; Verdigris Creek, Verdigris; Norfolk Creek, Norfolk Junction; Salt Creek, Havelock; Chadron Creek, Chadron; Mud Creek, Ravenna; Schlegel Creek, Valentine; Minnechaduza Creek, Valentine; Elkhorn River, Norfolk Junction; Elkhorn River, Ewing; Bazile Creek, Niobrara; Long Pine Creek, Long Pine; White River, Chadron; canal at Niobrara; Niobrara River, Valentine; Niobrara River, north of Long Pine; Wood Creek, Grand Island; South Loup River, Ravenna; Lincoln Creek, York; Dismal River, Dunning; Middle Loup River, Dunning; Beaver Creek, York; Ingalls Lake, Long Pine; Platte River, Grand Island; White River, Crawford; Niobrara River, Marsland; Belle Fourche River, Belle Fourche; Middle Creek, Belle Fourche; Cheyenne River, Hot Springs; Cottonwood Creek, Edgemont; Hat Creek, Ardmore; Rapid Creek, Rapid City; Beaver Creek, Buffalo Gap; Dakota River, Mitchell; Crow Creek, Chamberlain; Redwater Creek, Spearfish; Deer Creek, Glenrock; Platte River, Glenrock; Garden Creek, Casper; Platte River, Douglas.

This is one of the most abundant and widely distributed of the *Cyprinidæ*, it being found from the Great Lakes to Virginia, and westward to Wyoming and south to Texas. It is subject to great variation, and many nominal species have been based upon the differences in eye, snout, or scales presented by specimens from different parts of its range. None of these is, however, worthy of specific recognition, though several of the more pronounced forms may be recognized as subspecies.

The very large series of specimens and the numerous localities represented in the present collection show most perplexing variations even in this basin. As a rule the individuals from any particular stream can be told from those from any other stream. The differences lie chiefly in the relative bluntness of the snout, the stoutness of the body, size of eye, size and arrangement of the scales, and in the color. A typical specimen from Glenrock, Wyo., has the head 4; depth 4; eye 3½; snout 4½; D. 1, 8; A. 7; scales 6-34-3. One from Floyd River, Sioux City, has the eye somewhat larger (3⅓), and the snout shorter and more blunt (4). One from Rapid City, head 4⅜; depth 4⅛; eye 3⅜; snout 4; scales 6-35-3. All the specimens from this place have short, blunt heads and rather large eyes. One from Belle Fourche agrees with the Rapid City specimens except that the scales are rather smaller, 7-36-4. The lot from Fremont has larger scales (6-33-3), sharper snout, and more distinct plumbeous lateral band than those from farther west. The number of scales before the dorsal varies from 14 to 20, the usual number being 15 or 16. This does not seem to be correlated with any other variable character. The teeth, in numerous examples examined, were 4-4, hooked, and with slight grinding surface on two or three teeth.

**55. Notropis scylla** (Cope). Osage River, Mo. (as ? *Alburnus lincolatus* type, Agassiz, 1863); Red Cloud Creek, tributary of Platte River (as *Hybopsis scylla* type, Cope, 1871); upper Missouri region (as *Cliola chlora* type, Jordan, 1878); Marais des Cygnes (as *N. lincolatus*, Graham, 1885); South Platte River, Denver (Jordan, 1891*a*). If all of these references really belong to one species, it would stand as *Notropis lincolatus* (Agassiz).

**56. Notropis topeka** (Gilbert).

*Cliola* (*Hybopsis*) *topeka* Gilbert, Bull. Washburn Lab. Nat. Hist., vol. 1, No. 1. 13, September, 1884. Type locality: Shunganunga Creek, Topeka, Kans,

*Notropis aneolus* Hay, Proc. U. S. Nat. Mus. 1887, 245. Type locality: Saline River, Wakeeney, Kans.

Hundred and Two River, Bedford, Iowa (Jordan & Meek, 1885); Shunganunga Creek and Ellis, Kans. (Cragin, 1885*a*); Smoky Hill River, Wallace, Kans.; north fork of Solomon River, Kirwin, Kans.; Solomon River, Beloit, Kans. (Hay, 1887); Sappa Creek, Oberlin, Kans. (Gilbert, 1889); Boyer River at Arion, Iowa; Big Sioux River, Sioux City, Iowa (Meek, 1892); Floyd River at Sioux City and Lemars, Iowa; Salt Creek, Lincoln, Nebr.; and Blue River at Crete, Nebr. (Meek, 1894); Firesteel and Enemy, Rock creeks, Mitchell; Prairie Creek, Scotland; pond at Creighton.

The localities in which we found this pretty little fish are, as may be noticed, all close together. In Kansas it was found by Drs. Gilbert and Hay considerably farther west. All the waters in which we took it were pond-like, isolated portions of streams which dry up in parts of their course during dry weather. These ponds are partly supplied from small springs, the water is usually rather clear and cool, and there is an abundance of water vegetation. The bottom is mostly soft mud.

Male: Head 3⅝; depth 3⅓; eye 4⅓; snout 3½; interorbital width 2¾; D. 1, 8; A. 1, 7; scales 6-35-4, about 12 scales before the dorsal; lateral line more or less broken, slightly decurved; body short, compressed, and deep; head rather small, snout blunt; mouth somewhat oblique, subterminal, lower jaw included; maxillary not reaching eye; back somewhat elevated; caudal peduncle deep, 2 in head; fins moderate; dorsal inserted opposite ventrals, its height 1⅓ in head; pectorals short, 1½ in head. Color greenish above, orange below; scales above lateral line dark-edged; a rather distinct plumbeous lateral band; fins all rich red in life. Snout, top of head, and back as far as dorsal fin thickly covered with strong tubercles; scattered tubercles on sides; scales on ventral surface in front of ventral fins greatly thickened.

Female: Head a little shorter, fins not so red, and no tubercles.

Of the 31 specimens from Creighton, all but 8 are females, most of which

are nearly ripe with spawn. All but 8 of those from Prairie Creek are nearly ripe females; while all of those from Firesteel Creek are males.

**57. Notropis gilberti** Jordan & Meek.

*Notropis gilberti* Jordan & Meek, Proc. U. S. Nat. Mus. 1885, 4. Type locality: Valley Creek, Ottumwa, Iowa.

Grand River, Clinton, and Tabo Creek, Calhoun, Mo. (Jordan & Meek, 1885); South Platte River at Denver (Jordan, 1891*a*); Boyer River, Arion, Iowa; Soldier River, Charter Oak, Iowa (Meek, 1892); Verdigris Creek, Verdigris; canal at Niobrara; creek at Norfolk Junction; creek at Ewing; Bone Creek, Long Pine. This little fish seems to be quite rare. We found it in but five places and secured but 18 specimens. It appears to prefer the small streams or rivulets with sandy bottom and some current.

**58. Notropis piptolepis** (Cope). Red Cloud Creek, a tributary of the North Platte (as *Photogenis piptolepis* type, Cope, 1871). Not obtained by any other collector.

**59. Notropis shumardi** (Girard). Jones Creek, Dixon, Mo.; Little Piney River at Newburg and Arlington, Mo.; Gasconade River, Arlington, Mo. (as *N. boops*, Meek, 1891).

**60. Notropis hudsonius** (Clinton). "Kansas River branches" (Graham, 1885); Wild Cat Creek, Kans. (Cragin, 1885*a*); Big Sioux River at Sioux City (Meek, 1892); Floyd River at Sioux City; Spirit, East Okoboji, and West Okoboji lakes (Meek, 1894). This species was obtained by us at Mitchell, S. Dak., in Rock and Firesteel creeks, and in the Dakota River, where 45 specimens were collected. In the Dakota River, just below the milldam, we found it in abundance; none of the specimens, however, was over 3 inches in length. In Spirit Lake and the other lakes about it this is the most abundant minnow, and the principal live bait used by the anglers who frequent these lakes. From all other *Cyprinidæ* of the Missouri River this species may be known by the large black spot at the base of the tail, and the broad silver band on the side. The teeth of this species have usually been given as 1, 4–4, 0 or 1. As early as 1886 it was shown by Evermann & Bollman* that they are often 1, 4–4, 2, or even 2, 4–4, 2. An examination of numerous specimens in the present collection shows the same range in variation, even in examples from the same locality. The form described in 1893 from Winnipeg as *Notropis scopiferus*, by Eigenmann & Eigenmann, seems to be this species, with the teeth 2, 4–4, 2.

**61. Notropis lutrensis** (Baird & Girard). Big Creek, Hays City, Kans. (Evermann, collector, 1879); St. Joseph, Mo. (as *Cyprinella billingsiana* type and as *Moniana jugalis* type, Cope, 1871); Ward Creek, Shawnee County, Kans. (as *Cliola* (?) *gibbosa*, Gilbert, 1884); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Tabo Creek, Lexington, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (Jordan & Meek, 1885); Kansas River and Missouri River at St. Joseph (as *N. billingsiana*, Graham, 1885); "very abundant in Kansas" (Graham, 1885); Shunganunga and Ward creeks, Shawnee County, Kans. (Gilbert, 1885); Missouri River at St. Joseph, and Shunganunga and Ward creeks, Kans. (Cragin, 1885*a*); Republican River, Concordia, Kans.; Solomon River, Beloit, Kans.; north fork of Solomon River at Kirwin and Lenora, Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (Hay, 1887); Sappa Creek, Oberlin, Kans.; Logan, Kans.; Middle Beaver Creek, Smith County, Kans.; Spring Creek, Smith Center, Kans.; Osage River, La Cygne, Kans. (Gilbert, 1889); Little Piney River at Arlington and Newburg, Mo.; Marais River, Dixon, Mo. (Meek, 1891); South Platte River, Denver (Jordan, 1891*a*); Boyer River at Arion, Iowa (Meek,

* Notes on a collection of fishes from the Monongahela River, by Barton W. Evermann and Charles H. Bollman. Proc. N. Y. Ac. Sci. 1886, 335–340.

1892); Blue River at Crete; Elkhorn and Platte rivers at Fremont; Salt Creek at Lincoln; Floyd River at Sioux City and Lemars (Meek, 1894); canal at Niobrara; Elkhorn River, Norfolk Junction and Ewing; Verdigris Creek, Verdigris; Bazile Creek, Niobrara; Niobrara River at Long Pine and Valentine; Long Pine Creek at Long Pine; Beaver Creek at York; Lincoln Creek at York and Seward; creek at Ewing; Blue River, Crete; Salt Creek, Havelock; Mud Creek, Ravenna; South Loup River, Ravenna; Middle Loup River, Dunning; Blue River, Seward; Wood Creek, Grand Island; Dismal River at Dunning; Platte River, Grand Island; Dakota River at Mitchell; Enemy and Rock creeks at Mitchell; Crow Creek, Chamberlain; Emanuel and Choteau creeks, Springfield; North Platte River, Douglas.

As will appear from the localities given above, this is an abundant and generally distributed fish in Nebraska and South Dakota. It has been found by Professor Meek as far east as Des Moines, and by Mr. A. J. Woolman as far south as Chihuahua. It was found by us in nearly all the streams which we examined in eastern South Dakota and in Nebraska. In northwestern Nebraska and in the region in and about the Black Hills we did not find it; and Douglas, Wyo., is the only place in that State where we met with it. The most western place in Nebraska at which it was obtained is Ravenna. The longest specimens we have are 3¼ inches long. A fine male from Platte River, Grand Island, is described as follows: Head 4; depth 3; eye 4½; snout 3½; interorbital width 2½; D. I, 8; A. I, 9; scales 7-36-3, 16 before dorsal. Body short and deep, greatly compressed; back elevated and keel-like before dorsal; head pointed, mouth moderate, terminal, oblique; maxillary scarcely reaching the eye. Dorsal high, its longest rays 1⅓ in head; anal lower, 1⅔ in head; pectorals and ventrals short, about 1⅔ in head; caudal deeply forked, the lobes 1⅓ in head. Color steel-blue above, belly and all fins, except dorsal, blood-red; dorsal pale; postocular and subocular region red; a violet and crimson crescent behind opercle, changing to dull bluish in alcohol; nose, top of head, nuchal region, and sides along base of anal fin, profusely tuberculate; middle of side under dorsal fin with a patch of tubercles. In other specimens the caudal peduncle is thickly covered with strong tubercles. Very small individuals, not over 1¼ inches long, are strongly tuberculate and brightly colored, and have evidently reached the breeding age. The females average slightly smaller than the males and are not brightly colored.

62. **Notropis macrostomus** (Girard). Solomon River, Beloit, Kans. (Hay, 1887); Solomon River at Beloit and Saline River at Wakeeney, Kans. (as *N. umbrifer* type, Hay, 1887). Not seen by us.

63. **Notropis notatus** (Girard). Osage River, Mo. (as *Alburnus notatus* type, Agassiz, 1863); Piney River, Texas County, Mo. (Call, 1887).

64. **Notropis whipplii** (Girard). *Silver-fin; Satin-fin.* Little Piney River at Newburg and Arlington, Mo.; Osage Fork, Marshfield, Mo. (Meek, 1891); Big Sioux River at Sioux City (Meek, 1892).

65. **Notropis cornutus** (Mitchill). *Common Shiner.* Sweetwater River (as *Plargyrus bowmani* type, Girard, 1856 and 1858); Red Cloud Creek (as *Hypsilepis cornutus*, Cope, 1871); Ellis, Ellis County, Kans. (as *Minnilus cornutus*, Gilbert, 1884); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (as *N. megalops*, Jordan & Meek, 1885); Shunganunga and Ward creeks, Shawnee County, Kans.; Ellis, Kans.; Mill Creek, Alma, Kans. (as *N. megalops*, Gilbert, 1885); Shawnee, Wabaunsee, and Ellis counties, Kans. (Cragin, 1885*a*); Blacksmith Creek, Shawnee County, Kans. (as *N. megalops*, Gilbert, 1886); Solomon River, Beloit, Kans.; north fork of Solomon River at Kirwin and Lenora,

Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (as *N. megalops*, Hay, 1887); Big Piney River, Cabool, Mo.; Lock Fork at Mansfield, Mo. (as *N. megalops*, Meek, 1891); South Platte River, Denver (as *N. megalops*, Jordan, 1891*a*); Big Sioux River at Sioux City; Boyer River at Arion, Iowa; and Silver Lake, Iowa (as *N. megalops*, Meek, 1892); Floyd River at Lemars and Sioux City; Elkhorn River at Fremont and Salt Creek at Lincoln (as *N. megalops*, Meek, 1894); Dakota River at Lamoure and Jamestown (Woolman, 1896).

Obtained by us at the following places: Floyd River, Sioux City; Elkhorn River at Fremont, Norfolk Junction, and Ewing; creek at Ewing; Verdigris Creek, Verdigris; Norfolk Creek, Norfolk Junction; Rock Creek, Mitchell; Enemy Creek, Mitchell; Firesteel Creek, Mitchell; Prairie Creek, Scotland; Choteau Creek, Springfield; Emanuel Creek, Springfield; Deer Creek, Glenrock.

The shiner is abundant in the northeastern corner of Nebraska and the adjacent parts of Iowa and South Dakota. It is not uncommon in eastern Kansas, but appears to be rare in western Nebraska and in Wyoming. The only Wyoming localities from which it has been reported are Glenrock and the Sweetwater. We did not find it about the Black Hills. All the specimens obtained by us are small, the largest being but 4¼ inches long, from Scotland, S. Dak. Head 3⅓; depth 3⅓; eye 3⅜; snout 3⅜; D. I, 8; A. I, 8; scales 7-36-4, about 26 before dorsal. Body stout, compressed, head moderate; mouth moderate, terminal, oblique, the maxillary not quite reaching vertical at front of eye; caudal peduncle compressed and deep, least depth 2⅓ in head. Origin of dorsal opposite ventrals; scales closely imbricated and thin, deeper than long, especially in front; lateral line somewhat decurved. Sides silvery, with bluish reflections; back darker; cheek silvery, with fine dark punctulations on opercles; under parts pale; fins all pale, except dorsal and caudal, which have some fine dark specks. Not differing greatly from eastern specimens. A voracious minnow, taking the hook eagerly when better fish are wanted, but not without its value as an addition to the small boy's string.

**66. Notropis zonatus** (Agassiz). Osage River, Mo. (as *Alburnus zonatus*, Putnam, 1863); Ozark region of Missouri (Call, 1887); Big Piney River, Cabool, Mo.; Jones Creek, Dixon, Mo.; Gasconade River, Arlington, Mo.; Lock Fork, Mansfield, Mo.; Osage Fork, Marshfield, Mo.; Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo.; Sac River, Springfield, Mo. (Meek, 1891).

**67. Notropis jejunus** (Forbes). Sappa Creek, Oberlin, Kans. (Gilbert, 1889); Platte and Elkhorn rivers at Fremont (Meek, 1894).

Found by us at the following places: Platte River, Grand Island; Wood River, Grand Island; South Loup River, Ravenna; Middle Loup River, Dunning; Dismal River, Dunning; North Platte River, Douglas.

This interesting species was found only in a few places. We found it in none of the small sluggish creeks which we examined and it seemed to frequent only the open channels of the large, clear streams with considerable current and sandy bottom. It is not found in deep water, nor in water that is very cold; nor on gravel or rocky bottom; nor in pools or streams without some current. The specimens from Dunning and Grand Island are particularly fine, the longest measuring 3½ inches. Head 4 to 4⅓; depth 3⅝ to 4; eye 3½; D. I, 8; A. I, 7; scales 6-35 or 36-3. Teeth 2, 4-4, 2, hooked, and without grinding surface. Body rather heavy, compressed; head heavy; mouth large, terminal, oblique; maxillary reaching eye; caudal peduncle deep. Dorsal in front of ventrals; equidistant between snout and base of caudal fin. Scales large, thin, about 15 before the dorsal; lateral line somewhat decurved. Color, median line of back with a narrow but distinct dark line from head to caudal fin; upper part of side pale straw-color, but dusted

with numerous dark spots; middle of side with a broad plumbeous band, broader than eye, chiefly above lateral line; the upper edge of this band distinctly defined, the lower less distinct; lower sides and under parts pale; top of head dark, rest of head pale; cheeks and opercles silvery; fins all pale, dorsal and caudal with some dark specks.

68. **Notropis atherinoides** Rafinesque. Big Sioux River at Sioux City (Meek, 1892); Poplar River, Poplar, Mont. (Eigenmann, 1894).

69. **Notropis dilectus** (Girard). Kansas (as *Alburnus oligaspis* type, Cope, 1864*a*); Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (Jordan & Meek, 1885); Missouri River at Sioux City and Big Sioux River at Sioux Falls (Meek, 1892); Floyd River at Sioux City and Elkhorn River at Fremont (Meek, 1894); Elkhorn River, Norfolk Junction; Bazile Creek, Niobrara; Platte River, Grand Island; South Loup River, Ravenna; Dakota River, Mitchell. This species, like *N. jejunus*, is found usually in the clear, shallow streams on sandy bottom, but where the water is only moderately cold. It does not seem to be widely or generally distributed in the Missouri Basin. Many of the specimens obtained by us are unusually large, particularly those from Fremont and Ravenna, the largest measuring 3½ inches in total length. Head 4⅔; depth 5; eye 3⅓; snout 4; D. I, 8; A. I, 13; scales 6–40–3, 20 before the dorsal, closely imbricated and deeper than long; lateral line decurved. Body long and slender, compressed; head moderate, snout pointed; mouth large, oblique, terminal; maxillary reaching vertical of front of eye; eye large, equal to interorbital width; caudal peduncle long; its least depth 2½ in head. Origin of dorsal fin much behind insertion of ventrals nearer base of caudal than tip of snout. Color pale, upper parts dusted over with fine brown punctulations, thickest on edges of scales, thus resulting in faint cross-hatching; median line of back dark, darkest on caudal peduncle; middle of side with a broad silvery band, plumbeous above; under parts pale straw-color; head dusted above and on lips and chin; cheeks and opercles bright silvery; fins all pale except dorsal and anal, which have some fine dark specks. This trim minnow resembles *N. jejunus* in general appearance, but can be readily distinguished from all other species of *Notropis* found in the Missouri Basin by its large anal fin and the posterior position of the dorsal.

70. **Notropis rubrifrons** (Cope). St. Joseph, Mo. (as *Alburnellus percobromus* type, Cope, 1871); Blackwater River, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo. (Jordan & Meek, 1885); Kansas and Missouri rivers (Graham, 1885); Osage River, La Cygne, Kans. (Gilbert, 1889); Osage Fork, Marshfield, Mo.; Lock Fork, Mansfield, Mo.; Little Piney River at Arlington and Newburg, Mo.; Sac River, Springfield, Mo. (Meek, 1891).

71. **Notropis umbratilis umbratilis** (Girard). *Redfin.* Shunganunga Creek, Topeka (as *Minnilus* (*Lythrurus*) *nigripinnis* type, Gilbert, 1884); Shunganunga Creek (Cragin, 1885*a*); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (Jordan & Meek, 1885); Shunganunga Creek, Topeka (as *N. nigripinnis*, Gilbert, 1885); north fork of Solomon River, Lenora, Kans. (Hay, 1887); Lock Fork, Mansfield, Mo.; Osage Fork, Marshfield, Mo.; Marais River, Dixon, Mo.; Sac River, Springfield, Mo. (Meek, 1891).

72. **Phenacobius mirabilis** (Girard). Ward Creek, Shawnee County, Kans. (Gilbert, 1884); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Tabo Creek, Lexington and Calhoun, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo. (Jordan & Meek, 1885); common throughout Kansas (Graham, 1885); Shunganunga and Ward creeks, Shawnee County, Kans. (Gilbert, 1885); Shunganunga and Ward creeks (Cragin, 1885*a*); Solomon River, Beloit, Kans.; north fork

of Solomon River, Lenora, Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (Hay, 1887); Sappa Creek, Oberlin, Kans.; Logan, Kans.; Osage River, La Cygne, Kans. (Gilbert, 1889); Boyer River at Arion, Iowa (Meek, 1892); Blue River at Crete (Meek, 1894).

This does not appear to be an abundant fish in the Missouri Basin, but it is rather widely distributed. It was found by us only in Crow Creek near Chamberlain, S. Dak., and at Ravenna, Nebr., in Mud Creek. Head $4\frac{1}{4}$; depth $4\frac{2}{3}$; eye $4\frac{2}{3}$; snout $2\frac{2}{3}$; interorbital width $3\frac{1}{4}$. D. I, 8; A. I, 7; scales 6–48–4, about 17 before the dorsal. Largest example about 3 inches long.

**73. Phenacobius scopifer** (Cope). Missouri River near St. Joseph, Mo. (as *Sarcidium scopifer* type, Cope, 1871); Bear Creek, Boone County, Mo. (Call, 1887). This species may not be distinct from the preceding.

**74. Rhinichthys cataractæ dulcis** (Girard). *Western Dace.* Sweetwater River (as *Argyreus dulcis* type, Girard, 1856 and 1858); Kansas (as *R. maxillosus* type, Cope, 1864*a*); Kansas River near Fort Riley (as *R. maxillosus*, Cope, 1865); Red Cloud Creek and Platte River (as *R. maxillosus*, Cope, 1871); Battle Creek, S. Dak. (as *R. maxillosus*, Cope, 1879); northeastern Wyoming and Montana (as *R. ocella* type, Garman, 1881); Cheyenne, Wyo. (as *R. dulcis*, Garman, 1881); Kansas (as *R. maxillosus*, Garman, 1881); South Platte River at Denver and Hartsel Hot Springs, and Middle Boulder Creek, Boulder, Colo. (Jordan, 1891); Gardiner River (Jordan, 1891*a*); Beaverhead River at Dillon, Mont.; Red Rock River at Red Rock, Mont.; junction of Firehole and Gibbon rivers (Evermann, 1892); Poplar River at Poplar and Missouri River at Craig, Mont. (Eigenmann, 1894).

This species has been described as new three times from the Missouri Basin, as indicated above. The present collection contains about 500 specimens from 34 different localities, as follows: Creek at Verdigris; Minnechaduza Creek, Valentine; Niobrara River, Marsland; Bone Creek near Long Pine; Long Pine Creek, Long Pine; Middle Loup River, Dunning; White River at Chadron; Lone Tree Creek at Chadron; White River, Crawford; Chadron Creek, Chadron; Cheyenne River, Cheyenne Falls; Cheyenne River, Edgemont; Cottonwood Creek, Edgemont; Chicken Creek, Gammon's Ranch; Spearfish Creek, Spearfish; Redwater Creek, Beulah; Cox Lake near Beulah; Beaver Creek, Buffalo Gap; Rapid Creek, Rapid City; Fall River, Hot Springs; Whitewood Creek, Deadwood; Crow Creek, Gammon's Ranch; creek at Hill City; creek at Custer; Crow Creek, Chamberlain; Choteau Creek, Springfield; Big Goose Creek, Sheridan; Powder River, Arvada; south fork of Tongue River, Sheridan; Platte River, Glenrock; Garden Creek, Casper; Platte River, Casper; Deer Creek, Glenrock; Beaver Creek, Newcastle; overflow pond at Sheridan; Platte River, Douglas.

The variations shown by this large amount of material are very great, but the differences found among the individuals from one locality are often as great as are found among specimens from different localities. In mature individuals the origin of the dorsal is nearer base of caudal than tip of snout; or in about half of the specimens examined it is about midway between nostril and base of caudal, while in the others it is nearer nostril. The length of the snout varies from $1\frac{1}{2}$ to 2 times the diameter of the eye, and the extent to which it projects beyond the mouth is subject to variation. The thickness of the lips, the size of the barbel, the angle made by the two sides of the lower jaw, the number of scales, and the color are all subject to considerable variation. The specimens from Cheyenne Falls and other alkaline streams are very pale, while those from purer waters are usually dark. In the warm water from Hot Springs at Hot Springs, S. Dak., this was the only species found, it occurring there in great abundance. We examined this stream at many different places and found this fish everywhere abun-

dant, not only in the more open, swifter current, but in the more quiet nooks among the dense growth of *Chara* and about the outlets of springs whose water was very warm. This is a very interesting and remarkable fact, and was not what we expected. *Rhinichthys* is a group of fishes whose species seem to prefer cold water. If in any given region we wished to find *Rhinichthys* we looked for it in the coldest parts of the smaller streams, but here we found it in the warmest parts of a very warm stream.

**75. Rhinichthys atronasus** (Mitchill). *Black-nosed Dace.* This species has been reported from the Dakota River at Jamestown and La Moure, N. Dak., by Woolman (1896).

**76. Hybopsis æstivalis** (Girard). This species was found by us at Dunning, Nebr., in Middle Loup River, and at Ravenna, Nebr., in the South Loup River and Mud Creek, from which places 44 specimens were obtained. The largest of these are 2½ inches in total length. This species is readily distinguished from *H. gelidus* by its much shorter, blunter snout, and larger eye; the color is also different, both lobes of the caudal being pale and the fine dark dustings are more evident on both back and sides.

**77. Hybopsis hyostomus** (Gilbert). Blue River at Crete; Platte and Elkhorn rivers at Fremont (Meek, 1894).

**78. Hybopsis gelidus** (Girard). Milk River (as *Gobio gelidus* type, Girard, 1856 and 1858, and Suckley, 1860). Obtained by us at the following places: Powder River, Arvada; North Platte River, Douglas; North Platte River, Grand Island; Bazile Creek, Niobrara; White River, Chamberlain. Upon comparing these specimens with those collected at St. Joseph, Mo., in 1884, by Drs. Jordan and Meek, and which were identified by them as *H. gelidus*, we found important differences and were disposed to regard our specimens as being an undescribed species. But a reexamination of Girard's original description showed that our specimens were the true *H. gelidus*, and that the St. Joseph specimens had been erroneously referred to that species. These have since been described by Jordan and Evermann[1] under the name *Hybopsis meeki*.

The considerable number of excellent specimens which we have enables us to give a more detailed description of *H. gelidus* than has hitherto been published. Head 4; depth 5; eye 6¼; snout 2⅞; D. 8; A. 9; scales 6–44–4. Body slender, not much compressed, back little arched, head long and slender; mouth inferior, horizontal, broad, overhung by the very long pointed snout, which is considerably decurved; barbel short, 1⅞ in head; eyes very small, high up, midway of head; interorbital width equal to width of mouth, origin of dorsal a little nearer snout than base of caudal, directly over base of ventrals; free edge of dorsal fin slightly concave, the anterior ray but little produced, its length 1⅞ in head; free edge of anal little concave, length of first rays 1⅞ in head; pectorals much shorter than in *H. meeki*, 1½ in head, the first rays not produced or filamentous and not reaching ventrals; ventrals barely reaching vent, 1⅞ in head; caudal very long and deeply forked, the lobes as long as head, the lower slightly the longer. Lateral line complete, straight; teeth, 4–4, strongly hooked. Color, sides silvery, pale below; scales of back each with a group of fine dark specks on posterior border, these extending almost to lateral line; rest of back and upper part of sides sparsely dusted over with minute brownish specks; fins all pale except the caudal, the lower lobe of which is dark, with a narrow white border below; upper lobe slightly dark at base. From *Hybopsis meeki*, which it most closely resembles, this species may be distinguished by the much longer and more pointed snout, the smaller eye, the much shorter pectoral fins, and the darker coloration of the back.

[1] Fishes of North and Middle America, Part I, 317, 1896.

**79. Hybopsis meeki** Jordan & Evermann.

*Ceratichthys gelidus* Jordan & Gilbert, Synopsis, 216, 1883; in part.

*Hybopsis gelidus* Jordan & Meek, Proc. U. S. Nat. Mus. 1885, 10; branches of Missouri River, Graham, 1885; Missouri River at Sioux City, Meek, 1892.

*Hybopsis meeki* Jordan & Evermann, Fishes North and Middle America, Part 1, 317, 1896. Type locality: Missouri River, St. Joseph, Mo.

Head 4; depth 5½; D. 8; A. 8; lateral line 44. Body very slender, not elevated. Snout long, thick, blunt, overhanging the rather large mouth. Barbel as long as eye. Head slender and elongate. Eye small, rather high, 4½ in head. Mouth small, subterminal, the maxillary not extending to the eye. Fins all large; pectoral as long as head; caudal deeply forked. Lateral line decurved, scales rather large. Coloration silvery, unspotted; a dusky lateral streak ending in a blackish spot at base of caudal; lower lobe of caudal abruptly black, edged below with white. Male with the nuptial tubercles excessively developed, covering most of body. Length, 2 inches. Missouri River at St. Joseph in river channel. A curious little fish, hitherto confounded with *H. gelidus*. (Named for Dr. Seth Eugene Meek.)

**80. Hybopsis montanus** Meek. Upper Missouri region (type, Meek, 1884). The exact locality from which these specimens came is not known. They are three in number (Nos. 36882, U. S. Nat. Mus.) and are said to have been collected by Dr. F. V. Hayden.

**81. Hybopsis dissimilis** (Kirtland). Gasconade River, Arlington, Mo.; Little Piney River at Newburg and Arlington, Mo. (Meek, 1891).

**82. Hybopsis storerianus** (Kirtland). Grand River at Clinton, Mo., and Tabo Creek at Calhoun, Mo. (Jordan & Meek, 1885); Osage River and branches (Graham, 1885); Floyd River at Sioux City and Elkhorn River at Fremont (Meek, 1894); Mud Creek, Ravenna; Elkhorn River, Norfolk Junction; Platte River, Grand Island; Wood Creek, Grand Island. Very abundant at Ravenna, where 35 large specimens, 5 to 6 inches long, were obtained.

**83. Hybopsis kentuckiensis** (Rafinesque). *River Chub.* Sweetwater River (as *Nocomis nebracensis* type, Girard, 1856 and 1858); Kansas River near Fort Riley (as *Ceratichthys cyclotis*, Cope, 1865); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo. (as *H. biguttatus*, Jordan & Meek, 1885); Mill Creek and Fort Riley, Kans. (Cragin, 1885*a*); very common in Kansas (as *H. biguttatus*, Graham, 1885); Mill Creek, Alma, Kans. (as *H. biguttatus*, Gilbert, 1885); Mission and Blacksmith creeks, Shawnee County, Kans. (as *H. biguttatus*, Gilbert, 1887); Smoky Hill River, Wallace, Kans. (as *H. biguttatus*, Hay, 1887); Osage River, La Cygne, Kans. (as *H. biguttatus*, Gilbert, 1889); Big Piney River, Cabool, Mo.; Little Piney River at Arlington and Newburg, Mo.; Jones Creek, Dixon, Mo.; Gasconade River, Arlington, Mo.; Lock Fork, Mansfield, Mo.; Osage River, Marshfield, Mo.; Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo.; Sac River, Springfield, Mo. (Meek, 1891); Big Sioux River at Sioux Falls (Meek, 1892); Elkhorn River at Fremont (Meek, 1894); Dakota River and Pipestem Creek at Jamestown (Woolman, 1896).

**84. Couesius dissimilis** (Girard). Milk and Little Muddy rivers (as *Leucosomus dissimilis* type, Girard, 1856 and 1858); Poplar River, Poplar, Mont. (Eigenmann, 1894). Numerous specimens of this species were obtained by us as follows: Minnechaduza Creek, Valentine; Schlegel Creek, Valentine; Crow Creek, Chamberlain; Long Pine Creek, Long Pine; Beaver Creek, Buffalo Gap; Rapid Creek, Rapid City; creek at Hill City; creek at Custer; Big Goose Creek, Sheridan; south fork of Tongue River, Sheridan.

All of the streams in which it was found are clear and cold, and it probably does not occur in any of the warmer alkaline streams in the eastern and

central part of the region examined. It appears to be common, however, in certain Wyoming streams. The finest, largest, individuals obtained are those from Rapid Creek and Tongue River, the largest of these measuring about 6 inches in total length. Head 4⅓ to 4½; depth 4 to 5; eye 4 to 5; snout 3 to 4; D., 8; A., 8. There is considerable variation in the scales, the extremes being 12-72-8 and 12-64-8, the usual number, however, being 12-68-8. Occasionally there are 11 to 13 scales above (and including) the lateral line.

In the fifth edition of Jordan's Manual of Vertebrates, *Couesius dissimilis* is distinguished from *C. plumbeus* as having fewer scales in the lateral line, the number given for *dissimilis* being 60 and for *plumbeus* 68. This is evidently a mistake. Specimens in the National Museum of what have been called *plumbeus*, from Lake Superior and the Adirondacks, have 70 to 75 scales in the lateral line. This is not sufficiently different from western specimens to be of any specific value. While we can not see how these species can be distinguished by the scales, we think we have discovered a character which will serve to distinguish them, viz: The differences in the dorsal and anal fins, which may be stated thus:

*a.* Height of dorsal fin 1 to 1⅓ in head, free margin of fin concave, the anterior rays produced and extending beyond the others when the fin is depressed. Length of longest anal ray 1⅔ to 1⅓ in head, the free margin of the fin more or less concave, the anterior rays somewhat produced, and when deflexed extending slightly beyond other rays ..... *plumbeus.*

*aa.* Height of dorsal 1⅓ to 1½ in head; free margin of fin nearly straight, the anterior rays little if at all produced, and when depressed barely reaching beyond end of other rays. Length of longest anal ray 1⅓ in head, free margin of fin straight, anterior rays not produced and not extending beyond end of others when depressed ..... *dissimilis.*

These differences are well marked between the specimens of *dissimilis* examined and all specimens of *plumbeus* from the upper Great Lakes region. A specimen (U. S. N. M., No. 34388) collected in the Adirondacks by Mr. Fred Mather, seems to belong to *Couesius plumbeus*, though it does not wholly agree with those from Lake Superior. The height of the dorsal fin is 1⅓ in head, the anterior rays are somewhat produced and extend some beyond the other rays when the fin is depressed; the free margin is but slightly concave. The longest anal rays are contained 1⅔ times in length of head, the anterior rays are but little produced and do not reach beyond the others when deflexed; the free margin of the anal fin is nearly straight. The origin of the dorsal fin is midway between middle of pupil and base of caudal. This posterior position of the dorsal is a character, however, not possessed by the other specimens of *C. plumbeus* examined. This species differs from *C. greeni* of the Columbia and Frazer River basins in the smaller scales and in having the scales more crowded on the anterior part of the body. There is considerable variation in the squamation of this species, however. Examination of ten examples from Sheridan gives the following results:

| Number of rows of scales between front of dorsal fin and lateral line. | Number of scales in lateral line. | Number of rows of scales between lateral line and base of ventrals. | Number of scales in front of dorsal fin. |
|---|---|---|---|
| 11 | 60 | 8 | 32 |
| 12 | 63 | 10 | 40 |
| 12 | 63 | 8 | 40 |
| 12 | 66 | 8 | 35 |
| 12 | 63 | 9 | 40 |
| 11 | 60 | 9 | 36 |
| 11 | 60 | 9 | 35 |
| 12 | 65 | 9 | 36 |
| 15 | 70 | 9 | 40 |
| 12 | 60 | 9 | 40 |

The type of *C. dissimilis* has the head 3⅘; depth 4⅘; eye 4; snout 3⅗; interorbital 3; scales 12–66–9, 38 before dorsal. Of 21 specimens of *Couesius* from Rapid Creek all but one are infested more or less with a parasitic trematode embedded under the scales and showing as small black spots. All of those from Hill City and many from Custer and Sheridan are similarly affected.

**85. Platygobio gracilis** (Richardson). *Flat-headed Chub.* Fort Pierre, Fort Union, above Fort Union, Milk River, Yellowstone River, and Sweetwater River (as *Pogonichthys communis* type, Girard, 1856 and 1858); Milk River (as *Pogonichthys communis*, Suckley, 1860); near Bridger Pass (as *Pogonichthys* (*Platygobio*) *gulonellus* type, Cope, 1864*a*); Kansas River near Fort Riley (as *P. gulonellus*, Cope, 1865); Platte Valley (as *P. communis*, Gill, 1876); Fort Benton and Judith River (as *Pogonichthys communis*, Cope, 1879); Missouri River, St. Joseph, Mo. (Jordan & Meek, 1885); Kansas River (Graham, 1885); Missouri River at Sioux Falls (Meek, 1892); Poplar River at Poplar, and Missouri River at Craig, Mont. (Eigenmann, 1894); Platte River at Fremont (Meek, 1894).

This abundant minnow was found by us at the following places: White River near Chamberlain; Redwater Creek near Spearfish; canal at Niobrara; Bone Creek and Niobrara River near Long Pine; Middle Loup River at Dunning; Chadron Creek, Lone Tree Creek, and White River near Chadron; Platte River at Grand Island; Niobrara River near Valentine; Mud Creek and South Loup River at Ravenna; Clear Creek, Clermont; North Platte River at Glenrock, Casper, and Douglas; Cheyenne River at Edgemont and Cheyenne Falls; Powder River at Arvada; Deer Creek at Glenrock.

The flat-headed chub is preeminently the characteristic fish of the shallow alkaline streams of the middle Missouri Basin, and shows better than any other the peculiar bleaching effect of the alkaline waters of that region. The fishes are all reduced to a nearly uniform pale or faded appearance. Except those found in the headwaters above the alkali, they are almost wholly without pigment cells of any kind. Perhaps the most extreme case of bleaching is that of *P. gracilis*, which, of all American fishes, seems to be the one most perfectly adapted to life in these alkaline streams.

**86. Anguilla chrysypa** Rafinesque. *Common Eel.* "Believed to be common throughout the State" of Kansas (as *A. rostrata*, Graham, 1885); Kansas River at Lawrence and Topeka (Cragin, 1885*a*). The eel probably occurs abundantly in the lower portion of the Missouri Basin, but no definite records are known.

**87. Hiodon alosoides** (Rafinesque). *Toothed Herring.* Quaking Asp River (as *Hyodon chrysopsis*, Jordan, 1878); Missouri River, St. Joseph, Mo.; Tabo Creek, Lexington, Mo. (Jordan & Meek, 1885); Silver Lake (Cragin, 1885*a*); Republican River, Concordia, Kans.; Saline River, Wakeeney, Kans. (Hay, 1887); Missouri and Big Sioux rivers, Sioux City (Meek, 1892); Poplar River, Poplar, Mont. (Eigenmann, 1894); Floyd River at Sioux City, and Platte River at Fremont (Meek, 1894).

Young examples of this species were obtained as follows: Crow Creek, Chamberlain; Chotean Creek, Springfield; Bazile Creek and Ponca Creek, Niobrara; Loup River, Ravenna; White River, Chadron; Wood and Platte rivers, Grand Island; Platte River, Casper; and Clear Creek, Clermont. The largest specimens obtained do not exceed 6 inches in length. Though it was not secured in many of the streams examined by us, this species is no doubt generally distributed throughout the lower and middle Missouri River basin in all suitable waters. It is a fish of the open stream, being found where there is some current and where the depth is not great. It reaches a length of a foot or more, and is a handsome fish possessing some game qualities, though not of much food value. At Hot Springs we were told that this fish is found at Cheyenne Falls in considerable numbers in the spring, that it is locally known as the "whitefish," and that it affords some sport for the local anglers.

**88. Hiodon tergisus** Le Sueur. *Moon-eye.* West of Fort Union (as *Hyodon tergisus*, Suckley, 1860); Kansas River near Fort Riley (as *Hyodon tergisus*, Cope, 1865); Judith River and river pools near Battle Creek, S. Dak. (as *Hyodon tergisus*, Cope, 1879); "common in Kansas" (Graham, 1885); Kansas River at Topeka (Cragin, 1885*a*).

**89. Dorosoma cepedianum** (Le Sueur). *Hickory Shad; Mud Shad.* Missouri River, St. Joseph, Mo.; Tabo Creek, Lexington, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (Jordan & Meek, 1885); "very common" in Kansas (Graham, 1885); Shunganunga and Ward creeks, Kans. (Cragin, 1885*a*); Osage River, La Cygne, Kans. (Gilbert, 1889); Little Piney River at Newburg and Arlington, Mo. (Meek, 1891); Missouri River and Big Sioux River at Sioux City (Meek, 1892); Floyd River at Sioux City and Elkhorn River at Fremont (Meek, 1894).

**90. Pomolobus chrysochloris** Rafinesque. *Skipjack; Blue Herring.* "Abundant in large streams" in Kansas (Graham, 1885).

**91. Coregonus williamsoni cismontanus** Jordan. *Rocky Mountain Whitefish.* Headwaters of the tributaries of the upper Missouri as (*C. williamsonii*, Cope, 1879); Madison, Yellowstone, and Gardiner rivers, and Horsethief Creek, Mont., types, Jordan, 1891*b*); Red Rock River, Red Rock, Mont.; Beaverhead River, Dillon, Mont.; junction of Firehole and Gibbon rivers (Evermann, 1892); Missouri River, Craig, Mont. (Eigenmann, 1894).

Whitefish were found only in Tongue River and Big Goose Creek near Sheridan, 13 small specimens being secured. In Tongue River they are said to be quite common. This variety of Williamson's whitefish is found in most of the cold streams of the upper Missouri Basin, particularly in the streams about the Yellowstone Park. The differences which are assigned as distinguishing the Missouri River whitefish from Williamson's are scarcely perceptible, if at all. The body is said to be somewhat more slender and the fins lower. All the young examples in the present collections show the parr marks very distinctly.

**92. Salmo mykiss lewisi** (Girard). *Cut-throat Trout; Yellowstone Trout.* Falls of Missouri River (as *Salar lewisi* type, Girard, 1858); Falls of Missouri River (as *Salmo* (*Salar*) *lewisi*, Suckley, 1860); Yellowstone River, Yellow Creek, Gallatin Fork, and Yellowstone Lake (as *Salmo pleuriticus* type, Cope, 1872); St. Mary River (as *S. clarki*, Jordan, 1878); Yellowstone River at Livingston, Mont.; Gardiner River below the Falls; Solution Creek, Riddle Lake; Canyon Creek and Madison River, Yellowstone National Park (Jordan, 1891*b*); Atlantic Creek in Two-Ocean Pass and below the pass; upper Yellowstone River; Meadow Creek in Yellowstone Park; east fork of Gardiner River, and McClellan Creek, Helena, Mont. (Evermann, 1892).

Two specimens of the black-speckled trout are in the collection from south fork of Tongue River and two from Big Goose Creek near Sheridan. Numerous other examples were caught with hook from these streams. In these and in nearly all the streams in this part of Wyoming trout are abundant and afford excellent sport to the angler. Small parties often report catches of 400 to 600 as the result of two or three days' fishing. Upon comparing the specimens from Sheridan with others of the same size from Big Wood River at Galena, Idaho, the following differences are noted: The Sheridan specimens have the eye a little larger, the snout a little shorter, the maxillary notably longer and heavier, and the fins all much larger; the height of the dorsal is less than 2 in head and that of the anal is 1¾ in head. In the Idaho specimens the dorsal and anal are at least a fourth lower; the pectorals and ventrals are also correspondingly shorter. The Sheridan specimens have smaller scales and differ somewhat in coloration. In both, the back is profusely spotted throughout the entire length, but in the Sheridan specimens there are but few spots below the lateral line, while those from Idaho are almost as thickly spotted below the lateral line as on the back; in the Sher-

idan specimens the head has scarcely any spots; in the other, the head is well spotted; there is also a marked difference in the size of the spots, those on the Idaho specimens being much the larger. Contrasting these differences in tabular form we have the following:

| Characters contrasted. | Specimen (male) 10 inches long, Sheridan, Wyo. | Specimen (male) 9¼ inches long, Galena, Idaho. |
|---|---|---|
| Eye | 4⅓ in head | 5⅓ in head. |
| Snout | 5⅔ in head | 4⅔ in head. |
| Maxillary | Long and broad, upper edge convex. | Shorter and narrower, the two sides nearly parallel. |
| Dorsal fin | Large, its height less than 2 in head | Small, its height 2⅓ in head. |
| Anal fin | Large, 1⅔ in head | Smaller, 2⅓ in head. |
| Pectoral fins | Long, 1⅓ in head | Shorter, 2 in head. |
| Ventral fins | Long, 2 in head | Shorter, 2⅓ in head. |
| Scales | Small | Somewhat larger. |
| Coloration | Back and sides above lateral line profusely spotted, the spots small. Sides below lateral line with few spots. Head almost plain with only 2 or 3 spots behind eye. Red on throat in life. | Not materially different, except that the spots are smaller and less thickly placed on antedorsal region. Almost as numerous as above. Top of head and postorbital area with numerous spots; 2 or 3 spots on snout. No red on throat in life. |

These differences are very marked, and would certainly be of sufficient importance to justify the specific separation of the two if found to hold good throughout the range of each. But various more or less intermediate characters are shown in specimens from other localities, and it is probably best, for the present at least, to regard these forms as subspecies of typical *mykiss;* in which case the form found throughout the upper Missouri Basin and in the Snake River above Shoshone Falls will stand as *Salmo mykiss lewisi* (Girard), and the common form of the Snake River basin below Shoshone Falls, as *Salmo mykiss gibbsii* (Suckley). The eastern limit in Wyoming in the range of the black-speckled trout is only approximately known. We know that trout are abundant in Yellowstone Lake[1] and in the streams in and about the park, from which they are not barred by waterfalls; they are also in the Yellowstone River and its upper tributaries. It is undoubtedly in the Clark Fork of the Yellowstone and Big Horn River, though no specimens have been received from those streams. We know it is an abundant fish in the Tongue River basin, and it is probably found in the headwaters of Powder River, though we have no definite record of the fact. It is not found in any of the streams in or about the Black Hills, as we have already stated in this paper. At present the most eastern point from which specimens have been obtained, of which we have definite record, is Sheridan, Wyo., from south fork of Tongue River, and Big Goose Creek. Further investigations in Wyoming are very much to be desired, especially in the region drained by the Clark Fork of the Yellowstone, the Big Horn, Powder River, the North Platte, and the Sweetwater.

**93. Salmo mykiss stomias** (Cope). *Platte River Trout.* Kansas River near Fort Riley,[2] Kans. (as *Trutta lewisi*, Cope, 1865); Platte [Kansas] River near Fort Riley, Kans. (as *Salmo* (*Salar*) *stomias* type, Cope, 1871); Platte [Kansas] River (in part as *S. pleuriticus* type, Cope, 1872); Bear Creek, Morrison, Colo. (Jordan, 1891).

[1] In Ludlow's Report of a Reconnaissance from Carroll, Mont. Ter., on the Upper Missouri, to the Yellowstone National Park and return, made in the summer of 1875 (War Dept., 1876), we find the following interesting note (p. 20) concerning the trout of this lake: "There seem to be two varieties of trout here, the bulky ones of the Yellowstone, with bright yellow bellies and stripings of red, and a smaller kind, more silvery in appearance and exhibiting much greater activity and game qualities. These latter seemed to come generally from the [Tower] creek."

[2] Locality probably erroneous. The specimens more likely came from some point near the headwaters of the South Platte, where variety *stomias* is found.

[Introduced species.] **Salvelinus fontinalis** (Mitchill). *Eastern Brook Trout.* This species has been planted in a number of the streams of Nebraska, South Dakota, and Wyoming. Specimens were obtained by us in Spearfish Creek at Spearfish, Spring Creek at Bazile Mills, Long Pine Creek at Long Pine, Beaver Creek near Newcastle, and Big Goose Creek near Sheridan. In Spring Creek we found the brook trout abundant and doing well. At three hauls with a short seine we caught at least 15 trout (which were returned to the streams), mostly yearlings, though one was nearly a foot long. Mr. George Brooks, of Bazile Mills, informs us that recently a trout weighing 2 pounds 9 ounces was caught in this little stream. The plant was made here by the Nebraska fish commission some six or seven years ago, and has proved very successful. The stream is so small, however, that the trout will not, as a rule, attain a large size, and, unless fishing is carefully regulated, the stream will become fished out.

Long Pine Creek is a very good trout stream and we saw a number of very fine trout there. This creek has become noted throughout Nebraska and affords more and better trout fishing than any other stream in the State. The creek is a large one, the water is excellent, and there is an abundant food supply, consequently the trout grow to a large size and are of superior flavor. Spearfish Creek is apparently the best trout stream in the Black Hills, surpassing in length and volume of water any of the other streams suitable for trout in that region. Sufficient plants of trout have been made in the vicinity of Spearfish to demonstrate the excellent character of the water. These fish appear to be doing remarkably well, and the stream is able to support a much larger supply than it now contains. Beaver Creek, near Newcastle, is another excellent trout stream in which eastern brook trout and rainbow trout have been planted. There are, of course, numerous other streams in the Black Hills well suited to trout, but, so far as we were able to learn, no plantings of importance have been made in them.

**94. Thymallus ontariensis montanus** (Milner). *Montana Grayling.* Yellow Creek and Gallatin River and headwaters of Yellowstone River (as *Thymallus tricolor*, Cope, 1872); tributary of Missouri River at Camp Baker, Mont. (as *T. montanus* type, Milner, 1874); Madison River, Gallatin River, and Horsethief Creek, Mont. (as *T. signifer ontariensis*, Jordan, 1891*a*); Red Rock River, Red Rock, Mont.; Beaverhead River, Dillon, Mont.; junction of Firehole and Gibbon rivers (Evermann, 1892); Missouri River, Craig, Mont. (Eigenmann, 1894).

**95. Lucius lucius** (Linnæus). *Pike; Northern Pickerel.* St. Mary River (as *Esox lucius*, Jordan, 1878); Boyer River at Arion, Iowa (Meek, 1892); Floyd River at Lemars and Sioux City; East Okoboji, West Okoboji, and Spirit lakes (Meek, 1894); Dakota River at Jamestown (Woolman, 1896). This species was found in Elkhorn River near Norfolk, and in Rock Creek near Mitchell, where a single specimen a foot in length was secured. We were surprised not to find pickerel in any of the other waters examined, as the sluggish grassy streams and the small lakes would seem to be well suited to it. Further collecting will probably show it to be more common in eastern Nebraska and South Dakota than now appears.

**96. Fundulus diaphanus** (Le Sueur). Kansas River (Graham, 1885).

**97. Fundulus zebrinus** Jordan & Gilbert. Kansas River and branches (Graham, 1885); Ellis, Kans. (Cragin, 1885*a*); Ellis, Ellis County, Kans. (Gilbert, 1885); north fork of Solomon River, Lenora, Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (Hay, 1887); Republican River, Wano, Kans.; Logan, Kans. (Gilbert, 1889); Big Sioux River at Sioux City; Silver Lake, Iowa (Meek, 1892); East Okoboji Lake (Meek, 1894).

**98. Fundulus catenatus** (Storer). Jones Creek, Dixon, Mo.; Gasconade River, Arlington, Mo.; Little Piney River at Newburg and Arlington, Mo. (Meek, 1891).

**99. Fundulus lineatus** (Garman). Northeastern Wyoming (as *Zygonectes lineatus* type, Garman, 1881).

**100. Fundulus macdonaldi** (Meek). Jones Creek, Dixon, Mo.; Osage River, Marshfield, Mo. (as *Zygonectes macdonaldi* types, Meek, 1891).

**101. Fundulus floripinnis** (Cope). South Platte River near Denver (*Haplochilus floripinnis* type, Cope, 1874); Denver, Colo. (as *Haplochilus floripinnis*, Cope & Yarrow, 1876); South Platte River at Denver (as *Zygonectes floripinnis*, Jordan, 1891).

**102. Fundulus sciadicus** Cope. "Nebraska or Platte River" (type, Cope, 1865); Floyd River at Lemars; Platte and Elkhorn rivers at Fremont (Meek, 1894). Numerous specimens of this species were obtained. It was found at the following places: Ponds at Niobrara, Creighton, and Long Pine; Creighton Creek, Niobrara; Long Pine Creek, Long Pine; Dismal and Middle Loup rivers, Dunning; Loup River, Ravenna; Prairie Creek, Scotland, and Rock Creek, Mitchell. Specimens have recently been sent to the Commission from Dover, McCook County, S. Dak., by Mr. Fred. S. Butler. The center of abundance for this region seems to be in northeastern Nebraska and southeastern South Dakota, the largest number of specimens having been obtained about Scotland, Niobrara, and Long Pine. It was also common at Dunning, and probably occurs in all suitable waters of Nebraska and South Dakota. It seems to prefer the small grassy ponds and lakes, but it also finds a congenial home in the sluggish grassy creeks so common in this region. In the small, isolated pools along the creeks among the *Chara*, *Potamogeton*, and *Myriophyllum*, in which they abound, these little "top minnows" could usually be found in large numbers swimming about at the surface. Usually the vegetation was so abundant that it was difficult to secure any of these fish with the seine. A dip net or a very short seine generally gave the best results. The largest specimens secured are 2¾ inches long, and may be described as follows: Head 3⅔; depth 4; eye 4; snout 3½; interorbital width 1½ times eye. D. 10; A. 12; scales 35–10. Body short and stout; head flat, snout pointed, the lower jaw slightly projecting; caudal peduncle compressed and deep, its least depth nearly equal to snout and eye. Teeth in each jaw in about 3 series, those of the outer enlarged and somewhat curved inward. Fins all small; the pectorals about as long as depth of caudal peduncle; ventrals much shorter; origin of dorsal behind that of anal and nearer tip of caudal than to occiput. Color in life, rosy olivaceous, profusely covered with fine brownish punctulations; middle line of back darker; in spirits, uniform olivaceous or brownish, paler below; dark line on back evident.

**103. Eucalia inconstans** (Kirtland). *Brook Stickleback.* Poplar River, Poplar, Mont. (Eigenmann, 1894). The brook stickleback was found only in Crow Creek, near Chamberlain, and in the ponds and creek at Long Pine. Mr. Fred S. Butler, of Dover, S. Dak., has kindly sent us specimens from that place. Over 50 specimens were secured, all but 4 of them from Long Pine. In the small grassy ponds at the head of Long Pine Creek it is very abundant. The largest specimens are 2 inches in total length. Head 3½; depth 3⅓; eye 3⅓; snout 3½. D. IV or V–I, 10 or 11; A. I, 9 or 10. In 31 examples counted the dorsal was IV–I, 10 in 12; IV–I, 9 in 2; IV–I, 11 in 1; V–I, 10 in 10; V–I, 9 in 4, and V–I, 11 in 2. In the same examples the anal was I, 9 in 16 and I, 10 in the remaining 15. Body smooth throughout. Ventrals very short, wide apart, innominate bone covered by the skin about 1⅓ times length of ventrals. Color, dark brown above, pale below.

**104. Percopsis guttatus** Agassiz. *Trout Perch.* Kansas (as *P. hammondii* type, Gill, 1864); Kansas River near Fort Riley (as *P. hammondi*, Cope, 1865); Big Sioux River at Sioux City; Boyer River at Arion, Iowa (Meek, 1892); Floyd River at Lemars, and East Okoboji Lake (Meek, 1894).

**105. Labidesthes sicculus** (Cope). Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo. (Jordan & Meek, 1885); Big Piney River, Cabool, Mo.; Osage Fork, Marshfield, Mo.; Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo. (Meek, 1891).

**106. Pomoxis annularis** Rafinesque. *Crappie.* Missouri River, St. Joseph, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo. (Jordan & Meek, 1885); Kansas River at Lawrence (Graham, 1885); Soldier Creek, Kans. (Cragin, 1885*a*); Bear Creek, Boone County, Mo. (Call, 1887). Both species of *Pomoxis* are being extensively introduced into the waters of Kansas, Nebraska, and South Dakota, and it is not easy to determine definitely the natural western limit of either. It will be very close to the truth, however, if we put it in the eastern part of Nebraska and the Dakotas on the border of the alkali region.

**107. Pomoxis sparoides** (Lacépède). *Calico Bass.* Osage River, Kans. (Cragin, 1885*a*); East Okoboji Lake (Meek, 1894).

**108. Ambloplites rupestris** (Rafinesque). *Red-eye; Goggle-eye.* Kansas River at Lawrence (Cragin, 1885*a*); Big Sioux River at Sioux City and Sioux Falls (Meek, 1892); Floyd River at Sioux City (Meek, 1894). The western limit of this species is apparently about the same as that of the two species of *Pomoxis.* All three species could doubtless be introduced successfully into many of the small lakes in Nebraska and the Dakotas.

**109. Chænobryttus gulosus** (Cuvier & Valenciennes). *Warmouth.* Kansas River (Graham, 1885). This species ought to be found in the lakes of Iowa and those of the Dakotas, but no specimens have been reported from any point in the Missouri Basin, except those recorded from Kansas River by Professor Graham.

**110. Apomotis cyanellus** (Rafinesque). *Green Sunfish.* Kansas River near Fort Riley (as *Bryttus longulus*, Cope, 1865); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Tabo Creek at Lexington and Calhoun, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo.; Missouri River, St. Joseph, Mo. (Jordan & Meek, 1885); "common" in Kansas (Graham, 1885); Shunganunga and Ward creeks, Kans. (Cragin, 1885*a*); Ward and Shunganunga creeks, Shawnee County, Kans. (Gilbert, 1885); Blacksmith Creek, Shawnee County, Kans. (Gilbert, 1886); Solomon River, Beloit, Kans.; north fork of Solomon River, Lenora, Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (Hay, 1887); Osage River, La Cygne, Kans. (Gilbert, 1889); Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo.; Jones Creek, Dixon, Mo.; Gasconade River, Arlington, Mo.; Big Piney River, Cabool, Mo.; Little Piney River at Newburg and Arlington, Mo. (Meek, 1891); Big Sioux River at Sioux City and Sioux Falls; Soldier River at Charter Oak, and Boyer River at Arion, Iowa (Meek, 1892); Platte River at South Bend and Fremont (Meek, 1894).

This common sunfish was obtained in the following places: Rock, Enemy, and Firesteel creeks and Dakota River, Mitchell; Emanuel and Choteau creeks, Springfield; Prairie Creek, Scotland; Creighton Creek, Niobrara; ponds at Verdigris, Creighton, Norfolk Junction, Long Pine, and Dunning; Minnechaduza Creek, Valentine; Lake George, Carp Lake, and Ingalls Lake near Long Pine; Elkhorn River at Norfolk Junction and Ewing; South Loup River at Ravenna; and Bone Creek near Long Pine.

The collections contain 146 specimens from these localities. The species is most abundant in southeastern South Dakota, as is shown by the numerous specimens from the vicinity of Mitchell. It is also quite abundant in suitable places in eastern Nebraska, but is not common westward. About Long Pine, in Brown County, we found it to be rather common, and 9 specimens were obtained still farther west from Minnechaduza Creek near

Valentine, in Cherry County, and 9 specimens are in the collection from the ponds along Dismal River near Dunning, in Blaine County. Very suitable ponds near Chamberlain did not contain this or any other species of sunfish, though some 60 miles east of the place where we found it in Minnechaduza Creek. It seems probable that the western limit in Nebraska, of this sunfish, is not far from the one hundredth meridian, and that in the Dakotas it is some miles farther east. This western limit seems coincident with the disappearance of the small lakes and ponds of pure water and the appearance of the shallow, uncertain, alkaline streams so characteristic of western Nebraska and South Dakota. There is a number of suitable ponds and lakes farther west, particularly about the Black Hills, where sunfish would probably do well, but that they are not there is apparently due to the fact that the alkaline streams to the eastward have served as a barrier. This sunfish attains a considerable size in this region, especially in the lakes, and is of no little importance as a pan fish. Our specimens from Mitchell, Verdigris, and the Brown County lakes are particularly large and fine. In life the colors are very brilliant; dark greenish above and on sides, with bright blue lines on cheek; belly and posterior portion of body orange; soft part of opercular flap lemon; ventrals orange with white border; anal black at base, rays orange toward tips, outer edge orange and white; caudal lobes with some deep orange.

**111. Lepomis megalotis** (Rafinesque). *Long-eared Sunfish.* Osage Fork, Marshfield, Mo. (Meek, 1891); Silver Lake, Iowa (Meek, 1892).

**112. Lepomis humilis** (Girard). *Red-spotted Sunfish.* Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (Jordan & Meek, 1885); "locally abundant" in Kansas (Graham, 1885); Ellis, Kans.; Ward and Shunganunga creeks, Shawnee County, Kans. (Gilbert, 1885, and Cragin, 1885*a*); Blacksmith Creek, Shawnee County, Kans. (Gilbert, 1886); Bear Creek, Boone County, Mo. (Call, 1887); Solomon River, Beloit, Kans.; north fork of Solomon River, Kirwin, Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (Hay, 1887); Sappa Creek, Oberlin, Kans.; La Cygne, Kans.; Solomon River, Wano, Kans. (Gilbert, 1889); Marais River, Dixon, Mo. (Meek, 1891); Big Sioux River at Sioux City and Sioux Falls, and Boyer River at Arion, Iowa (Meek, 1892); Platte River at South Bend and Fremont; Elkhorn River at Fremont; Blue River at Crete; Salt Creek at Lincoln; Floyd River at Lemars and Sioux City (Meek, 1894); and Dover, S. Dak. (Butler, 1896).

This sunfish was obtained at the following places: Rock and Firesteel creeks and Dakota River, Mitchell; Prairie Creek, Scotland; pond at Norfolk Junction, and Blue River at Stewart. A total of 88 specimens are in the collection, all but 30 being from the streams about Mitchell. While this species is abundant about Mitchell it does not appear to be so elsewhere. The most westerly point at which we found it in Nebraska is Norfolk Junction. Evidently its range does not extend so far to the westward as does that of *A. cyanellus*. The life colors are very bright; belly, spots on sides and three or four rows on cheek rich orange; ventrals, anal, and tip of dorsal, orange; iris red. This sunfish does not reach so large a size as *A. cyanellus*, but it is, nevertheless, of considerable value as a pan fish.

**113. Lepomis macrochirus** Rafinesque. Osage Fork, Marshfield, Mo.; Lock Fork, Mansfield, Mo. (Meek, 1891).

**114. Lepomis pallidus** (Mitchill). *Blue-gill Sunfish.* Missouri River, St. Joseph, Mo. (Jordan & Meek, 1885); Little Piney River at Newburg and Arlington, Mo.; Big Piney River, Cabool, Mo.; Gasconade River, Arlington, Mo.; Osage Fork, Marshfield, Mo. (Meek, 1891); Spirit Lake (Meek, 1894).

**115. Eupomotis gibbosus** (Linnæus). *Common Sunfish; Pond Sunfish.* Osage River at Ottawa, Kans. (Cragin, 1885*a*); Spirit Lake (Meek, 1894).

**116. Micropterus dolomieu** Lacépède. *Small-mouthed Black Bass.* Marais des Cygnes (Graham, 1885); Ozark region of Missouri (Call, 1887); Gasconade River, Arlington, Mo.; Little Piney River at Newburg and Arlington, Mo.; Osage Fork, Marshfield, Mo.; Marais River, Dixon, Mo. (Meek, 1891); Spirit Lake (Meek, 1894).

**117. Micropterus salmoides** (Lacépède). *Large-mouthed Black Bass.* Missouri River, St. Joseph, Mo.; Blackwater, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (Jordan & Meek, 1885); Kansas River at Lawrence (Graham, 1885); Soldier Creek, Kans. (Cragin, 1885*a*); Big Piney River, Cabool, Mo.; Little Piney River at Newburg and Arlington, Mo.; Osage Fork, Marshfield, Mo.; Lock Fork, Mansfield, Mo. (Meek, 1891); Floyd River at Lemars and Sioux City; Platte and Elkhorn rivers at Fremont; Spirit Lake (Meek, 1894).

This was not found at any point in South Dakota, and in Nebraska it was found only at Norfolk Junction, Ewing, and Ravenna. Only young individuals were seen. Whether the black bass is native in any of these streams is not absolutely certain. It has been planted extensively by the Nebraska fish commission and it is not unlikely that it has been introduced into these streams. At any rate the eastern parts of Nebraska and the Dakotas quite certainly mark the western limit of the natural habitat of the large-mouthed black bass. The numerous small lakes of these States seem to be well suited to it and it will no doubt prove profitable to keep them well stocked not only with the large-mouthed black bass, but with the rock bass, warmouth, ring perch, and the various species of sunfish. East of the Black Hills some of the tributaries of the Cheyenne are also well suited to the needs of these species and they could be very properly stocked.

**118. Stizostedion vitreum** (Mitchill). *Wall-eyed Pike.* Kansas River (Graham, 1885); Soldier Creek, Kans. (Cragin, 1885*a*); Big Sioux River (Meek, 1892); West Okoboji and Spirit lakes (Meek, 1894). Found by us only in Crow Creek near Chamberlain, in Rock Creek at Mitchell, Choteau Creek near Springfield, South Loup River at Ravenna, Long Pine Creek at Long Pine, and Clear Creek at Clermont. In all these places it is probably abundant, though we secured only a few small specimens. Large ones were seen in Choteau and Long Pine creeks, and we were informed that the wall-eyed pike is found in most of the larger creeks and rivers of eastern Nebraska and the Dakotas, and that it is the principal game fish. The larger lakes and the larger, more open streams of this region are fairly well adapted to the requirements of this fish; the waters are not unsuitable and an ample supply of desirable food is found in the various smaller fishes which, though not very great as to number of species, are abundant as regards individuals. The same is true of the next species, the sauger. We are of the opinion that these waters are capable of supporting a much larger supply of these species than now exists in them; judicious plantings of fry in the more suitable streams would, in a few years, result in a large increase in the abundance of this valuable food-fish and the angler would find the region an attractive one. Each of the 10 specimens examined possessed but 3 pyloric cæca.

**119. Stizostedion canadense boreum** (Girard). *Sand Pike; Gray Pike; Sauger.* Milk River (as *S. boreus*, Suckley, 1860); Kansas River near Fort Riley (as *Stizostedium americanum*, Cope, 1865); Missouri River at Fort Benton and elsewhere (as *Lucioperca borea*, Cope, 1879); Missouri River, St. Joseph, Mo. (Jordan & Meek, 1885); Kansas River and Mill Creek, Kans. (Graham, 1885); Big Sioux River (Meek, 1892); Poplar River, Poplar, Mont. (Eigenmann, 1894); Spirit Lake, Floyd River at Lemars and Sioux City, and Platte River at Fremont (Meek, 1894).

Found by us at the following places: Chotoau Creek near Springfield; White River near Chamberlain; and North Platte River at Grand Island, Glenrock, and Casper. Only 7 specimens were secured, all of them being small. The sauger is probably equally abundant with the wall-eyed pike in this region, but its habitat seems to extend farther west. Though not attaining as large size as the wall-eyed pike, the sauger reaches a length of a foot or more and possesses game qualities which render it a fish of no little importance in the Missouri Basin. The number of pyloric cæca in six of the seven specimens examined was 4, in the other there were 5. It is not always easy to distinguish the young of these species by external characters, but the number and relative lengths of the pyloric cæca seem to constitute reliable differences.

**120. Perca flavescens** (Mitchill). *Yellow Perch; Ring Perch.* Big Sioux River at Sioux City and Sioux Falls, and Silver Lake, Iowa (Meek, 1892); East Okoboji and Spirit lakes (Meek, 1894); Dakota River at Jamestown (Woolman, 1896). This perch was found only in the streams about Mitchell, nine specimens being obtained from Enemy, Rock, and Firesteel creeks and Dakota River. This is the most western point from which it has been reported, and is probably near the western boundary of its habitat.

**121. Percina caprodes** (Rafinesque). *Log Perch; Hog-nosed Darter.* Eastern Kansas (Graham, 1885); Snokomo Creek, Wabaunsee County, Kans. (Gilbert, 1886); Osage Fork, Marshfield, Mo.; Lock Fork, Mansfield, Mo. (Meek, 1891).

**122. Hadropterus phoxocephalus** (Nelson). Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (as *Hadropterus phoxocephalus*, Jordan & Meek, 1885); Marais des Cygnes (Graham, 1885); Osage River, La Cygne, Kans. (Gilbert, 1889).

**123. Hadropterus aspro** (Cope & Jordan). Snokomo Creek, Wabaunsee County, Kans. (Gilbert, 1886); Gasconade and Little Piney rivers, Arlington, Mo. (Meek, 1891); Big Sioux River (Meek, 1892); Floyd River at Sioux City (Meek, 1894); Dakota River at Jamestown (Woolman, 1896).

The black-sided darter is rare in these States. We found it only in Norfolk Creek at Norfolk Junction and Elkhorn River at Ewing, at which places 20 specimens were obtained. All are young fish except 4 from Norfolk Creek. Head $3\frac{2}{3}$; depth 5; eye $4\frac{1}{2}$; snout $4\frac{1}{2}$. Dorsal XII to XIV-14; anal II, 7. Scales 8 or 9-59 to 61-10. Body rather long and slender; head long, snout long and pointed, not much decurved, the upper lip on level with orbit; premaxillaries not protractile; maxillary reaching vertical of pupil; lower jaw slightly included; interorbital width narrow, $1\frac{1}{3}$ in eye; gill membranes scarcely united; fins large; longest dorsal spines about $2\frac{1}{3}$ in head; soft dorsal higher, its rays less than 2 in head; dorsal fins close together; origin of spinous dorsal midway between tip of snout and origin of soft dorsal; anal large, as high as soft dorsal; pectoral long, $1\frac{1}{6}$ in head, nearly reaching tip of ventrals. Breast and nape naked; cheeks with a few small scales; opercles with larger and more numerous scales; ventral line of scales somewhat enlarged; lateral line complete. Colors in alcohol not essentially different from more eastern specimens; back with about 9 large irregular black or brownish-black blotches, surrounded by paler vermiculations; side with about 6 or 7 large dark or black blotches which are more or less confluent; under parts pale, without dark markings; upper parts of opercle and cheek dark; a dark line downward and another forward from the eye; base of spinous dorsal pale, then a broad dark band more or less made up of oblong spots on the membranes becoming gradually paler toward top of fin; soft dorsal and anal barred with brownish; other fins all plain; young with a small black spot at base of caudal. Length of longest specimen, 3 inches.

**124. Hypohomus cymatotænia** (Gilbert & Meek). Osage Fork, Marshfield, Mo.; Little Piney River, Arlington, Mo.; Marais River, Dixon, Mo. (Meek, 1891).

**125. Hypohomus nianguæ** (Gilbert & Meek). Niangua River, Marshfield, Mo. (Meek, 1891).

**126. Cottogaster uranidea** (Jordan & Gilbert). Little Piney River and Gasconade River, Arlington, Mo. (Meek, 1891).

**127. Diplesion blennioides** (Rafinesque). Wild Cat Creek, Manhattan, Kans. (Graham, 1885); Lock Fork, Mansfield, Mo.; Osage Fork, Marshfield, Mo.; Little Piney River at Newburg and Arlington, Mo.; Gasconade River, Arlington, Mo.; Marais River, Dixon, Mo.; Sac River, Springfield, Mo. (Meek, 1891).

**128. Boleosoma nigrum** Rafinesque. *Johnny Darter.* Platte River near Fort Kearney, Nebr. (as *Pœcilichthys mesæus* type, Cope, 1864 and 1865; this second reference is by error made to Fort Riley, Kans.); Tabo Creek, Lafayette County, Mo. (as *Pœcilichthys beani* type, Jordan, 1884); Hundred and Two River at Bedford, Iowa, and Maryville, Mo.; Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (as *Boleosoma olmstedi maculatum*, Jordan & Meek, 1885); Kansas River (as *B. olmstedi maculatum*, Graham, 1885); Shunganunga Creek and Blacksmith Creek, Shawnee County, Kans. (as *B. olmstedi maculatum*, Gilbert, 1886); Big Creek, Texas County, Mo., and Bear Creek, Boone County, Mo. (as *B. olmstedi ozarcanum*, Call, 1887); Solomon River, Beloit, Kans.; north fork of Solomon River, Lenora, Kans.; Saline River, Wakeeney, Kans. (as *B. olmstedi*, Hay, 1887); Sappa Creek, Oberlin, Kans. (as *Etheostoma olmstedi maculatum*, Gilbert, 1889); Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo.; Lock Fork, Mansfield, Mo. (Meek, 1891); South Platte River, Denver (Jordan, 1891); Big Sioux River at Sioux City and Sioux Falls; Silver Lake, Iowa, and Boyer River at Arion, Iowa (Meek, 1892); Platte and Elkhorn rivers at Fremont; State fish commission ponds at South Bend, Nebr.; Spirit and East Okoboji lakes; Floyd River at Lemars and Sioux City; Elkhorn River at Fremont (Meek, 1894); Dakota River at Jamestown (Woolman, 1896).

Much less common than *E. iowæ*. We found it only at the following places: Enemy and Rock creeks, Mitchell; Norfolk Creek, Norfolk Junction, and Elkhorn River, Ewing. The total number of specimens obtained is 66, the majority being from Norfolk Junction and Ewing. They do not differ appreciably from more eastern examples, as the following description of specimens from Rock Creek shows: Head 3¾; depth 6½; eye 4; snout 4. D. VIII or IX–11 to 13; A. I, 7 or 8. Scales 6–46 to 50–6 or 7. Body slender, fusiform; head short; snout blunt and decurved, the upper lip below level of lower edge of orbit; maxillaries protractile; gill membranes scarcely connected. Eyes high up, the interorbital width narrow, 1¼ in eye. Cheeks and breast naked; opercles with a few scales; nape mostly scaled; lateral line nearly straight and usually complete, an occasional scale, especially in posterior portion, without pore; ventral line with ordinary scales. Opercular spine well developed; no black humeral scale. Colors as in typical *nigrum*.

**129. Etheostoma zonale** (Cope). Big Sioux River at Sioux City (Meek, 1892).

**130. Etheostoma iowæ** Jordan & Meek. This is by far the most abundant and widely distributed darter in this region. It was found by us in the following localities: Crow Creek, Chamberlain; Enemy and Rock creeks, Mitchell; Emanuel and Choteau creeks, Springfield; Prairie Creek, Scotland; Creighton Creek, Niobrara; pond at Creighton; Minnechaduza Creek, Valentine; pond at Verdigris; Elkhorn River, Norfolk Junction; ponds at Long Pine, and in the State fish commission ponds at South Bend. At most of these places we found it to be abundant, the collections containing not fewer than 350 excellent specimens. It is also an abundant species in the Dakota River at Jamestown (Woolman, 1896). This species is preeminently an inhabitant of small lakes, ponds, isolated overflow pools along river courses, and of the slug-

gish, grassy creeks of the prairie region. Wherever we found a small pond or slowly flowing stream with plenty of aquatic vegetation and a more or less muddy bottom, there we found this little darter in large numbers. Similar ponds or streams in Texas yield *Boleichthys fusiformis*, while in such places in the lower Wabash Basin we find *Ethcostoma chlorosoma*.

The following description is based primarily upon the specimens from Creighton: Head 3⅓; depth 5¼; eye 5; snout 4⅔. D. VIII to X-9 to 11; A. II, 7; scales 6-53-7, the lateral line arched anteriorly, incomplete, developed on about 30 scales. Body rather long and slender, resembling *E. fusiforme*, anterior part of back elevated, the caudal peduncle long; head moderate, snout rather short, blunt and decurved; mouth small, nearly horizontal, the lower jaw included; maxillary reaching pupil; premaxillaries not protractile; gill membranes scarcely connected. Vertical fins high in male, lower in female; pectoral about as long as head; dorsals usually well separated; anal smaller than soft dorsal, the first spine the stronger. Scales strongly ctenoid; opercle usually pretty well scaled and some scales on cheek; there is, however, much variation in these characters; ventral line with ordinary scales; nape scaled, breast naked. Colors in life: male with 10 or 11 brick-red vertical bars, the first under the pectoral; these bars are somewhat irregular in position and extent, but they do not meet under the belly nor do they usually reach above the lateral line; interspaces between the red bars two or three times as wide and pale greenish; head and back rusty or grayish; a dark line downward from the eye and another forward to tip of snout; opercle and region in front of pectoral silvery; basal half or two-fifths of spinous dorsal dark green, above this a broad, bright-red band, then a narrow, pale-blue line, narrowly bordered above by paler; soft dorsal mottled with light rusty; caudal with about five ashy crossbars; pectorals and anal nearly plain; ventrals plain; female without any bright colors, the general color rusty greenish, the dorsals and caudal mottled or barred with olivaceous.

In alcohol these specimens show the following colors: Body light coffee-color, small brown spots arranged in somewhat obscure longitudinal series, plainest on back and caudal peduncle; side with about 10 or 11 irregular, dark cross blotches; back with 6 or 7 dark cross blotches; under parts pale; head dusted with dark; a dark line downward from the eye, another forward on upper jaw, meeting its fellow on snout. In the male, the spinous dorsal has at the base a broad brown band two-fifths height of fin, this followed by a pale strip of equal width, then a narrow dark strip, and the fin finally pale along the margin; in the female these stripes are broken up into dots; soft dorsal, caudal, anal, and pectorals barred or vermiculated with light brown; ventrals pale. The variations in the squamation and in the fin formulas are very great, and must be carefully considered in determining the relationships of this and kindred species.

First, as to the squamation. Twenty-one examples were carefully examined, and the number of scales in the lateral line varied from 50 to 58, there being 50 scales in 1, 51 in 2, 52 in 2, 53 in 5, 54 in 3, 55 in 3, and 58 in 5. The number of developed pores in the lateral line ranges from 17 to 31. The number of scales in a transverse series varies from 10 to 15, counting from front of soft dorsal to middle line of belly. Usually the cheeks and opercles are fairly well scaled; in some cases they are densely scaled, while in others there are but few scales on the opercle, and still fewer or even none on the cheek. These specimens, with imperfect squamation of cheeks and opercles, are the form described under the name *Ethcostoma quappelle*, by Eigenmann & Eigenmann.

The formula for the dorsal fins was found to be VIII–9 in 5; VIII–10 in 1, IX–9 in 1, IX–10 in 3, IX–11 in 2, IX–12 in 1, X–10 in 4, X–11 in 2, and XI–11 in 1. In 25 specimens which we collected at South Bend and which we examined for Professor Meek, the formula was IX–10 in 9, X–11 in 5, X–10 in 4, IX–11 in 4, IX–9 in 2, and XI–10 in 1. In the single specimen upon which *E. quappelle* was based it is IX–9. The anal fin is usually II, 7, though occasionally it is II, 6, or II, 8. The specimens from Crow Creek near Chamberlain, 39 in number, differ somewhat from Creighton specimens in having the scales smaller, usually 55 to 58 in lateral line, fewer pores developed, and the cheeks and opercles more nearly naked. The largest specimens in our collections are from Creighton, Mitchell, and Niobrara and are 2¾ inches long.

131. **Etheostoma cœruleum spectabile** (Agassiz). Ellis, Ellis County, Kans. (as *Pœcilichthys cœruleus*, Gilbert, 1884); Kansas River (as *E. variatum*, Graham, 1885); Ellis, Kans. (as *E. variatum*, Gilbert, 1885 and Cragin, 1885*a*); Blackwater Creek, Brownsville, Saline County, Mo.; Flat Creek, Sedalia, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (as *Etheostoma variatum spectabile*, Jordan & Meek, 1885); Bigler, Texas County, Mo. (Call, 1887); Little Piney River at Newburg and Arlington, Mo.; Big Piney River, Cabool, Mo.; Gasconade River, Arlington, Mo.; Lock Fork, Mansfield, Mo.; Osage Fork, Marshfield, Mo.; Jones Creek and Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo.; Sac River, Springfield, Mo. (Meek, 1891). Whether all these references belong properly to the variety *spectabile* is doubtful; some of them may have been based upon typical *cœruleum* specimens. In the Ozark region of Missouri it is probable that only *spectabile* occurs.

132. **Etheostoma lepidum** (Baird & Girard). Shunganunga Creek, Topeka; spring near Maple Hill, Wabaunsee County, Kans.; Ellis, Kans. (Gilbert, 1886); north fork of Solomon River, Lenora, Kans.; Saline River, Wakeeney, Kans.; Smoky Hill River, Wallace, Kans. (Hay, 1887).

133. **Etheostoma punctulatum** (Agassiz). Jones Creek, Dixon, Mo.; Big Piney River, Cabool, Mo.; Osage Fork, Marshfield, Mo.; Lock Fork and Niangua River, Mansfield, Mo. (Meek, 1891).

134. **Etheostoma flabellare** Rafinesque. *Fan-tailed Darter.* Jones Creek and Marais River, Dixon, Mo.; Little Piney River, Mo.; Osage Fork, Marshfield, Mo.; Niangua River, Marshfield, Mo. (Meek, 1891).

135. **Boleichthys fusiformis** (Girard). Marais des Cygnes (as *Ethcostoma fusiforme*, Graham, 1885).

136. **Boleichthys exilis** Girard. Little Muddy River (as *Boleichthys exilis* type, Girard, 1859); Cannon Ball River (as *B. warreni* type, Girard, 1859).

137. **Microperca punctulata** Putnam. Jones Creek, Dixon, Mo. (Meek, 1891).

138. **Roccus chrysops** (Rafinesque). *White Perch.* Kansas River and Mill Creek, Kans. (Graham, 1885); Big Sioux River and Silver Lake, Iowa (Meek, 1892).

139. **Morone interrupta** Gill. *Yellow Bass.* The only record of the occurrence of this fish in the Missouri Basin is that given by Cragin (1885*a*), who reports it from the Kansas River (presumably at Lawrence) on the authority of Prof. Frank H. Snow, of the Kansas State University.

140. **Aplodinotus grunniens** Rafinesque. *Fresh-water Drum.* Milk River (as *Amblodon grunniens*, Suckley, 1860); Missouri River, St. Joseph, Mo.; Grand River, Clinton, Mo.; Tabo Creek, Calhoun, Mo. (Jordan & Meek, 1885); Kansas River (Graham, 1885, and Cragin, 1885*a*); Big Sioux River at Sioux City (Meek, 1892); Elkhorn River at Fremont (Meek, 1894).

141. **Cottus bairdi** Girard. *Blob*; *Molly-crawl-abottom.* "All streams of the Ozark region" (as *Uranidea richardsoni*, Call, 1887); Big Piney River, Cabool, Mo.; Little Piney River at Newburg and Arlington, Mo.; Osage Fork, Marshfield, Mo.; Lock Fork, Mansfield, Mo.; Jones Creek and Marais River, Dixon, Mo.; Niangua River, Marshfield, Mo.; Sac River, Springfield, Mo. (Meek, 1891).

**142. Cottus bairdi punctulatus** (Gill). *Rocky Mountain Blob.* Between Bridger Pass and Fort Bridger (as *Potamocottus punctulatus* type, Gill, 1862); Gallatin Fork of the Missouri River (as *Uranidea punctulata,* Cope, 1872); Gibbon and Madison rivers and Canyon Creek, Yellowstone National Park (Jordan, 1891*a*); Beaverhead River, Dillon, Mont.; Red Rock River, Red Rock, Mont.; Canyon Creek, Yellowstone Park; junction of Firehole and Gibbon rivers (Evermann, 1892); Missouri River, Craig, Mont. (Eigenmann, 1894).

**143. Lota lota maculosa** (Le Sueur). *Ling; Lawyer.* Battle Creek, S. Dak. (as *L. maculosa,* Cope, 1879); Missouri River at Wyandotte, Kans. (Cragin, 1885*a*); Missouri River at Leavenworth (Gilbert, 1887); Red Rock River, Red Rock, Mont. (Evermann, 1892); Cheyenne River at Cheyenne Falls, S. Dak. (Evermann, 1893); Missouri River, Craig, Mont. (Eigenmann, 1894). One specimen of the ling, 13 inches long, was taken in the south fork of the Cheyenne at Cheyenne Falls, S. Dak. Like all the fishes found in Cheyenne River this is greatly bleached and is much paler than specimens from the Great Lakes.

## NOMINAL SPECIES DESCRIBED FROM MISSOURI BASIN LOCALITIES.

The total number of nominal species and subspecies which have been described from Missouri Basin localities is 74, representing 52 species as now recognized, and all but 28 of these 52 species had been previously described from localities not in the Missouri Basin.

| Nominal species | Date. | Identification. | Type locality. |
|---|---|---|---|
| Acipenser copei Duméril | 1870 | Acipenser rubicundus | Upper Missouri. |
| Acipenser rauchi Duméril | 1870 | do | Osage River, Missouri. |
| Acipenser anasimus Duméril | 1870 | do | Missouri River. |
| Lepidosteus otarius Cope | 1865 | Lepisosteus osseus | Kansas River near Fort Riley, Kans. |
| Pimelodus olivaceus Girard | 1858 | Ictalurus punctatus | Fort Pierre, Milk and Yellowstone rivers, and Nebraska. |
| Pimelodus hammondii Abbott | 1860 | do | Fort Riley, Kans. |
| Pimelodus notatus Abbott | 1860 | do | Do. |
| Ictalurus simpsonii Gill | 1862 | do | Big Sandy River of Kansas (Platte River). |
| Amiurus obesus Gill | 1862 | Ameiurus melas | Nebraska. |
| Noturus occidentalis Gill | 1862 | Noturus flavus | Platte River. |
| Carpiodes bison Agassiz | 1855 | Carpiodes carpio | Osage River, Missouri. |
| Carpiodes damalis Girard | 1850 | Carpiodes velifer | Milk River. |
| Carpiodes grayi Cope | 1870 | do | "Probably from one of the Western States." |
| Pantosteus jordani Evermann | 1893 | Pantosteus jordani | Red Rock and Beaverhead rivers, Montana. |
| Catostomus (Acomus) griseus Girard. | 1850 | Catostomus griseus | Milk River. |
| Catostomus (Acomus) lactarius Girard. | 1856 | do | Do. |
| Catostomus retropinnis Jordan | 1878 | do | Milk River, Montana. |
| Catostomus sucklii Girard | 1856 | Catostomus commersonii | Upper Missouri River and tributaries. |
| Catostomus chloropteron Abbott | 1860 | do | Kansas. |
| Ptychostomus hayden Girard | 1856 | Minytrema melanops | Missouri River at Fort Pierre and Yellowstone River. |
| Ptychostomus bucco Cope | 1871 | Moxostoma bucco | St. Joseph, Mo. |
| Campostoma hippops Cope | 1864 | Campostoma anomalum | Platte River at Fort Kearney. |
| Chrosomus dakotensis Evermann & Cox. | 1896 | Chrosomus dakotensis | Crow Creek, Chamberlain, S. Dak. |
| Hybognathus evansi Girard | 1856 | Hybognathus nuchale evansi. | Missouri River at Fort Pierre. |
| Hybognathus argyritus Girard | 1856 | Hybognathus argyrite | Milk River. |
| Pimephales fasciatus Girard | 1856 | Pimephales promelas | Yellowstone River. |
| Coliscus parietalis Cope | 1871 | do | Missouri River at St. Joseph, Mo. |
| Semotilus macrocephalus Girard | 1836 | Semotilus atromaculatus | Fort Pierre. |
| Semotilus speciosus Girard | 1856 | do | Sweetwater River. |
| Semotilus hammondii Abbott | 1856 | do | Kansas River near Fort Riley. |
| Phoxinus milnerianus Cope | 1879 | Leuciscus milnerianus | Probably Battle Creek, S. Dak. |
| Cliola smithii Evermann & Cox. | 1896 | Cliola smithii | Prairie Creek, Scotland, S. Dak. |

| Nominal species. | Date. | Identification. | Type locality. |
|---|---|---|---|
| Notropis germanus Hay | 1887 | Notropis heterodon | Smoky Hill River, Wallace, Kans. |
| Hybopsis missuriensis Cope | 1874 | Notropis blennius | Missouri River at St. Joseph. |
| Alburnus lineolatus Agassiz | 1863 | Not identifiable; may be Notropis scylla. | Osage River, Missouri. |
| Hybopsis scylla Cope | 1871 | Notropis scylla | Red Cloud Creek, a tributary of North Platte River. |
| Cliola chlora Jordan | 1878 | do | Upper Missouri region. |
| Cliola (Hybopsis) topeka Gilbert. | 1884 | Notropis topeka | Shunganunga Creek, Topeka, Kans. |
| Notropis æneolus Hay | 1887 | do | Saline River, Wakeeney, Kans. |
| Photogenis piptolepis Cope | 1871 | Notropis piptolepis | Red Cloud Creek, a tributary of North Platte River. |
| Cyprinella billingsiana Cope | 1871 | Notropis lutrensis | St. Joseph, Mo. |
| Moniana jugalis Cope | 1871 | do | Do. |
| Notropis umbrifer Hay | 1887 | Notropis macrostomus | Solomon River, Beloit, Kans. |
| Alburnus notatus Agassiz | 1863 | Notropis notatus | Osage River, Missouri. |
| Plargyrus bowmani Girard | 1856 | Notropis cornutus | Sweetwater River. |
| Alburnus oligaspis Cope | 1864 | Notropis dilectus | Kansas. |
| Alburnellus percobromus Cope | 1871 | Notropis rubrifrons | St. Joseph, Mo. |
| Minnilus (Lythrurus) nigripinnis Gilbert. | 1884 | Notropis umbratilis umbratilis. | Shunganunga Creek, Topeka. |
| Sarcidium scopifer Cope | 1871 | *Phenacobius scopifer* | Missouri River, St. Joseph, Mo. |
| Argyreus dulcis Girard | 1856 | Rhinichthys cataractæ dulcis. | Sweetwater River. |
| Rhinichthys maxillosus Cope | 1864 | do | Kansas. |
| Rhinichthys ocella Garman | 1881 | do | Northeastern Wyoming and Montana. |
| Gobio gelidus Girard | 1856 | Hybopsis gelidus | Milk River. |
| Hybopsis meeki Jordan & Evermann. | 1896 | Hybopsis meeki | Missouri River at St. Joseph. |
| Hybopsis *montanus* Meek | 1884 | Hybopsis montanus | Upper Missouri region. |
| Nocomis nebraconsis Girard | 1856 | Hybopsis kentuckiensis | Sweetwater River. |
| Leucosomus dissimilis Girard | 1856 | Couesius dissimilis | Milk and Little Muddy rivers. |
| Pogonichthys communis Girard. | 1856 | Platygobio gracilis | Fort Pierre; Fort Union; above Fort Union; Milk River; Yellowstone River; Sweetwater River. |
| Pogonichthys (Platygobio) gulonellus Cope. | 1865 | do | Near Bridger Pass. |
| Coregonus williamsoni cismontanus Jordan. | 1891 | Coregonus williamsoni cismontanus. | Madison, Yellowstone, and Gardiner rivers, and Horsethief Springs, Montana. |
| Salar lewisi Girard | 1858 | Salmo mykiss lewisi | Falls of Missouri River. |
| Salmo pleuriticus Cope | 1872 | do | Yellowstone River; Yellowstone Creek, Gallatin Fork, and Yellowstone Lake. |
| Salmo (Salar) stomias Cope | 1871 | Salmo mykiss stomias | Kansas River near Fort Riley. |
| Thymallus *montanus* Milner | 1874 | Thymallus ontariensis montanus. | Tributary of Missouri River at Camp Baker, Montana. |
| Zygonectes lineatus Garman | 1881 | Fundulus lineatus | Northeastern Wyoming. |
| Zygonectes macdonaldi Meek | 1891 | Fundulus macdonaldi | Jones Creek, Dixon, Mo.; Osage River, Mansfield, Mo. |
| Fundulus floripinnis Cope | 1874 | Fundulus floripinnis | South Platte River at Denver. |
| Fundulus sciadicus Cope | 1865 | Fundulus sciadicus | "Nebraska or Platte River." |
| Percopsis hammondii Gill | 1864 | Percopsis guttatus | Kansas. |
| Pœcilichthys mesæus Cope | 1864 | Bolcosoma nigrum | Platte River near Fort Kearney, Nebr. |
| Pœcilichthys beani Jordan | 1884 | do | Tabo Creek, Lafayette County, Mo. |
| Bolcichthys exilis Girard | 1859 | Bolcichthys exilis | Little Muddy River. |
| Bolcichthys warreni Girard | 1859 | do | Cannon Ball River. |
| Potamocottus punctulatus Gill. | 1862 | Cottus bairdi punctulatus. | Between Bridger Pass and Fort Bridger. |

## DISTRIBUTION OF SPECIES BY STATES.

The following table shows the distribution by States of the fishes of the Missouri Basin:

| No. | Families and species. | Missouri. | Iowa. | Kansas. | Nebraska. | South Dakota. | North Dakota. | Montana. | Wyoming. | Colorado. |
|---|---|---|---|---|---|---|---|---|---|---|
| | PETROMYZONIDÆ. | | | | | | | | | |
| 1 | Ichthyomyzon concolor | | | × | | × | | | | |
| 2 | Ichthyomyzon castaneus | | | × | | | | | | |
| 3 | Lampetra wilderi | | | × | | | | | | |
| | POLYODONTIDÆ. | | | | | | | | | |
| 4 | Polyodon spathula | | × | × | × | | | × | | |
| | ACIPENSERIDÆ. | | | | | | | | | |
| 5 | Acipenser rubicundus | × | × | × | × | × | | | | |
| 6 | Scaphirhynchus platorynchus | × | × | × | × | | × | × | × | |
| | LEPISOSTEIDÆ. | | | | | | | | | |
| 7 | Lepisosteus osseus | × | × | × | | × | | | | |
| 8 | Lepisosteus platostomus | | | × | | × | | | | |
| | AMIIDÆ. | | | | | | | | | |
| 9 | Amia calva | | | × | | | | | | |
| | SILURIDÆ. | | | | | | | | | |
| 10 | Ictalurus furcatus | × | | × | | | | | | |
| 11 | Ictalurus punctatus | × | × | × | × | × | | × | × | |
| 12 | Ameiurus natalis | × | | × | | | × | | | |
| 13 | Ameiurus nebulosus | × | | × | | | × | | | |
| 14 | Ameiurus melas | × | × | × | × | × | × | | | |
| 15 | Leptops olivaris | × | | × | | × | | | | |
| 16 | Noturus flavus | × | × | × | × | × | | × | × | |
| 17 | Schilbeodes gyrinus | | × | | × | × | | | | |
| 18 | Schilbeodes exilis | × | | × | | | | | | |
| 19 | Schilbeodes miurus | | | × | | | | | | |
| | CATOSTOMIDÆ. | | | | | | | | | |
| 20 | Ictiobus cyprinella | × | | × | × | | | | | |
| 21 | Ictiobus urus | × | | × | | | | | | |
| 22 | Ictiobus bubalus | × | × | × | | × | | | | |
| 23 | Carpiodes carpio | × | | × | × | × | | | | |
| 24 | Carpiodes velifer | × | × | × | × | | | × | | |
| 25 | Cycleptus elongatus | | | × | | | | | | |
| 26 | Pantosteus jordani | | | | × | × | | × | × | |
| 27 | Catostomus griseus | | | | × | | | × | × | × |
| 28 | Catostomus catostomus | | | | | | | | × | |
| 29 | Catostomus commersonii | × | × | × | × | × | × | × | × | |
| 30 | Catostomus nigricans | × | | × | | | | | | |
| 31 | Erimyzon succetta oblongus | | | × | | | | | | |
| 32 | Minytrema melanops | | | × | × | | | × | | |
| 33 | Moxostoma bucco | × | | | | | | | | |
| 34 | Moxostoma aureolum | × | × | × | × | × | × | × | × | |
| 35 | Placopharynx duquesnii | | × | | | | | | | |
| | CYPRINIDÆ. | | | | | | | | | |
| 36 | Campostoma anomalum | × | × | × | × | × | × | | × | |
| 37 | Chrosomus erythrogaster | × | | × | | | | | | |
| 38 | Chrosomus dakotensis | | | | × | × | | | | |
| 39 | Hybognathus nuchale | × | × | × | × | | × | | | |
| 40 | Hybognathus nuchale evansi | | | × | × | × | | × | × | |
| 41 | Hybognathus argyrite | | | | | | | × | | |
| 42 | Hybognathus nubilum | × | × | | × | × | | | × | |
| 43 | Pimephales promelas | × | × | × | × | × | × | × | | |
| 44 | Pimephales notatus | × | × | × | × | | × | | | |
| 45 | Semotilus atromaculatus | × | × | × | × | × | × | | × | |
| 46 | Leuciscus elongatus | | | × | | | | | | |
| 47 | Leuciscus neogæus | | | | | × | | | | |
| 48 | Leuciscus milnerianus | | | | | × | | | | |

*Distribution of the Fishes of the Missouri Basin*—Continued.

| No. | Families and species. | Missouri. | Iowa. | Kansas. | Nebraska. | South Dakota. | North Dakota. | Montana. | Wyoming. | Colorado. |
|---|---|---|---|---|---|---|---|---|---|---|
| | CYPRINIDÆ—continued. | | | | | | | | | |
| 49 | Abramis chrysoleucas | × | × | × | × | | | | | |
| 50 | Cliola vigilax | × | × | | × | | | | | |
| 51 | Cliola smithi | | | | × | × | | | | |
| 52 | Notropis cayuga | × | × | | × | × | × | | | |
| 53 | Notropis heterodon | | × | × | | | | | | |
| 54 | Notropis blennius | × | × | × | × | × | × | | × | |
| 55 | Notropis scylla | × | | × | × | | | × | | |
| 56 | Notropis topeka | | × | × | × | × | | | | |
| 57 | Notropis gilberti | × | × | | × | | | | | × |
| 58 | Notropis piptolepis | | | | × | | | | | |
| 59 | Notropis shumardi | × | | | | | | | | |
| 60 | Notropis hudsonius | | × | × | | × | | | | |
| 61 | Notropis lutrensis | × | × | × | × | × | | | × | × |
| 62 | Notropis macrostomus | | | × | | | | | | |
| 63 | Notropis notatus | × | | | | | | | | |
| 64 | Notropis whipplii | × | × | | | | | | | |
| 65 | Notropis cornutus | × | × | × | × | × | × | | × | × |
| 66 | Notropis zonatus | × | | | | | | | | |
| 67 | Notropis jejunus | | | × | × | | | | × | |
| 68 | Notropis atherinoides | | × | | | | | × | | |
| 69 | Notropis dilectus | × | × | × | × | × | | | | |
| 70 | Notropis rubrifrons | × | | × | | | | | | |
| 71 | Notropis umbratilis umbratilis | × | × | × | | | | | | |
| 72 | Phenacobius mirabilis | × | × | × | × | × | | | | |
| 73 | Phenacobius scopifer | × | | | | | | | | |
| 74 | Rhinichthys cataractæ dulcis | | | × | × | × | × | × | × | × |
| 75 | Rhinichthys atronasus | | | | | × | | | | |
| 76 | Hybopsis æstivalis | | | | × | | | | | |
| 77 | Hybopsis hyostomus | | | | × | | | | | |
| 78 | Hybopsis gelidus | | | | × | × | | × | × | |
| 79 | Hybopsis meeki | × | × | | | | | | | |
| 80 | Hybopsis montanus | | | | | | | × | | |
| 81 | Hybopsis dissimilis | × | | | | | | | | |
| 82 | Hybopsis storerianus | × | | × | × | | | | | |
| 83 | Hybopsis kentuckiensis | × | × | × | × | | × | | × | |
| 84 | Couesius dissimilis | | | | × | × | | × | × | |
| 85 | Platygobio gracilis | × | | × | × | × | × | × | × | |
| | ANGUILLIDÆ. | | | | | | | | | |
| 86 | Anguilla chrysypa | | | × | | | | | | |
| | HIODONTIDÆ. | | | | | | | | | |
| 87 | Hiodon alosoides | × | × | × | × | × | | × | × | |
| 88 | Hiodon tergisus | | | × | | × | | | | |
| | CLUPEIDÆ. | | | | | | | | | |
| 89 | Dorosoma cepedianum | × | × | × | × | | | | | |
| 90 | Pomolobus chrysochloris | | | × | | | | | | |
| | SALMONIDÆ. | | | | | | | | | |
| 91 | Coregonus williamsoni cismontanus | | | | | | | × | × | |
| 92 | Salmo mykiss lewisi | | | | | | | × | × | |
| 93 | Salmo mykiss stomias | | | ×? | | | | | | × |
| | THYMALLIDÆ. | | | | | | | | | |
| 94 | Thymallus ontariensis montanus | | | | | | | × | | |
| | LUCIIDÆ. | | | | | | | | | |
| 95 | Lucius lucius | | × | | × | | × | × | | |
| | PŒCILIIDÆ. | | | | | | | | | |
| 96 | Fundulus diaphanus | | | × | | | | | | |
| 97 | Fundulus zebrinus | | × | × | | | | | | |
| 98 | Fundulus catenatus | × | | | | | | | | |
| 99 | Fundulus lineatus | | | | | | | | × | |
| 100 | Fundulus macdonaldi | × | | | | | | | | |
| 101 | Fundulus floripinnis | | | | | | | | | × |
| 102 | Fundulus sciadicus | | × | | × | × | | | | |

*Distribution of the Fishes of the Missouri Basin*—Continued.

| No. | Families and species. | Missouri. | Iowa. | Kansas. | Nebraska. | South Dakota. | North Dakota. | Montana. | Wyoming. | Colorado. |
|---|---|---|---|---|---|---|---|---|---|---|
| | GASTEROSTEIDÆ. | | | | | | | | | |
| 103 | Eucalia inconstans | | | | × | × | | × | | |
| | PERCOPSIDÆ. | | | | | | | | | |
| 104 | Percopsis guttatus | | × | × | | | | | | |
| | ATHERINIDÆ. | | | | | | | | | |
| 105 | Labidesthes sicculus | × | | | | | | | | |
| | CENTRARCHIDÆ. | | | | | | | | | |
| 106 | Pomoxis annularis | × | | × | | | | | | |
| 107 | Pomoxis sparoides | | × | × | | | | | | |
| 108 | Ambloplites rupestris | | × | × | | × | | | | |
| 109 | Chænobryttus gulosus | | | × | | | | | | |
| 110 | Apomotis cyanellus | × | × | × | × | × | | | | |
| 111 | Lepomis megalotis | × | × | | | | | | | |
| 112 | Lepomis humilis | × | × | × | × | × | | | | |
| 113 | Lepomis macrochirus | × | | | | | | | | |
| 114 | Lepomis pallidus | × | × | | | | | | | |
| 115 | Eupomotis gibbosus | | × | | | | | | | |
| 116 | Micropterus dolomieu | × | × | × | | | | | | |
| 117 | Micropterus salmoides | × | × | × | × | | | | | |
| | PERCIDÆ. | | | | | | | | | |
| 118 | Stizostedion vitreum | | × | × | × | × | | | | |
| 119 | Stizostedion canadense boreum | × | × | × | × | × | | × | | |
| 120 | Perca flavescens | | × | | | × | × | | | |
| 121 | Percina caprodes | × | | × | | | | | | |
| 122 | Hadropterus phoxocephalus | × | | × | | | | | | |
| 123 | Hadropterus aspro | × | × | × | × | | × | | | |
| 124 | Hypohomus cymatotænia | × | | | | | | | | |
| 125 | Hypohomus nianguæ | × | | | | | | | | |
| 126 | Cottogaster uranidea | × | | | | | | | | |
| 127 | Diplesion blennioides | × | | × | | | | | | |
| 128 | Boleosoma nigrum | × | × | × | × | × | × | | | × |
| 129 | Etheostoma zonale | | × | | | | | | | |
| 130 | Etheostoma iowæ | | | | × | × | × | | | |
| 131 | Etheostoma cœruleum spectabile | × | | × | | | | | | |
| 132 | Etheostoma lepidum | | | × | | | | | | |
| 133 | Etheostoma punctulatum | × | | | | | | | | |
| 134 | Etheostoma flabellare | × | | | | | | | | |
| 135 | Boleichthys fusiformis | | | × | | | | | | |
| 136 | Boleichthys exilis | | | | | | × | | | |
| 137 | Microperca punctulata | × | | | | | | | | |
| | SERRANIDÆ. | | | | | | | | | |
| 138 | Roccus chrysops | | × | × | | | | | | |
| 139 | Morone interrupta | | | × | | | | | | |
| | SCIÆNIDÆ. | | | | | | | | | |
| 140 | Aplodinotus grunniens | × | × | × | × | | | × | | |
| | COTTIDÆ. | | | | | | | | | |
| 141 | Cottus bairdi | × | | | | | | | | |
| 142 | Cottus bairdi punctulatus | | | | | | | × | × | |
| | GADIDÆ. | | | | | | | | | |
| 143 | Lota lota maculosa | | | × | | × | | × | | |
| | Total | 77 | 59 | 86 | 50 | 49 | 23 | 30 | 26 | 8 |

## RECOMMENDATIONS REGARDING THE FOOD-FISHES OF THE MISSOURI BASIN.

Of the 143 species of fishes known from the Missouri Basin at least 42 may be regarded as food-fishes of more or less importance. They are the following:

| | | |
|---|---|---|
| Common Sturgeon. | Common Redhorse. | Warmouth Bass. |
| Chuckle-head Cat. | Big-jawed Sucker. | Green Sunfish. |
| Channel Cat. | Creek Chub. | Long-eared Sunfish. |
| Common Bullhead. | River Chub. | Red-spotted Sunfish. |
| Black Bullhead. | Toothed Herring. | Blue-gill. |
| Mud Cat. | Moon-eye. | Common Sunfish. |
| Yellow Cat. | Rocky Mountain Whitefish. | Large-mouth Black Bass. |
| Common Buffalo-fish. | Yellowstone Trout. | Small-mouth Black Bass. |
| Small-mouth Buffalo. | Platte River Trout. | Wall-eyed Pike. |
| Carp Sucker. | Montana Grayling. | Sauger. |
| Gourd-seed Sucker. | Northern Pickerel. | Yellow Perch. |
| Milk River Sucker. | Crappie. | White Perch. |
| Long-nosed Sucker. | Calico Bass. | Freshwater Drum. |
| Common White Sucker. | Rock Bass | Ling. |

To these may be added the following species which have been introduced into the waters of the Yellowstone National Park by the United States Fish Commission:

| | | |
|---|---|---|
| Rainbow Trout. | Von Behr Trout. | Eastern Brook Trout. |

These three species and perhaps others, including the carp, have been introduced by several of the State fish commissions and by the United States Fish Commission in various places in these States.

The trout, whitefish, and grayling are, of course, primarily game fishes, and are of interest chiefly to the angler. Their abundance in the upper waters of this basin attracts annually a large number of anglers to that region. The supply, though yet large, is diminishing. There is no reason, however, why the supply of these species can not be greatly increased in the waters in which they are already found and plants may very properly be made in a number of suitable streams in which they are not indigenous; but the pond and river fishes are the species whose cultivation will result in the greatest good to the Missouri River States.

The six species of catfishes named above are all well suited to the lower and middle portions of the Missouri Basin. The same is true of the suckers and the spiny-rayed fishes. Nearly all of these species are found in abundance in the ponds and bayous along the Mississippi in Illinois, where the Commission has for several years been collecting them for distribution to various suitable waters.

No better work can be done than to make liberal shipments of buffalo, suckers, catfish, bullheads, black bass, sunfish, crappies, etc., to the suitable waters in western Iowa, Kansas, Nebraska, South Dakota, and Wyoming. The suckers, buffalo, and large catfish should be put in the streams; the bullheads, sunfishes, bass, crappies, etc., will do well in the numerous ponds and small lakes.

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# 6.—A REVIEW OF THE FOREIGN FISHERY-TRADE OF THE UNITED STATES.

By CHARLES H. STEVENSON.

## SYNOPSIS.


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## INTRODUCTION.

*Importance of the foreign trade.*—There are few things of greater or more lasting benefit to the fishermen of the United States than the extension of the markets for their products. It is the demand for the produce of the fisheries that places a value upon them, and the variation of this demand is the principal regulator of prices. In the case of some items—certain smoked and canned fish and oils, for instance—the foreign demand is of as much importance as the home market, and the increase or decrease of that demand is of great consequence to fishermen and preparators of those products. In considering the methods of benefiting the fishing interests of this country it is important, therefore, that due attention be paid to increasing the trade in those products that are at present consumed largely in foreign countries.

There is also the possibility of an increase in foreign trade through the preparation of other fishery products in ways suited to foreign markets, by means of which many resources of this country, at present unrecognized or neglected, could be utilized and made to yield addi-

tional income to the fishermen. The development of this trade is retarded by the fact that few dealers or preparators of fishery products have opportunities of becoming acquainted with the foreign markets, the kind of articles that may be disposed of, and the methods of preparation suited to the foreign demands. The building up of trade in those countries is accompanied with many difficulties. Preparators and producers must cater to the foreign markets with energy equal to that exercised in the domestic trade, and should possess accurate knowledge of the present condition and requirements of the trade with those countries.

At one time a very large portion of the exports of this country consisted of dried codfish. In 1774 the value of exported cod was upward of $1,000,000, representing one-sixth of the whole export trade of the United States, for the aggregate value of the exports was then but $6,165,413. In 1804 the value of the exports of the United States was $41,467,477, of which cod represented $2,400,000, the proportion being as 17.2 to 1. In 1857, however, the total domestic exports of the United States were valued at $338,985,065, of which the value of cod was only $570,348, the proportion being as 594 to 1. The decrease in the value of exported codfish since 1804 was $1,829,652, while the increase in the value of the other exports was $297,517,588.

Since 1857 considerable foreign trade has been developed in pickled and canned fish and miscellaneous fishery products; so that, while in 1894 the exports of cod were but $704,652, the aggregate value of the fishery exports was $4,258,306, out of a total export trade of $869,204,937, the proportion being as 1 to 204.

The principal fishery exports at the present time are canned salmon, dried cod, fresh and canned oysters, whalebone, spermaceti, smoked and pickled herring, pickled mackerel, and whale and fish oils.

The total value of domestic fishery products exported from 1790 to 1894, inclusive, approximates $331,000,000, of which $115,956,126 represents the exports during the last twenty years.

The possibilities for increasing our exports are apparent from an examination of the following summary compiled from the "British Statistical Abstract for the Principal and Other Foreign Countries," and from other trade reports, showing the total imports of fishery products into several of the principal foreign countries and the imports from the United States. While the value of this summary is necessarily limited by the lack of returns for many countries, especially for those in South America and the West Indies, and by the limited classification in most of the countries here named, yet it clearly indicates the small share that this country has in supplying the foreign fishery markets.

*Statement of the imports of fishery products into several of the principal foreign countries and the imports from the United States during the year 1893.*

| Designation. | Total imports. | | Imports from United States. | |
|---|---|---|---|---|
| | Quantity. | Value. | Quantity. | Value. |
| China (including Hongkong): | *Pounds.* | | *Pounds.* | |
| Beche-de-mer | 5,535,333 | $1,046,082 | | |
| Seaweed and agar-agar | 60,582,000 | 887,642 | | |
| All other fishery products | 44,600,533 | 3,092,334 | | *$178,807 |
| Total China | 110,717,866 | 5,026,058 | | 178,807 |
| Denmark: | | | | |
| Fresh fish | 12,382,071 | 843,128 | | |
| Preserved or salted fish | 27,618,099 | 497,480 | | *365 |
| Total Denmark | 40,000,170 | 1,340,608 | | 365 |
| France: | | | | |
| Fresh fish | 16,744,607 | 1,666,622 | | |
| Salted, dried, or smoked fish | 103,117,129 | 5,680,487 | | |
| Sardines and other prepared fish | 8,399,362 | 964,834 | 154,039 | 26,971 |
| Oysters, fresh and canned | | 12,100 | | 534 |
| Lobsters and other crustacea, fresh | 3,067,963 | 537,165 | | |
| Lobsters, canned or prepared | 3,257,568 | 627,399 | 1,957,275 | 376,966 |
| Mussels and other shellfish | 15,633,808 | 273,730 | | |
| Fish bladders, sounds, and roe | 9,852,243 | 259,366 | 178,246 | 4,691 |
| Marine oils | 12,211,154 | 1,206,868 | 376,788 | 17,832 |
| Spermaceti | 21,612 | 6,621 | 12,339 | 3,781 |
| Sponges | 1,364,656 | 1,854,891 | 153,524 | 201,602 |
| Whalebone | 477,062 | 1,461,741 | 106,784 | 327,192 |
| Coral, pearls, etc | | 948,083 | | |
| Total France | | 15,499,907 | | 959,569 |
| German Empire: | | | | |
| Herring | 281,357,000 | 6,744,908 | | |
| Italy: | | | | |
| Fish of all sorts | 101,167,894 | 5,795,790 | | *2,299 |
| Portugal: | | | | |
| Cod | 43,126,385 | 1,789,560 | *4,100 | *204 |
| Russia: | | | | |
| Fish, salted or dried | 287,607,104 | 4,901,484 | | |
| Spain: | | | | |
| Cod and stock fish, salted | 97,811,488 | 4,795,278 | | |
| Sweden: | | | | |
| Fish, fresh, salted, etc | 96,554,990 | 2,130,064 | | *154 |
| United Kingdom: | | | | |
| Fresh fish | 134,153,488 | 2,429,766 | 41,064 | 7,413 |
| Salted or prepared fish | 115,400,320 | 9,095,814 | 13,896,736 | 1,468,912 |
| Shellfish, all sorts | 36,715,616 | 1,354,453 | 17,542,784 | 522,862 |
| Isinglass | 900,144 | 444,701 | | |
| Marine oils | 32,237,120 | 2,014,604 | 3,568,320 | 150,890 |
| Marine shells | | 2,210,893 | | *51,028 |
| Sponges | 1,325,133 | 893,465 | 135,562 | 64,320 |
| Whalebone | 352,016 | 637,024 | *3,002 | *9,091 |
| Total United Kingdom | | 19,080,720 | | 2,274,516 |
| Grand total | | 67,105,037 | | 3,415,914 |

* From Report on Commerce and Navigation for year ending June 30, 1894.

It is important that attention be paid not only to the foreign markets, but also to the preparation of articles to take the place of foreign products in our domestic trade. The list of fishery imports contains a large number of articles for the production of which the United States has abundant resources, and the trade is enjoyed by foreign countries because of greater care or peculiar methods in preparation.

As the fisheries formed one of the principal sources of wealth of the early settlers of this country, it is not strange that for many years little necessity should have existed for the importation of fishery products. But as the wealth of the people increased and the trade facilities were enlarged, the demand for foreign preparations gradually extended. About the beginning of the present century these importations were confined almost exclusively to dried cod and pickled herring from the British Provinces in North America. But the demands of the domestic markets have so increased that, notwithstanding the remarkable resources of the United States and the extensive development and energetic prosecution of the fisheries, the foreign preparations during recent years have unduly competed with the domestic products. During the fiscal year ending June 30, 1894, for instance, the value of the fishery imports for consumption was $6,276,903, while the domestic exports were worth but $4,258,306, an excess in favor of the former of $2,018,597. In 1893 the excess of imports over exports was $2,166,811, in 1892 it was $1,283,859, and in 1891 only $769,458. In 1890 the exports exceeded the imports by $1,646,825, and in 1889 by $1,698,994. It thus appears that during the last six years there has been a constant increase in the dependence of the United States on foreign countries for fishery products.

As a suggestion of the practicability of increasing the fishery exports of the United States, in addition to more actively competing with foreign fishery products in the domestic markets, this paper is presented, comprising a general review of the principal features of the trade.

*Sources of information.*—The data on which this report is based have been obtained from various sources. The figures showing the value of the fishery imports and exports since 1820 have been compiled from the custom-house returns as published by the United States Treasury Department in the Annual Report on Commerce and Navigation. The United States statutes have furnished the rates of duty exacted on the products imported into this country. The present rates of duty imposed on fishery products imported into foreign countries have been compiled from the International Customs Journal, published by the International Customs Tariff Bureau, Brussels, Belgium, and from the publications of the Bureau of American Republics.

The writer acknowledges with much pleasure the suggestions received from Dr. Hugh M. Smith in the preparation of this paper, and the assistance rendered by Mr. John N. Cobb and other employees of the division of fisheries in comparing and verifying the tables.

## I.—THE BALANCE OF TRADE.

*Annual trade since 1820.*—The extent of the foreign fishery-trade of the United States is exhibited in Table 1, showing for a series of 74 years, ending June 30, 1894, the value of the fishery products imported for consumption, the domestic exports, and the balance of trade each year. For the years prior to 1869 it is impracticable to show with exactness the imports for consumption during each year. Hence the difference between the total imports and the foreign exports is accepted as a true statement of the imports for consumption. For convenience of comparison the imports of fishery products and the foreign exports are set forth in the first and second columns, respectively.

The general statement of "imports" embraces all entries of imported articles made at the custom-houses either for immediate consumption or for warehouse. Of the warehouse entries, portions may be subsequently exported, and are then classed as foreign exports.

The statement of "imports for consumption" includes the entries of all articles for immediate consumption and the withdrawals from warehouse for consumption in this country.

The general statement of "imports" and the statement of "imports for consumption" for any period always differ to the extent that the quantity and value of entries for warehouse for the period differ from the quantity and value of withdrawals from warehouse for consumption; and this for a series of years differs little from the extent of the foreign exports.

The term "imported for consumption" is a technical designation, and does not necessarily imply that the goods were actually consumed, but simply that they were delivered into the custody of the importer, and that the duties have been paid.[1]

Whenever used in this report, unless otherwise stated, the term "exports" comprises only domestic exports, and does not include foreign merchandise transshipped in bond through this country.

From 1821 to 1894, inclusive, the total imports for consumption aggregated $152,735,501, and the domestic exports $274,096,530, an excess over the imports for consumption of $121,361,029. The total imports of fishery products during this period were valued at $167,422,617, and the foreign exports at $14,339,675.

These figures include not only the articles most generally classed as products of the fisheries, such as all fresh, dried, pickled, and canned fish and shellfish, marine oils, spermaceti, fish sounds and whalebone, but also shells of marine mollusks, sponges, corals, seaweeds, ambergris, ambergris oil, etc.

[1] Commerce and Navigation of the United States, 1894, p. IX.

1. *Statement of the foreign fishery-trade of the United States during each year from 1821 to 1894, inclusive.*

| Year ending— | Imports. | Foreign exports. | Imports for consumption. | Domestic exports. | Excess of imports for consumption over domestic exports. | Excess of domestic exports over imports for consumption. |
|---|---|---|---|---|---|---|
| Sept. 30, 1821 | $13,186 | $3,080 | $10,106 | $1,499,188 | ..... | $1,489,082 |
| 1822 | 19,255 | 1,463 | 17,792 | 1,389,579 | ..... | 1,371,787 |
| 1823 | 31,914 | 260 | 31,654 | 1,658,224 | ..... | 1,626,570 |
| 1824 | 43,411 | 4,761 | 38,650 | 1,610,990 | ..... | 1,572,340 |
| 1825 | 29,500 | 383 | 29,117 | 1,595,065 | ..... | 1,565,948 |
| 1826 | 18,841 | 590 | 18,251 | 1,473,388 | ..... | 1,455,137 |
| 1827 | 24,971 | 1,704 | 23,267 | 1,575,332 | ..... | 1,552,065 |
| 1828 | 10,469 | 400 | 10,069 | 1,693,980 | ..... | 1,683,911 |
| 1829 | 16,182 | ..... | 16,182 | 1,817,100 | ..... | 1,800,918 |
| 1830 | 27,624 | 3,774 | 23,850 | 1,725,270 | ..... | 1,701,420 |
| 1831 | 49,421 | 276 | 49,145 | 1,889,472 | ..... | 1,840,327 |
| 1832 | 28,584 | 972 | 27,612 | 2,558,538 | ..... | 2,530,926 |
| 1833 | 45,640 | 4,552 | 41,097 | 2,402,469 | ..... | 2,361,372 |
| 1834 | 42,955 | 1,800 | 41,155 | 2,071,493 | ..... | 2,030,338 |
| 1835 | 88,279 | 21,576 | 66,703 | 2,174,524 | ..... | 2,107,821 |
| 1836 | 115,894 | 65,379 | 50,515 | 2,666,058 | ..... | 2,615,543 |
| 1837 | 98,044 | 9,260 | 88,784 | 2,711,452 | ..... | 2,622,668 |
| 1838 | 96,571 | 800 | 95,771 | 3,175,576 | ..... | 3,079,805 |
| 1839 | 342,755 | 9,034 | 333,721 | 1,917,969 | ..... | 1,584,248 |
| 1840 | 275,352 | 7,062 | 268,290 | 3,199,170 | ..... | 2,930,880 |
| 1841 | 225,036 | 15,188 | 209,848 | 2,846,851 | ..... | 2,637,003 |
| 1842 | 128,533 | 7,476 | 121,057 | 2,823,010 | ..... | 2,701,953 |
| June 30, 1843 | 91,871 | 1,643 | 90,228 | 2,112,548 | ..... | 2,022,320 |
| 1844 | 264,227 | 3,164 | 261,063 | 3,350,501 | ..... | 3,089,438 |
| 1845 | 290,165 | 321 | 289,844 | 4,507,124 | ..... | 4,217,256 |
| 1846 | 288,834 | 213 | 288,621 | 3,453,398 | ..... | 3,164,777 |
| 1847 | 481,607 | 100,028 | 381,579 | 3,468,033 | ..... | 3,086,454 |
| 1848 | 832,508 | 246,865 | 585,643 | 1,980,963 | ..... | 1,395,319 |
| 1849 | 645,917 | 135,706 | 510,211 | 2,547,654 | ..... | 2,037,443 |
| 1850 | 561,125 | 143,948 | 417,177 | 2,824,818 | ..... | 2,407,641 |
| 1851 | 782,751 | 173,359 | 609,392 | 3,294,691 | ..... | 2,685,299 |
| 1852 | 622,734 | 208,004 | 414,730 | 2,282,442 | ..... | 1,867,612 |
| 1853 | 1,142,541 | 363,859 | 778,682 | 3,279,413 | ..... | 2,500,731 |
| 1854 | 1,177,677 | 381,724 | 795,953 | 3,044,301 | ..... | 2,248,348 |
| 1855 | 1,055,113 | 354,080 | 701,033 | 3,516,894 | ..... | 2,815,861 |
| 1856 | 2,269,184 | 279,278 | 1,989,906 | 3,356,797 | ..... | 1,366,891 |
| 1857 | 2,143,135 | 262,965 | 1,880,170 | 3,739,644 | ..... | 1,859,474 |
| 1858 | 2,289,678 | 230,580 | 2,059,098 | 3,550,295 | ..... | 1,491,197 |
| 1859 | 2,646,358 | 199,716 | 2,446,642 | 4,462,974 | ..... | 2,016,332 |
| 1860 | 2,724,824 | 242,421 | 2,482,403 | 4,156,480 | ..... | 1,674,077 |
| 1861 | 2,211,265 | 184,798 | 2,026,467 | 4,451,515 | ..... | 2,425,048 |
| 1862 | 1,328,525 | 56,076 | 1,272,449 | 3,987,298 | ..... | 2,714,849 |
| 1863 | 1,464,372 | 131,260 | 1,333,112 | 5,056,006 | ..... | 3,722,894 |
| 1864 | 2,078,991 | 138,804 | 1,940,187 | 4,306,303 | ..... | 2,366,116 |
| 1865 | 2,583,860 | 144,150 | 2,439,710 | 4,795,619 | ..... | 2,355,909 |
| 1866 | 4,375,109 | 129,019 | 4,246,090 | 3,562,519 | $683,571 | ..... |
| 1867 | 2,330,077 | 429,951 | 1,900,126 | 3,663,634 | ..... | 1,763,508 |
| 1868 | 1,658,766 | 353,890 | 1,304,876 | 3,717,248 | ..... | 2,412,372 |
| 1869 | 2,790,357 | 312,498 | 2,411,309 | 3,001,720 | ..... | 590,411 |
| 1870 | 3,070,407 | 315,844 | 2,685,523 | 2,870,517 | ..... | 184,994 |
| 1871 | 2,897,293 | 376,018 | 2,461,276 | 2,994,037 | ..... | 532,761 |
| 1872 | 2,754,277 | 347,136 | 2,433,970 | 3,443,171 | ..... | 1,009,201 |
| 1873 | 3,726,183 | 544,090 | 3,176,280 | 3,320,406 | ..... | 144,126 |
| 1874 | 3,874,239 | 206,800 | 3,666,301 | 3,566,743 | 99,558 | ..... |
| 1875 | 3,704,028 | 217,456 | 3,597,088 | 4,844,847 | ..... | 1,247,139 |
| 1876 | 3,255,831 | 153,492 | 3,177,309 | 5,806,445 | ..... | 2,629,136 |
| 1877 | 2,935,269 | 235,781 | 2,796,990 | 5,734,675 | ..... | 2,937,685 |
| 1878 | 3,788,836 | 237,034 | 3,592,079 | 6,436,248 | ..... | 2,844,169 |
| 1879 | 3,839,368 | 298,759 | 3,546,276 | 6,281,288 | ..... | 2,735,012 |
| 1880 | 4,374,973 | 244,242 | 4,115,454 | 5,248,131 | ..... | 1,132,677 |
| 1881 | 4,995,860 | 210,166 | 4,759,133 | 5,554,834 | ..... | 795,701 |
| 1882 | 5,142,311 | 361,480 | 4,771,871 | 6,213,358 | ..... | 1,441,487 |
| 1883 | 6,050,780 | 356,213 | 5,647,650 | 6,279,720 | ..... | 632,070 |
| 1884 | 6,713,176 | 447,815 | 6,361,715 | 5,664,885 | 696,830 | ..... |
| 1885 | 5,909,429 | 328,514 | 5,647,123 | 6,018,745 | ..... | 371,622 |
| 1886 | 4,604,843 | 376,075 | 4,084,719 | 5,264,646 | ..... | 1,179,927 |
| 1887 | 5,162,125 | 455,115 | 4,732,719 | 5,154,180 | ..... | 421,361 |
| 1888 | 5,808,813 | 514,350 | 5,183,610 | 5,518,552 | ..... | 334,942 |
| 1889 | 5,790,558 | 326,079 | 5,364,345 | 7,063,339 | ..... | 1,698,994 |
| 1890 | 6,355,955 | 552,195 | 5,811,560 | 7,458,385 | ..... | 1,646,825 |
| 1891 | 7,511,608 | 435,063 | 6,980,035 | 6,210,577 | 769,458 | ..... |
| 1892 | 7,107,456 | 391,099 | 6,687,446 | 5,403,587 | 1,283,859 | ..... |
| 1893 | 8,227,195 | 416,941 | 7,708,189 | 5,541,878 | 2,166,311 | ..... |
| 1894 | 6,926,807 | 621,408 | 6,276,903 | 4,258,306 | 2,018,597 | ..... |
| Total | 167,422,617 | 14,339,675 | 152,735,501 | 274,096,530 | ..... | 121,361,029 |

It appears from the preceding summary that prior to 1839 the imports of fishery products were of small extent, averaging less than $50,000 annually. A considerable increase then followed, but until 1891 the domestic exports each year greatly exceeded the imports for consumption with only three exceptions. The exceptions were in 1866, 1874, and 1884, and were caused by unusual trade conditions, resulting from the beginning and ending of free-trade relations with the British Provinces. The imports for consumption have so increased that since 1891 they have greatly exceeded the domestic exports.

*Trade in each class of fishery products.*—Table 2 shows for each kind of product (1) the imports for consumption, (2) the domestic exports, (3) the total trade, (4) the percentage of the total trade, and (5 and 6) the balance of trade during the year ending June 30, 1894. The individual items most prominent in the statement of total trade are pickled mackerel, 10.81 per cent; marine shells, 10.55 per cent; canned salmon, 9.75 per cent; pickled herring, 9.15 per cent; dried cod, 8.61 per cent, and sardines, 8.55 per cent. It appears that the trade in pickled or brine-salted fish represents 22.76 per cent of the total trade; canned goods, 20.65 per cent, and dried and fresh fish, 11.12 and 5.81 per cent, respectively. The fresh fish entering into the foreign trade are nearly all imported, the exports, which amount to about 8 per cent of the imports, consisting of haddock and other fish shipped to Montreal, Quebec, and other places in Canada. Of dried fish, the exports exceed the imports by about 200 per cent; in the pickled-fish trade the imports are about eight times as valuable as the exports; but the trade in canned goods is almost equally divided between imports and exports, with an excess slightly in favor of the latter.

2. *Classified statement of the extent and relation of the foreign fishery-trade of the United States during the year ending June 30, 1894.*

| Designation. | Imports for consumption. | Domestic exports. | Total trade. | Percentage of total trade. | Excess of imports for consumption over exports. | Excess of exports over imports for consumption. |
|---|---|---|---|---|---|---|
| Fresh fish: | | | | | | |
| Salmon | $156,163 | ..... | $156,163 | 1.48 | $156,163 | ..... |
| Herring— | | | | | | |
| Bait | 2,829 | ..... | 2,829 | .03 | 2,829 | ..... |
| Food | 3,090 | ..... | 3,090 | .03 | 3,090 | ..... |
| Other fresh fish | 401,309 | $48,820 | 450,129 | 4.27 | 352,489 | ..... |
| Total fresh | 563,391 | 48,820 | 612,211 | 5.81 | 514,571 | ..... |
| Dried, smoked, or cured fish: | | | | | | |
| Cod, haddock, hake, etc | 202,725 | 704,052 | 907,377 | 8.61 | ..... | $501,927 |
| Herring | 23,570 | 123,882 | 147,452 | 1.40 | ..... | 100,312 |
| Others | 66,406 | 50,966 | 117,372 | 1.11 | 15,440 | ..... |
| Total dried, etc | 292,701 | 879,500 | 1,172,201 | 11.12 | 15,440 | 602,239 |
| Pickled or brine-salted fish: | | | | | | |
| Herring | 950,268 | 13,457 | 963,725 | 9.15 | 936,811 | ..... |
| Mackerel | 1,095,702 | 43,082 | 1,138,784 | 10.81 | 1,052,620 | ..... |
| Salmon | 84,442 | 58,659 | 143,101 | 1.36 | 25,783 | ..... |
| Others | 16,368 | 135,859 | 152,227 | 1.44 | ..... | 119,491 |
| Total brine-salted | 2,146,780 | 251,057 | 2,397,837 | 22.76 | 2,015,214 | 119,491 |

2. *Classified statement of the extent and relation of the foreign fishery-trade of the United States during the year ending June 30, 1894*—Continued.

| Designation. | Imports for consumption. | Domestic exports. | Total trade. | Percentage of total trade. | Excess of imports for consumption over exports. | Excess of exports over imports for consumption. |
|---|---|---|---|---|---|---|
| Canned fish: | | | | | | |
| Salmon | $620 | $1,026,215 | $1,026,835 | 9.75 | ..... | $1,025,595 |
| Sardines | 900,780 | ..... | 900,780 | 8.55 | $900,780 | ..... |
| Others | 103,901 | 143,402 | 247,303 | 2.35 | ..... | 39,501 |
| Total canned | 1,005,301 | 1,169,617 | 2,174,918 | 20.65 | 900,780 | 1,065,096 |
| Shellfish, etc.: | | | | | | |
| Lobsters (fresh), shrimp and turtle | 199,199 | 249,721 | 448,920 | 4.26 | ..... | 50,522 |
| Lobsters, canned | 574,710 | ..... | 574,710 | 5.45 | 574,710 | ..... |
| Oysters, fresh and canned | ..... | 688,653 | 688,653 | 6.54 | ..... | 688,653 |
| All other fish and shellfish | ..... | 204,833 | 204,833 | 1.94 | ..... | 204,833 |
| Total shellfish, etc | 773,909 | 1,143,207 | 1,917,116 | 18.19 | 574,710 | 944,008 |
| Miscellaneous products: | | | | | | |
| Ambergris | 5,112 | ..... | 5,112 | .05 | 5,112 | ..... |
| Coral | 1,911 | ..... | 1,911 | .02 | 1,911 | ..... |
| Isinglass or fish glue | 5,934 | ..... | 5,934 | .06 | 5,934 | ..... |
| Oils, marine | 184,510 | 140,851 | 325,361 | 3.09 | 43,659 | ..... |
| Seaweeds | 4,174 | ..... | 4,174 | .04 | 4,174 | ..... |
| Shells | 1,037,152 | 74,328 | 1,111,480 | 10.55 | 962,824 | ..... |
| Skins, fish and shark | 5 | 993 | 998 | .01 | ..... | 988 |
| Sounds, fish | 36,375 | ..... | 36,375 | .35 | 36,375 | ..... |
| Spermaceti | ..... | 99,467 | 99,467 | .94 | ..... | 99,467 |
| Sponges | 217,456 | 8,497 | 225,953 | 2.14 | 208,959 | ..... |
| Whalebone | 2,192 | 441,969 | 444,161 | 4.22 | ..... | 439,777 |
| Total miscellaneous | 1,494,821 | 766,105 | 2,260,926 | 21.47 | 1,268,948 | 540,232 |
| Grand total | 6,276,903 | 4,258,306 | 10,535,209 | 100.00 | 2,018,597 | ..... |

*The trade with each country.*—The extent of trade with each country appears in Table 3, showing the value of fishery products imported from and exported to, and the balance of trade with each foreign country during the year ending June 30, 1894. In this table omission is made of ambergris, coral, cuttle-fish bone, seaweed and skins, the customs returns not being in sufficient detail to permit a statement of the trade in these articles with each country. As the customs returns do not show the imports for consumption from each country, it is necessary in this compilation to use the extent of the imports, although the former would furnish a better basis for comparison.

3. *Statement of the fishery-trade (exclusive of ambergris, coral, cuttle-fish bone, seaweed, and skins) with each foreign country during the year ending June 30, 1894.*

| Countries. | Imports. | Domestic exports. | Excess of imports over exports. | Excess of exports over imports. |
|---|---|---|---|---|
| Europe: | | | | |
| Austria-Hungary | $168,391 | ..... | $168,391 | ..... |
| Azores, and Madeira Islands | 79 | $2,079 | ..... | $2,000 |
| Belgium | 22,436 | 5,483 | 16,953 | ..... |
| Denmark | 1,298 | 1,017 | 281 | ..... |
| France | 1,029,242 | 198,968 | 830,274 | ..... |
| Germany | 90,865 | 438,333 | ..... | 347,468 |
| Greece | 11,867 | ..... | 11,867 | ..... |
| Italy | 30,355 | 5,044 | 25,311 | ..... |
| Netherlands | 502,755 | 58,845 | 443,910 | ..... |
| Portugal | 47,478 | 10 | 47,468 | ..... |
| Russia | ..... | 1,280 | ..... | 1,280 |
| Spain | 1,168 | 2,111 | ..... | 943 |
| Sweden and Norway | 627,390 | 552 | 626,838 | ..... |

3. *Statement of the fishery-trade (exclusive of ambergris, coral, cuttle-fish bone, seaweed, and skins) with each foreign country during the year ending June 30, 1894*—Continued.

| Countries. | Imports. | Domestic exports. | Excess of imports over exports. | Excess of exports over imports. |
|---|---|---|---|---|
| Europe—Continued. | | | | |
| Switzerland | $3,223 | | $3,223 | |
| United Kingdom— | | | | |
| England | 782,628 | $1,304,493 | | $521,865 |
| Ireland | 111,477 | | 111,477 | |
| Scotland | 256,185 | 70,143 | 186,042 | |
| Total Europe | 3,686,837 | 2,088,958 | | |
| North America: | | | | |
| Canada— | | | | |
| Nova Scotia and New Brunswick | 2,058,543 | 18,222 | 2,040,321 | |
| Quebec and Ontario | 173,339 | 234,097 | | 60,758 |
| British Columbia | 107,125 | 17,407 | 89,718 | |
| Newfoundland and Labrador | 136,305 | 343 | 135,962 | |
| Miquelon, Langley, etc | 117,255 | 175 | 117,080 | |
| Mexico | 33,947 | 49,336 | | 15,389 |
| Central America— | | | | |
| Costa Rica | 1,214 | 20,263 | | 19,049 |
| Guatemala | | 8,442 | | 8,442 |
| Honduras | 268 | 2,234 | | 1,966 |
| Nicaragua | 1,714 | 9,081 | | 7,367 |
| San Salvador | | 2,226 | | 2,226 |
| British Honduras | 82 | 6,636 | | 6,554 |
| Bermuda | 60 | 6,433 | | 6,373 |
| West Indies— | | | | |
| British | 146,135 | 103,584 | 42,551 | |
| Danish | 4,716 | 1,892 | 2,824 | |
| Dutch | 85 | 10,440 | | 10,355 |
| French | 100 | 5,045 | | 5,845 |
| Haiti | 1,712 | 652,723 | | 651,011 |
| Santo Domingo | 2,328 | 82,599 | | 80,271 |
| Spanish— | | | | |
| Cuba | 42,466 | 117,752 | | 75,286 |
| Puerto Rico | 411 | 6,353 | | 5,942 |
| Total North America | 2,827,805 | 1,356,183 | | |
| South America: | | | | |
| Argentina | | 15,700 | | 15,700 |
| Brazil | 1,285 | 61,383 | | 60,098 |
| Chili | | 16,057 | | 16,057 |
| Colombia | 44,918 | 27,631 | 17,287 | |
| Ecuador | | 6,578 | | 6,578 |
| Guianas— | | | | |
| British | | 30,867 | | 30,867 |
| Dutch | | 29,499 | | 29,499 |
| French | | 8,460 | | 8,460 |
| Peru | | 5,101 | | 5,101 |
| Uruguay | | 3,887 | | 3,887 |
| Venezuela | 5,904 | 36,071 | | 30,077 |
| Total South America | 52,107 | 241,234 | | |
| Asia and Oceanica: | | | | |
| China | 38,156 | 3,064 | 35,092 | |
| East Indies, British | 6,136 | 5,800 | 336 | |
| Dutch | 167 | | 107 | |
| Hongkong | 11,231 | 175,743 | | 164,512 |
| Japan | 28,794 | 1,230 | 27,564 | |
| Russia | 396 | | 396 | |
| Turkey | 6,001 | | 6,001 | |
| British Australasia | 3,311 | 235,086 | | 231,775 |
| French Oceanica | 224,757 | 11,431 | 213,326 | |
| Philippine Islands | 479 | | 479 | |
| Hawaiian Islands | 39 | 105,101 | | 105,062 |
| Total Asia and Oceanica | 319,467 | 537,455 | | |
| Africa: | | | | |
| British Africa | | 24,220 | | 24,220 |
| Canary Islands | | 314 | | 314 |
| French Africa | 355 | | 355 | |
| Liberia | | 2,095 | | 2,095 |
| Total Africa | 355 | 26,629 | | |
| All other islands and ports | 1,746 | 7,847 | | 2,017 |
| Grand total | 6,888,407 | 4,258,306 | | |

The most extensive fishery trade is carried on with the Dominion of Canada, the aggregate value of the imports from and exports to those provinces in 1894 being $2,608,733, nearly all of which represents imports. Ranking next in extent of fishery-trade are England, France, Haiti, Sweden and Norway, Netherlands, and Germany, respectively. The following summary shows the extent of the trade in 1894 with those countries with which it generally exceeds $100,000:

4. *Statement of the total fishery-trade (exclusive of ambergris, coral, cuttle-fish bone, seaweed, and skins) with each principal foreign country during the year ending June 30, 1894.*

| Designation. | Imports. | Domestic exports. | Total. | Per-centage of total. |
|---|---|---|---|---|
| Canada | $2,339,007 | $269,726 | $2,608,733 | 23.39 |
| England | 782,628 | 1,304,493 | 2,087,121 | 18.72 |
| France | 1,029,242 | 198,968 | 1,228,210 | 11.02 |
| Haiti | 1,712 | 652,723 | 654,435 | 5.87 |
| Sweden and Norway | 627,390 | 552 | 627,942 | 5.63 |
| Netherlands | 502,755 | 58,845 | 561,600 | 5.04 |
| Germany | 90,865 | 438,333 | 529,198 | 4.74 |
| Scotland | 256,185 | 70,143 | 326,328 | 2.93 |
| British West Indies | 146,135 | 103,584 | 249,719 | 2.24 |
| French Oceanica | 224,757 | 11,431 | 236,188 | 2.13 |
| British Australasia | 3,311 | 235,086 | 238,397 | 2.14 |
| Hongkong | 11,231 | 175,743 | 186,974 | 1.68 |
| Newfoundland | 136,305 | 343 | 136,648 | 1.22 |
| Austria-Hungary | 168,391 | ..... | 168,391 | 1.51 |
| Cuba | 42,466 | 117,752 | 160,218 | 1.44 |
| Miquelon, Langley, etc | 117,255 | 175 | 117,430 | 1.05 |
| Ireland | 111,477 | ..... | 111,477 | 1.00 |
| Hawaiian Islands | 39 | 105,101 | 105,140 | .94 |
| All others | 207,256 | 515,308 | 812,564 | 7.31 |
| Total | 6,888,407 | 4,258,306 | 11,146,713 | 100.00 |

## II.—THE IMPORT TRADE.

*Imports from 1821 to 1853.*—As fish were among the principal food resources of the United States during its early history, it is not remarkable that the imports of fishery products were of small extent. With the increase of the fisheries of the British North American Provinces, the marketing of the products of those fisheries was gradually extended in this country. Those products were largely pickled mackerel, salmon, herring, shad, etc., dried cod, and fish oil. The total imports increased in value from $13,186 in 1821 to $1,142,541 in 1853. From 1821 to 1853 inclusive, the total value of fishery products imported aggregated $7,776,706, of which $7,330,268 worth, or 94 per cent, were received from the British Provinces. During this period, however, the exports of foreign fishery-products amounted to $1,536,900, leaving $6,239,806 as the value imported for consumption in this country.

Table 5, modified from a compilation[1] of the Bureau of Statistics, United States Treasury Department, shows in classified form the annual imports of fishery products during each year from 1821 to 1853, inclusive, and a separate statement of the value of the annual imports from the British North American Provinces and from all other countries.

5. *Classified statement of the imports of fishery products into the United States during each year from 1821 to 1853, inclusive.*

| Year ending— | Dried or smoked fish. | | Brine-salted or pickled fish. | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Salmon. | | Mackerel. | | Herring and shad. | |
| | Quintals. | Values. | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. |
| Sept. 30, 1821 | 346 | ..... | 1,048 | ..... | 7 | ..... | (a) | (a) |
| 1822 | 712 | ..... | 1,244 | ..... | 387 | ..... | (a) | (a) |
| 1823 | 2,909 | ..... | 1,507 | ..... | 67 | ..... | (a) | (a) |
| 1824 | 1,144 | ..... | 4,574 | ..... | 790 | ..... | (a) | (a) |
| 1825 | 1,628 | ..... | 1,540 | ..... | 242 | ..... | (a) | (a) |
| 1826 | 757 | ..... | 1,013 | ..... | 87 | ..... | (a) | (a) |
| 1827 | 685 | ..... | 1,540 | ..... | 39 | ..... | (a) | (a) |
| 1828 | 434 | ..... | 730 | ..... | 38 | ..... | (a) | (a) |
| 1829 | 492 | ..... | 699 | ..... | 95 | ..... | (a) | (a) |
| 1830 | 351 | ..... | 1,621 | ..... | 391 | ..... | (a) | (a) |
| 1831 | 1,363 | ..... | 2,315 | ..... | 4,552 | ..... | (a) | (a) |
| 1832 | 1,359 | ..... | 2,104 | ..... | 32 | ..... | (a) | (a) |
| 1833 | 6,068 | ..... | 1,652 | ..... | 20 | ..... | (a) | (a) |
| 1834 | 824 | $7,795 | 2,009 | $22,616 | 223 | $691 | (a) | (a) |
| 1835 | 1,379 | 13,425 | 2,546 | 28,606 | 8,163 | 29,316 | (a) | (a) |
| 1836 | 1,872 | 12,178 | 2,976 | 35,884 | 6,037 | 36,470 | (a) | (a) |
| 1837 | 2,043 | 13,528 | 3,543 | 50,035 | 1,256 | 9,089 | (a) | (a) |
| 1838 | 2,015 | 14,111 | 3,790 | 58,791 | 182 | 1,595 | (a) | (a) |
| 1839 | 4,295 | 24,303 | 5,338 | 73,768 | 7,046 | 60,374 | (a) | (a) |
| 1840 | 4,001 | 19,355 | 4,860 | 78,232 | 11,823 | 114,590 | (a) | (a) |
| 1841 | 2,433 | 19,262 | 4,951 | 72,317 | 10,887 | 116,450 | (a) | (a) |
| 1842 | 1,265 | 5,186 | 4,093 | 54,079 | 8,194 | 58,812 | (a) | (a) |
| June 30, 1843 | 188 | 1,411 | 2,640 | 26,993 | 12,334 | 57,457 | c 899 | c $2,048 |
| 1844 | 360 | 3,067 | (a) | (a) | (a) | (a) | (a) | (a) |
| 1845 | 1,297 | 9,646 | (a) | (a) | (a) | (a) | (a) | (a) |
| 1846 | 875 | 9,319 | (a) | (a) | (a) | (a) | (a) | (a) |
| 1847 | 8,274 | 25,711 | (a) | (a) | (a) | (a) | (a) | (a) |
| 1848 | 51,826 | 127,799 | 7,633 | 80,944 | 122,594 | 535,128 | (a) | (a) |

[1] Quarterly report of the Chief of the Bureau of Statistics, Treasury Department, for the three months ending December 31, 1886, p. 406.

a Included with "All other fish."

c Exclusive of 1844–1847.

5. *Classified statement of the imports of fishery products into the United States during each year from 1821 to 1853, inclusive*—Continued.

| Year ending— | Dried or smoked fish. | | Brine-salted or pickled fish. | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Salmon. | | Mackerel. | | Herring and shad. | |
| | Quintals. | Values. | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. |
| June 30, 1849... | 22,520 | $43,709 | 8,244 | $81,200 | 138,505 | $465,286 | 13,961 | $29,761 |
| 1850... | 25,115 | 45,961 | 8,721 | 85,447 | 75,491 | 335,736 | 10,868 | 37,037 |
| 1851... | 14,795 | 27,769 | 7,964 | 85,705 | 102,638 | 549,525 | 21,714 | 54,449 |
| 1852... | 49,299 | 55,171 | 7,947 | 96,526 | 78,334 | 327,613 | 26,696 | 73,584 |
| 1853... | 97,507 | 214,016 | 7,235 | 94,341 | 54,411 | 329,233 | 66,584 | 159,027 |
| Total.... | 310,461 | *b* 692,722 | *c* 106,677 | *d* 1,026,084 | *c* 644,855 | *d* 3,027,374 | *e* 140,222 | *e* 355,006 |

| Year ending— | All other fish. | | Whale and fish oil. | | Total values. | Imported from— | |
|---|---|---|---|---|---|---|---|
| | Barrels. | Values. | Gallons. | Values. | | British North American provinces. | All other countries. |
| Sept. 30, 1821.... | 116 | ..... | 418 | ..... | *h* $13,186 | $12,223 | $963 |
| 1822.... | 95 | ..... | 1,194 | ..... | *h* 19,255 | 18,831 | 424 |
| 1823.... | 268 | ..... | 2,231 | ..... | *h* 31,914 | 30,466 | 1,448 |
| 1824.... | 651 | ..... | 786 | ..... | *h* 43,411 | 42,968 | 443 |
| 1825.... | 778 | ..... | 200 | ..... | *h* 29,500 | 29,337 | 163 |
| 1826.... | 242 | ..... | 194 | ..... | *h* 18,841 | 18,649 | 192 |
| 1827.... | 101 | ..... | 238 | ..... | *h* 24,971 | 24,537 | 434 |
| 1828.... | 187 | ..... | 4,609 | ..... | *h* 10,469 | 9,944 | 525 |
| 1829.... | 138 | ..... | 1,372 | ..... | *h* 16,182 | 15,343 | 839 |
| 1830.... | 715 | ..... | 96 | ..... | *h* 27,624 | 27,001 | 623 |
| 1831.... | 454 | ..... | 456 | ..... | *h* 49,421 | 47,686 | 1,735 |
| 1832.... | 264 | ..... | 421 | ..... | *h* 28,584 | 28,318 | 266 |
| 1833.... | 840 | ..... | 6,571 | ..... | *h* 45,649 | 42,714 | 2,935 |
| 1834.... | 1,515 | $11,838 | 34 | $15 | 42,955 | 35,562 | 7,393 |
| 1835.... | 3,144 | 15,435 | 4,088 | 1,497 | 88,279 | 82,172 | 6,107 |
| 1836.... | 5,094 | 30,774 | 1,421 | 588 | 115,894 | 90,611 | 25,283 |
| 1837.... | 3,111 | 24,828 | 767 | 564 | 98,044 | 84,081 | 13,963 |
| 1838.... | 3,521 | 21,775 | 781 | 299 | 96,571 | 90,364 | 6,207 |
| 1839.... | 14,489 | 71,489 | 400,151 | 112,821 | 342,755 | 219,934 | 122,821 |
| 1840.... | 8,810 | 48,979 | 37,236 | 14,196 | 275,352 | 257,881 | 17,471 |
| 1841.... | 2,175 | 14,149 | 6,705 | 2,849 | 225,036 | 215,029 | 10,007 |
| 1842.... | 1,791 | 8,754 | 3,573 | 1,102 | 128,533 | 122,767 | 5,766 |
| June 30, 1843.... | 1,391 | 3,704 | 771 | 258 | 91,871 | 89,183 | 2,688 |
| 1844.... | 43,542 | 261,013 | 297 | 147 | 264,227 | 261,349 | 2,878 |
| 1845.... | 30,506 | 280,519 | (*g*) | (*g*) | 290,165 | 283,178 | 6,987 |
| 1846.... | 31,402 | 279,515 | (*g*) | (*g*) | 288,834 | 284,584 | 4,250 |
| 1847.... | 91,113 | 452,357 | 11,706 | 3,539 | 481,607 | 470,107 | 11,500 |
| 1848.... | 23,344 | 71,774 | 84,077 | 16,863 | 832,508 | 816,687 | 15,821 |
| 1849.... | 5,363 | 13,097 | 39,609 | 12,864 | 645,917 | 615,554 | 30,363 |
| 1850.... | 13,300 | 38,451 | 44,765 | 18,403 | 561,125 | 522,942 | 38,183 |
| 1851.... | 21,016 | 64,022 | 3,220 | 1,281 | 782,751 | 765,489 | 17,262 |
| 1852.... | 20,083 | 65,993 | 8,803 | 3,847 | 622,734 | 603,534 | 19,200 |
| 1853.... | 31,153 | 90,143 | 541,332 | 255,781 | 1,142,541 | 1,071,243 | 71,298 |
| Total..... | 360,712 | *f* 1,868,609 | 1,207,582 | *f* 447,004 | 7,776,706 | 7,330,268 | 446,438 |

*b* Exclusive of 1821-1833.
*c* Exclusive of 1844-1847.
*d* Exclusive of 1821-1833 and 1844-1847.
*e* Exclusive of 1821-1842 and 1844-1848.
*f* Exclusive of 1821-1833.
*g* Not known.
*h* Exclusive of whale and fish oil, the value of which is unknown.

*Imports from 1854 to 1868.*—The annual imports during each year from 1854 to 1868, inclusive, are shown in Table 6. From September 11, 1854, to March 17, 1866, fishery products from the British North American Provinces were admitted into this country free of duty. As the classification of the receipts from the Provinces differed somewhat from the classification of other receipts, a separate statement is made of the imports not under reciprocity and those under reciprocity treaty. This compilation, like Table 5, shows the extent of the imports, and it should be considered with Table 1 to learn the value of the imports for consumption.

6. *Classified statement of the imports of fishery products into the United States during each year from 1854 to 1868, inclusive.*

| Year ending June 30— | Imports not under reciprocity treaty. | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Fish, dried or smoked. | | Pickled or brine-salted fish. | | | | | |
| | | | Salmon. | | Mackerel. | | Herring. | |
| | Quintals. | Values. | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. |
| 1854 | 76,074 | $181,469 | 6,810 | $94,335 | 62,499 | $477,131 | 61,485 | $158,348 |
| 1855 | 111,913 | 265,934 | 6,316 | 85,796 | 80,990 | 432,431 | a46,902 | 129,938 |
| 1856 | 65,908 | 158,233 | 685 | 3,100 | 81 | 138 | a 3,587 | 22,808 |
| 1857 | 43,994 | 96,607 | 700 | 3,940 | 20 | 144 | a 8,831 | 49,213 |
| 1858 | 41,151 | 111,709 | 337 | 2,446 | 45 | 369 | 3,892 | 18,905 |
| 1859 | 40,450 | 107,615 | 1,127 | 6,763 | 5,067 | 6,661 | 7,756 | 39,001 |
| 1860 | 66,417 | 149,217 | 4 | 111 | 58 | 258 | 5,489 | 38,308 |
| 1861 | 53,448 | 120,462 | 132 | 1,110 | 110 | 695 | 5,053 | 28,367 |
| 1862 | (b) | (b) | 58 | 460 | ..... | ..... | c2,595 | 22,400 |
| 1863 | (b) | (b) | 88 | 419 | ..... | ..... | c3,332 | 29,037 |
| 1864 | (b) | (b) | 72 | 956 | ..... | ..... | c4,342 | 34,569 |
| 1865 | (b) | (b) | 13 | 188 | 10 | 152 | 4,107 | 38,394 |
| 1866 | (b) | (b) | 786 | 4,317 | 5,312 | 48,121 | 8,842 | 81,761 |
| 1867 | (b) | (b) | 6,670 | 129,051 | 77,503 | 675,986 | 102,929 | 396,948 |
| 1868 | (b) | (b) | 6,546 | 90,287 | 41,656 | 364,439 | 62,650 | 291,435 |
| Total | d499,415 | d1,191,246 | 30,344 | 423,294 | 273,351 | 2,006,525 | 331,801 | 1,379,432 |

| Year ending June 30— | Imports not under reciprocity treaty—Continued. | | | | | | |
|---|---|---|---|---|---|---|---|
| | Sardines in oil. | All other fish. | | Whale and fish oil. | | Total. | |
| | Values. | Barrels. | Values. | Gallons. | Values. | Values. | |
| 1854 | (e) | 41,652 | $149,824 | 243,334 | $116,570 | $1,177,677 | |
| 1855 | (e) | 26,050 | 86,231 | 103,844 | 36,050 | 1,036,980 | |
| 1856 | (e) | 454 | 2,658 | 18,430 | 8,044 | 194,087 | |
| 1857 | (e) | 706 | 4,633 | 36,558 | 17,693 | 172,230 | |
| 1858 | $274,137 | 980 | 5,209 | 37,437 | 18,627 | 431,402 | |
| 1859 | 251,278 | 1,763 | 8,073 | 7,220 | 3,504 | 423,495 | |
| 1860 | 299,079 | 757 | 4,990 | 185,908 | 41,903 | 534,466 | |
| | | *Pounds.* | | | | | |
| 1861 | 220,624 | 194,850 | 6,538 | 73,325 | 29,662 | 413,453 | |
| 1862 | 180,417 | 1,152,934 | 20,747 | 26,983 | 14,428 | 250,452 | |
| 1863 | 383,223 | 3,071,842 | 77,343 | 42,808 | 17,184 | 507,206 | |
| 1864 | 504,079 | 1,702,166 | 45,262 | 34,097 | 16,970 | 601,836 | |
| 1865 | 304,713 | 743,173 | 20,002 | 11,397 | 6,427 | 370,476 | |
| 1866 | 937,020 | 5,539,948 | 133,842 | 178,496 | 117,409 | 1,323,370 | |
| 1867 | 478,619 | 14,318,175 | 466,289 | 300,152 | 183,184 | 2,330,077 | |
| 1868 | 471,707 | 13,347,948 | 372,389 | 125,006 | 68,509 | 1,658,766 | |
| Total | 4,318,396 | ..... | 1,411,225 | 1,425,840 | 696,764 | 11,426,882 | |

| Year ending June 30— | Imports under reciprocity treaty with British North American provinces. | | | | | | | | All imports. |
|---|---|---|---|---|---|---|---|---|---|
| | Fish, dried or smoked. | | Fish, pickled or brine-salted. | | All other fish. | Whale and fish oil. | | Total. | |
| | Pounds. | Values. | Barrels. | Values. | Values. | Gallons. | Values. | Values. | Values. |
| 1854 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | $1,177,677 |
| 1855 | 256,892 | $8,211 | 1,038 | $5,582 | $5,408 | 1,458 | $932 | $18,133 | 1,055,113 |
| 1856 | 19,569,744 | 528,788 | 240,585 | 1,330,268 | 29,705 | 249,189 | 179,340 | 2,074,197 | 2,269,184 |
| 1857 | 18,289,717 | 470,416 | 226,064 | 1,162,933 | 62,365 | 364,888 | 275,182 | 1,970,896 | 2,143,135 |
| 1858 | 10,446,060 | 341,855 | 235,090 | 1,172,916 | 182,898 | 269,059 | 160,607 | 1,858,276 | 2,280,678 |
| 1859 | 15,244,423 | 422,505 | 278,774 | 1,328,969 | 156,559 | 558,350 | 314,830 | 2,222,863 | 2,646,358 |
| 1860 | 8,847,090 | 313,491 | 301,917 | 1,389,852 | 256,417 | 428,660 | 230,598 | 2,190,358 | 2,724,824 |
| 1861 | 13,577,887 | 415,201 | 202,976 | 945,603 | 305,192 | 245,230 | 131,816 | 1,797,812 | 2,211,265 |
| 1862 | 5,046,947 | 143,602 | 179,076 | 678,093 | 102,272 | 110,665 | 64,106 | 1,078,073 | 1,328,525 |
| 1863 | 12,257,852 | 253,925 | 94,220 | 384,011 | 198,613 | 206,124 | 120,617 | 957,166 | 1,464,372 |
| 1864 | 17,894,506 | 290,647 | 152,327 | 781,090 | 331,348 | 90,570 | 74,070 | 1,477,155 | 2,078,991 |
| 1865 | 15,010,007 | 288,501 | 240,412 | 1,510,257 | 391,088 | 87,766 | 23,588 | 2,213,384 | 2,583,860 |
| 1866 | (e) | 383,561 | (e) | 1,527,352 | 799,213 | (e) | 341,013 | 3,051,739 | 4,375,109 |
| 1867 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2,330,077 |
| 1868 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 1,658,766 |
| Total | f132,040,643 | 3,858,703 | f2,152,485 | 12,222,926 | 2,911,108 | f2,561,965 | 1,917,255 | 20,910,052 | 32,336,934 |

a Including shad.
b Included with "All other fish."
c Including mackerel.
d Exclusive of 1862–1868.
e Not known.
f Exclusive of 1866.

*Imports from 1869 to 1894.*—Table 7 shows in classified form the values of all fishery products imported for consumption during each year from 1869 to 1894, inclusive. This statement covers the period in which the imports have made the greatest increase, the value during the last four years of this series being 176 per cent greater than during the first four years. This increase has occurred in nearly all articles, but it is most pronounced in case of brine-salted or pickled fish, shell-fish, miscellaneous canned fish, and miscellaneous fishery products.

7. *Classified statement of the imports for consumption of fishery products into the United States during each year from 1869 to 1894, inclusive.*

| Year ending June 30— | Fresh or frozen. | Dried or smoked. | Brine-salted. | Canned fish and shell-fish. | |
|---|---|---|---|---|---|
| | | | | Sardines. | Others. |
| 1869 | Unknown. | $287,934 | $908,039 | $640,159 | $33,218 |
| 1870 | do | 263,982 | 896,976 | 980,989 | 33,990 |
| 1871 | do | 249,691 | 863,803 | 912,555 | 40,784 |
| 1872 | $242,675 | 130,039 | 696,942 | 683,095 | 71,470 |
| 1873 | 279,320 | 190,693 | 980,726 | 986,769 | 84,308 |
| 1874 | 297,532 | 247,046 | 1,360,316 | 886,677 | 260,016 |
| 1875 | 346,315 | 347,296 | 1,228,135 | 610,705 | 416,264 |
| 1876 | 274,091 | 292,925 | 1,293,221 | 587,880 | 124,300 |
| 1877 | 315,858 | 321,240 | 926,406 | 722,097 | 42,491 |
| 1878 | 342,729 | 409,066 | 1,489,003 | 681,673 | 40,916 |
| 1879 | 283,734 | 454,338 | 1,187,207 | 833,302 | 68,887 |
| 1880 | 321,161 | 519,030 | 1,114,267 | 1,115,662 | 101,381 |
| 1881 | 376,722 | 795,853 | 1,301,135 | 956,022 | 176,349 |
| 1882 | 474,529 | 913,441 | 1,210,711 | 796,279 | 356,626 |
| 1883 | 572,533 | 1,290,527 | 1,548,009 | 773,629 | 371,684 |
| 1884 | 708,170 | 1,279,025 | 2,044,845 | 976,754 | 283,082 |
| 1885 | 736,765 | 1,242,800 | 1,694,214 | 677,068 | 419,619 |
| 1886 | 668,887 | 524,548 | 906,833 | 762,879 | 324,099 |
| 1887 | 754,209 | 511,991 | 1,398,223 | 817,675 | 357,364 |
| 1888 | 867,490 | 581,439 | 1,469,971 | 940,036 | 486,995 |
| 1889 | 928,344 | 609,306 | 1,476,888 | 806,097 | 614,023 |
| 1890 | 879,205 | 535,374 | 1,988,307 | 764,506 | 632,128 |
| 1891 | 652,271 | 434,822 | 2,410,868 | 1,000,843 | 1,044,615 |
| 1892 | 510,870 | 364,933 | 2,114,247 | 1,175,892 | 629,270 |
| 1893 | 535,104 | 401,299 | 2,196,226 | 1,258,158 | 696,258 |
| 1894 | 563,391 | 292,701 | 2,146,780 | 900,780 | 679,231 |
| Total | 11,931,905 | 13,491,429 | 36,852,298 | 22,249,081 | 8,389,368 |

| Year ending June 30— | Shellfish and turtles. | Fish sounds, isinglass, etc. | Marine oils. | Miscellaneous products. | Total values. |
|---|---|---|---|---|---|
| 1869 | | $8,719 | $426,874 | $100,366 | $2,411,309 |
| 1870 | $3,808 | 8,089 | 369,167 | 128,522 | 2,685,523 |
| 1871 | 4,260 | 6,542 | 204,228 | 179,413 | 2,461,276 |
| 1872 | 8,984 | 28,437 | 158,504 | 413,824 | 2,433,970 |
| 1873 | 10,920 | 123,750 | 119,788 | 400,006 | 3,176,280 |
| 1874 | 60,152 | 96,244 | 163,046 | 295,272 | 3,606,301 |
| 1875 | 129,382 | 52,401 | 185,404 | 281,786 | 3,597,688 |
| 1876 | 13,356 | 42,322 | 151,249 | 397,965 | 3,177,309 |
| 1877 | 15,175 | 32,236 | 119,340 | 301,247 | 2,796,990 |
| 1878 | 12,071 | 104,552 | 211,847 | 300,222 | 3,592,079 |
| 1879 | 4,835 | 202,765 | 125,547 | 385,661 | 3,546,276 |
| 1880 | 15,859 | 198,025 | 223,139 | 506,930 | 4,115,454 |
| 1881 | 15,243 | 243,239 | 361,956 | 532,614 | 4,759,133 |
| 1882 | 31,642 | 169,148 | 270,250 | 549,245 | 4,771,871 |
| 1883 | 39,516 | 189,575 | 280,575 | 581,602 | 5,647,650 |
| 1884 | 30,472 | 129,224 | 373,773 | 536,370 | 6,361,715 |
| 1885 | 55,469 | 166,305 | 209,845 | 445,038 | 5,647,123 |
| 1886 | 64,632 | 181,784 | 88,811 | 562,246 | 4,084,719 |
| 1887 | 76,452 | 185,662 | 85,839 | 545,304 | 4,732,719 |
| 1888 | 105,161 | 176,843 | 92,515 | 463,160 | 5,183,610 |
| 1889 | 123,093 | 112,302 | 105,938 | 588,264 | 5,364,345 |
| 1890 | 125,831 | 63,186 | 95,947 | 727,076 | 5,811,560 |
| 1891 | 180,783 | 112,100 | 113,775 | 1,029,952 | 6,980,035 |
| 1892 | 207,221 | 76,093 | 151,000 | 1,457,920 | 6,687,446 |
| 1893 | 255,780 | 74,198 | 285,593 | 2,005,573 | 7,708,189 |
| 1894 | 199,199 | 42,309 | 184,510 | 1,268,002 | 6,276,903 |
| Total | 1,789,296 | 2,826,056 | 5,158,460 | 14,989,580 | 117,677,473 |

A series of tables is next presented, showing in detail the quantities and values of the various kinds of fishery products included in each classification noted in the preceding table.

The fresh fish consist principally of various sea fish received from Nova Scotia, fish caught on the north side of the Great Lakes, and of salmon. The extent of these imports increased almost constantly until 1891, when a duty of one-fourth of a cent per pound was imposed on herring and three-fourths of a cent on salmon and all other fresh fish, all being admitted free of duty previous to that time. While this duty had little effect on the receipts of salmon and other valuable species, yet it diminished very considerably the imports of cheaper fish, such as hake, herring, etc. The average value of all fresh fish received in 1889 was only $1.92 per 100 pounds; in 1894 it was $4.87 per 100 pounds, the increase being due almost entirely to an elimination of the cheap grades. The customs returns do not present a very extensive classification of the fresh fish imported, but such returns as are available are given in Table 8.

8. *Statement of the fresh fish imported for consumption into the United States during each year from 1872 to 1894, inclusive.*

| Year ending June 30— | Mackerel. | | Salmon. | | Trout. | |
|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| 1884 | (a) | (a) | 1,015,923 | $120,318 | (a) | (a) |
| 1885 | (a) | (a) | 1,336,541 | 152,822 | (a) | (a) |
| 1886 | (a) | (a) | 1,303,704 | 144,719 | (a) | (a) |
| 1887 | (a) | (a) | 1,583,464 | 119,361 | (a) | (a) |
| 1888 | 1,418,330 | $76,514 | 768,727 | 77,726 | 2,156,307 | $67,907 |
| 1889 | 546,547 | 27,640 | 1,011,456 | 104,875 | 3,229,531 | 104,992 |
| 1890 | 783,079 | 44,596 | 873,014 | 91,022 | 3,192,409 | 105,804 |
| 1891 | 736,779 | 22,166 | 844,940 | 80,649 | (a) | (a) |
| 1892 | (a) | (a) | 1,242,760 | 105,565 | (a) | (a) |
| 1893 | (a) | (a) | 1,238,605 | 116,124 | (a) | (a) |
| 1894 | (a) | (a) | 1,891,742 | 156,163 | (a) | (a) |

| Year ending June 30— | Whitefish. | | All others. | | Total. | |
|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| 1872 | | | | | 7,647,482 | $242,675 |
| 1873 | | | | | 8,386,624 | 279,320 |
| 1874 | | | | | 9,332,878 | 297,532 |
| 1875 | | | | | 14,887,205 | 346,315 |
| 1876 | | | | | 12,327,015 | 274,091 |
| 1877 | | | | | 13,453,033 | 315,858 |
| 1878 | | | | | 9,914,296 | 342,729 |
| 1879 | | | | | 7,949,063 | 283,734 |
| 1880 | | | | | 10,780,051 | 321,101 |
| 1881 | | | | | 13,066,101 | 376,722 |
| 1882 | | | | | 15,321,009 | 474,529 |
| 1883 | | | | | 15,860,390 | 572,533 |
| 1884 | (a) | (a) | 18,910,363 | $587,852 | 19,926,286 | 708,170 |
| 1885 | (a) | (a) | 18,315,020 | 583,943 | 19,651,561 | 736,765 |
| 1886 | (a) | (a) | 19,702,995 | 624,168 | 21,006,699 | 768,887 |
| 1887 | (a) | (a) | 26,911,790 | 634,848 | 28,495,254 | 754,209 |
| 1888 | 2,870,054 | $105,675 | 26,165,772 | 539,668 | 33,388,190 | 867,490 |
| 1889 | 3,048,791 | 100,221 | 40,557,570 | 584,616 | 48,393,895 | 928,344 |
| 1890 | 2,648,678 | 86,103 | 33,373,961 | 551,680 | 40,871,201 | 879,205 |
| 1891 | (a) | (a) | 22,030,351 | 549,456 | 23,012,070 | 652,271 |
| 1892 | (a) | (a) | 9,370,965 | 405,305 | 10,613,725 | 510,870 |
| 1893 | (a) | (a) | 10,867,641 | 418,980 | 12,106,246 | 535,104 |
| 1894 | (a) | (a) | 9,681,799 | 407,228 | 11,573,541 | 563,391 |

a Classed with "All others."

Table 9 shows the quantities and values of dried cod, smoked herring, and other dried or smoked fish imported for consumption. A duty of one-half cent per pound was imposed on these imports prior to 1891, and since then it has been three-fourths of a cent per pound, the effect of this increase being apparent in the diminished receipts in 1891 and the following years. The large and abrupt decrease in imports in 1886 was due to the termination of the Washington treaty, which admitted free of duty fish from the British North American Provinces. The slight difference in the imports of dried or smoked fish during the first and the last year here reported is somewhat noticeable.

9. *Statement of the dry-salted and smoked fish imported for consumption into the United States during each year from 1869 to 1894, inclusive.*

| Year ending June 30— | Cod, haddock, hake, etc. | | Herring. | | Others. | | Total. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds.* | Values. | Pounds. | Values. | Pounds. | Values. |
| 1869 | (a) | (a) | (a) | (a) | 8,943,318 | $287,934 | 8,943,318 | $287,934 |
| 1870 | (a) | (a) | (a) | (a) | 7,209,130 | 263,982 | 7,209,130 | 263,982 |
| 1871 | (a) | (a) | (a) | (a) | 6,762,520 | 249,691 | 6,762,520 | 249,691 |
| 1872 | (a) | (a) | (a) | (a) | 3,558,990 | 130,039 | 3,558,990 | 130,039 |
| 1873 | (a) | (a) | (a) | (a) | 5,128,404 | 190,693 | 5,128,404 | 190,693 |
| 1874 | (a) | (a) | 1,029,095 | $34,670 | 7,227,130 | 212,376 | 8,256,225 | 247,046 |
| 1875 | (a) | (a) | 1,547,245 | 63,223 | 8,284,969 | 284,073 | 9,832,214 | 347,296 |
| 1876 | (a) | (a) | 1,535,950 | 57,560 | 6,728,177 | 235,365 | 8,264,127 | 292,925 |
| 1877 | (a) | (a) | 1,582,853 | 39,459 | 6,389,522 | 281,781 | 7,972,375 | 321,240 |
| 1878 | (a) | (a) | 2,109,150 | 52,715 | 11,088,603 | 356,351 | 13,197,753 | 409,066 |
| 1879 | (a) | (a) | 1,912,355 | 46,975 | 12,336,836 | 407,363 | 14,249,191 | 454,338 |
| 1880 | (a) | (a) | 2,543,075 | 69,986 | 15,074,528 | 449,044 | 17,617,603 | 519,030 |
| 1881 | (a) | (a) | 3,384,215 | 92,604 | 23,670,336 | 703,249 | 27,054,551 | 795,853 |
| 1882 | (a) | (a) | 5,441,805 | 134,378 | 24,190,551 | 779,063 | 29,632,356 | 913,441 |
| 1883 | (a) | (a) | 3,283,890 | 120,014 | 27,427,083 | 1,170,513 | 30,710,973 | 1,290,527 |
| 1884 | 26,828,085 | $993,489 | 8,330,041 | 137,975 | 8,904,676 | 147,561 | 39,063,402 | 1,279,025 |
| 1885 | 32,326,086 | 943,116 | 10,441,355 | 129,034 | 4,843,457 | 170,050 | 47,611,498 | 1,242,800 |
| 1886 | 10,998,072 | 286,505 | 4,246,970 | 64,457 | 5,402,340 | 173,586 | 20,647,382 | 524,548 |
| 1887 | 8,997,750 | 264,260 | 5,533,802 | 86,390 | 5,252,836 | 161,341 | 19,784,388 | 511,991 |
| 1888 | 10,446,892 | 316,259 | 3,994,101 | 80,007 | 4,759,754 | 178,573 | 19,200,747 | 581,439 |
| 1889 | 9,752,941 | 317,687 | 4,226,839 | 122,027 | 5,040,840 | 109,682 | 19,020,020 | 609,396 |
| 1890 | 8,303,585 | 247,327 | 4,824,261 | 99,362 | 5,525,606 | 188,085 | 18,653,452 | 535,374 |
| 1891 | 6,845,576 | 254,074 | 3,723,654 | 91,032 | 2,152,448 | 89,716 | 12,721,678 | 434,822 |
| 1892 | 5,804,548 | 229,255 | 2,294,150 | 52,442 | 1,839,126 | 83,236 | 9,941,833 | 364,933 |
| 1893 | 7,433,163 | 291,531 | 1,710,634 | 33,815 | 1,702,958 | 75,953 | 10,936,755 | 401,299 |
| 1894 | 5,408,750 | 202,725 | 852,480 | 28,570 | 1,728,111 | 66,406 | 8,049,341 | 292,701 |
| Total ... | b133,206,048 | b4,346,228 | c74,548,529 | c1,638,295 | 216,262,249 | 7,506,906 | 424,020,826 | 13,491,429 |

*From 1874 to 1883, inclusive, the weight is estimated at 5 pounds per box.
a Included with "Others."
b Exclusive of 1869-1883.
c Exclusive of 1869-1873.

Brine-salted fish constitute the most important class of fishery products imported into this country. Herring and mackerel are the most important species, the others being salmon, cod, etc. Of the 5,054,554 barrels of brine-salted fish imported for consumption during the twenty-six years ending in 1894, as shown in Table 10, 56 per cent were herring, 37 per cent mackerel, and 3 per cent salmon. However, the herring only slightly exceeded the mackerel in total value, the imports of the former being worth $16,978,802, and of the latter $16,401,462. The imports of pickled fish vary somewhat from year to year, yet the general increase is quite noticeable.

The rate of duty on herring and mackerel during the period herein reported has been uniformly $1 and $2 per barrel, respectively. On salmon, previous to 1884, the duty was $3 per barrel, and since then only $2 per barrel. The rate of duty on other pickled fish was $1.50 previous to 1884 and $2 per barrel since then. These tariff rates, however, did not relate to the imports from the British North American Provinces during the operation of the Washington treaty.

10. *Statement of the brine-salted or pickled fish imported for consumption into the United States during each year from 1869 to 1894, inclusive.*

| Year ending June 30— | Herring. | | Mackerel. | | Salmon. | | Others.[a] | | Total. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. |
| 1869 | 91,568 | $425,213 | 27,481 | $306,696 | 8,455 | $110,591 | 9,782 | $65,539 | 137,236 | $908,039 |
| 1870 | 87,284 | 398,596 | 28,480 | 291,528 | 10,629 | 137,055 | 9,961 | 69,797 | 136,345 | 896,976 |
| 1871 | 62,022 | 356,760 | 28,479 | 309,074 | 9,356 | 145,264 | 7,003 | 52,705 | 106,860 | 863,803 |
| 1872 | 62,475 | 332,707 | 39,572 | 247,701 | 5,344 | 80,171 | 7,455 | 36,363 | 114,846 | 696,942 |
| 1873 | 63,498 | 352,235 | 70,651 | 523,577 | 4,579 | 73,231 | 4,555 | 31,683 | 143,283 | 980,726 |
| 1874 | 82,730 | 433,999 | 90,874 | 806,089 | 4,875 | 65,026 | 9,770 | 54,602 | 188,258 | 1,360,316 |
| 1875 | 98,191 | 516,978 | 78,132 | 587,349 | 4,812 | 62,940 | 9,893 | 60,879 | 190,528 | 1,228,135 |
| 1876 | 107,319 | 493,102 | 76,599 | 695,917 | 4,200 | 49,970 | 8,852 | 54,172 | 196,970 | 1,293,221 |
| 1877 | 76,699 | 397,522 | 44,178 | 373,897 | 5,438 | 61,783 | 16,390 | 93,254 | 142,705 | 926,406 |
| 1878 | 95,308 | 431,832 | 102,001 | 907,081 | 8,596 | 109,309 | 5,403 | 40,781 | 211,308 | 1,489,003 |
| 1879 | 77,037 | 383,494 | 101,453 | 650,067 | 9,586 | 108,363 | 7,175 | 45,283 | 195,251 | 1,187,207 |
| 1880 | 74,559 | 445,620 | 112,308 | 492,934 | 8,258 | 118,259 | 11,944 | 57,454 | 207,159 | 1,114,267 |
| 1881 | 93,987 | 519,342 | 120,361 | 615,162 | 5,848 | 91,382 | 15,838 | 75,249 | 236,034 | 1,301,135 |
| 1882 | 114,300 | 649,900 | 57,802 | 394,323 | 4,751 | 86,478 | 12,802 | 80,010 | 189,715 | 1,210,711 |
| 1883 | 150,440 | 914,433 | 52,073 | 427,476 | 4,725 | 93,639 | 17,537 | 112,461 | 224,775 | 1,548,009 |
| 1884 | 165,019 | 976,816 | 88,231 | 873,680 | 6,447 | 100,946 | 16,205 | 93,403 | 275,902 | 2,044,845 |
| 1885 | 183,818 | 858,240 | 92,147 | 702,030 | 5,621 | 73,000 | 12,984 | 60,935 | 294,570 | 1,694,214 |
| 1886 | 92,660 | 617,035 | 31,848 | 222,716 | 4,398 | 40,073 | 2,930 | 21,009 | 131,836 | 900,833 |
| 1887 | 107,189 | 748,321 | 64,925 | 563,855 | 4,588 | 67,092 | 2,841 | 18,955 | 179,543 | 1,398,223 |
| 1888 | 126,104 | 826,251 | 56,646 | 548,073 | 4,673 | 68,916 | 3,853 | 26,731 | 191,270 | 1,469,971 |
| 1889 | 112,453 | 796,651 | 42,394 | 574,722 | 4,903 | 77,070 | 8,437 | 28,445 | 163,247 | 1,476,888 |
| 1890 | 123,831 | 880,238 | 71,038 | 1,011,921 | 3,989 | 68,102 | 3,550 | 28,046 | 202,408 | 1,988,307 |
| 1891 | 128,363 | 954,697 | 113,276 | 1,356,113 | *b* 4,836 | 79,959 | 2,796 | 20,099 | 249,271 | 2,410,868 |
| 1892 | 150,602 | 1,167,376 | 88,209 | 863,191 | *b* 4,307 | 60,918 | 3,622 | 22,762 | 246,831 | 2,114,247 |
| 1893 | 163,050 | 1,151,112 | 84,217 | 900,588 | *b* 4,546 | 63,722 | 2,747 | 20,804 | 254,560 | 2,196,226 |
| 1894 | 141,476 | 950,268 | 94,836 | 1,095,702 | *b* 5,508 | 84,442 | 2,017 | 16,368 | 243,837 | 2,146,780 |
| Total | 2,831,992 | 16,978,802 | 1,858,361 | 16,401,462 | 153,409 | 2,184,251 | 210,792 | 1,287,783 | 5,054,554 | 36,852,298 |

[a] For quantities and values of pickled cod among "Others," see p. 476.
[b] On basis of 200 pounds to the barrel, see p. 510.

The quantity of each form of sardines imported is shown in Table 49, on page 504.

The "other canned fish and shellfish" comprises all in oil exclusive of sardines, and fish and shellfish canned without oil, the latter including canned lobsters, herring, mackerel, salmon, eels, etc. A classification

of these imports more in detail than previously given appears in the following table. Since 1869 a duty of 30 per cent ad valorem has been imposed on fish prepared in oil. On those canned without oil a duty of 35 per cent ad valorem was imposed previous to 1884; from 1884 to 1891 the rate has been 25 per cent, and since then 30 per cent.

11. *Statement of the canned fish and shellfish, exclusive of sardines, imported for consumption into the United States from 1869 to 1894, inclusive.*

| Year ending June 30— | In oil, etc., exclusive of sardines. | Plain canned, or without oil. | | | | | Total. |
|---|---|---|---|---|---|---|---|
| | | Lobsters. | Salmon. | Herring. | Mackerel. | All other. | |
| 1869 | $30,861 | (a) | (a) | (a) | (a) | $2,457 | $33,318 |
| 1870 | 30,465 | (a) | (a) | (a) | (a) | 3,525 | 33,990 |
| 1871 | 34,173 | (a) | (a) | (a) | (a) | 6,611 | 40,784 |
| 1872 | 40,041 | (a) | (a) | (a) | (a) | 31,429 | 71,470 |
| 1873 | 27,175 | (a) | (a) | (a) | (a) | 57,133 | 84,308 |
| 1874 | 15,811 | (a) | (a) | (a) | (a) | 244,205 | 260,016 |
| 1875 | 27,117 | (a) | (a) | (a) | (a) | 389,147 | 416,264 |
| 1876 | 27,490 | (a) | (a) | (a) | (a) | 96,810 | 124,300 |
| 1877 | 15,996 | (a) | (a) | (a) | (a) | 26,495 | 42,491 |
| 1878 | 15,849 | (a) | (a) | (a) | (a) | 25,067 | 40,916 |
| 1879 | 13,835 | (a) | (a) | (a) | (a) | 55,052 | 68,887 |
| 1880 | 14,647 | (a) | (a) | (a) | (a) | 86,734 | 101,381 |
| 1881 | 21,056 | (a) | (a) | (a) | (a) | 155,293 | 176,349 |
| 1882 | 31,362 | (a) | (a) | (a) | (a) | 325,264 | 356,626 |
| 1883 | 24,272 | (a) | (a) | (a) | (a) | 347,412 | 371,684 |
| 1884 | 35,914 | $193,587 | $285 | (a) | (a) | 53,296 | 283,082 |
| 1885 | 22,387 | 357,730 | 9 | (a) | (a) | 39,493 | 419,619 |
| 1886 | 19,982 | 252,054 | 3,503 | (a) | (a) | 48,560 | 324,099 |
| 1887 | 17,528 | 267,901 | 719 | (a) | (a) | 71,216 | 357,364 |
| 1888 | 25,097 | 412,863 | 1,102 | $3,022 | $5,536 | 39,375 | 486,995 |
| 1889 | 27,614 | 522,547 | 2,193 | 3,503 | 1,894 | 56,272 | 614,023 |
| 1890 | 27,725 | 568,150 | 479 | 2,894 | 3,445 | 29,435 | 632,128 |
| 1891 | *b* 64,769 | 906,008 | 388 | 6,514 | 6,936 | (c) | 1,044,615 |
| 1892 | *b* 51,380 | 561,778 | 88 | 10,712 | 5,312 | (c) | 629,270 |
| 1893 | *b* 71,167 | 609,741 | 56 | 14,286 | 1,008 | (c) | 696,258 |
| 1894 | *b* 88,877 | 574,710 | 620 | 13,106 | 1,918 | (c) | 679,231 |

*a* Included with "All other, plain canned."
*b* Includes "All other, plain canned."
*c* Included with "In oil, etc."

"Shellfish and turtles" consists principally of fresh lobsters received from Nova Scotia. It also includes fresh and prepared shrimp, crawfish, and other shellfish and turtles. All of these products are admitted free of duty. It is impossible to give a classification of the separate articles, other than is afforded by Table 64, on page 522, showing the countries from which they were received during a series of recent years.

The quantity and value of each variety of fish sounds and isinglass imported for consumption are shown in Table 77, and similar data for marine oils are given in Table 67.

The miscellaneous fishery products comprise ambergris, ambergris oil, coral, seaweed, shells of marine mollusks and crustaceans, skins of various fishes, spermaceti in the form of candles, sponges, and whalebone. The value of the imports of these separate articles is shown in Table 12, but a more extensive account of the varieties, quantities, and values is given in other tables of this report.

12. *Statement of the values of miscellaneous fishery products imported for consumption during each year from 1869 to 1894, inclusive.*

| Year ending June 30— | Ambergris. | Ambergris oil. | Coral, crude and manufactured. | Dulse, or sea weed. | Shells, rough and manufactured. | Skins, fish and shark. | Spermaceti candles. | Sponges. | Whalebone, uncut and manufactured. | Total. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1869 | ..... | ..... | $22,417 | $3,504 | $1,826 | ..... | $2,545 | $74,731 | $1,343 | $106,366 |
| 1870 | ..... | ..... | 18,975 | 2,890 | 8,441 | ..... | 3,932 | 93,952 | 332 | 128,522 |
| 1871 | ..... | ..... | 37,877 | 1,094 | 22,244 | ..... | 4,762 | 113,127 | 309 | 179,413 |
| 1872 | $1,328 | ..... | 59,081 | ..... | 188,283 | ..... | 8,029 | 153,443 | 3,060 | 413,824 |
| 1873 | 1,110 | $31 | 64,035 | ..... | 136,138 | ..... | 3,666 | 189,986 | 5,040 | 400,006 |
| 1874 | 4,046 | 322 | 28,080 | ..... | 129,887 | ..... | 4,789 | 121,798 | 5,750 | 295,272 |
| 1875 | 5,217 | ..... | 34,845 | ..... | 125,649 | ..... | 1,963 | 110,440 | 3,672 | 281,786 |
| 1876 | 1,700 | 706 | 33,668 | 1,611 | 257,241 | ..... | 3,969 | 87,621 | 11,449 | 397,965 |
| 1877 | 694 | 745 | 29,368 | 859 | 172,251 | ..... | 6,302 | 88,798 | 2,230 | 301,247 |
| 1878 | 93 | 185 | 13,919 | ..... | 187,507 | ..... | 6,991 | 90,127 | 1,400 | 300,222 |
| 1879 | 3,215 | ..... | 11,474 | ..... | 231,743 | ..... | 4,618 | 130,515 | 4,090 | 385,661 |
| 1880 | ..... | 2,962 | 5,554 | 45 | 294,730 | ..... | 6,422 | 183,690 | 13,527 | 506,930 |
| 1881 | 55 | 2,402 | 2,591 | 1,577 | 288,154 | $75 | 2,794 | 229,292 | 5,614 | 532,614 |
| 1882 | 5,408 | ..... | 2,143 | ..... | 239,231 | 37 | 5,974 | 293,621 | 2,831 | 549,245 |
| 1883 | 2,715 | 390 | 1,983 | ..... | 296,254 | 23 | 5,088 | 270,462 | 4,687 | 581,602 |
| 1884 | 4,015 | 92 | 158 | 979 | 258,639 | 173 | ..... | 241,874 | 30,440 | 536,370 |
| 1885 | 5,685 | ..... | 659 | 5,058 | 164,080 | 325 | ..... | 235,519 | 33,712 | 445,038 |
| 1886 | 1,673 | 175 | 218 | 2,051 | 245,848 | 35 | ..... | 296,963 | 14,683 | 562,246 |
| 1887 | 2,649 | 542 | 307 | 2,046 | 228,799 | 146 | ..... | 302,510 | 7,705 | 545,304 |
| 1888 | 6,774 | ..... | 594 | 5,190 | 178,839 | 1,395 | ..... | 268,651 | 1,708 | 463,160 |
| 1889 | 5,852 | ..... | 461 | 4,707 | 279,763 | 527 | ..... | 277,373 | 19,581 | 588,264 |
| 1890 | 1,454 | 2,920 | 531 | 4,699 | 340,654 | 605 | ..... | 352,885 | 23,328 | 727,076 |
| 1891 | 3,731 | 1,509 | 213 | 1,931 | 638,576 | 604 | ..... | 381,879 | 1,500 | 1,029,952 |
| 1892 | 1,288 | 427 | 1,378 | 3,150 | 1,116,536 | 320 | ..... | 331,241 | 3,580 | 1,457,920 |
| 1893 | 6,667 | ..... | 1,265 | 5,867 | 1,621,681 | 63 | ..... | 365,249 | 4,781 | 2,005,573 |
| 1894 | 5,112 | ..... | 1,911 | 4,174 | 1,037,152 | 5 | ..... | 217,456 | 2,192 | 1,268,002 |
| Total .. | 70,481 | 13,468 | 374,005 | 52,641 | 8,690,146 | 4,333 | 71,844 | 5,503,203 | 208,559 | 14,989,580 |

The quantities and values of fishery products imported for consumption in 1894 are presented in greater detail in the following compilation, showing (1) the items of fishery products imported, (2) the units of quantity used, (3) the quantities and (4) values imported, (5) average values per unit of quantity, (6) the rates of duty exacted, (7) the amount of duties collected, and (8) the average ad valorem rates of duty:

13. *Detailed statement of the fishery products imported for consumption during the year ending June 30, 1894.*

| Items. | Units of quantity. | Quantities. | Values. | Average values per unit of quantity. | Rates of duty. | Amount of duty. | Average ad valorem rates of duty. |
|---|---|---|---|---|---|---|---|
| Fish: | | | | | | | |
| Fresh— | | | | | | | |
| Herring— | | | | | | | *P. ct.* |
| Food | Pounds. | 211,991 | $3,090 | $0.014 | ½ c. per lb .. | $530 | 17.11 |
| Bait | ....do ... | 391,892 | 2,829 | .007 | Free ..... | ..... | Free. |
| Salmon | ....do ... | 1,891,742 | 156,163 | .083 | ½ c. per lb .. | 14,188 | 9.09 |
| Other fresh fish | ....do ... | 9,077,916 | 401,309 | .044 | .....do ..... | 68,084 | 16.97 |
| Total fresh | ....do ... | 11,573,541 | 563,391 | ..... | ..... | 82,802 | ..... |
| Dried or smoked— | | | | | | | |
| Cod, haddock, etc | ....do ... | 5,408,750 | 202,725 | .037 | ½ c. per lb .. | 41,016 | 20.23 |
| Herring | ....do ... | 852,480 | 23,570 | .028 | .....do ..... | 6,394 | 27.13 |
| Other dried or smoked fish | ....do ... | 1,728,111 | 66,406 | .038 | .....do ..... | 12,961 | 19.52 |
| Total dried or smoked | ....do ... | 8,049,341 | 292,701 | ..... | ..... | 60,371 | ..... |
| Pickled or brine-salted— | | | | | | | |
| Cod, haddock, etc | Barrels. | 20 | 112 | 5.60 | $2 per bbl.. | 41 | 36.25 |
| Herring | ....do ... | 141,476 | 950,268 | 6.73 | $1 per bbl.. | 141,476 | 14.89 |
| Mackerel | ....do ... | 94,836 | 1,095,702 | 11.55 | $2 per bbl.. | 189,672 | 17.31 |
| Salmon | Pounds. | 1,101,502 | 84,442 | .077 | 1 c. per lb .. | 11,015 | 13.04 |
| Other pickled fish | Barrels. | 1,996 | 16,256 | 8.14 | $2 per bbl.. | 3,993 | 24.56 |
| Total pickled | ..... | ..... | 2,146,780 | ..... | ..... | 346,197 | ..... |

13. *Detailed statement of the fishery products imported for consumption during the year ended June 30, 1894*—Continued.

| Items. | Units of quantity. | Quantities. | Values. | Average values per unit of quantity. | Rates of duty. | Amount of duty. | Average ad valorem rates of duty. |
|---|---|---|---|---|---|---|---|
| Fish—Continued. | | | | | | | |
| Canned— | | | | | | | *P. ct.* |
| Herring | | | $13,106 | | 30 per cent. | $3,932 | 30 |
| Mackerel | | | 1,918 | | ....do .... | 575 | 30 |
| Salmon | | | 620 | | ....do .... | 186 | 30 |
| Other canned fish | | | 88,877 | | .... do .... | 26,663 | 30 |
| Total canned | | | 104,521 | | | 31,356 | |
| Sardines— | | | | | | | |
| Whole boxes *a* | Boxes | 9,985 | 2,793 | $0.279 | 10 c. per box | 998 | 35.75 |
| Half boxes | ....do ... | 471,995 | 91,254 | .193 | 5 c. per box | 23,600 | 25.86 |
| Quarter boxes | ....do ... | 9,365,021 | 766,637 | .082 | 2½ c. per box | 234,126 | 30.54 |
| Other form | | | 40,096 | | 40 per cent. | 16,038 | 40 |
| Total sardines | | | 900,780 | | | 274,762 | |
| Crustaceans, etc.: | | | | | | | |
| Lobsters, canned | Pounds | 4,071,397 | 574,710 | .141 | Free | | Free. |
| Lobsters, fresh, and shrimp and turtles. | | | 199,199 | | Free | | Free. |
| Total crustaceans, etc. | | | 773,909 | | | | |
| Oils, marine: | | | | | | | |
| Cod-liver | Gallons | 209,865 | 99,318 | .48 | 15 c. per gall | 31,480 | 31.70 |
| Fish | ....do ... | 344,134 | 74,362 | .22 | 8 c. per gall | 27,531 | 37.02 |
| Seal | ....do ... | 7,869 | 2,956 | .37 | .....do ..... | 630 | 21.29 |
| Whale | ....do ... | 27,110 | 7,874 | .29 | .....do ..... | 2,169 | 27.54 |
| Total oil | ....do ... | 588,978 | 184,510 | | | 61,810 | |
| Miscellaneous products: | | | | | | | |
| Ambergris | Pounds | 37 | 5,112 | 138.162 | Free | | Free. |
| Coral— | | | | | | | |
| Uncut | | | 153 | | Free | | Free. |
| Manufactured | | | 1,758 | | 25 per cent. | 439 | 25 |
| Isinglass or fish glue, valued at— | | | | | | | |
| Above 7 cts. per lb | Pounds | 560 | 36 | .064 | 1½ c. per lb | 8 | 23.33 |
| From 7 to 30 cts. per lb. | ....do ... | 1,975 | 233 | .118 | 25 per cent. | 58 | 25 |
| Above 30 cts. per lb. | ....do ... | 2,817 | 5,665 | 2.011 | 30 per cent. | 1,670 | 30 |
| Seaweed, preparations (n. e. s.). | | | 4,174 | | 20 per cent. | 835 | 20 |
| Shells— | | | | | | | |
| Not ground or cut (n.e.s.) | | | 643,251 | | Free | | Free. |
| Mother-of-pearl— | | | | | | | |
| Not cut | | | 2,507 | | Free | | Free. |
| Manufactures of | | | 378,381 | | 40 per cent. | 151,353 | 40 |
| Cuttlefish bone | Pounds | 149,708 | 13,013 | .087 | Free | | Free. |
| Skins, fish and shark | | | 5 | | Free | | Free. |
| Sounds or bladders | Pounds | 199,571 | 30,375 | .152 | | | Free. |
| Sponges | | | 217,456 | | 20 per cent. | 43,491 | 20 |
| Whalebone— | | | | | | | |
| Not manufactured | Pounds | 640 | 669 | 1.045 | Free | | Free. |
| Manufactures of | | | 1,523 | | 30 per cent. | 457 | 30 |
| Total miscellaneous | | | 1,310,311 | | | 198,311 | |
| Grand total | | | 6,276,903 | | | 1,055,609 | 16.82 |

*a* Dimensions of whole boxes, 5 by 4 by 3½ inches; half boxes, 5 by 4 by 1⅝ inches; quarter boxes 4¾ by 3½ by 1¼ inches.

*Character of imports from each country.*—In considering the total fishery-trade with each country it is necessary to omit ambergris, coral, seaweeds, and skins, as the customs returns are not in sufficient detail to permit a statement of the trade in those articles with each foreign country. The total value of fishery imports, omitting the above-enumerated articles, averages about $6,000,000 annually, principally from Nova Scotia, France, England, Norway and Sweden, Netherlands, and Scotland. The value of the fishery products imported during the

year ending June 30, 1894, was $6,888,407, of which Nova Scotia and New Brunswick sent $2,058,543, France $1,029,242, England $782,628, Norway and Sweden $627,390, and Netherlands $502,755.

The Nova Scotia fishery products imported into the United States are principally canned and fresh lobsters, pickled mackerel, and dried cod. The imports from France consist almost entirely of sardines. Norway and Sweden send principally pickled mackerel, pickled herring, and cod oil. Over 99 per cent of the imports from the Netherlands represents pickled herring. The imports of fishery products from the West Indies, Mexico, and the Central and South American Republics are small, their total value in 1894 being as follows: West Indies, $197,953; Mexico, $33,947; Central America, $3,278, and South America, $52,197; a total of $287,375, consisting largely of marine shells, sponges, shrimp, and fish sounds. This added to the $2,475,312, the value of fish received from Canada and Newfoundland, $117,255 from Miquelon, and $60 from Bermuda, makes a total of $2,880,002 received from the American continent. The receipts from Europe amounted to $3,686,837, consisting principally of sardines, pickled herring, mackerel, marine shells, and sponges. The imports of shells, shrimp, dried fish, oil, etc., from Asia and Oceanica aggregated $319,467, leaving $2,101 as the receipts from African and other ports.

The following compilation shows the quantities and values of each fishery product imported into the United States during the year ending June 30, 1894. The totals necessarily differ from the statements of the imports for consumption, as explained on page 438.

14. *Statement by countries of the quantity and value of each fishery product imported into the United States during the year ending June 30, 1894.*

| Countries from which imported. | Fresh or frozen. | | | | | Dried, smoked, or cured. | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Salmon. | | Bait. | | Others. | Cod, haddock, hake, pollock, etc. | | Herring. | |
| | Lbs. | Values. | Lbs. | Values. | Values. | Lbs. | Values. | Lbs. | Values. |
| Europe: | | | | | | | | | |
| Azores, and Madeira Islands | | | | | | 250 | $13 | | |
| France | | | | | | 414,055 | 20,405 | | |
| Germany | | | | | | 20,654 | 1,040 | 1,090 | $35 |
| Italy | | | | | $2 | 1,561 | 63 | | |
| Netherlands | | | | | | | | 7,227 | 341 |
| Sweden and Norway | | | | | | 402,424 | 20,016 | 220,373 | 6,961 |
| United Kingdom— | | | | | | | | | |
| England | | | | | 280 | 3,200 | 173 | 110,314 | 4,864 |
| Scotland | | | | | | 1,000 | 49 | 10,296 | 752 |
| Total Europe | | | | | 282 | 843,744 | 41,759 | 349,300 | 12,953 |
| North America: | | | | | | | | | |
| Canada— | | | | | | | | | |
| Nova Scotia, New Brunswick, etc. | 1,242,040 | $115,971 | 19,900 | $269 | 278,876 | 8,154,544 | 299,255 | 2,875,648 | 63,939 |
| Quebec, Ontario, etc. | 645,824 | 39,996 | 1,665 | 50 | 113,159 | 8,080 | 293 | 1,800 | 100 |
| British Columbia | 3,872 | 219 | | | 10,250 | 515 | 27 | | |
| Newfoundland and Labrador | | | 371,992 | 2,560 | 250 | 1,216,394 | 52,764 | 1,000 | 16 |
| Miquelon, Langley, etc. | | | | | | 3,105,371 | 110,936 | | |
| Central America— | | | | | | | | | |
| Nicaragua | | | | | | 1,874 | 60 | | |
| Mexico | | | | | 576 | | | | |
| West Indies— | | | | | | | | | |
| Cuba | | | | | | 66,515 | 3,900 | | |
| Total North America | 1,892,336 | 156,186 | 393,557 | 2,879 | 403,111 | 12,553,293 | 467,247 | 2,878,448 | 64,115 |

14. *Statement by countries of the quantity and value of each fishery product imported into the United States during the year ending June 30, 1894*—Continued.

| Countries from which imported. | Fresh or frozen. | | | | | Dried, smoked, or cured. | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Salmon. | | Bait. | | Others. | Cod, haddock, hake, pollock, etc. | | Herring. | |
| | Lbs. | Values. | Lbs. | Values. | Values. | Lbs. | Values. | Lbs. | Values. |
| Asia: | | | | | | | | | |
| China | | | | | $30 | | | 60 | $11 |
| Hongkong | | | | | 39 | 7,383 | $249 | | |
| Japan | | | | | | 1,773 | 50 | | |
| Total Asia | | | | | 69 | 9,156 | 299 | 60 | 11 |
| Grand total | 1,892,336 | $156,186 | 393,557 | $2,879 | 403,462 | 13,406,193 | 509,305 | 3,227,808 | 77,079 |

| Countries from which imported. | Pickled or brine-salted. | | | | | | Sardines. | All other fish. |
|---|---|---|---|---|---|---|---|---|
| | Herring. | | Mackerel. | | Salmon. | | | |
| | Barrels. | Values. | Barrels. | Values. | Lbs. | Values. | Values. | Values. |
| Europe: | | | | | | | | |
| Austria-Hungary | | | | | | | $22 | |
| Azores, and Madeira Islands | | | | | | | | $66 |
| Belgium | | | | | | | 21,808 | 421 |
| Denmark | 24 | $70 | | | | | | 37 |
| France | | | 3 | $24 | | | 841,377 | 15,791 |
| Germany | 4,409 | 31,138 | | | | | 1,903 | 14,894 |
| Italy | 7 | 66 | 19 | 192 | 11 | $1 | 9,497 | 8,220 |
| Netherlands | 46,992 | 408,095 | 2 | 19 | | | | 751 |
| Portugal | | | | | | | 47,474 | 4 |
| Spain | | | | | | | 1,022 | 146 |
| Sweden and Norway | 38,753 | 151,993 | 16,777 | 280,381 | | | 30,427 | 44,485 |
| United Kingdom— | | | | | | | | |
| England | 1,178 | 6,600 | 27,078 | 323,954 | | | 21,026 | 23,521 |
| Ireland | 40 | 276 | 11,001 | 111,201 | | | | |
| Scotland | 31,128 | 200,524 | 3,975 | 38,345 | | | 59 | 15,198 |
| Total Europe | 122,531 | 888,762 | 58,855 | 754,116 | 11 | 1 | 974,615 | 123,534 |
| North America: | | | | | | | | |
| Dominion of Canada— | | | | | | | | |
| Nova Scotia and New Brunswick | 16,773 | 47,856 | 39,328 | 378,472 | 536,520 | 36,182 | | 78,287 |
| Quebec, Ontario, etc | 224 | 857 | 91 | 888 | 2,658 | 217 | 767 | 11,145 |
| British Columbia | | | | | 149,410 | 17,592 | | 78,883 |
| Newfoundland | 5,320 | 21,249 | 4 | 33 | 405,407 | 30,396 | | 14,077 |
| Miquelon, Langley, etc | 1,034 | 3,487 | | | | | | |
| Central America— | | | | | | | | |
| Honduras | | | | | | | 91 | |
| Nicaragua | 1 | 9 | | | | | | 34 |
| Mexico | | | | | | | 35 | 1,835 |
| West Indies— | | | | | | | | |
| Cuba | 1 | 11 | | | | | 1,340 | 736 |
| Total North America | 23,353 | 73,469 | 39,423 | 379,393 | 1,093,995 | 84,387 | 2,233 | 184,997 |
| South America: | | | | | | | | |
| Colombia | | | | | | | | 96 |
| Asia: | | | | | | | | |
| China | | | | | | | | 24,164 |
| Hongkong | 4 | 4 | | | 1,200 | 29 | | 6,969 |
| Japan | | | | | | | | 186 |
| Russia | 15 | 76 | | | 11,875 | 298 | | 22 |
| Total Asia | 19 | 80 | | | 13,075 | 327 | | 31,341 |
| Africa, French | | | | | | | 104 | 151 |
| All other islands and ports | | | | | | | | 17 |
| Grand total | 145,903 | 962,311 | 98,278 | 1,133,509 | 1,107,081 | 84,715 | 976,952 | 340,136 |

14. *Statement by countries of the quantity and value of each fishery product imported into the United States during the year ending June 30, 1894*—Continued.

| Countries from which imported. | Lobsters, canned. | | Lobsters, fresh, and shrimp and turtles. | Fish sounds. | | Fish and whale oil. | | Shells and manufactures of shells. | Sponges. | Total. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Lbs. | Values. | Values. | Lbs. | Values. | Gallons. | Values. | Values. | Values. | Values. |
| Europe: | | | | | | | | | | |
| Austria-Hungary | | | | | | | | $160,639 | $7,730 | $168,391 |
| Azores, and Madeira Islands | | | | | | | | | | 79 |
| Belgium | | | | | | 450 | $194 | 13 | | 22,436 |
| Denmark | | | | 11,527 | $1,191 | | | | | 1,298 |
| France | | | $144 | | | | | 148,612 | 2,889 | 1,029,242 |
| Germany | 140 | $22 | | 173 | 14 | 24,113 | 11,045 | 29,767 | 1,007 | 90,805 |
| Greece | | | | | | | | | 11,867 | 11,867 |
| Italy | | | | 219 | 10 | | | 11,394 | 910 | 30,355 |
| Netherlands | | | | | | | | 3,284 | 265 | 502,755 |
| Portugal | | | | | | | | | | 47,478 |
| Spain | | | | | | | | | | 1,168 |
| Sweden and Norway | | | | 214 | 38 | 196,202 | 93,089 | | | 627,390 |
| Switzerland | | | | | | | | 3,223 | | 3,223 |
| United Kingdom— | | | | | | | | | | |
| England | | | 51 | 55,896 | 17,464 | 11,203 | 5,523 | 320,399 | 58,773 | 782,628 |
| Ireland | | | | | | | | | | 111,477 |
| Scotland | | | | | | 3,356 | 1,258 | | | 256,185 |
| Total | 140 | 22 | 195 | 68,029 | 18,717 | 235,324 | 111,109 | 677,331 | 83,441 | 3,686,837 |
| North America: | | | | | | | | | | |
| Canada— | | | | | | | | | | |
| Nova Scotia and New Brunswick | 3,862,162 | 543,830 | 180,177 | 87,601 | 10,306 | 104,436 | 25,073 | 50 | | 2,058,543 |
| Quebec, Ontario | 35,560 | 5,122 | 429 | 45 | 23 | 542 | 233 | | | 173,339 |
| British Columbia | | | | | | 620 | 154 | | | 107,125 |
| Newfoundland and Labrador | 720 | 75 | | | | 55,353 | 14,885 | | | 136,305 |
| Miquelon, Langley | | | | | | 12,417 | 2,832 | | | 117,255 |
| Mexico | | | 2,825 | 530 | 104 | | | 28,572 | | 33,947 |
| Central America— | | | | | | | | | | |
| Costa Rica | | | | | | | | 1,214 | | 1,214 |
| Honduras | | | | | | | | 172 | 5 | 268 |
| Nicaragua | | | | | | | | 1,605 | | 1,714 |
| British Honduras | | | | | | | | | 82 | 82 |
| Bermuda | | | | | | | | 60 | | 60 |
| West Indies— | | | | | | | | | | |
| British | | | 2,217 | | | | | 3,769 | 140,149 | 146,135 |
| Danish | | | | | | | | 4,716 | | 4,716 |
| Dutch | | | 85 | | | | | | | 85 |
| French | | | | | | | | 100 | | 100 |
| Spanish, Cuba | | | 850 | 1,664 | 82 | | | | 35,541 | 42,466 |
| Puerto Rico | | | | | | | | 411 | | 411 |
| Haiti | | | | | | | | 1,712 | | 1,712 |
| Santo Domingo | | | | | | | | 2,328 | | 2,328 |
| Total | 3,898,442 | 549,027 | 186,583 | 89,840 | 10,515 | 173,377 | 43,177 | 44,709 | 175,777 | 2,827,805 |
| South America: | | | | | | | | | | |
| Brazil | | | | 9,664 | 1,266 | | | 19 | | 1,285 |
| Colombia | | | | | | | | 44,822 | | 44,918 |
| Venezuela | | | 75 | 33,437 | 5,912 | 10 | 7 | | | 5,994 |
| Total | | | 75 | 43,101 | 7,178 | 10 | 7 | 44,841 | | 52,197 |
| Asia and Oceanica: | | | | | | | | | | |
| China | | | 13,325 | | | 4,668 | 607 | 19 | | 38,156 |
| East Indies, British | | | | | | | | 6,136 | | 6,136 |
| Dutch | | | | | | | | 167 | | 167 |
| Hongkong | | | 3,483 | | | | | 458 | | 11,231 |
| Japan | | | 370 | | | 156,456 | 24,656 | 3,384 | 148 | 28,794 |
| Russia | | | | | | | | | | 396 |
| Turkey | | | | | | | | 5,021 | 80 | 6,001 |
| British Australasia | | | | | | | | 3,311 | | 3,311 |
| French Oceanica | | | | | | | | 224,757 | | 224,757 |
| Philippine Islands | | | | | | | | 479 | | 479 |
| Hawaiian Islands | | | | | | | | 39 | | 39 |
| Total | | | 17,178 | | | 161,124 | 25,263 | 244,671 | 228 | 319,467 |
| Africa, French | | | | | | | | 100 | | 355 |
| All other islands and ports | | | | | | | | 1,729 | | 1,746 |
| Grand total | 3,898,582 | 549,049 | 204,031 | 200,970 | 36,410 | 569,835 | 179,556 | 1,013,381 | 259,446 | 6,888,407 |

*Import duties from 1789 to 1894.*—Excepting a period of 23 years of reciprocity treaties (from September 11, 1854, to March 17, 1866, and from July 1, 1873, to June 30, 1885), when free trade in fishery products existed between the United States and the British North American Provinces, the principal products of the American fisheries have been protected by moderately heavy duties imposed on foreign importations.

The first customs act of the United States Congress (1st Cong., 1st sess., Ch. II) provided a duty of 50 cents per quintal on dried or cured fish, 75 cents per barrel on pickled fish, and 5 per cent on all other fishery products imported. In 1804 the rate on pickled fish was changed to 40 cents to $1 per barrel according to varieties, and in 1812 all duties on imported fishery products were doubled. Most of these duties were affected by the Clay compromise act of 1833. The developing trade in sardines, canned fish, etc., resulted in imposing a duty of 20 per cent ad valorem on those products in 1842 and fresh fish intended for immediate consumption were admitted free of duty. The Walker tariff act of 1846 made a uniform duty rate of 20 per cent ad valorem, except that 30 per cent was required on salted salmon and 40 per cent on sardines and canned fish. Since then these rates have been modified from time to time, the duties have been changed from ad valorem to specific and vice versa, and certain minor articles have been placed on the free list. The rates of duty collected on the various imported fishery products from the origin of the United States Government to the present time are shown in the following compilation:

15. *Comparative statement of the rates of import duty imposed on fishery products under the principal tariff enactments from July 4, 1789, to August 27, 1894, inclusive*

| Designation. | First Congress, first session, Ch. II, July 4, 1789, taking effect Aug. 1, 1789. | Eighth Congress, first session, Ch. LXVII, March 27, 1804, taking effect July 1, 1804. | Twelfth Congress, first session, Ch. CXII, July 1, 1812, taking effect July 1, 1812. | Fourteenth Congress, first session, Ch. CVII, April 27, 1816, taking effect July 1, 1816. | Twenty-seventh Congress, second session, Ch. CCLXX, Aug. 30, 1842, taking effect Aug. 30, 1842. |
|---|---|---|---|---|---|
| Fresh fish, for daily consumption. | ..... | ..... | ..... | ..... | Free. |
| Dried or smoked fish, all kinds. | 50 c. per quintal. | 50 c. per quintal. | $1 per quintal. | $1 per quintal | $1 per quintal. |
| Pickled or brine-salted fish: | | | | | |
| Herring | 75 c. per bbl. | 40 c. per bbl. | 80 c. per bbl. | $1 per bbl. | $1.50 per bbl. |
| Mackerel | | 60 c. per bbl. | $1.20 per bbl. | $1.50 per bbl. | $1.50 per bbl. |
| Salmon | | $1 per bbl. | $2 per bbl. | $2 per bbl. | $2 per bbl. |
| All other— | | | | | |
| In barrels | ..... | 40 c. per bbl. | 80 c. per bbl. | $1 per bbl. | $1 per bbl. |
| Not in barrels | ..... | ..... | ..... | ..... | 20 per cent. |
| Canned fish: | | | | | |
| Sardines | ..... | ..... | ..... | ..... | 20 per cent. |
| Other canned fish | ..... | ..... | ..... | ..... | 20 per cent. |
| Miscellaneous: | | | | | |
| Ambergris | ..... | ..... | ..... | ..... | 20 per cent. |
| Coral | ..... | ..... | ..... | ..... | 20 per cent. |
| Fish glue | ..... | ..... | ..... | ..... | 20 per cent. |
| Oil— | | | | | |
| Cod liver | ..... | ..... | ..... | 15 c. per gall. | 15 c. per gall. |
| Sperm | ..... | ..... | ..... | 25 c. per gall. | 25 c. per gall. |
| Fish, seal, and whale. | ..... | ..... | ..... | 15 c. per gall. | 15 c. per gall. |
| Sounds or isinglass. | ..... | ..... | ..... | ..... | 20 per cent. |
| Spermaceti | 6 c. per lb | 6 c. per lb | 12 c. per lb | 6 per cent | 8 per cent. |
| Sponges | ..... | ..... | ..... | ..... | 20 per cent. |
| Whalebone | ..... | ..... | ..... | ..... | 12½ per cent. |
| Unenumerated | 5 per cent | 15 per cent | 30 per cent | 15 per cent | 20 per cent. |

15. *Comparative statement of the rates of import duty imposed on fishery products under the principal tariff enactments from July 4, 1789, to August 27, 1894, inclusive*—Cont'd.

| Designation. | Twenty-ninth Congress, first session, Ch. LXXIV, July 30, 1846, taking effect Dec. 1, 1846. | Thirty-fourth Congress, third session, Ch. XCVIII, Mar. 3, 1857, taking effect July 1, 1857. | Thirty-sixth Congress, second session, Ch. LXVIII, Mar. 2, 1861, taking effect Apr. 1, 1861. | Thirty-seventh Congress, second session, Ch. CLXIII, July 14, 1862, taking effect Aug. 1, 1862. | Thirty-eighth Congress, first session, Ch. CLXXI, June 30, 1864, taking effect July 1, 1864. |
|---|---|---|---|---|---|
| Fresh fish: | | | | | |
| Herring, Salmon, All other | 20 per cent. | 15 per cent. | ½ c. per lb. | ½ c. per lb. | ½ c. per lb. |
| For immediate consumption. | | 15 per cent. | Free | Free | Free. |
| Dried or smoked: | | | | | |
| Cod, hake, etc., Herring, All other (n. o. p.) | 20 per cent. | 15 per cent. | ½ c. per lb. | ½ c. per lb. | ½ c. per lb. |
| Salmon | 30 per cent. | 24 per cent. | 30 per cent. | 30 per cent. | 30 per cent. |
| Pickled fish: | | | | | |
| Herring | 20 per cent. | 15 per cent. | $1 per bbl. | $1 per bbl. | $1 per bbl. |
| Mackerel | | | $2 per bbl. | $2 per bbl. | $2 per bbl. |
| Salmon | | | $3 per bbl. | $3 per bbl. | $3 per bbl. |
| All other— | | | | | |
| In barrels | | | $1.50 per bbl. | $1.50 per bbl. | $1.50 per bbl. |
| Not in barrels | | | ½ c. per lb. | ½ c. per lb. | ½ c. per lb. |
| Canned fish: | | | | | |
| Sardines | 40 per cent. | 30 per cent. | 30 per cent. | 30 per cent. | 50 per cent. |
| Other fish in oil | 40 per cent. | 30 per cent. | 30 per cent. | 30 per cent. | 30 per cent. |
| All other canned fish. | 40 per cent. | 30 per cent. | 30 per cent. | 35 per cent. | 35 per cent. |
| Shellfish | | | | | Free. |
| Miscellaneous products: | | | | | |
| Ambergris | 20 per cent. | 4 per cent. | Free | Free | Free. |
| Cuttlefish bone | 20 per cent. | 15 per cent. | | 5 c. per lb. | 5 c. per lb. |
| Oil, fish and whale | 20 per cent. | 15 per cent. | 20 per cent. | 20 per cent. | 20 per cent. |
| Seal | | 4 per cent. | 10 per cent. | 10 per cent. | 10 per cent. |
| Seaweed (dulse) | | | | | $5 per ton and 15 per cent. |
| Shells, unmanufactured. | 5 per cent. | 4 per cent. | Free | Free | Free. |
| Manufactures of | 30 per cent. | 24 per cent. | 30 per cent. | 35 per cent. | 35 per cent. |
| Skins, fish and shark. | 20 per cent. | 15 per cent. | 20 per cent. | 20 per cent. | 20 per cent. |
| Sounds or isinglass | 20 per cent. | 15 per cent. | 20 per cent. | 30 per cent. | 30 per cent. |
| Spermaceti | 20 per cent. | 15 per cent. | 8 c. per lb. | 8 c. per lb. | 8 c. per lb. |
| Sponges | 20 per cent. | 8 per cent. | 10 per cent. | 20 per cent. | 20 per cent. |
| Whalebone— | | | | | |
| Unmanufactured | 20 per cent. | 15 per cent. | 20 per cent. | 20 per cent. | 20 per cent. |
| Manufactures of | | | 30 per cent. | 35 per cent. | 35 per cent. |
| Unenumerated— | | | | | |
| Crude | 20 per cent. | 15 per cent. | 10 per cent. | 10 per cent. | 10 per cent. |
| Manufactured | | | 20 per cent. | 20 per cent. | 20 per cent. |

| Designation. | Forty-second Congress, second session, Ch. CCCXV, June 6, 1872, taking effect Aug. 1, 1872. | Forty-third Congress, second session, Ch. XXXVI, Feb. 8, 1875, taking effect Feb. 8, 1875. | Forty-seventh Congress, second session, Ch. CXXI, Mar. 3, 1883, taking effect Mar. 4, 1883. | Fifty-first Congress, second session, Ch. MCCXLIV, Oct. 1, 1890, taking effect Oct. 6, 1890. | Fifty-third Congress, second session, Ch. CCCXLIX, Aug. 27, 1894, taking effect Aug. 27, 1894. |
|---|---|---|---|---|---|
| Fresh fish: | | | | | |
| Herring | ½ c. per lb. | ½ c. per lb. | ½ c. per lb. | ½ c. per lb. | ½ c. per lb. |
| Salmon | | 35 per cent. | 25 per cent. | ½ c. per lb. | ½ c. per lb. |
| All other | | ½ c. per lb. | ½ c. per lb. | ½ c. per lb. | ½ c. per lb. |
| For immediate consumption. | Free | Free | Free | | |
| Frozen or packed in ice. | | | | | Free. *a* |
| Dried or smoked: | | | | | |
| Cod, hake, etc., Herring, All other (n. o. p.) | ½ c. per lb. | ½ c. per lb. | ½ c. per lb. | ¾ c. per lb. | ¾ c. per lb. |
| Salmon | 30 per cent. | 30 per cent. | 25 per cent. | 1 c. per lb. | ¾ c. per lb. |

*a* Other than herring or salt-water fish, which are classed with "all other." The Treasury Department has held that fish, fresh, whether caught in fresh or salt water, if imported otherwise than "frozen or packed in ice" are dutiable at the rate of ten per cent ad valorem, under section 3 of the act of 1894, as an unenumerated unmanufactured article.

15. *Comparative statement of the rates of import duty imposed on fishery products under the principal tariff enactments from July 4, 1789, to August 27, 1894, inclusive*—Cont'd.

| Designation. | Forty-second Congress, second session, Ch. CCCXV, June 6, 1872, taking effect Aug. 1, 1872. | Forty-third Congress, second session, Ch. XXXVI, Feb. 8, 1875, taking effect Feb. 8, 1875. | Forty-seventh Congress, second session, Ch. CXXI, Mar. 3, 1883, taking effect Mar. 4, 1883. | Fifty-first Congress, second session Ch. MCCXLIV, Oct. 1, 1890, taking effect Oct. 6, 1890. | Fifty-third Congress, second session, Ch. CCCXLIX, Aug. 27, 1894, taking effect Aug. 27, 1894. |
|---|---|---|---|---|---|
| Pickled fish: | | | | | |
| Herring | $1 per bbl | $1 per bbl | ½ c. per lb | $1 per bbl | ½ c. per lb. |
| Mackerel | $2 per bbl | $2 per bbl | 1 c. per lb | $2 per bbl | ¾ c. per lb. |
| Salmon | $3 per bbl | $3 per bbl | 1 c. per lb | 1 c. per lb | ¾ c. per lb. |
| All other— | | | | | |
| In barrels | $1.50 per bbl | $1.50 per bbl | 1 c. per lb | $2 per bbl | ¾ c. per lb. |
| Not in barrels | ½ c. per lb | ½ c. per lb | ½ c. per lb | ¾ c. per lb | ¾ c. per lb. |
| Canned fish: | | | | | |
| Sardines in tin boxes— | | | | | |
| Not over 5 by 4 by 3½ inches. | 50 per cent. | 15 c. per box | 10 c. per box | 10 c. per box | 10 c. per box. |
| Not over 5 by 4 by 1⅝ inches. | | 7½ c. per box | 5 c. per box | 5 c. per box | 5 c. per box. |
| Not over 4¾ by 3⅜ by 1¼ inches. | | 4 c. per box | 2½ c. per box | 2½ c. per box | 2½ c. per box. |
| In any other form. | | 60 per cent. | 40 per cent. | 40 per cent. | 40 per cent. |
| Other fish in oil | 30 per cent. | 30 per cent. | 30 per cent. | 30 per cent. | 20 per cent. |
| All other canned fish. | 35 per cent. | 35 per cent. | 25 per cent. | 30 per cent. | 20 per cent. |
| Fish for bait | Free | Free | Free | Free | Free. |
| Shrimp and other shellfish. | Free | Free | Free | Free | Free. |
| Miscellaneous products: | | | | | |
| Ambergris | Free | Free | Free | Free | Free. |
| Ambergris oil | Free | Free | Free | Free | Free. |
| Coral— | | | | | |
| Not cut | Free | Free | Free | Free | Free. |
| Cut or manufactured. | 30 per cent. | 30 per cent. | 25 per cent. | 25 per cent. | 25 per cent. |
| Cuttlefish bone | Free | Free | Free | Free | Free. |
| Oil— | | | | | |
| Cod liver | 20 per cent. | 20 per cent. | 25 per cent. | 15 c. per gall | 20 per cent. |
| Sperm | | | | 8 c. per gall | 25 per cent. |
| Fish, seal, and whale. | | | | 8 c. per gall | 25 per cent. |
| Seaweed (dulse) | Free | Free | Free | Free | Free. |
| Shells— | | | | | |
| Not cut or ground. | Free | Free | Free | Free | Free. |
| Manufactured | Free | 35 per cent. | 25 per cent. | Free | Free. |
| Pearl— | | | | | |
| Not cut | 35 per cent. | Free | Free | Free | Free. |
| Manufactures of. | 35 per cent. | Free | 25 per cent. | 40 per cent. | 30 per cent. |
| Skins, fish and shark. | 20 per cent. | 20 per cent. | Free | Free | Free. |
| Sounds, or bladders— | | | | | |
| Crude | Free | Free | Free | Free | Free. |
| Prepared (isinglass). | Free | Free | 25 per cent. | 1½ c. per lb., or 25 to 30 p. ct. | 25 per cent. |
| Spermaceti | 8 per cent. | | | | |
| Sponges | 20 per cent. | 20 per cent. | 20 per cent. | 20 per cent. | 10 per cent. |
| Whalebone— | | | | | |
| Unmanufactured | Free | Free | Free | Free | Free. |
| Manufactures of. | 35 per cent. | 35 per cent. | 30 per cent. | 30 per cent. | 25 per cent. |

NOTE.—When no rates are affixed to articles in any column they are not enumerated in the respective enactments, and consequently must be regarded as "unenumerated" and subject to the duty levied thereon. But in some cases they are classed with enumerated articles of similar character.

The effect of the tariff regulations from 1869 to 1894, inclusive, appears in Table 16, showing the value of each principal class of fishery products imported for consumption and the amount of duty paid thereon during each of those years. For convenience of comparison, the total value of all imports for consumption into the United States, the amount of duties collected, exclusive of additional and discriminating duties, and the average ad valorem rate during each year is shown in the last three columns of this table.

16. *Classified statement of the values of fishery products imported for consumption and the amount of duties paid thereon during each year from 1869 to 1894, inclusive, and comparison with the total imports for consumption into the United States.*

| Year ending June 30— | Fish and shellfish. | | Marine oils. | | Marine shells. | | Sponges. | | Sounds, isinglass, etc. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Values. | Duties. | Values. | Duties. | Values. | Duties. | Values. | Duties. | Values. | Duties. |
| 1869 | $1,869,350 | $561,590 | $426,874 | $61,081 | $1,826 | $177 | $74,731 | $14,946 | $8,719 | $2,512 |
| 1870 | 2,179,745 | 727,976 | 369,167 | 48,640 | 8,441 | 2,214 | 93,952 | 18,790 | 8,089 | 2,128 |
| 1871 | 2,071,093 | 660,225 | 204,228 | 30,978 | 22,244 | 4,114 | 113,127 | 22,625 | 6,542 | 1,953 |
| 1872 | 1,833,205 | 547,547 | 158,504 | 31,701 | 188,283 | 8,040 | 153,443 | 30,689 | 28,437 | 8,328 |
| 1873 | 2,532,736 | 772,545 | 119,788 | 23,997 | 136,138 | 1,745 | 189,986 | 37,997 | 123,750 | 153 |
| 1874 | 3,111,739 | 409,253 | 163,046 | 14,221 | 129,887 | 1,074 | 121,798 | 24,360 | 96,244 | ..... |
| 1875 | 3,078,097 | 348,098 | 185,404 | 4,752 | 125,649 | 2 | 110,440 | 22,088 | 52,401 | ..... |
| 1876 | 2,585,773 | 353,587 | 151,249 | 9,928 | 257,241 | ..... | 87,621 | 17,524 | 42,322 | ..... |
| 1877 | 2,344,167 | 375,917 | 119,340 | 5,350 | 172,251 | ..... | 88,798 | 17,760 | 32,236 | ..... |
| 1878 | 2,975,458 | 337,473 | 211,847 | 7,093 | 187,507 | ..... | 90,127 | 18,025 | 104,552 | ..... |
| 1879 | 2,832,303 | 439,413 | 125,547 | 8,738 | 231,743 | ..... | 130,515 | 26,103 | 202,765 | ..... |
| 1880 | 3,187,360 | 601,089 | 223,139 | 10,509 | 204,730 | ..... | 183,690 | 36,738 | 198,025 | ..... |
| 1881 | 3,621,224 | 469,353 | 361,956 | 13,664 | 288,154 | ..... | 229,292 | 45,858 | 243,239 | ..... |
| 1882 | 3,783,228 | 414,916 | 270,250 | 17,508 | 230,231 | ..... | 293,021 | 58,724 | 169,148 | ..... |
| 1883 | 4,595,898 | 357,979 | 280,575 | 15,384 | 296,254 | ..... | 270,462 | 54,092 | 189,575 | ..... |
| 1884 | 5,322,348 | 352,177 | 373,773 | 32,508 | 258,630 | 3,067 | 241,874 | 48,375 | 129,224 | 9,078 |
| 1885 | 4,825,935 | 281,972 | 209,845 | 22,420 | 164,080 | 2,820 | 235,519 | 46,104 | 166,305 | 11,276 |
| 1886 | 3,251,878 | 502,288 | 88,811 | 22,203 | 245,848 | 5,663 | 296,963 | 59,393 | 181,784 | 9,283 |
| 1887 | 3,915,914 | 611,038 | 85,839 | 21,461 | 228,709 | 3,979 | 302,510 | 60,502 | 185,662 | 15,403 |
| 1888 | 4,451,092 | 645,507 | 92,515 | 23,128 | 178,830 | 4,619 | 268,651 | 53,730 | 176,843 | 8,804 |
| 1889 | 4,557,841 | 595,944 | 105,938 | 26,485 | 279,763 | 2,875 | 277,373 | 55,475 | 112,302 | 4,669 |
| 1890 | 4,925,351 | 674,642 | 95,947 | 23,987 | 340,654 | 8,652 | 352,885 | 70,577 | 63,186 | 3,162 |
| 1891 | 5,724,202 | 893,967 | 113,775 | 33,300 | 638,576 | 40,037 | 381,879 | 76,376 | 112,106 | 5,606 |
| 1892 | 5,602,433 | 880,385 | 151,000 | 40,603 | 1,116,536 | 78,041 | 331,241 | 66,248 | 76,093 | 4,079 |
| 1893 | 5,342,825 | 922,243 | 285,593 | 87,099 | 1,621,681 | 113,537 | 365,249 | 73,050 | 74,198 | 4,743 |
| 1894 | 4,782,082 | 795,488 | 184,510 | 61,810 | 1,037,152 | 151,353 | 217,456 | 43,491 | 42,309 | 1,736 |
| Total | 94,703,377 | 14,624,112 | 5,168,460 | 698,548 | 8,690,140 | 433,809 | 5,503,203 | 1,099,640 | 2,826,056 | 92,373 |

| Year ending June 30— | All other fishery products. | | Total fishery products. | | | All imports for consumption. | | |
|---|---|---|---|---|---|---|---|---|
| | Values. | Duties. | Values. | Duties. | Average ad valorem rate of duty. | Values. | Duties. *a* | Average ad valorem rate of duty. |
| | | | | | *Per cent.* | | | *Per cent.* |
| 1869 | $20,809 | $7,772 | $2,411,309 | $648,078 | 26.45 | $394,449,174 | $176,114,004 | 44.65 |
| 1870 | 26,129 | 6,796 | 2,685,523 | 806,544 | 30.03 | 426,346,010 | 191,221,769 | 42.23 |
| 1871 | 44,042 | 12,330 | 2,461,276 | 732,225 | 29.75 | 500,216,122 | 201,985,575 | 38.94 |
| 1872 | 72,098 | 19,798 | 2,433,970 | 646,103 | 26.55 | 560,419,034 | 212,030,727 | 37.00 |
| 1873 | 73,882 | 19,022 | 3,176,280 | 856,359 | 26.96 | 663,146,657 | 184,556,045 | 26.95 |
| 1874 | 43,587 | 9,557 | 3,666,301 | 548,465 | 14.96 | 567,443,527 | 160,185,383 | 26.88 |
| 1875 | 45,697 | 10,875 | 3,507,088 | 386,415 | 10.46 | 526,260,576 | 154,271,805 | 28.20 |
| 1876 | 53,103 | 10,793 | 3,177,309 | 391,832 | 12.33 | 464,586,307 | 144,982,442 | 30.19 |
| 1877 | 40,198 | 9,963 | 2,796,990 | 408,990 | 14.62 | 439,829,389 | 128,223,207 | 26.68 |
| 1878 | 22,588 | 5,524 | 3,592,079 | 368,115 | 10.25 | 438,422,408 | 127,015,185 | 27.13 |
| 1879 | 23,403 | 4,702 | 3,546,276 | 478,956 | 13.50 | 439,292,374 | 133,159,025 | 28.97 |
| 1880 | 28,510 | 3,121 | 4,115,454 | 651,457 | 13.39 | 627,555,271 | 182,415,162 | 29.07 |
| 1881 | 15,168 | 1,708 | 4,759,183 | 530,583 | 11.15 | 650,619,000 | 193,561,011 | 29.75 |
| 1882 | 16,393 | 1,623 | 4,771,871 | 492,771 | 10.33 | 716,213,948 | 215,617,660 | 30.11 |
| 1883 | 14,886 | 2,656 | 5,647,650 | 430,111 | 7.62 | 700,829,073 | 209,659,699 | 29.92 |
| 1884 | 35,857 | 271 | 6,361,715 | 446,376 | 7.02 | 667,575,389 | 189,844,995 | 28.44 |
| 1885 | 45,439 | 1,355 | 5,647,123 | 365,047 | 6.49 | 579,580,054 | 177,319,650 | 30.59 |
| 1886 | 19,435 | 1,151 | 4,084,719 | 599,981 | 14.68 | 625,308,814 | 188,379,397 | 30.13 |
| 1887 | 13,995 | 464 | 4,732,719 | 713,747 | 15.09 | 683,418,981 | 212,032,424 | 31.03 |
| 1888 | 15,670 | 817 | 5,183,610 | 736,665 | 14.21 | 712,248,026 | 213,509,802 | 29.98 |
| 1889 | 31,128 | 151 | 5,364,345 | 685,599 | 12.78 | 741,431,398 | 218,701,774 | 29.50 |
| 1890 | 33,537 | 11 | 5,811,560 | 781,031 | 13.44 | 773,074,812 | 225,317,076 | 29.12 |
| 1891 | 9,407 | 402 | 6,980,035 | 1,049,988 | 15.04 | 854,519,577 | 215,790,686 | 25.25 |
| 1892 | 10,143 | 1,746 | 6,687,446 | 1,071,102 | 16.00 | 813,601,345 | 173,097,671 | 21.26 |
| 1893 | 18,643 | 2,764 | 7,708,189 | 1,203,436 | 15.61 | 844,454,583 | 198,373,453 | 23.49 |
| 1894 | 13,394 | 1,731 | 6,276,903 | 1,055,609 | 16.82 | 636,614,420 | 128,881,869 | 20.25 |
| Total | 796,231 | 138,003 | 117,677,473 | 17,086,485 | ..... | 16,048,057,529 | 4,757,248,305 | ..... |

*a* Exclusive of additional and discriminating duties.

*Reciprocity treaties of 1854 and 1873.*—The principal imports of fishery products are from the British North American Provinces, and between those Provinces and the United States there have been two treaties permitting the free interchange of fishery products. The first was in force from September 11, 1854, to March 17, 1866; and the second, known as the Washington treaty, from July 1, 1873, to June 30, 1885. Information is not available to show the quantity of fish imported for consumption[1] from the Provinces during the continuance of the first treaty, nor the amount of duties thereby released, but during a period of 13 years preceding and following that treaty the duties collected on imports from the provinces amounted to $3,016,091, an average of $232,007 per annum. On the same basis the amount of duties released by that treaty was nearly $3,000,000, but it was actually much in excess of that amount. The following compilation shows the estimated amount of duties remitted by the second reciprocity treaty with the British North American Provinces:

17. *Statement of the value of fishery products imported for consumption free of duty under the second reciprocity treaty with the British North American Provinces and the estimated amount of duty remitted.*

| Year ending June 30— | Fishery products imported for consumption. | Estimated duties remitted. |
|---|---|---|
| 1874 | $1,587,234 | $302,882 |
| 1875 | 1,847,684 | 477,042 |
| 1876 | 1,555,861 | 363,564 |
| 1877 | 1,118,109 | 260,016 |
| 1878 | 1,859,772 | 431,564 |
| 1879 | 1,539,073 | 411,275 |
| 1880 | 1,557,667 | 475,688 |
| 1881 | 2,179,863 | 597,961 |
| 1882 | 1,148,725 | 937,088 |
| 1883 | 2,735,604 | 553,571 |
| 1884 | 3,147,716 | 635,528 |
| 1885 | 2,700,831 | 689,002 |
| Total | 22,984,139 | 6,225,781 |

*Customs law of August 27, 1894.*—The tariff enactment of 1894 made several modifications in the rates of duty exacted on fishery products by the customs law of 1890. The paragraphs relating to fishery products are set forth in the following comparative form, the first column containing the provisions in the law now operative and the second representing the rates of duty required by the law of 1890:

| 1894. | 1890. |
|---|---|
| 19. Gelatin, glue, isinglass or fish glue, and prepared fish bladders or fish sounds, 25 per cent ad valorem. | 27. Gelatin, glue, and isinglass or fish glue, valued at not above 7 cents per per pound, 1½ cents per pound; valued at above 7 cents per pound and not above 30 cents per pound, 25 per cent ad valorem; valued at above 30 cents per pound, 30 per cent ad valorem. |
| 28. Cod-liver oil, 20 per cent ad valorem. | 38. Cod-liver oil, 15 cents per gallon. |
| 34. Seal, herring, whale, and other fish oil not specially provided for in this act, 25 per cent ad valorem. | 46. Seal, herring, whale, and other fish oil not specially provided for in this act, 8 cents per gallon. |
| 69. Sponges, sea moss or Iceland moss, 10 per cent ad valorem. | 86. Sponges, 20 per cent ad valorem. |

[1] A classified statement of the imports (but not imports for consumption) from the British Provinces during the continuation of the reciprocity treaty from September 11, 1854, to March 17, 1866, is given in Table 6, on page 443.

1894—Continued.

208. Anchovies and sardines, packed in oil or otherwise, in tin boxes measuring not more than 5 inches long, 4 inches wide, and 3½ inches deep, 10 cents per whole box; in half boxes, measuring not more than 5 inches long, 4 inches wide, and 1⅝ inches deep, 5 cents each; in quarter boxes, measuring not more than 4¾ inches long, 3½ inches wide, and 1¼ inches deep, 2½ cents each; when imported in any other form, 40 per cent ad valorem.
209. Fish, smoked, dried, salted, pickled, or otherwise prepared for preservation, three-fourths of 1 cent per pound.
210. Herrings, pickled, frozen, or salted, and salt-water fish frozen or packed in ice, one-half of 1 cent per pound.
211. Fish in cans or packages made of tin or other material, except anchovies and sardines, and fish packed in any other manner, not specially enumerated or provided for in this act, 26 per cent ad valorem.
(Not provided for in tariff act of 1894.)
337. Pearls, including pearls strung but not set, 10 per cent ad valorem.
351. Manufactures of * * * bladders (3), coral (4), * * * or of which these substances or either of them is the component material of chief value, not specially provided for in this act, 25 per cent ad valorem.
352. Manufactures of * * * whalebone, * * * 25 per cent ad valorem.
354. Manufactures of * * * mother-of-pearl, gelatin, and shell, or of which these substances or either of them is the component material of chief value, not specially provided for in this act, * * * 35 per cent ad valorem.

1890—Continued.

291. Anchovies and sardines, packed in oil or otherwise, in tin boxes measuring not more than 5 inches long, 4 inches wide, and 3½ inches deep, 10 cents per whole box; in half boxes, measuring not more than 5 inches long, 4 inches wide, and 1⅝ inches deep, 5 cents each; in quarter boxes, measuring not more than 4¾ inches long, 3½ inches wide, and 1¼ inches deep, 2½ cents each; when imported in any other form, 40 per cent ad valorem.
292. Fish, packed in barrels or half barrels, and mackerel or salmon, pickled or salted, 1 cent per pound.
293. Fish, smoked, dried, salted, pickled, frozen, packed in ice, or otherwise prepared for preservation, and fresh fish, not specially provided for in this act, three-fourths of 1 cent per pound.
294. Herrings, pickled or salted, one-half of 1 cent per pound; herrings, fresh, one-fourth of 1 cent per pound.
295. Fish in cans or packages made of tin or other material, except anchovies and sardines, and fish packed in any other manner, not specially enumerated or provided for in this act, 30 per cent ad valorem.
296. Cans or packages made of tin or other metal containing shellfish admitted free of duty, not exceeding one quart in contents, (1) shall be subject to a duty of 8 cents per dozen cans or packages, and when exceeding one quart (2) shall be subject to an additional duty of 4 cents per dozen for each additional half quart or fractional part thereof: *Provided*, That until June 30, 1891, such cans or packages shall be admitted as now provided by law.
453. Pearls, 10 per cent ad valorem.
459. Manufactures of * * * bladders, coral, * * * or of which these substances or either of them is the component material of chief value, not specially provided for in this act, 25 per cent ad valorem.
460. Manufactures of * * * whalebone, * * * 30 per cent ad valorem.
462. Manufactures of * * * mother-of-pearl and shell, or of which these substances or either of them is the component material of chief value, not specially provided for in this act, 40 per cent ad valorem.

## The following articles were exempted from duty:

370. Ambergris.
403. Bladders, and all integuments of animals, and fish sounds or bladders, crude, salted for preservation, and unmanufactured, not specially provided for in this act.
456. Coral, marine, uncut, and unmanufactured.
465. Cuttlefish bone.
471. Eggs of birds, fish, and insects. * * *
481. Fish, frozen, or packed in ice, fresh.
482. Fish for bait.
483. Fish skins.
524. Kelp.
558. Moss, seaweeds, and vegetable substances, crude and unmanufactured, not otherwise specially provided for in this act.
568. Oils, * * * ambergris, * * * and also spermaceti; whale and other fish oils of American fisheries, and all fish and other products of such fisheries. * * *
580. Pearl, mother of, not sawed or cut, or otherwise manufactured.
613. Shells of all kinds, not cut, ground, or otherwise manufactured.
615. Shrimps and other shellfish, canned or otherwise.
661. Turtles.
671. Whalebone, unmanufactured.

480. Ambergris.
507. Bladders, including fish bladders or fish sounds, crude, and all integuments of animals, not specially provided for in this act.
457. Coral, marine, uncut, and unmanufactured.
555. Cuttlefish bone.
561. Eggs of birds, fish, and insects.
571. Fish, the product of American fisheries, and fresh or frozen fish (except salmon) caught in fresh waters by American vessels, or with nets or other devices owned by citizens of the United States.
572. Fish for bait.
573. Fish skins.
623. Kelp.
653. Moss, seaweeds, and vegetable substances, crude or unmanufactured, not otherwise specially provided for in this act.
661. Oils, * * * ambergris, * * * and also spermaceti; whale and other fish oils of American fisheries, and all other articles the product of such fisheries.
673. Pearl, mother of, not sawed, cut, polished, or otherwise manufactured.
701. Shells of all kinds, not cut, or otherwise manufactured.
703. Shrimps and other shellfish.
744. Turtles.
753. Whalebone, unmanufactured.

*Import duties in foreign countries.*—The rates of duty imposed on fishery products imported for consumption in the United States do not greatly differ from the average in other countries. Of European countries, the average rates of duty in Austria, France, Greece, Russia, Spain, and Switzerland are somewhat higher, while the average in Denmark, Germany, Italy, Netherlands, Portugal, and Sweden is generally less. There are no duties on fishery products imported into Great Britain, and most articles are admitted free into Belgium. On the American continent, the specific rates of duty in Haiti, Santo Domingo, Cuba, Puerto Rico, Mexico, Nicaragua, Salvador, Argentina, Bolivia, Brazil, Chile, Colombia, Uruguay, and Venezuela average greater than in the United States, while the duties are less in Canada, the Bahamas, Barbados, Jamaica, Leeward Islands, Windward Islands, Dutch West Indies, French West Indies, British Honduras, Ecuador, British Guiana, and Peru. In Australia the specific duties are greater than on similar products in the United States, but the ad valorem duties are much less, averaging only about 12 per cent. In French Oceanica, China, Korea, Siam, Japan, Ceylon, and British New Guinea the import duties are very much less than in the United States.

Table 18 shows approximately the rates of duty imposed on the principal fishery products imported into certain foreign countries, and is arranged so as to compare readily with the present rates of duty on similar products imported into the United States. The comparative rates of duty imposed in each foreign country on each of the principal fishery products are shown in succeeding tables.

18. *Comparative statement showing approximately the rates of duty imposed on fishery products imported into certain countries.*

| Item. | Austria-Hungary. | France. | Germany. | Italy. | Canada. |
|---|---|---|---|---|---|
| Fish: | *Per 100 lbs.* | *Per 100 lbs.* | *Per 100 lbs.* | *Per 100 lbs.* | |
| Fresh | $0.29 | $0.435 | Free. | Free. | 25 per cent ad val. |
| Dried or salted— | | | | | |
| Cod | .72 | 4.20 | | | |
| Herring | .433 | 1.32 | $0.32 | $0.437 | $0.50 per 100 lbs. *a* |
| Other dried fish | .72 | 2.19 | | | |
| Pickled— | | | | | |
| Herring | | | | | .50 per 100 lbs. |
| Mackerel | 2.17 | 2.19 | .32 | .525 | 1.00 per 100 lbs. |
| Salmon | | | 1.297 | | Do. |
| Cod and other pickled fish. | | | | | .50 per 100 lbs. |
| Sardines— | | | | | |
| Whole boxes | | | | | .05 per box. |
| Half boxes | 5.80 | 2.19 | 0.486 | 2.626 | .025 per box. |
| Quarter boxes | | | | | .02 per box. |
| Other | | | | | 30 per cent ad val. |
| Other canned fish | 5.80 | 2.19 | 0.486 | 2.626 | 25 per cent ad val. |
| Oil: | | | | | |
| Cod-liver | | .526 | | 1.31 | 20 per cent ad val. |
| Fish | | | | .525 | |
| Seal, whale, etc | | .439–1.317 | | 1.31 | |
| Fish glue | .871 | 3.50 | | 1.31 | $3 per 100 lbs. |
| Fish sounds | | Free. | | | 20 per cent ad val. |
| Spermaceti | .58 | $0.439 | | | Do. |
| Whalebone | .72 | Free and $8.75 | | | Free. |

*a* Smoked, $1.

18. *Comparative statement showing approximately the rates of duty imposed on fishery products imported into certain countries*—Continued.

| Item. | Haiti. | Jamaica. | Brazil. | British Guiana. | Cuba. | Santo Domingo. |
|---|---|---|---|---|---|---|
| Fish: | *Per 100 lbs.* | *Per 100 lbs.* | *Per 100 lbs.* | *Per 100 lbs.* | *Per 100 lbs.* | *Per 100 lbs.* |
| Fresh | ..... | Free. | $1.00 | Free. | Free. | ..... |
| Dried or salted— | | | | | | |
| Cod | $1.35 | $0.74 | 1.00 | $0.44 | $0.76 | $0.85 |
| Herring | .72 | *a*.74 | | | | |
| Other dried fish | ..... | *b*.74 | | | | |
| Pickled— | | | | | | |
| Herring | .72 | .304 | 1.00 | .125 | .76 | 1.27 |
| Mackerel | | | | .50 | 1.197 | *c* No. 1, 1.90 |
| Salmon | | .49 | | | | 3.39 |
| Cod and other pickled fish. | | | | .125 | .76 | ..... |
| Sardines— | *Per box.* | | | | | |
| Whole boxes | $0.10 | 8 per cent ad val. | 11.88 | 1.00 | 5.04 | 9.50 |
| Half boxes | .06 | | | | | |
| Quarter boxes | .04 | | | | | |
| Other canned fish | 9.65 | .. do ..... | 11.88 | *d*1.00 | ..... | ..... |
| Oil: | | | | | | |
| Cod-liver | ..... | $0.18 per gall. | 15.84 | 25c. per gal. | ..... | ..... |
| Fish | ..... | | 3.70 | | 2.184 | 1.27 |
| Seal, whale, etc | ..... | | 3.70 | | 1.89 | 1.58 |
| | *Per 100 lbs.* | | | | | |
| Fish glue | $4.82 | ..... | ..... | ..... | ..... | ..... |
| Spermaceti | 33.77 | ..... | 9.90 | ..... | ..... | 7.07 |
| Whalebone | ..... | ..... | 6.44 | ..... | 63.00 | 7.92 |

| Item. | Costa Rica. | Argentina. | Chile. | Colombia. | Venezuela. | United States. |
|---|---|---|---|---|---|---|
| Fish: | *Per 100 lbs.* | *Per 100 lbs.* | *Per 100 lbs.* | *Per 100 lbs.* | *Per 100 lbs.* | *Per 100 lbs.* |
| Fresh | $1.54 | Free. | ..... | $1.10 | ..... | $0.50 |
| Dried or salted— | | | | | | |
| Cod | 1.54 | $3.92 | $1.72 | ..... | $2.20 | .75 |
| Herring | | | | | | |
| Other dried fish | | | 2.17 | ..... | | |
| Pickled— | | | | | | |
| Herring | 1.54 | 4.20 | 1.72 | 1.10 | 2.20 | .50 |
| Mackerel | | | 2.40 | | | .75 |
| Salmon | | | 1.72 | | | |
| Cod and other pickled fish. | | | | | | |
| Sardines— | | | | | | *Per box.* |
| Whole boxes | ..... | ..... | ..... | ..... | ..... | $0.10 |
| Half boxes | ..... | ..... | ..... | ..... | ..... | .05 |
| Quarter boxes | ..... | 13.13 | 5.10 | 4.41 | 2.20 | .025 |
| Other | ..... | ..... | ..... | ..... | ..... | 10 per cent ad val. |
| Other canned fish | ..... | ..... | 2.40 | 4.41 | 6.57 | 20 per cent ad val. |
| Oil: | 2.42 | .14 | | | | |
| Cod-liver | ..... | 2.10 | ..... | ..... | 10.94 | 20 per cent ad val. |
| Fish | ..... | ..... | ..... | ..... | 6.57 | |
| Seal, whale, etc | ..... | ..... | 1.35 | ..... | ..... | 25 p. ct. ad val. |
| Fish glue | 2.42 | 43.77 | 2.57 | 4.41 | ..... | |
| Fish sounds | ..... | ..... | ..... | ..... | ..... | Free. |
| Spermaceti | 1.54 | 8.75 | 8.30 | 4.41 | 6.57 | 25 per cent ad val. |
| Whalebone | 11.90 | ..... | 4.55 | ..... | ..... | Free. |

*a* Smoked, $0.50.
*b* Smoked, $1.
*c* No. 2, $1.58 per 100 lbs.; No. 3, $1.27 per 100 lbs.
*d* Salmon and oysters free.

## III.—THE EXPORT TRADE.

*Exports from 1790 to 1820.*—The products of the fisheries comprised a large portion of the early exports from the United States. At the close of the last century the value exceeded $2,000,000 annually, consisting almost entirely of products of the cod and whale fisheries, the former being from 5 to 10 times as valuable as the latter. The extent of the exports from 1790 to 1820, inclusive, is set forth in Table 19, compiled from the American State Papers and from Pitkin's Statistics. The value of the exports from 1792 to 1802, inclusive, is not definitely known, and for the years from 1803 to 1816, inclusive, the values of sperm oil and spermaceti are aggregated, as also are those of whale oil and whalebone.

19. *Statement of the exports of fishery products from the United States during each year from 1790 to 1820, inclusive.*

| Year ending September 30— | Fish. | | | | | Marine oils. | |
|---|---|---|---|---|---|---|---|
| | Dried or smoked. | | Pickled or brine-salted. | | | Sperm. | |
| | Quintals. | Values. | Barrels. | Kegs. | Values. | Gallons. | Values. |
| 1790 | 378,721 | $828,531 | 36,804 | ..... | $113,165 | a 5,431 | $79,542 |
| 1791 | 383,237 | 958,093 | 57,424 | ..... | 172,272 | 134,505 | 53,838 |
| 1792 | 364,898 | (b) | 48,277 | ..... | (b) | 63,383 | (b) |
| 1793 | 372,825 | (b) | 45,440 | ..... | (b) | 140,056 | (b) |
| 1794 | 436,554 | (b) | 36,030 | ..... | (b) | 82,493 | (b) |
| 1795 | 400,818 | (b) | 55,999 | ..... | (b) | 80,856 | (b) |
| 1796 | 377,713 | (b) | 84,558 | 5,256 | (b) | 104,045 | (b) |
| 1797 | 406,016 | (b) | 69,782 | 7,351 | (b) | 27,556 | (b) |
| 1798 | 411,075 | (b) | 66,827 | 6,220 | (b) | 128,758 | (b) |
| 1799 | 428,495 | (b) | 63,543 | 15,903 | (b) | 114,264 | (b) |
| 1800 | 392,726 | (b) | 50,388 | 12,403 | (b) | 221,762 | (b) |
| 1801 | 410,948 | (b) | 85,935 | 10,424 | (b) | 91,684 | (b) |
| 1802 | 440,954 | (b) | 75,819 | 13,220 | (b) | 28,470 | (b) |
| 1803 | 461,870 | 1,620,000 | 76,831 | 11,565 | 560,000 | 46,984 | (c) |
| 1804 | 507,825 | 2,400,000 | 89,442 | 13,045 | 640,000 | 5,550 | (c) |
| 1805 | 514,549 | 2,058,000 | 56,770 | 7,207 | 348,000 | 72,624 | (c) |
| 1806 | 537,457 | 2,150,000 | 64,615 | 10,155 | 366,000 | 42,785 | (c) |
| 1807 | 473,924 | 1,896,000 | 57,621 | 13,743 | 302,000 | 44,330 | (c) |
| 1808 | 155,808 | 623,000 | 18,957 | 3,036 | 98,000 | 612 | (c) |
| 1809 | 345,648 | 1,123,000 | 54,577 | 9,380 | 282,000 | 51,071 | (c) |
| 1810 | 280,804 | 913,000 | 34,674 | 5,964 | 214,000 | 63,910 | (c) |
| 1811 | 216,387 | 757,000 | 44,716 | 9,398 | 305,000 | 136,249 | (c) |
| 1812 | 169,019 | 592,000 | 23,009 | 3,143 | 146,000 | 63,216 | (c) |
| 1813 | 60,022 | 210,000 | 13,333 | 568 | 81,000 | ..... | (c) |
| 1814 | 31,310 | 128,000 | 8,436 | 87 | 50,000 | ..... | (c) |
| 1815 | 102,824 | 494,000 | 36,141 | 3,062 | 218,000 | 8,018 | (c) |
| 1816 | 217,802 | 935,000 | 37,979 | 6,983 | 221,000 | 2,756 | (c) |
| 1817 | 267,514 | 1,003,178 | 44,426 | 15,551 | 324,872 | 11,300 | 11,300 |
| 1818 | 308,717 | 1,080,510 | 55,110 | 7,100 | 317,355 | 208,467 | 156,350 |
| 1819 | 280,555 | 1,052,081 | 66,563 | 6,746 | 409,497 | 75,360 | 55,520 |
| 1820 | 321,419 | 964,257 | 87,916 | 7,309 | 538,433 | 9,307 | 6,980 |
| Total | 10,518,524 | ..... | 1,649,451 | 204,918 | ..... | 2,121,070<br>a 5,431 | ..... |

a Barrels. b Not separately reported. c Included with whale and fish oil.

19. *Statement of the exports of fishery products from the United States during each year from 1790 to 1820, inclusive*—Continued.

| Year ending September 30— | Marine oils (continued). Whale and fish. | | Spermaceti. | | Whalebone. | | Total. |
|---|---|---|---|---|---|---|---|
| | Gallons. | Values. | Pounds. | Values. | Pounds. | Values. | Values. |
| 1790 | *a* 15,765 | $124,908 | 70,379 | $27,724 | 121,281 | $20,417 | $1,194,287 |
| 1791 | 447,323 | 89,465 | 182,400 | 54,720 | 124,829 | 24,966 | 1,353,354 |
| 1792 | 436,423 | (*b*) | 157,520 | (*b*) | 154,407 | (*b*) | ..... |
| 1793 | 512,780 | (*b*) | 235,600 | (*b*) | 202,620 | (*b*) | ..... |
| 1794 | 1,000,208 | (*b*) | 214,960 | (*b*) | 354,617 | (*b*) | ..... |
| 1795 | 810,524 | (*b*) | 240,720 | (*b*) | 410,664 | (*b*) | ..... |
| 1796 | 1,176,650 | (*b*) | 221,903 | (*b*) | 308,314 | (*b*) | ..... |
| 1797 | 582,425 | (*b*) | 130,438 | (*b*) | 452,127 | (*b*) | ..... |
| 1798 | 700,040 | (*b*) | 144,149 | (*b*) | 62,805 | (*b*) | ..... |
| 1799 | 420,949 | (*b*) | 240,301 | (*b*) | 89,552 | (*b*) | ..... |
| 1800 | 204,468 | (*b*) | 181,321 | (*b*) | 32,636 | (*b*) | ..... |
| 1801 | 215,522 | (*b*) | 200,666 | (*b*) | 23,106 | (*b*) | ..... |
| 1802 | 379,976 | (*b*) | 135,637 | (*b*) | 80,334 | (*b*) | ..... |
| 1803 | 550,535 | *c* 280,000 | 238,034 | *d* 175,000 | 69,802 | (*e*) | 2,035,000 |
| 1804 | 646,505 | *c* 310,000 | 127,602 | *d* 70,000 | 134,006 | (*e*) | 3,420,000 |
| 1805 | 626,089 | *c* 315,060 | 180,535 | *d* 163,000 | 21,335 | (*e*) | 2,884,000 |
| 1806 | 826,233 | *c* 418,000 | 294,789 | *d* 182,000 | 50,594 | (*e*) | 3,116,000 |
| 1807 | 932,797 | *c* 476,000 | 172,132 | *d* 130,000 | 104,635 | (*e*) | 2,804,000 |
| 1808 | 198,019 | *c* 88,000 | 45,130 | *d* 23,000 | 8,660 | (*e*) | 832,000 |
| 1809 | 421,282 | *c* 169,000 | 214,444 | *d* 136,000 | 8,825 | (*e*) | 1,710,000 |
| 1810 | 544,734 | *c* 222,000 | 187,190 | *d* 132,000 | 42,843 | (*e*) | 1,481,000 |
| 1811 | 186,661 | *c* 78,000 | 257,094 | *d* 273,000 | 30,346 | (*e*) | 1,413,000 |
| 1812 | 106,369 | *c* 56,000 | 157,596 | *d* 141,000 | 8,128 | (*e*) | 935,000 |
| 1813 | 4,979 | *c* 2,500 | 26,522 | 10,500 | ..... | ..... | 304,000 |
| 1814 | 837 | *c* 1,000 | 21,154 | 9,000 | ..... | ..... | 188,000 |
| 1815 | 68,921 | *c* 57,000 | 312,065 | *d* 143,000 | 174 | (*e*) | 912,000 |
| 1816 | 177,810 | *c* 116,000 | 116,916 | 59,000 | ..... | ..... | 1,331,000 |
| 1817 | 460,888 | 230,444 | 201,939 | 100,970 | 3,668 | 734 | 1,671,498 |
| 1818 | 986,252 | 493,126 | 305,142 | 137,314 | 9,300 | 1,581 | 2,186,236 |
| 1819 | 860,112 | 430,056 | 169,919 | 76,463 | 8,038 | 804 | 2,024,421 |
| 1820 | 1,262,094 | 631,047 | 267,177 | 106,871 | 25,202 | 5,040 | 2,252,628 |
| Total | {15,748,405 / *a* 15,765} | ..... | 5,741,374 | ..... | 2,042,848 | ..... | ..... |

*a* Barrels.
*b* Not separately reported.
*c* Includes value of sperm oil.
*d* Includes value of whalebone.
*e* Included with spermaceti.

*Exports from 1821 to 1894.*—Table 20, compiled from the annual reports on commerce and navigation, United States Treasury Department, shows the exports of domestic fishery products during each year from 1821 to 1894, inclusive. Prior to 1865, fresh fish were not specially enumerated, and the same is true of "canned fish and other products" prior to 1869, and of oysters prior to 1864; but the imports of those articles before the years stated were not of great extent. It appears from this table that of the $274,096,530 worth of domestic fishery products exported since 1820, $86,744,975 worth, or 31 per cent, was marine oils; $51,990,798, or 19 per cent, dried or smoked fish; 12 per cent, whalebone; 6 per cent, brine-salted fish; 5 per cent, oysters, and 4 per cent, spermaceti.

20. *Classified statement of the domestic exports of fishery products from the United States during each year from 1821 to 1894, inclusive.*

| Year ending— | Fish, shellfish, etc. | | | | | | | Marine oils. | |
|---|---|---|---|---|---|---|---|---|---|
| | Fresh fish. | Dried or smoked fish. | | Brine-salted or pickled fish. | | Canned and other prepared fish. | Oysters. | Sperm oil. | |
| | Values. | Quintals. | Values. | Barrels. | Values. | Values. | Values. | Gallons. | Values. |
| Sept. 30— | | | | | | | | | |
| 1821 | ..... | 267,305 | $708,778 | 76,950 | $264,813 | ..... | ..... | 7,250 | $5,340 |
| 1822 | ..... | 241,228 | 666,730 | 70,026 | 249,108 | ..... | ..... | 7,610 | 6,060 |
| 1823 | ..... | 262,766 | 734,024 | 76,772 | 270,776 | ..... | ..... | 18,333 | 8,972 |
| 1824 | ..... | 310,189 | 873,685 | 74,173 | 263,019 | ..... | ..... | 23,578 | 10,500 |
| 1825 | ..... | 300,857 | 830,356 | 71,902 | 248,417 | ..... | ..... | 30,548 | 17,679 |
| 1826 | ..... | 260,803 | 667,742 | 86,877 | 257,180 | ..... | ..... | 35,528 | 23,517 |
| 1827 | ..... | 247,321 | 747,171 | 67,054 | 240,276 | ..... | ..... | 78,661 | 48,220 |
| 1828 | ..... | 265,217 | 819,926 | 64,454 | 246,737 | ..... | ..... | 297,276 | 190,669 |
| 1829 | ..... | 294,761 | 747,541 | 62,030 | 220,527 | ..... | ..... | 140,241 | 92,554 |
| 1830 | ..... | 229,796 | 530,690 | 66,953 | 225,987 | ..... | ..... | 58,814 | 38,618 |
| 1831 | ..... | 230,577 | 625,393 | 92,861 | 304,441 | ..... | ..... | 78,159 | 53,526 |
| 1832 | ..... | 250,514 | 749,909 | 103,274 | 306,812 | ..... | ..... | 48,212 | 38,161 |
| 1833 | ..... | 249,689 | 712,317 | 86,897 | 277,973 | ..... | ..... | 50,392 | 42,589 |
| 1834 | ..... | 253,132 | 630,384 | 61,931 | 223,290 | ..... | ..... | 60,935 | 50,048 |
| 1835 | ..... | 287,721 | 783,895 | 52,097 | 224,639 | ..... | ..... | 63,827 | 52,531 |
| 1836 | ..... | 210,769 | 746,464 | 48,629 | 221,420 | ..... | ..... | 155,142 | 119,787 |
| 1837 | ..... | 188,943 | 588,506 | 40,946 | 181,334 | ..... | ..... | 177,004 | 151,875 |
| 1838 | ..... | 206,028 | 626,245 | 42,034 | 192,758 | ..... | ..... | 166,805 | 137,809 |
| 1839 | ..... | 208,720 | 709,218 | 24,328 | 141,320 | ..... | ..... | 86,047 | 85,015 |
| 1840 | ..... | 211,425 | 541,858 | 42,576 | 179,106 | ..... | ..... | 434,608 | 430,490 |
| 1841 | ..... | 252,199 | 602,810 | 36,927 | 148,973 | ..... | ..... | 349,393 | 343,300 |
| 1842 | ..... | 256,083 | 567,782 | 41,416 | 162,324 | ..... | ..... | 287,761 | 233,114 |
| June 30— | | | | | | | | | |
| 1843 | ..... | 174,220 | 381,175 | 29,537 | 116,042 | ..... | ..... | 476,688 | 310,768 |
| 1844 | ..... | 271,610 | 699,836 | 44,168 | 197,179 | ..... | ..... | 451,317 | 344,930 |
| 1845 | ..... | 288,380 | 803,353 | 43,478 | 208,654 | ..... | ..... | 1,054,301 | 975,195 |
| 1846 | ..... | 277,401 | 699,559 | 56,588 | 230,495 | ..... | ..... | 772,019 | 697,570 |
| 1847 | ..... | 258,870 | 659,629 | 31,072 | 136,221 | ..... | ..... | 795,792 | 738,456 |
| 1848 | ..... | 206,549 | 609,482 | 22,518 | 109,315 | ..... | ..... | 206,431 | 208,832 |
| 1849 | ..... | 197,457 | 419,092 | 22,630 | 93,085 | ..... | ..... | 526,817 | 572,763 |
| 1850 | ..... | 168,600 | 365,349 | 19,483 | 91,445 | ..... | ..... | 730,743 | 788,794 |
| 1851 | ..... | 151,088 | 367,729 | 21,616 | 113,932 | ..... | ..... | 905,778 | 1,044,967 |
| 1852 | ..... | 134,732 | 354,127 | 19,622 | 98,883 | ..... | ..... | 644,765 | 809,274 |
| 1853 | ..... | 131,665 | 371,607 | 15,060 | 89,409 | ..... | ..... | 1,131,008 | 1,418,845 |
| 1854 | ..... | 131,316 | 389,973 | 25,669 | 102,187 | ..... | ..... | 847,535 | 1,105,907 |
| 1855 | ..... | 119,926 | 379,892 | 17,176 | 94,111 | ..... | ..... | 958,744 | 1,593,832 |
| 1856 | ..... | 168,971 | 578,011 | 31,309 | 173,939 | ..... | ..... | 540,784 | 977,005 |
| 1857 | ..... | 174,765 | 570,348 | 36,048 | 211,383 | ..... | ..... | 819,081 | 1,216,888 |
| 1858 | ..... | 161,269 | 487,007 | 30,892 | 197,441 | ..... | ..... | 890,923 | 1,097,505 |
| 1859 | ..... | 209,350 | 642,901 | 35,361 | 203,760 | ..... | ..... | 1,341,025 | 1,737,734 |
| 1860 | ..... | 219,628 | 690,088 | 34,119 | 191,634 | ..... | ..... | 1,335,736 | 1,789,089 |
| 1861 | ..... | 219,324 | 634,941 | 48,085 | 244,028 | ..... | ..... | 1,518,457 | 2,110,823 |
| 1862 | $79,453 | 250,819 | 712,584 | 68,042 | 330,685 | ..... | ..... | 739,477 | 962,003 |
| 1863 | ..... | 228,234 | 921,131 | 75,262 | 429,316 | ..... | ..... | 1,034,704 | 1,569,287 |
| 1864 | ..... | 192,505 | 967,918 | 75,280 | 508,568 | $20,543 | $85,089 | 851,066 | 1,298,058 |
| 1865 | 13,890 | 157,472 | 1,107,955 | 56,874 | 632,690 | ..... | 126,889 | 700,186 | 1,511,323 |
| 1866 | 192,198 | 139,693 | 734,427 | 34,305 | 360,074 | ..... | 200,409 | 510,978 | 1,180,381 |
| 1867 | 189,281 | 109,114 | 596,586 | 22,591 | 217,494 | ..... | 181,271 | 570,894 | 1,482,570 |
| 1868 | 184,774 | 129,074 | 598,137 | 25,033 | 209,461 | ..... | 121,946 | 662,570 | 1,379,814 |
| 1869 | 65,348 | 88,415 | 398,825 | 24,228 | 213,455 | 272,397 | 89,266 | 717,172 | 1,361,388 |
| 1870 | 69,131 | 111,672 | 579,334 | 30,935 | 253,211 | 387,739 | 134,804 | 499,797 | 794,432 |
| 1871 | 39,983 | 119,618 | 592,598 | 29,653 | 226,360 | 470,945 | 168,122 | 539,582 | 692,409 |
| 1872 | 67,832 | 126,613 | 588,194 | 30,642 | 209,077 | 635,533 | 173,711 | 693,674 | 979,082 |
| 1873 | 64,577 | 118,076 | 569,151 | 16,747 | 109,201 | 677,171 | 243,723 | 756,306 | 1,095,831 |
| 1874 | 56,974 | 129,982 | 612,589 | 29,000 | 220,041 | 1,128,208 | 223,733 | 529,903 | 827,991 |
| 1875 | 69,448 | 129,752 | 710,121 | 51,025 | 359,669 | 1,855,550 | 170,277 | 491,130 | 847,014 |
| 1876 | 80,879 | 175,528 | 900,306 | 54,291 | 417,281 | 2,102,522 | 214,196 | 892,762 | 1,360,240 |
| 1877 | 114,338 | 159,648 | 791,785 | 76,227 | 486,738 | 2,492,405 | 260,620 | 634,991 | 879,805 |
| 1878 | 84,278 | 188,831 | 766,154 | 57,554 | 416,162 | 3,204,965 | 393,061 | 723,398 | 801,218 |
| 1879 | 80,437 | 197,130 | 748,747 | 47,764 | 290,862 | 2,951,833 | 453,306 | 812,928 | 719,831 |
| 1880 | 124,962 | 179,450 | 739,231 | 54,345 | 284,293 | 2,336,893 | 543,895 | 482,153 | 487,004 |
| 1881 | 97,539 | 212,691 | 840,199 | 52,092 | 264,723 | 2,807,993 | 582,249 | 314,568 | 303,113 |
| 1882 | 89,148 | 159,512 | 635,155 | 38,224 | 244,454 | 3,221,707 | 612,793 | 540,064 | 551,212 |
| 1883 | 72,875 | 158,445 | 882,830 | 48,551 | 372,385 | 3,223,870 | 620,636 | 275,021 | 290,417 |
| 1884 | 62,009 | 197,352 | 1,149,952 | 45,034 | 296,896 | 2,661,587 | 572,487 | 343,069 | 325,385 |
| 1885 | 33,350 | 220,505 | 1,079,115 | 60,004 | 310,170 | 2,754,665 | 715,619 | 209,846 | 183,499 |
| 1886 | 29,734 | 190,253 | 890,311 | 59,371 | 288,188 | 2,268,649 | 732,019 | 170,808 | 149,936 |
| 1887 | 14,751 | 195,736 | 852,212 | 36,070 | 216,619 | 2,148,163 | 733,973 | 157,160 | 119,267 |
| 1888 | 28,965 | 201,590 | 988,401 | 19,981 | 156,454 | 2,145,458 | 858,652 | 136,092 | 94,568 |
| 1889 | 27,151 | 178,911 | 941,732 | 20,601 | 136,609 | 4,029,572 | 834,171 | 98,832 | 69,628 |
| 1890 | 48,086 | 198,308 | 980,245 | 26,898 | 136,036 | 4,039,220 | 837,230 | 162,565 | 124,601 |
| 1891 | 40,084 | 201,082 | 1,076,381 | 35,392 | 190,799 | 2,808,249 | 817,108 | 62,552 | 46,866 |
| 1892 | 66,498 | 173,024 | 933,324 | 39,505 | 216,751 | 2,561,919 | 744,271 | 140,655 | 103,031 |
| 1893 | 100,656 | 180,434 | 910,145 | 28,105 | 181,412 | 2,933,477 | 625,079 | 115,104 | 61,245 |
| 1894 | 48,829 | 190,456 | 879,500 | 36,593 | 192,398 | 1,682,830 | 688,653 | 85,204 | 72,141 |
| Total | 2,337,449 | 14,777,089 | 51,990,708 | 3,382,943 | 17,404,920 | 57,893,033 | 13,768,267 | 34,274,408 | 44,451,467 |

20. *Classified statement of the domestic exports of fishery products from the United States during each year from 1821 to 1894, inclusive*—Continued.

| Year ending— | Marine oils (cont'd). Whale and fish oils. | | Spermaceti. | | Whalebone. | | All other fishery products. | Total. |
|---|---|---|---|---|---|---|---|---|
| | Gallons. | Values. | Pounds. | Values. | Pounds. | Values. | Values. | Values. |
| Sept. 30— | | | | | | | | |
| 1821 | 1,068,025 | $348,001 | 424,952 | $169,777 | 16,340 | $1,480 | ..... | $1,499,188 |
| 1822 | 990,325 | 311,415 | 399,925 | 151,226 | 25,202 | 5,040 | ..... | 1,389,579 |
| 1823 | 1,453,126 | 415,713 | 749,973 | 212,337 | 86,474 | 16,402 | ..... | 1,658,224 |
| 1824 | 1,251,836 | 296,708 | 508,181 | 157,772 | 60,693 | 9,306 | ..... | 1,610,990 |
| 1825 | 1,072,615 | 250,200 | 617,072 | 202,188 | 212,062 | 46,225 | ..... | 1,595,065 |
| 1826 | 652,401 | 183,343 | 836,280 | 288,104 | 186,709 | 53,502 | ..... | 1,473,388 |
| 1827 | 481,180 | 142,648 | 1,003,658 | 316,061 | 241,085 | 80,956 | ..... | 1,575,332 |
| 1828 | 488,468 | 140,279 | 904,597 | 255,378 | 120,128 | 40,991 | ..... | 1,693,080 |
| 1829 | 1,237,902 | 358,822 | 1,055,906 | 261,315 | 404,225 | 136,341 | ..... | 1,817,100 |
| 1830 | 1,833,106 | 568,326 | 1,082,941 | 249,292 | 404,910 | 112,357 | ..... | 1,725,270 |
| 1831 | 1,637,534 | 554,440 | 847,384 | 217,830 | 565,926 | 133,842 | ..... | 1,889,472 |
| 1832 | 3,605,913 | 1,009,728 | 859,886 | 207,333 | 1,044,227 | 186,595 | ..... | 2,558,538 |
| 1833 | 3,298,872 | 924,810 | 905,318 | 259,451 | 1,203,176 | 185,329 | ..... | 2,402,469 |
| 1834 | 2,614,814 | 740,610 | 851,556 | 257,718 | 873,983 | 109,434 | ..... | 2,071,493 |
| 1835 | 2,217,321 | 773,486 | 920,746 | 284,019 | 270,977 | 55,954 | ..... | 2,174,524 |
| 1836 | 2,362,325 | 1,049,460 | 1,018,520 | 341,907 | 731,500 | 187,008 | ..... | 2,066,058 |
| 1837 | 3,624,001 | 1,271,545 | 892,852 | 294,510 | 1,129,509 | 223,082 | ..... | 2,711,452 |
| 1838 | 4,824,376 | 1,556,775 | 1,074,569 | 340,531 | 1,634,570 | 321,458 | ..... | 3,175,576 |
| 1839 | 1,482,908 | 515,484 | 466,896 | 178,142 | 1,445,098 | 288,790 | ..... | 1,917,969 |
| 1840 | 4,520,878 | 1,404,984 | 853,938 | 332,353 | 1,892,259 | 310,379 | ..... | 3,199,170 |
| 1841 | 4,094,924 | 1,260,660 | 599,057 | 231,960 | 1,271,363 | 259,148 | ..... | 2,846,851 |
| 1842 | 3,900,728 | 1,315,411 | 986,010 | 318,997 | 918,280 | 225,382 | ..... | 2,823,010 |
| June 30— | | | | | | | | |
| 1843 | 2,479,916 | 803,774 | 965,073 | 243,308 | 898,773 | 257,481 | ..... | 2,112,548 |
| 1844 | 4,104,504 | 1,464,068 | 606,454 | 180,492 | 1,149,607 | 403,090 | ..... | 3,350,501 |
| 1845 | 4,505,662 | 1,520,363 | 812,879 | 236,917 | 2,084,019 | 762,042 | ..... | 4,507,124 |
| 1846 | 2,052,874 | 946,298 | 1,083,830 | 295,606 | 1,607,892 | 583,870 | ..... | 3,453,398 |
| 1847 | 3,189,502 | 1,070,650 | 705,150 | 191,467 | 2,031,137 | 671,601 | ..... | 3,468,033 |
| 1848 | 1,607,038 | 552,388 | 598,452 | 186,839 | 1,054,379 | 314,107 | ..... | 1,980,963 |
| 1849 | 2,783,480 | 965,597 | 503,911 | 159,403 | 1,198,250 | 337,714 | ..... | 2,547,054 |
| 1850 | 1,470,197 | 672,040 | 742,528 | 260,107 | 1,981,231 | 646,483 | ..... | 2,824,818 |
| 1851 | 2,004,886 | 882,485 | 538,549 | 195,916 | 2,281,931 | 689,662 | ..... | 3,294,691 |
| 1852 | 892,309 | 440,387 | 397,398 | 143,098 | 1,184,156 | 436,073 | ..... | 2,282,442 |
| 1853 | 321,989 | 223,247 | 343,992 | 112,600 | 2,825,000 | 1,003,705 | ..... | 3,279,413 |
| 1854 | 718,842 | 490,426 | 255,825 | 77,991 | 2,156,864 | 817,817 | ..... | 3,044,301 |
| 1855 | 705,492 | 485,505 | 666,680 | 181,874 | 1,944,809 | 781,080 | ..... | 3,510,894 |
| 1856 | 646,694 | 526,338 | 201,390 | 64,857 | 1,982,800 | 1,036,047 | ..... | 3,356,797 |
| 1857 | 414,466 | 363,065 | 185,503 | 70,038 | 2,042,390 | 1,307,322 | ..... | 3,739,044 |
| 1858 | 840,127 | 597,107 | 168,897 | 66,012 | 1,103,301 | 1,105,223 | ..... | 3,550,295 |
| 1859 | 996,341 | 598,762 | 126,229 | 46,278 | 1,380,465 | 1,233,539 | ..... | 4,462,074 |
| 1860 | 1,335,736 | 537,547 | 157,783 | 51,829 | 1,068,895 | 896,293 | ..... | 4,150,480 |
| 1861 | 1,009,408 | 581,264 | 456,408 | 143,907 | 979,231 | 736,552 | ..... | 4,451,515 |
| 1862 | 2,599,316 | 1,280,697 | 280,526 | 64,481 | 796,384 | 556,795 | ..... | 3,987,298 |
| 1863 | 2,055,511 | 1,483,593 | 229,472 | 76,946 | 603,186 | 575,733 | ..... | 5,056,006 |
| 1864 | 416,405 | 438,957 | 624,129 | 184,608 | 548,099 | 793,562 | ..... | 4,306,303 |
| 1865 | 644,547 | 816,494 | 224,162 | 93,062 | 313,912 | 493,316 | ..... | 4,795,019 |
| 1866 | 177,509 | 205,250 | 191,799 | 33,592 | 486,370 | 656,188 | ..... | 3,562,510 |
| 1867 | 426,882 | 319,840 | 77,715 | 23,330 | 618,363 | 653,253 | ..... | 3,603,634 |
| 1868 | 706,534 | 507,476 | 332,023 | 128,337 | 696,064 | 587,303 | ..... | 3,717,248 |
| 1869 | 94,361 | 81,800 | 253,445 | 88,706 | 405,396 | 384,435 | $46,040 | 3,001,720 |
| 1870 | 310,878 | 228,278 | 82,520 | 27,172 | 386,728 | 343,937 | 52,479 | 2,870,517 |
| 1871 | 862,434 | 452,937 | 157,263 | 42,170 | 353,742 | 251,562 | 56,882 | 2,994,037 |
| 1872 | 1,171,646 | 552,756 | 190,736 | 56,996 | 172,889 | 137,855 | 41,535 | 3,443,171 |
| 1873 | 288,263 | 154,243 | 197,671 | 55,815 | 324,653 | 329,214 | 21,480 | 3,320,406 |
| 1874 | 573,775 | 280,750 | 304,865 | 78,346 | 114,530 | 115,098 | 17,013 | 3,566,743 |
| 1875 | 895,907 | 413,411 | 238,641 | 61,725 | 251,572 | 291,165 | 66,407 | 4,844,847 |
| 1876 | 1,067,515 | 436,072 | 141,157 | 35,915 | 154,500 | 215,327 | 37,701 | 5,800,445 |
| 1877 | 1,026,038 | 442,165 | 153,552 | 41,027 | 71,708 | 160,666 | 65,066 | 5,734,675 |
| 1878 | 904,988 | 411,808 | 228,276 | 58,302 | 154,016 | 264,980 | 35,320 | 6,436,248 |
| 1879 | 2,236,265 | 756,248 | 147,503 | 35,489 | 78,322 | 199,753 | 44,782 | 6,281,288 |
| 1880 | 1,022,889 | 349,109 | 197,847 | 45,018 | 131,332 | 255,847 | 81,879 | 5,248,131 |
| 1881 | 597,812 | 229,726 | 214,205 | 40,945 | 227,117 | 326,400 | 61,077 | 5,554,834 |
| 1882 | 1,083,925 | 420,730 | 265,593 | 48,721 | 220,787 | 325,333 | 64,105 | 6,213,358 |
| 1883 | 226,983 | 115,490 | 396,869 | 66,651 | 326,835 | 599,550 | 26,016 | 6,279,720 |
| 1884 | 488,015 | 190,704 | 259,947 | 48,553 | 92,653 | 319,508 | 37,804 | 5,664,885 |
| 1885 | 977,768 | 321,227 | 277,271 | 63,683 | 188,482 | 470,039 | 87,378 | 6,018,745 |
| 1886 | 1,184,871 | 361,171 | 334,918 | 125,840 | 165,436 | 385,058 | 33,740 | 5,264,646 |
| 1887 | 1,348,804 | 352,114 | 330,222 | 139,056 | 173,452 | 523,267 | 54,158 | 5,154,180 |
| 1888 | 1,360,409 | 315,277 | 226,576 | 84,018 | 318,056 | 799,042 | 47,717 | 5,518,552 |
| 1889 | 483,208 | 127,412 | 425,479 | 111,386 | 261,555 | 762,464 | 23,214 | 7,063,339 |
| 1890 | 1,844,041 | 440,773 | 449,384 | 116,757 | 190,484 | 705,500 | 29,928 | 7,458,385 |
| 1891 | 1,404,769 | 354,337 | 207,574 | 71,202 | 150,322 | 717,230 | 22,321 | 6,210,577 |
| 1892 | 829,173 | 234,937 | 273,981 | 90,842 | 82,797 | 427,462 | 24,552 | 5,403,587 |
| 1893 | 90,696 | 31,683 | 340,192 | 105,012 | 148,130 | 543,045 | 49,624 | 5,541,378 |
| 1894 | 209,167 | 68,710 | 342,786 | 99,407 | 152,709 | 441,969 | 83,818 | 4,258,306 |
| Total | 111,014,515 | 42,293,508 | 36,072,116 | 10,940,519 | 55,215,494 | 31,803,573 | 1,212,906 | 274,096,530 |

From the preceding compilation it appears that during the ten years following 1875 the value of the fishery products annually exported varied little from $6,000,000. From 1887 to 1890 the value steadily increased, reaching $7,458,385 during the last year, the highest record. A steady decline has occurred since 1890, the exports during 1894 being $3,200,079 less than in 1890 and smaller than during any previous year for twenty years.

While some falling off is apparent in the exports of dried or smoked fish, oysters, and the products of the whale fishery, yet the principal cause of the decrease since 1890 is the remarkable reduction in value of "canned and other prepared fish." The value of these decreased from $4,039,220 in 1890 to $1,682,830 in 1894, a difference of $2,356,390. This class is made up principally of canned salmon, the exports of which were worth $3,259,344 in 1890 and only $1,026,197 in 1894.

A series of tables is next presented, showing, so far as practicable, the quantities and values of the various kinds of fishery products included in each classification noted in the preceding table.

It is impracticable to show the quantity of fresh fish exported prior to 1884, but the quantity and value of those exported annually from 1884 to 1894, inclusive, are shown in Table 21. This consists of fresh or frozen fish shipped to countries adjacent to the United States, and principally to Quebec, Cuba, and Mexico.

21. *Statement of the domestic exports of fresh fish during each year from 1884 to 1894, inclusive.*

| Year ending June 30— | Pounds. | Values. | Average value per pound. |
|---|---|---|---|
| | | | *Cents.* |
| 1884 | 1,641,061 | $62,009 | 3.8 |
| 1885 | 1,035,242 | 33,350 | 3.2 |
| 1886 | 913,114 | 29,734 | 3.2 |
| 1887 | 463,381 | 14,751 | 3.2 |
| 1888 | 919,497 | 28,965 | 3.1 |
| 1889 | 1,062,557 | 27,151 | 2.6 |
| 1890 | 1,043,162 | 48,086 | 4.6 |
| 1891 | 868,796 | 40,084 | 4.6 |
| 1892 | 1,414,019 | 66,498 | 4.7 |
| 1893 | 2,718,341 | 100,656 | 3.7 |
| 1894 | 1,115,742 | 48,820 | 4.4 |
| Total | 13,194,912 | 500,104 | ..... |

During the 104 years ending in 1894 the exports of dried or smoked fish amounted to 25,295,613 quintals, valued at about $89,000,000. The exports prior to 1840 consisted almost entirely of dry-salted cod and similar fish, as haddock, hake, etc.; but the increasing trade in smoked herring resulted in the exportation of large quantities of that product, especially about 1860. In addition to those species, halibut, mullet, sturgeon, etc., either smoked or dry salted, are now exported in considerable quantities.

The following compilation shows separately the quantities and values of cod, herring, and other dried or smoked fish exported during a series of years ending in 1894:

22. *Statement of the domestic exports of dried or smoked fish during each year from 1884 to 1894, inclusive.*

| Year ending June— | Cod, haddock, hake, etc. | | Herring. | | Other species. | | Total. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| 1884 | 14,929,123 | $734,946 | (a) | (a) | 7,174,332 | $415,006 | 22,103,455 | $1,149,952 |
| 1885 | 18,178,987 | 724,858 | (a) | (a) | 6,517,596 | 354,257 | 24,696,583 | 1,079,115 |
| 1886 | 15,064,195 | 602,934 | (a) | (a) | 5,644,202 | 287,377 | 21,308,397 | 890,311 |
| 1887 | 10,943,748 | 587,082 | (a) | (a) | 4,978,226 | 265,130 | 21,922,574 | 852,212 |
| 1888 | 17,820,883 | 819,559 | 2,948,620 | $79,539 | 1,809,568 | 89,303 | 22,579,071 | 988,401 |
| 1889 | 15,625,928 | 754,619 | 2,404,433 | 80,281 | 2,007,615 | 106,832 | 20,037,976 | 941,732 |
| 1890 | 17,030,019 | 793,186 | 3,664,704 | 103,091 | 1,515,790 | 83,968 | 22,210,513 | 980,245 |
| 1891 | 17,313,170 | 890,277 | 3,777,535 | 105,260 | 1,431,444 | 80,844 | 22,522,149 | 1,076,381 |
| 1892 | 14,435,878 | 705,199 | 3,279,263 | 82,772 | 1,663,572 | 85,353 | 19,378,713 | 933,324 |
| 1893 | 14,853,627 | 728,475 | 4,085,378 | 93,412 | 1,941,591 | 88,258 | 20,880,596 | 910,145 |
| 1894 | 14,733,648 | 704,652 | 5,118,025 | 123,882 | 1,479,407 | 50,966 | 21,331,080 | 879,500 |
| Total | 177,529,206 | 8,105,787 | 25,277,958 | 668,237 | 36,163,943 | 1,907,294 | 238,971,107 | 10,081,318 |

*a* Included with "Other species."

The brine-salted or pickled fish consist of herring, mackerel, salmon, cod, alewives, etc. Table 23 shows the quantities and values of the domestic herring exported during a series of years ending in 1894. The value of pickled salmon exported is shown in Table 24.

23. *Statement of the domestic exports of brine-salted or pickled fish (exclusive of salmon) during each year from 1884 to 1894, inclusive.*

| Year ending June 30— | Herring. | | Mackerel. | | Others, except salmon. | | Total. | |
|---|---|---|---|---|---|---|---|---|
| | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. |
| 1884 | (a) | (a) | 13,102 | $107,950 | 31,932 | $188,946 | 45,034 | $296,896 |
| 1885 | (a) | (a) | 24,512 | 139,663 | 35,492 | 170,507 | 60,004 | 310,170 |
| 1886 | (a) | (a) | 28,505 | 143,847 | 30,806 | 144,341 | 59,371 | 288,188 |
| 1887 | (a) | (a) | 15,760 | 106,967 | 20,310 | 109,652 | 36,070 | 216,619 |
| 1888 | 3,668 | $22,146 | 7,036 | 71,149 | 9,277 | 63,159 | 19,981 | 156,454 |
| 1889 | 3,221 | 17,756 | 1,303 | 18,876 | 16,077 | 99,977 | 20,601 | 136,609 |
| 1890 | 2,267 | 9,614 | 948 | 15,512 | 23,683 | 110,910 | 26,898 | 136,036 |
| 1891 | 3,012 | 12,352 | 2,295 | 37,128 | 30,085 | 147,319 | 35,392 | 196,799 |
| 1892 | 2,700 | 11,481 | 3,490 | 47,108 | 30,315 | 158,162 | 36,505 | 216,751 |
| 1893 | 1,802 | 8,660 | 2,455 | 33,480 | 23,788 | 139,272 | 28,105 | 181,412 |
| 1894 | 3,501 | 13,457 | 3,224 | 43,082 | 29,808 | 135,859 | 36,593 | 192,398 |
| Total | 20,231 | 95,466 | 102,630 | 764,762 | 281,693 | 1,468,104 | 404,554 | 2,328,332 |

*a* Included with "Others, except salmon."

The class "Canned and other prepared fish" is made up principally of canned salmon, but it also includes all other canned fish, brine-salted salmon, shellfish other than oysters, and all other fish. Table 24 shows, so far as practicable, the value of these exports during the twenty-six years ending in 1894.

24. *Statement of the domestic "Canned and other prepared fish" exported during each year from 1869 to 1894, inclusive.*

| Year ending June 30— | Salted salmon. | Canned salmon. | All other canned fish. | Shellfish other than oysters. | All other fish. | Total. |
|---|---|---|---|---|---|---|
| 1869 | ..... | ..... | $24,454 | ..... | $247,943 | $272,397 |
| 1870 | ..... | ..... | 4,941 | ..... | 382,798 | 387,739 |
| 1871 | ..... | ..... | 27,208 | ..... | 443,737 | 470,945 |
| 1872 | ..... | ..... | ..... | ..... | 635,533 | 635,533 |
| 1873 | ..... | ..... | ..... | ..... | 677,171 | 677,171 |
| 1874 | ..... | ..... | ..... | ..... | 1,128,208 | 1,128,208 |
| 1875 | ..... | ..... | ..... | ..... | 1,855,550 | 1,855,550 |
| 1876 | ..... | ..... | ..... | ..... | 2,102,522 | 2,102,522 |
| 1877 | ..... | ..... | ..... | $1,746 | 2,490,659 | 2,492,405 |
| 1878 | ..... | ..... | ..... | 6,069 | 3,198,896 | 3,204,965 |
| 1879 | ..... | ..... | ..... | 11,846 | 2,939,987 | 2,951,833 |
| 1880 | ..... | ..... | ..... | 9,801 | 2,327,092 | 2,336,893 |
| 1881 | ..... | ..... | ..... | 4,327 | 2,803,636 | 2,807,963 |
| 1882 | ..... | ..... | ..... | 2,701 | 3,219,006 | 3,221,707 |
| 1883 | ..... | ..... | ..... | 21,308 | 3,202,562 | 3,223,870 |
| 1884 | $110,531 | $2,323,026 | ..... | 228,030 | ..... | 2,661,587 |
| 1885 | 82,114 | 2,260,567 | ..... | 411,984 | ..... | 2,754,665 |
| 1886 | 43,450 | 1,875,109 | ..... | 350,090 | ..... | 2,268,649 |
| 1887 | 78,208 | 1,719,685 | ..... | 350,270 | ..... | 2,148,163 |
| 1888 | 61,046 | 1,608,815 | 62,510 | 284,144 | 128,943 | 2,145,458 |
| 1889 | 54,173 | 3,364,560 | 100,023 | 359,256 | 151,560 | 4,029,572 |
| 1890 | 69,042 | 3,259,344 | 143,599 | 372,238 | 194,997 | 4,039,220 |
| 1891 | 83,993 | 2,098,957 | 139,392 | 337,893 | 208,014 | 2,868,249 |
| 1892 | 78,680 | 1,738,405 | 146,067 | 382,029 | 216,678 | 2,561,919 |
| 1893 | 49,230 | 2,279,625 | 166,902 | 275,793 | 161,927 | 2,933,477 |
| 1894 | 58,059 | 1,026,215 | 143,402 | 249,721 | 204,833 | 1,682,830 |

The miscellaneous fishery products exported consist principally of marine shells and sponges, but include also fish-skins and a variety of other articles. In customs returns many minor products are included with the unenumerated articles. The following table shows, so far as practicable, the exports of miscellaneous fishery products since 1868:

25. *Statement of the domestic exports of miscellaneous fishery products during each year from 1869 to 1894, inclusive.*

| Year ending June 30— | Caviar. | Clams for bait. | Fish sounds and glue. | Shells. | Sponges. | Walrus teeth. | a Whale and fish foots. | Miscellaneous. | Total. |
|---|---|---|---|---|---|---|---|---|---|
| 1869 | ..... | ..... | ..... | $11,008 | ..... | ..... | $35,032 | ..... | $46,040 |
| 1870 | ..... | ..... | $4,605 | 2,100 | $5,500 | ..... | 32,994 | b $7,280 | 52,479 |
| 1871 | ..... | ..... | 163 | ..... | 1,546 | ..... | 39,546 | b 15,627 | 56,882 |
| 1872 | ..... | ..... | ..... | ..... | ..... | ..... | 37,925 | b 3,610 | 41,535 |
| 1873 | ..... | ..... | ..... | ..... | ..... | ..... | 21,480 | ..... | 21,480 |
| 1874 | ..... | ..... | ..... | ..... | ..... | ..... | 17,013 | ..... | 17,013 |
| 1875 | ..... | ..... | 2,587 | ..... | ..... | $23,653 | 40,227 | ..... | 66,467 |
| 1876 | ..... | ..... | ..... | ..... | ..... | 8,076 | 29,625 | ..... | 37,701 |
| 1877 | ..... | ..... | ..... | 4,825 | 396 | 7,651 | 52,194 | ..... | 65,066 |
| 1878 | ..... | ..... | ..... | 9,172 | 8,000 | ..... | 18,148 | ..... | 35,320 |
| 1879 | ..... | ..... | ..... | 13,831 | 16,313 | 200 | 14,438 | ..... | 44,782 |
| 1880 | ..... | $5,775 | ..... | 69,107 | 4,141 | ..... | 2,856 | ..... | 81,879 |
| 1881 | ..... | 7,249 | ..... | 39,792 | 6,736 | 400 | 7,800 | ..... | 61,977 |
| 1882 | ..... | 2,803 | ..... | 46,341 | 4,111 | ..... | 10,850 | ..... | 64,105 |
| 1883 | ..... | ..... | ..... | 15,148 | 7,518 | ..... | 3,350 | ..... | 26,016 |
| 1884 | ..... | ..... | 3,021 | 25,311 | 9,472 | ..... | ..... | ..... | 37,804 |
| 1885 | ..... | ..... | ..... | 63,898 | 23,480 | ..... | ..... | ..... | 87,378 |
| 1886 | ..... | ..... | ..... | 8,133 | 25,007 | ..... | ..... | ..... | 33,740 |
| 1887 | ..... | ..... | ..... | 16,572 | 37,586 | ..... | ..... | ..... | 54,158 |
| 1888 | ..... | ..... | ..... | 11,136 | 36,581 | ..... | ..... | ..... | 47,717 |
| 1889 | ..... | ..... | ..... | 2,243 | 20,971 | ..... | ..... | ..... | 23,214 |
| 1890 | ..... | ..... | ..... | 4,635 | 25,293 | ..... | ..... | ..... | 29,928 |
| 1891 | ..... | ..... | ..... | 1,500 | 20,821 | ..... | ..... | ..... | 22,321 |
| 1892 | ..... | ..... | ..... | 12,609 | 10,320 | ..... | ..... | c 1,623 | 24,552 |
| 1893 | $6,187 | ..... | ..... | 33,033 | 8,858 | ..... | ..... | c 1,546 | 49,624 |
| 1894 | ..... | ..... | ..... | 74,328 | 8,497 | ..... | ..... | c 993 | 83,818 |

a A residuum of whale and fish oil. b Sperm pressings. c Fish skins.

*The character of exports to each country.*—The domestic fishery products exported from the United States are sent principally to England, Haiti, Germany, Canada, Australia, France, and Hongkong. In 1894 the value of the exports amounted to $4,258,306, of which $1,304,493 was sent to England, $652,723 to Haiti, $438,333 to Germany, $269,726 to Canada, $235,086 to Australia, $198,968 to France, and $175,743 to Hongkong.

The exports to England are principally canned salmon, fresh oysters, whale oil, and spermaceti. To Haiti are sent salted cod, smoked herring, pickled mackerel, and other pickled fish; to Germany, whalebone, spermaceti, and prepared fish of various kinds; Canada receives fresh oysters, smoked haddock, and various kinds of fresh fish; Australia, canned and pickled salmon, canned oysters, and spermaceti. The exports to France consist almost entirely of whalebone, spermaceti, and fish and whale oil; and those to Hongkong, of dried shrimp, with a small quantity of canned salmon and various kinds of dried fish.

Table 26 shows the quantities and values of domestic fishery products exported to various foreign countries during the fiscal year ending June 30, 1894. The quantity sent to Europe was valued at $2,088,958; to Canada and Newfoundland, $270,069; to other ports of the North American continent, $1,086,114; to South America, $241,234; to Asia and Oceanica, $537,455; to African and other ports, $34,476; making a grand total of $4,258,306.

The most valuable products were canned salmon, worth $1,026,215; salted cod, etc, $704,652; oysters, $688,653; whalebone, $441,969; shrimp and other shellfish, $249,721; and whale and fish oils, $140,851.

The dried or smoked and the brine-salted fish are marketed principally in the West Indies, those islands receiving, in 1894, 83 per cent of the exports of the former and 74 per cent of the latter. South America received 8 per cent of the dried fish and 3 per cent of the brine-salted. The canned fish are sent principally to England and Australia, those countries receiving 60 and 16 per cent, respectively, of the exports of this class. Of oysters, England received 64 and Canada 25 per cent of the total exports. Scotland ranks first in the marine oil trade, with England a close second, the exports to each amounting to 36 and 32 per cent, respectively, of the total. The whalebone is marketed almost exclusively in Germany, France, and the Netherlands, 97 per cent of the total exports going to those countries. England and France control the trade in marine shells, and the former receives the greater portion of the sponges exported from this country.

26. *Statement by articles and countries of the domestic exports of fishery products from the United States during the year ending June 30, 1894.*

| Countries to which exported. | Fresh fish other than salmon. | | Dried, smoked, or cured. | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Cod, haddock, hake, and pollock. | | Herring. | | Other. | |
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | | | |
| Azores, and Madeira Islands | | | 4,100 | $204 | | | | |
| Belgium | | | 48 | 10 | | | | |
| Total Europe | | | 4,148 | 214 | | | | |
| North America: | | | | | | | | |
| Canada— | | | | | | | | |
| Nova Scotia, New Brunswick, etc | 27,500 | $599 | 270 | 21 | 280 | $20 | | |
| Quebec, Ontario, etc | 824,663 | 41,331 | 235,066 | 13,371 | 2,086 | 132 | 84,497 | $4,226 |
| British Columbia | 7,295 | 422 | 27,735 | 1,504 | 560 | 29 | 502 | 36 |
| Mexico | 12,749 | 877 | 20,075 | 1,209 | 2,176 | 63 | 686 | 67 |
| Central America— | | | | | | | | |
| Costa Rica | | | 211,985 | 11,660 | 8,083 | 202 | | |
| Guatemala | | | 54,510 | 3,405 | | | | |
| Honduras | | | 15,385 | 810 | 305 | 13 | | |
| Nicaragua | | | 47,937 | 2,816 | 924 | 32 | | |
| Salvador | | | 7,200 | 459 | | | | |
| British Honduras | | | 81,171 | 4,480 | 4,391 | 118 | | |
| Bermuda | | | 7,995 | 419 | 420 | 12 | | |
| West Indies— | | | | | | | | |
| British | 2,932 | 246 | 735,635 | 36,006 | 197,590 | 4,423 | 372 | 14 |
| Danish | | | 7,800 | 417 | 1,050 | 24 | | |
| Dutch | | | 71,093 | 3,767 | 45,380 | 1,157 | | |
| French | | | 1,638 | 96 | 212,540 | 4,989 | | |
| Haiti | | | 8,922,079 | 432,573 | 3,133,453 | 74,877 | | |
| Santo Domingo | | | 1,038,927 | 47,281 | 789,385 | 18,475 | | |
| Spanish— | | | | | | | | |
| Cuba | 234,188 | 5,016 | 1,256,262 | 61,102 | 374,332 | 10,347 | 967,857 | 21,387 |
| Puerto Rico | | | 20,030 | 1,009 | 135,554 | 3,784 | | |
| Total North America | 1,109,327 | 48,491 | 12,762,793 | 622,465 | 4,908,509 | 118,697 | 1,053,914 | 25,730 |
| South America: | | | | | | | | |
| Argentina | | | 1,400 | 70 | | | | |
| Brazil | | | 57,920 | 3,155 | 750 | 21 | | |
| Chile | | | 3,300 | 165 | | | | |
| Colombia | | | 219,135 | 12,783 | 31,016 | 863 | | |
| Ecuador | | | 11,100 | 580 | | | | |
| Guianas— | | | | | | | | |
| British | 6,415 | 329 | 129,359 | 5,993 | 27,000 | 548 | 43 | 8 |
| Dutch | | | 737,278 | 22,181 | 28,300 | 619 | | |
| French | | | 228,562 | 6,697 | 16,310 | 341 | | |
| Peru | | | 500 | 35 | 100 | 3 | | |
| Venezuela | | | 270,453 | 14,251 | 91,562 | 2,398 | | |
| Total South America | 6,415 | 329 | 1,659,067 | 65,910 | 195,038 | 4,793 | 43 | 8 |
| Asia and Oceanica: | | | | | | | | |
| China | | | 14,510 | 950 | 80 | 5 | | |
| Hongkong | | | 20,600 | 1,181 | | | 152,600 | 9,182 |
| Japan | | | 750 | 48 | | | | |
| British Australasia | | | 63,480 | 3,442 | | | | |
| French Oceanica | | | 7,260 | 441 | | | | |
| Hawaiian Islands | | | 179,275 | 9,040 | | | 272,850 | 16,046 |
| Total Asia and Oceanica | | | 285,875 | 15,102 | 80 | 5 | 425,450 | 25,228 |
| Africa: | | | | | | | | |
| British Africa | | | 11,140 | 407 | 2,914 | 80 | | |
| Canary Islands | | | | | 3,654 | 95 | | |
| Liberia | | | 10,625 | 554 | 7,830 | 212 | | |
| Total Africa | | | 21,765 | 961 | 14,398 | 387 | | |
| Grand total | 1,115,742 | 48,820 | 14,733,048 | 704,052 | 5,118,025 | 123,882 | 1,479,407 | 50,966 |

26. *Statement by articles and countries of the domestic exports of fishery products from the United States during the year ending June 30, 1894*—Continued.

| Countries to which exported. | Pickled or brine-salted. | | | | | | |
|---|---|---|---|---|---|---|---|
| | Mackerel. | | Herring. | | Salmon.* | Other. | |
| | Barrels. | Values. | Barrels. | Values. | Values. | Barrels. | Values. |
| Europe: | | | | | | | |
| Belgium | ..... | ..... | ..... | ..... | $12 | ..... | ..... |
| Germany | ..... | ..... | ..... | ..... | 389 | 12 | $60 |
| Netherlands | ..... | ..... | ..... | ..... | 352 | ..... | ..... |
| England | ..... | ..... | 100 | $350 | 763 | 18 | 110 |
| Total Europe | ..... | ..... | 100 | 350 | 1,496 | 30 | 170 |
| North America: | | | | | | | |
| Canada— | | | | | | | |
| Nova Scotia, New Brunswick, etc | 32 | $256 | ..... | ..... | ..... | 345 | 1,222 |
| Quebec, Ontario, etc | 15 | 192 | 25 | 105 | 226 | 43 | 265 |
| British Columbia | 13 | 200 | 2 | 14 | 2,691 | 2 | 27 |
| Mexico | 8 | 127 | ..... | 2 | 1,224 | ..... | ..... |
| Central America— | | | | | | | |
| Costa Rica | 25 | 317 | 13 | 66 | 107 | 40 | 250 |
| Guatemala | 7 | 98 | ..... | ..... | ..... | ..... | ..... |
| Honduras | 1 | 17 | ..... | ..... | 18 | ..... | ..... |
| Nicaragua | 43 | 514 | ..... | ..... | 19 | 2 | 14 |
| British Honduras | 33 | 466 | 20 | 91 | 30 | 8 | 43 |
| Bermuda | 11 | 175 | 2 | 13 | 40 | 2 | 9 |
| West Indies— | | | | | | | |
| British | 270 | 3,688 | 1,871 | 6,553 | 2,510 | 3,153 | 13,682 |
| Danish | 5 | 60 | 5 | 20 | 6 | 24 | 110 |
| Dutch | 58 | 815 | 299 | 1,871 | 336 | 4 | 19 |
| French | 11 | 132 | 2 | 10 | 431 | ..... | ..... |
| Haiti | 1,758 | 24,717 | 362 | 1,522 | 742 | 25,367 | 115,361 |
| Santo Domingo | 635 | 7,517 | 427 | 1,708 | 254 | 12 | 77 |
| Spanish— | | | | | | | |
| Cuba | 100 | 1,250 | 6 | 32 | 371 | 96 | 487 |
| Puerto Rico | 34 | 478 | ..... | ..... | 304 | ..... | ..... |
| Total North America | 3,065 | 41,079 | 3,034 | 11,507 | 9,369 | 29,107 | 131,566 |
| South America: | | | | | | | |
| Brazil | 8 | 112 | ..... | ..... | 56 | ..... | ..... |
| Chile | ..... | ..... | ..... | ..... | 17 | ..... | ..... |
| Colombia | 76 | 1,064 | 262 | 1,149 | 126 | 5 | 28 |
| Ecuador | 5 | 66 | ..... | ..... | ..... | ..... | ..... |
| Guianas— | | | | | | | |
| British | 31 | 288 | 14 | 58 | 48 | 45 | 285 |
| Dutch | ..... | ..... | ..... | ..... | 232 | 536 | 3,021 |
| French | 10 | 115 | ..... | ..... | ..... | 22 | 106 |
| Venezuela | 15 | 219 | 13 | 65 | 348 | 2 | 10 |
| Total South America | 145 | 1,864 | 289 | 1,272 | 827 | 610 | 3,510 |
| Asia and Oceanica: | | | | | | | |
| Hongkong | ..... | ..... | ..... | ..... | 5 | ..... | ..... |
| British Australasia | ..... | ..... | ..... | ..... | 13,335 | ..... | ..... |
| French Oceanica | ..... | ..... | ..... | ..... | 1,976 | ..... | ..... |
| Hawaiian Islands | ..... | ..... | ..... | ..... | 30,709 | ..... | ..... |
| Total Asia and Oceanica | ..... | ..... | ..... | ..... | 46,025 | ..... | ..... |
| Africa: | | | | | | | |
| British Africa | ..... | ..... | 53 | 230 | ..... | ..... | ..... |
| Liberia | 14 | 139 | 25 | 98 | ..... | 121 | 613 |
| Total Africa | 14 | 139 | 78 | 328 | ..... | 121 | 613 |
| All other islands and ports | ..... | ..... | ..... | ..... | 942 | ..... | ..... |
| Grand total | 3,224 | 43,082 | 3,501 | 13,457 | 58,659 | 29,868 | 135,859 |

* Includes a small quantity of fresh salmon.

26. *Statement by articles and countries of the domestic exports of fishery products from the United States during the year ending June 30, 1894*—Continued.

| Countries to which exported. | Canned. | | | All other fish. | Shellfish. | | Fish oil. | |
|---|---|---|---|---|---|---|---|---|
| | Salmon. | | Other. | | Oysters. | Other. | | |
| | Pounds. | Values. | Values. | Values. | Values. | Values. | Gallons. | Values. |
| Europe: | | | | | | | | |
| Azores, and Madeira Islands | 144 | $18 | ..... | ..... | ..... | $2,457 | ..... | ..... |
| Belgium | 540 | 61 | ..... | ..... | $490 | 290 | ..... | ..... |
| Denmark | ..... | ..... | ..... | $365 | 565 | ..... | ..... | ..... |
| France | 280 | 28 | ..... | 3,421 | 406 | 1,782 | 17,392 | $5,631 |
| Germany | 8,445 | 1,218 | $1,591 | 158,433 | 6,452 | 802 | ..... | ..... |
| Italy | 3,264 | 384 | 720 | ..... | ..... | 1,195 | 5,000 | 1,850 |
| Netherlands | ..... | ..... | 117 | 1,041 | 68 | 20 | ..... | ..... |
| Portugal | ..... | ..... | ..... | ..... | ..... | 10 | ..... | ..... |
| Spain | ..... | ..... | 9 | 55 | ..... | ..... | 500 | 100 |
| Sweden and Norway | ..... | ..... | ..... | 35 | 110 | ..... | ..... | ..... |
| United Kingdom— | | | | | | | | |
| England | 7,720,747 | 712,017 | 2,815 | 6,182 | 440,130 | 10,916 | 18,559 | 6,094 |
| Scotland | 1,440 | 179 | 210 | 50 | 5,858 | 225 | 54,105 | 16,240 |
| Total Europe | 7,734,860 | 713,905 | 5,462 | 169,582 | 454,078 | 17,697 | 95,556 | 29,915 |
| North America: | | | | | | | | |
| Canada— | | | | | | | | |
| Nova Scotia, New Brunswick, etc | ..... | ..... | ..... | 89 | 6,767 | 7,912 | ..... | ..... |
| Quebec, Ontario, etc | ..... | ..... | 1,331 | 2,221 | 159,920 | 7,632 | 541 | 151 |
| British Columbia | 24,150 | 1,506 | 741 | 977 | 6,794 | 1,601 | ..... | ..... |
| Newfoundland and Labrador | 288 | 28 | 43 | 63 | 205 | 4 | ..... | ..... |
| Miquelon, Langley, etc | 1,600 | 175 | ..... | ..... | ..... | ..... | ..... | ..... |
| Mexico | 59,625 | 5,980 | 7,211 | 9,820 | 13,344 | 3,067 | 978 | 482 |
| Central America— | | | | | | | | |
| Costa Rica | 37,271 | 3,791 | 1,922 | 108 | 944 | 792 | 52 | 20 |
| Guatemala | 10,015 | 1,047 | 2,865 | 2 | 369 | 556 | ..... | ..... |
| Honduras | 2,743 | 279 | 409 | 30 | 325 | 333 | ..... | ..... |
| Nicaragua | 13,255 | 1,329 | 2,597 | 18 | 957 | 747 | 18 | 38 |
| Salvador | 2,730 | 284 | 1,323 | ..... | 160 | ..... | ..... | ..... |
| British Honduras | 9,791 | 1,019 | 126 | ..... | 119 | 144 | ..... | ..... |
| Bermuda | 20,759 | 2,504 | 2,068 | 114 | 647 | 427 | ..... | ..... |
| West Indies— | | | | | | | | |
| British | 185,459 | 19,199 | 9,273 | 2,663 | 2,041 | 544 | 2,841 | 1,126 |
| Danish | 4,404 | 469 | 132 | 50 | 276 | 328 | ..... | ..... |
| Dutch | 5,265 | 612 | 1,914 | 162 | 228 | 12 | 8 | 3 |
| French | 1,110 | 117 | 123 | 40 | 7 | ..... | ..... | ..... |
| Haiti | 660 | 78 | 980 | 909 | 303 | 140 | 130 | 71 |
| Santo Domingo | 2,048 | 212 | 3,910 | 2,862 | 258 | 45 | ..... | ..... |
| Spanish— | | | | | | | | |
| Cuba | 12,596 | 1,418 | 2,795 | 1,120 | 9,248 | 1,399 | 4,352 | 1,565 |
| Puerto Rico | 1,248 | 137 | 151 | 11 | 412 | 17 | 40 | 15 |
| Total North America | 395,017 | 40,190 | 39,914 | 21,259 | 203,324 | 25,700 | 8,960 | 3,471 |
| South America: | | | | | | | | |
| Argentina | 30,010 | 3,283 | 5,501 | 30 | 4,799 | 2,017 | ..... | ..... |
| Brazil | 89,759 | 9,501 | 30,631 | ..... | 3,345 | 14,347 | ..... | ..... |
| Chile | 43,984 | 4,575 | 2,493 | ..... | 800 | 7,712 | ..... | ..... |
| Colombia | 25,352 | 2,958 | 3,909 | 536 | 649 | 1,564 | 3 | 7 |
| Ecuador | 19,499 | 2,084 | 1,105 | ..... | 1,194 | 1,549 | ..... | ..... |
| Guianas— | | | | | | | | |
| British | 111,070 | 11,184 | 7,182 | 4,416 | 385 | 140 | ..... | ..... |
| Dutch | 10,176 | 1,033 | 1,008 | 1,067 | 61 | 277 | ..... | ..... |
| French | ..... | ..... | 524 | 282 | ..... | 335 | ..... | ..... |
| Peru | 11,528 | 1,435 | 1,356 | 235 | 947 | 709 | 1,000 | 381 |
| Uruguay | 12,520 | 1,486 | 898 | ..... | 657 | 798 | ..... | ..... |
| Venezuela | 31,577 | 3,291 | 13,167 | 201 | 1,321 | 699 | ..... | ..... |
| Total South America | 385,475 | 40,830 | 67,774 | 6,770 | 14,158 | 30,147 | 1,003 | 388 |
| Asia and Oceanica: | | | | | | | | |
| China | 4,305 | 448 | 205 | ..... | 1,073 | 383 | ..... | ..... |
| East Indies, British | 49,200 | 5,056 | 524 | ..... | ..... | 220 | ..... | ..... |
| Hongkong | 85,520 | 8,681 | 249 | 900 | ..... | 152,410 | ..... | ..... |
| Japan | 8,870 | 915 | 267 | ..... | ..... | ..... | ..... | ..... |
| British Australasia | 1,707,810 | 179,489 | 4,854 | 5,764 | 10,163 | 2,273 | ..... | ..... |
| French Oceanica | 80,650 | 8,323 | 636 | ..... | ..... | 55 | ..... | ..... |
| Hawaiian Islands | 199,469 | 20,364 | 3,368 | ..... | 5,206 | 20,112 | ..... | ..... |
| Total Asia and Oceanica | 2,135,824 | 223,276 | 10,103 | 6,664 | 16,442 | 175,453 | ..... | ..... |
| Africa: | | | | | | | | |
| British Africa | 19,142 | 2,120 | 19,732 | 144 | 608 | 520 | ..... | ..... |
| Canary Islands | 432 | 46 | ..... | ..... | 17 | 156 | ..... | ..... |
| Liberia | 760 | 78 | ..... | 401 | ..... | ..... | ..... | ..... |
| Total Africa | 20,334 | 2,250 | 19,732 | 545 | 625 | 682 | ..... | ..... |
| All other islands and ports | 55,500 | 5,764 | 417 | 13 | 26 | 42 | ..... | ..... |
| Grand total | 10,727,010 | 1,026,215 | 143,402 | 204,833 | 688,653 | 249,721 | 105,519 | 33,774 |

26. *Statement by articles and countries of the domestic exports of fishery products from the United States during the year ending June 30, 1894*—Continued.

| Countries to which exported. | Whale oil. | | Spermaceti. | | Whalebone. | | Marine shells. | Sponges. | Total. |
|---|---|---|---|---|---|---|---|---|---|
| | Gallons. | Values. | Pounds. | Values. | Pounds. | Values. | Values. | Values. | Values. |
| Europe: | | | | | | | | | |
| Azores, and Madeira Islands | | | | | | | | | $2,679 |
| Belgium | | | 3,381 | $1,020 | 1,157 | $3,600 | | | 5,483 |
| Denmark | | | 309 | 87 | | | | | 1,017 |
| France | 31,030 | $13,225 | 7,255 | 2,196 | 55,423 | 156,359 | $14,980 | $940 | 198,968 |
| Germany | 2,274 | 1,783 | 157,331 | 46,311 | 72,161 | 215,750 | 5,564 | | 438,333 |
| Italy | | | 2,831 | 825 | | | | 70 | 5,044 |
| Netherlands | | | 1,558 | 400 | 20,824 | 56,538 | | 299 | 58,845 |
| Portugal | | | | | | | | | 10 |
| Russia | | | 4,708 | 1,280 | | | | | 1,280 |
| Spain | | | 6,694 | 1,922 | | | 25 | | 2,111 |
| Sweden and Norway | | | | | | | | 398 | 552 |
| United Kingdom— | | | | | | | | | |
| England | 59,906 | 38,278 | 79,125 | 22,646 | 3,002 | 9,091 | 50,528 | 4,573 | 1,504,493 |
| Scotland | 49,726 | 34,827 | 42,309 | 12,054 | | | 500 | | 70,143 |
| Total Europe | 142,936 | 88,113 | 305,501 | 88,741 | 152,567 | 441,358 | 71,597 | 6,280 | 2,088,958 |
| North America: | | | | | | | | | |
| Canada— | | | | | | | | | |
| Nova Scotia, New Brunswick, etc | 303 | 269 | | | | | a 993 | 74 | 18,222 |
| Quebec, Ontario, etc | 2,193 | 1,144 | 1,092 | 255 | 108 | 492 | 137 | 966 | 234,097 |
| British Columbia | 2,041 | 800 | | | | | | 5 | 17,407 |
| Newfoundland and Labrador | | | | | | | | | 343 |
| Miquelon, Langley, etc | | | | | | | | | 175 |
| Mexico | 14,265 | 5,446 | 1,477 | 87 | 8 | 25 | 4 | 235 | 49,330 |
| Central America— | | | | | | | | | |
| Costa Rica | 50 | 24 | | | | | | | 20,263 |
| Guatemala | 200 | 100 | | | | | | | 8,442 |
| Honduras | | | | | | | | | 2,234 |
| Nicaragua | | | | | | | | | 9,081 |
| Salvador | | | | | | | | | 2,226 |
| British Honduras | | | | | | | | | 6,636 |
| Bermuda | 5 | 5 | | | | | | | 6,433 |
| West Indies— | | | | | | | | | |
| British | 40 | 29 | | | | | 1,580 | 7 | 103,584 |
| Danish | | | | | | | | | 1,892 |
| Dutch | 92 | 44 | | | | | | | 10,440 |
| French | | | | | | | | | 5,945 |
| Haiti | 250 | 200 | | | | | | 250 | 652,723 |
| Santo Domingo | | | | | | | | | 82,599 |
| Spanish— | | | | | | | | | |
| Cuba | 160 | 121 | | | 26 | 94 | | | 117,752 |
| Puerto Rico | 10 | 8 | | | | | | 27 | 6,353 |
| Total North America | 19,609 | 8,190 | 2,569 | 342 | 142 | 611 | 1,721<br>a 993 | 1,564 | 1,356,183 |
| South America: | | | | | | | | | |
| Argentina | | | | | | | | | 15,700 |
| Brazil | 20 | 15 | | | | | | 200 | 61,383 |
| Chile | 16 | 9 | | | | | | 286 | 16,057 |
| Colombia | 2,592 | 1,950 | | | | | | 45 | 27,631 |
| Ecuador | | | | | | | | | 6,578 |
| Guianas— | | | | | | | | | |
| British | | | | | | | | | 30,867 |
| Dutch | | | | | | | | | 29,499 |
| French | | | | | | | | | 8,460 |
| Peru | | | | | | | | | 5,101 |
| Uruguay | | | | | | | | 48 | 3,887 |
| Venezuela | 10 | 7 | 62 | 20 | | | | 74 | 36,071 |
| Total South America | 2,638 | 1,981 | 62 | 20 | | | | 653 | 241,234 |

a Fish skins.

26. *Statement by articles and countries of the domestic exports of fishery products from the United States during the year ending June 30, 1894*—Continued.

| Countries to which exported. | Whale oil. | | Spermaceti. | | Whalebone. | | Marine shells. | Sponges. | Total. |
|---|---|---|---|---|---|---|---|---|---|
| | Gallons. | Values. | Pounds. | Values. | Pounds. | Values. | Values. | Values. | Values. |
| Asia and Oceanica: | | | | | | | | | |
| China | | | | | | | | | $3,064 |
| East Indies, British | | | | | | | | | 5,800 |
| Hongkong | 8,117 | $3,135 | | | | | | | 175,743 |
| Japan | | | | | | | | | 1,230 |
| British Australasia | 15,019 | 5,402 | 34,654 | $10,364 | | | | | 235,086 |
| French Oceanica | | | | | | | | | 11,431 |
| Hawaiian Islands | 533 | 256 | | | | | | | 105,101 |
| Total Asia and Oceanica | 23,669 | 8,793 | 34,654 | 10,364 | | | | | 537,455 |
| Africa: | | | | | | | | | |
| British Africa | | | | | | | $367 | | 24,220 |
| Canary Islands | | | | | | | | | 314 |
| Liberia | | | | | | | | | 2,095 |
| Total Africa | | | | | | | 367 | | 26,629 |
| All other islands and ports | | | | | | | 643 | | 7,847 |
| Grand total | 188,852 | 107,077 | 342,786 | 99,467 | 152,709 | $441,969 | 74,328 a993 | $8,497 | 4,258,306 |

a Fish skins.

*Reciprocity treaties with other American countries.*—The provisions of section 3 of the tariff act of 1890 resulted in reciprocal treaties or agreements relating to nine countries in the Western Hemisphere, by which the duties on fish (and about 2,000 other articles) of United States production were affected, in some cases being entirely abrogated and in others reduced 25 or 50 per cent. These agreements related to the following countries:

| Countries. | Date of taking effect. |
|---|---|
| Brazil | April 1, 1891 |
| Cuba | Sept. 1, 1891 |
| Puerto Rico | Do. |
| Santo Domingo | Do. |
| Salvador | Feb. 1, 1892 |
| British West Indies | Do. |
| Nicaragua | Mar. 12, 1892 |
| Honduras | May 25, 1892 |
| Guatemala | May 30, 1892 |

It does not appear, however, that these discriminations in favor of the United States had any appreciable effect toward increasing the fishery exports to those countries. The repeal in 1894 of the act of 1890 resulted in a termination of these reciprocal relations.

For an account of the Canadian reciprocity trade see p. 458.

## IV.—COD, HADDOCK, HAKE, AND POLLOCK.

*General statements of trade.*—Dried cod was the first domestic fishery product exported from the United States. In 1774 the value of the exported cod was $1,000,000, constituting one-sixth of the whole commerce of the United States. In 1804 the domestic exports of the United States were valued at $41,467,477, of which the exports of cod amounted to 567,825 quintals, with a valuation of $2,400,000, this being the largest quantity ever exported from this country during any one year.

While large quantities of cured cod and similar fish are now imported for consumption in this country, yet the imports are exceeded by the exports. During the ten years ending June 30, 1894, imports of dried cod for consumption amounted to 106,377,963 pounds, valued at $3,352,739, while the domestic exports were 162,600,083 pounds, worth $7,370,841, an excess of 56,222,120 pounds and $4,018,102, an average of 5,622,212 pounds and $401,810 per year. This average excess is somewhat reduced, owing to the large imports of 1885, the last year in which the Washington treaty was operative. Considering only the last nine years, the average annual excess of the exports over the imports for consumption has been 7,818,868 pounds and $470,706. The annual product of dry-salted cod in the United States is about 65,000,000 pounds, valued at $2,600,000.

The following table shows for the ten years ending June 30, 1894, the quantity and value of the dry-salted cod imported for consumption, the quantity and value of the domestic exports, the balance of trade each year, and the average value per 100 pounds of imported and of exported fish. The extent of the imports of dried cod from 1821 to the present time is shown in the general tables of imports on pages 441–446. The domestic exports of cod are contained in Tables 19 and 20 on pages 462–464.

27. *Statement of the codfish trade during a series of ten years ending June 30, 1894.*

| Year ending June 30— | Imports for consumption. | | Domestic exports. | | Balance of trade. | | Average value per 100 pounds. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Dollars. | Imports. | Exports. |
| 1885..... | 32,326,686 | $943,116 | 18,178,987 | $724,858 | +14,147,699 | +$218,258 | $2.92 | $3.99 |
| 1886..... | 10,998,072 | 286,505 | 15,664,195 | 602,934 | — 4,666,123 | — 316,429 | 2.61 | 3.85 |
| 1887..... | 8,997,750 | 264,260 | 16,943,748 | 587,082 | — 7,945,998 | — 322,882 | 2.94 | 3.46 |
| 1888..... | 10,446,892 | 316,259 | 17,820,883 | 819,550 | — 7,373,991 | — 503,300 | 3.03 | 4.70 |
| 1889..... | 9,752,941 | 317,087 | 15,625,928 | 754,019 | — 5,872,987 | — 436,932 | 3.26 | 4.83 |
| 1890..... | 8,303,585 | 247,327 | 17,030,019 | 793,180 | — 8,726,434 | — 545,850 | 2.98 | 4.66 |
| 1891..... | 6,845,576 | 254,074 | 17,313,170 | 890,277 | —10,467,594 | — 636,203 | 3.71 | 5.14 |
| 1892..... | 5,804,548 | 229,255 | 14,435,878 | 765,199 | — 8,631,330 | — 535,944 | 4.95 | 5.30 |
| 1893..... | 7,433,163 | 291,531 | 14,853,627 | 728,475 | — 7,420,464 | — 436,944 | 3.92 | 4.90 |
| 1894..... | 5,468,750 | 202,725 | 14,733,648 | 704,052 | — 9,264,898 | — 501,927 | 3.71 | 4.78 |
| Total.. | 106,377,963 | 3,352,739 | 162,600,083 | 7,370,841 | —56,222,120 | —4,018,102 | ..... | ..... |

NOTE.—In balance of trade, + indicates excess of imports over exports, and — indicates excess of exports over imports.

During each year small quantities of brine-salted cod are imported into the United States. This trade has never been of great importance. The following compilation shows the imports for consumption during the ten years ending June 30, 1894:

28. *Statement of the quantity and value of brine-salted codfish imported for consumption during each year from 1885 to 1894, inclusive.*

| Year ending June 30— | Barrels. | Values. | Average values per barrel. |
|---|---|---|---|
| 1885 | 613 | $2,030 | $3.31 |
| 1886 | 193 | 839 | 4.36 |
| 1887 | 14 | 152 | 11.26 |
| 1888 | 131 | 626 | 4.80 |
| 1889 | 524 | 4,248 | 8.12 |
| 1890 | 342 | 3,363 | 9.86 |
| 1891 | 51 | 237 | 4.69 |
| 1892 | 76 | 724 | 9.53 |
| 1893 | 20 | 158 | 7.73 |
| 1894 | 20 | 112 | 5.52 |
| Total | 1,984 | 12,489 | ..... |

Table 29 shows for the ten years ending June 30, 1894, the quantities and values of dried cod and similar fish imported from and domestic dried fish exported to each foreign country, the balance of trade with each country, and the average value per 100 pounds of the imported and of the exported fish.

It appears that during this period the imports from Europe amounted to 4,172,214 pounds, and the exports to 1,950,312 pounds, the trade with that continent amounting to 2 per cent of the total trade in this product. The imports and exports to other North American States and colonies amounted to 149,504,941 and 120,092,877 pounds, respectively, or nearly 86 per cent of the total trade. The trade with South America is exclusively in exports, amounting to 33,961,845 pounds.

The exports of dried fish to Asia, Africa, and other ports amounted to 6,595,049 pounds, and the imports therefrom were 16,881 pounds, consisting principally of Chinese and Japanese dried fish.

Considering the average value, it appears that the imports from Europe were the most valuable, averaging $5.01 per 100 pounds. The imports from other American countries averaged $3.30 and those from Asia and Oceanica $3.98, giving an average value for all imports of $3.35 per 100 pounds. The exports were worth $4.53 per 100 pounds, those to France, Asia and Oceanica, and Central America being the most valuable. The large quantity exported to Haiti is worthy of note, that island receiving considerably over 50 per cent of the total exports of dried or smoked fish from the United States.

29. *Statement of the balance of trade in dry-salted cod and similar fish between the United States and each foreign country during the ten years ending June 30, 1894.*

| Countries. | Imports. | | Exports. | | Balance of trade. | | Average value per 100 pounds. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Imports. | Exports. |
| **Europe:** | | | | | | | | |
| Azores, and Madeira Islands | | | 817,968 | $30,060 | — 817,968 | — $30,060 | | $3.67 |
| Denmark | | | 5,325 | 279 | — 5,325 | — 279 | | 5.24 |
| France | 526,795 | $26,370 | 8,350 | 542 | + 518,445 | + 25,828 | $5.01 | 6.49 |
| Germany | 21,907 | 1,128 | 3,658 | 166 | + 18,249 | + 962 | 5.10 | 4.54 |
| Italy | 15,724 | 746 | | | + 15,724 | + 746 | 4.74 | |
| Netherlands | 5,368 | 374 | 25,750 | 1,288 | — 20,382 | — 914 | 6.97 | 5.01 |
| Portugal | | | 1,055,570 | 33,140 | — 1,055,570 | — 33,140 | | 3.14 |
| Spain | 2,390 | 226 | 1,520 | 78 | + 870 | + 148 | 9.46 | 5.13 |
| Sweden and Norway | 3,552,488 | 179,953 | | | + 3,552,488 | + 179,953 | 5.07 | |
| United Kingdom— | | | | | | | | |
| England | 36,516 | 1,727 | 32,165 | 1,683 | + 4,351 | + 44 | 4.73 | 5.23 |
| Scotland | 11,026 | 437 | | | + 11,026 | + 437 | 3.96 | |
| Total Europe | 4,172,214 | 210,961 | 1,950,312 | 67,236 | + 2,221,902 | + 143,725 | 5.01 | 3.45 |
| **North America:** | | | | | | | | |
| Canada— | | | | | | | | |
| Nova Scotia, New Brunswick, etc | 113,944,077 | 3,669,498 | 223,520 | 5,606 | +113,720,557 | +3,663,892 | 3.22 | 2.51 |
| Quebec, Ontario, etc | 605,263 | 17,286 | 300,369 | 17,182 | + 304,894 | + 104 | 2.85 | 5.72 |
| British Columbia | 13,230 | 1,041 | 212,338 | 12,275 | — 199,108 | — 11,234 | | 5.78 |
| Newfoundland and Labrador | 22,419,258 | 835,535 | | | + 22,419,258 | + 835,535 | 3.29 | |
| Miquelon, Langley, etc | 11,503,258 | 368,561 | | | + 11,503,258 | + 368,561 | 3.20 | |
| Greenland, Iceland, and Faroe Islands | 9,500 | 270 | | | + 9,500 | + 270 | 2.84 | |
| Mexico | | | 337,773 | 19,945 | — 337,773 | — 19,945 | | 5.90 |
| Central America— | | | | | | | | |
| Costa Rica | | | 1,946,603 | 112,378 | — 1,946,603 | — 112,378 | | 5.77 |
| Guatemala | | | 297,623 | 19,207 | — 297,623 | — 19,207 | | 6.45 |
| Honduras | | | 187,672 | 10,886 | — 187,672 | — 10,886 | | 5.80 |
| Nicaragua | | | 684,379 | 39,658 | — 684,379 | — 39,658 | | 5.79 |
| San Salvador | | | 41,980 | 2,704 | — 41,980 | — 2,704 | | 6.44 |
| British Honduras | | | 1,306,704 | 59,965 | — 1,306,704 | — 59,965 | | 4.59 |
| Bermudas | | | 56,434 | 2,493 | — 56,434 | — 2,493 | | 4.42 |
| West Indies— | | | | | | | | |
| British | | | 6,489,880 | 271,948 | — 6,489,880 | — 271,948 | | 4.19 |
| Danish | | | 709,270 | 29,121 | — 709,270 | — 29,121 | | 4.10 |
| Dutch | | | 818,972 | 41,374 | — 818,972 | — 41,374 | | 5.05 |
| French | 688,988 | 24,732 | 1,168,045 | 50,748 | — 479,057 | — 26,016 | 3.59 | 4.34 |
| Haiti | | | 84,315,736 | 3,939,699 | — 84,315,736 | —3,939,699 | | 4.67 |
| Santo Domingo | | | 8,039,647 | 353,013 | — 8,039,647 | — 353,013 | | 4.39 |
| Spanish— | | | | | | | | |
| Cuba | 321,367 | 23,238 | 12,527,558 | 515,839 | — 12,206,191 | — 492,601 | 7.23 | 4.12 |
| Puerto Rico | | | 428,374 | 18,093 | — 428,374 | — 18,093 | | 4.22 |
| Total North America | 149,504,941 | 4,940,161 | 120,092,877 | 5,522,134 | + 29,412,064 | — 581,973 | 3.30 | 4.60 |
| **South America:** | | | | | | | | |
| Argentina | | | 34,900 | 1,243 | — 34,900 | — 1,243 | | 3.56 |
| Brazil | | | 1,047,212 | 55,945 | — 1,047,212 | — 55,945 | | 5.34 |
| Chile | | | 15,962 | 875 | — 15,962 | — 875 | | 5.48 |
| Colombia | | | 10,458,011 | 618,111 | — 10,458,011 | — 618,111 | | 5.91 |
| Ecuador | | | 21,240 | 1,152 | — 21,240 | — 1,152 | | 5.42 |
| Guiana: | | | | | | | | |
| British | | | 818,460 | 31,204 | — 818,460 | — 31,204 | | 3.81 |
| Dutch | | | 11,340,852 | 335,356 | — 11,340,852 | — 335,356 | | 2.96 |
| French | | | 7,315,471 | 234,703 | — 7,315,471 | — 234,703 | | 3.21 |
| Peru | | | 14,502 | 847 | — 14,502 | — 847 | | 5.84 |
| Venezuela | | | 2,895,235 | 140,837 | — 2,895,235 | — 140,837 | | 4.86 |
| Total South America | | | 33,961,845 | 1,420,273 | — 33,961,845 | —1,420,273 | | 4.18 |

29. *Statement of the balance of trade in dry-salted cod and similar fish between the United States and each foreign country during the ten years ending June 30, 1894*—Continued.

| Countries. | Imports. | | Exports. | | Balance of trade. | | Average value per 100 pounds. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Imports. | Exports. |
| Asia and Oceanica: | | | | | | | | |
| China | | | 111,198 | $7,073 | — 111,198 | — $7,073 | | $6.36 |
| Hongkong | 10,090 | $430 | 392,380 | 22,343 | — 382,290 | — 21,913 | $4.26 | 5.69 |
| Japan | 3,798 | 123 | 51,480 | 3,048 | — 47,682 | — 2,925 | 3.24 | 5.92 |
| British Australasia | | | 2,955,850 | 180,059 | —2,955,850 | — 180,059 | | 6.09 |
| British East Indies | | | 39,500 | 2,548 | — 39,500 | — 2,548 | | 6.45 |
| French Oceanica | | | 41,860 | 2,618 | — 41,860 | — 2,618 | | 6.25 |
| Hawaiian Islands | | | 2,406,769 | 121,609 | —2,406,769 | — 121,609 | | 5.05 |
| Total Asia and Oceanica | 13,888 | 553 | 5,999,037 | 339,298 | —5,985,149 | — 338,745 | 3.98 | 5.65 |
| Africa: | | | | | | | | |
| British Africa | | | 149,224 | 5,029 | — 149,224 | — 5,029 | | 3.37 |
| French Africa | | | 7,353 | 282 | — 7,353 | — 282 | | 3.83 |
| Liberia | | | 365,169 | 12,377 | — 365,169 | — 12,377 | | 3.39 |
| Spanish Africa | | | 7,210 | 291 | — 7,210 | — 291 | | 4.04 |
| Total Africa | | | 528,956 | 17,979 | — 528,956 | — 17,979 | | 3.40 |
| All other islands and ports | 2,993 | 116 | 67,056 | 3,918 | — 64,063 | — 3,802 | 3.88 | 5.84 |
| Grand total | 153,694,036 | 5,151,791 | 162,600,083 | 7,370,838 | —8,906,047 | —2,219,047 | 3.35 | 4.53 |

NOTE.—In balance of trade, + indicates excess of imports over exports, and — indicates excess of exports over imports.

*Imports of dried cod by countries.*—Since the terminination of the Washington treaty, the imports of dried cod, haddock, and other ground fish have ranged from 10,500,000 to 15,000,000 pounds annually, but a large part of these imports is entered for the purpose of transshipment in bond to other countries, leaving, as already noted, only from 5,500,000 to 11,000,000 pounds as the quantity of foreign-cured cod, etc., entered for consumption in this country. During the operation of the Washington treaty the imports for consumption averaged about 30,000,000 pounds annually.

Nearly all of these fish are received from Nova Scotia, New Brunswick, and Newfoundland. Some come from Sweden and Norway, and from Miquelon and other French settlements on the south coast of Newfoundland. Shipments are also received nearly every year from other countries, as France, Germany, England, etc., but the imports from those countries are small.

Table 30 shows the quantities and values of dried or cured cod and other ground fish, imported into the United States from the various countries during a series of ten years ending June 30, 1894, the total quantities and values imported for consumption, and the amount of duties paid thereon. The total quantity entered during these ten years was 153,694,036 pounds, valued at $5,151,791. Of this quantity, however, 47,316,073 pounds were exported, leaving 106,377,963 pounds, worth $3,352,739, as the quantity of foreign dried or cured fish entered for consumption in this country, the duty on which amounted to $429,812.

30. *Statement by countries of the imports of dry-salted cod and similar fish during each of the ten years ending June 30, 1894.*

| Countries from which imported. | 1885. | | 1886. | | 1887. | | 1888. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | | | |
| Germany | | | | | 200 | $44 | | |
| Italy | | | 870 | $61 | | | 2,100 | $73 |
| Netherlands | | | | | 110 | 4 | | |
| Spain | | | | | | | 700 | 95 |
| Sweden and Norway | | | 104,732 | 7,082 | 248,690 | 10,949 | 465,419 | 19,841 |
| United Kingdom— | | | | | | | | |
| England | | | 9,381 | 677 | 10,064 | 171 | 173 | 7 |
| Total Europe | | | 114,983 | 7,820 | 259,064 | 11,168 | 468,392 | 20,016 |
| North America: | | | | | | | | |
| Canada— | | | | | | | | |
| Nova Scotia, New Brunswick, etc. | 29,386,186 | $823,110 | 11,717,524 | 263,036 | 9,476,948 | 231,593 | 11,541,168 | 383,829 |
| Quebec, Ontario, etc. | 50,920 | 2,527 | 8,610 | 321 | 339,669 | 5,586 | 63,142 | 1,748 |
| Newfoundland and Labrador | 2,962,472 | 119,101 | 1,772,248 | 70,490 | 2,194,658 | 77,584 | 2,142,280 | 69,936 |
| Miquelon, Langley, etc. | | | 207,938 | 8,082 | 2,187,989 | 70,036 | 823,855 | 31,453 |
| West Indies— | | | | | | | | |
| French | | | 473,324 | 16,576 | 215,664 | 8,156 | | |
| Spanish—Cuba | | | 28,507 | 2,445 | 40,268 | 3,002 | 10,394 | 747 |
| Total North America | 32,399,578 | 944,738 | 14,208,151 | 360,950 | 14,455,196 | 395,957 | 14,580,839 | 487,713 |
| Asia: | | | | | | | | |
| Hongkong | | | 212 | 19 | | | | |
| All other islands and ports | | | 734 | 31 | 115 | 5 | | |
| Grand total | 32,399,578 | 944,738 | 14,324,080 | 368,820 | 14,714,375 | 407,130 | 15,049,231 | 507,729 |
| Total entered for consumption | 32,326,686 | 943,116 | 10,998,072 | 286,505 | 8,997,750 | 264,260 | 10,446,892 | 316,259 |
| Amount of duty | | | | 54,990 | | 44,989 | | 52,235 |

| Countries from which imported. | 1889. | | 1890. | | 1891. | | 1892. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | | | |
| France | | | | | 1,702 | $67 | | |
| Germany | | | | | 600 | 32 | 3 | $1 |
| Italy | 400 | $27 | 439 | $16 | 6,025 | 312 | 2,738 | 119 |
| Netherlands | 1,000 | 100 | | | 2,000 | 100 | 1,410 | 107 |
| Spain | 900 | 95 | | | 750 | 30 | 40 | 6 |
| Sweden and Norway | 474,592 | 23,982 | 108,759 | 5,552 | 334,837 | 19,683 | 387,033 | 23,487 |
| United Kingdom— | | | | | | | | |
| England | 8,560 | 419 | 1,600 | 97 | 2,800 | 134 | 738 | 49 |
| Scotland | 7,216 | 259 | | | | | 1,000 | 36 |
| Total Europe | 492,668 | 24,882 | 110,798 | 5,665 | 348,714 | 20,358 | 392,962 | 23,805 |
| North America: | | | | | | | | |
| Canada— | | | | | | | | |
| Nova Scotia, New Brunswick, etc. | 9,200,614 | 327,013 | 8,638,337 | 290,115 | 9,189,943 | 376,963 | 7,500,390 | 316,531 |
| Quebec, Ontario, etc. | 24,839 | 1,196 | 1,344 | 84 | 43,191 | 2,328 | 64,418 | 3,203 |
| British Columbia | 7,815 | 716 | 3,300 | 213 | 200 | 12 | 800 | 43 |
| Newfoundland and Labrador | 2,926,763 | 92,364 | 2,240,082 | 76,710 | 3,021,220 | 108,416 | 2,378,891 | 100,322 |
| Miquelon, Langley, etc. | 1,155,342 | 28,717 | 1,741,451 | 36,471 | 326,722 | 15,445 | | |
| Greenland, Iceland and Faroe Islands | | | 6,000 | 180 | 3,500 | 90 | | |
| West Indies— | | | | | | | | |
| Cuba | | | | | 48,529 | 3,501 | 70,607 | 5,537 |
| Total North America | 13,405,373 | 450,006 | 12,639,514 | 403,723 | 12,633,305 | 506,755 | 10,015,106 | 425,636 |
| Asia: | | | | | | | | |
| Hongkong | | | | | | | 2,000 | 126 |
| Grand total | 13,898,041 | 474,888 | 12,750,312 | 409,388 | 12,982,019 | 527,113 | 10,410,068 | 449,567 |
| Total entered for consumption | 9,752,941 | 317,687 | 8,303,585 | 247,327 | 6,845,576 | 254,074 | 5,804,548 | 229,255 |
| Amount of duty | | 48,765 | | 41,518 | | 47,016 | | 43,534 |

30. *Statement by countries of the imports of dry-salted cod and similar fish during each of the ten years ending June 30, 1894*—Continued.

| Countries from which imported. | 1893. | | 1894. | | Total. | |
|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | |
| France | 110,438 | $5,898 | 414,655 | $20,405 | 526,705 | $26,370 |
| Germany | 450 | 11 | 20,654 | 1,040 | 21,907 | 1,128 |
| Italy | 1,591 | 75 | 1,561 | 63 | 15,724 | 746 |
| Netherlands | 848 | 63 | ..... | ..... | 5,368 | 374 |
| Spain | ..... | ..... | ..... | ..... | 2,390 | 226 |
| Sweden and Norway | 1,026,002 | 49,361 | 402,424 | 20,016 | 3,552,488 | 179,953 |
| United Kingdom— | | | | | | |
| England | ..... | ..... | 3,200 | 173 | 36,516 | 1,727 |
| Scotland | 1,810 | 93 | 1,000 | 49 | 11,026 | 437 |
| Total Europe | 1,141,139 | 55,501 | 843,494 | 41,746 | 4,172,214 | 210,961 |
| North America: | | | | | | |
| Canada— | | | | | | |
| Nova Scotia, New Brunswick, etc | 9,048,423 | 358,053 | 8,154,544 | 299,255 | 113,944,077 | 3,669,498 |
| Quebec, Ontario, etc | 1,050 | 50 | 8,080 | 293 | 005,263 | 17,286 |
| British Columbia | 600 | 30 | 515 | 27 | 13,230 | 1,041 |
| Newfoundland and Labrador | 1,555,250 | 67,848 | 1,216,394 | 52,764 | 22,419,258 | 835,535 |
| Miquelon, Langley, etc | 1,954,590 | 67,421 | 3,105,371 | 110,936 | 11,503,258 | 308,561 |
| Greenland, Iceland, and Faroe Islands | ..... | ..... | ..... | ..... | 9,500 | 270 |
| West Indies— | | | | | | |
| French | ..... | ..... | ..... | ..... | 688,988 | 24,732 |
| Spanish—Cuba | 56,547 | 4,100 | 66,515 | 3,906 | 321,367 | 23,238 |
| Total North America | 12,616,460 | 497,502 | 12,551,419 | 467,181 | 149,504,941 | 4,940,161 |
| Asia: | | | | | | |
| Hongkong | 495 | 36 | 7,383 | 249 | 10,090 | 430 |
| Japan | 2,025 | 73 | 1,773 | 50 | 3,798 | 123 |
| Total Asia | 2,520 | 109 | 9,156 | 299 | 13,888 | 553 |
| All other islands and ports | 20 | 1 | 2,124 | 79 | 2,993 | 116 |
| Grand total | 13,760,139 | 553,113 | 13,406,193 | 509,305 | 153,694,036 | 5,151,791 |
| Total entered for consumption | 7,433,163 | 291,531 | 5,468,750 | 202,725 | 106,377,963 | 3,352,739 |
| Amount of duty | ..... | 55,749 | ..... | 41,016 | ..... | 429,812 |

*Exports of cod by countries.*—Exports of dried codfish are made principally to Haiti, Cuba, Colombia, Dutch Guiana, Santo Domingo, and other South and Central American States and the West Indian Islands. Of the 162,600,083 pounds exported during the last ten years, Haiti received 84,315,736 pounds, or 52 per cent. All the American States and colonies combined received 153,984,722 pounds, or 95 per cent; Asia and Oceanica received 5,999,037 pounds, or 3 per cent; Europe, 1,950,312 pounds, or 1 per cent; the remaining 596,012 pounds going to African and other ports. The exports of cod to European countries appear very small when compared with the large imports into those countries. In 1893 France imported 94,218,948 pounds of codfish, worth $4,949,037. During the same year Portugal imported 43,126,385 pounds, worth $1,789,560, and Spain 97,811,488 pounds, worth $4,795,278. The imports into other European countries doubtless equaled one-half those into France, Portugal, and Spain, making an aggregate of 350,000,000 pounds, valued at $17,000,000, of which the United States furnished only 48,350 pounds, or about $\frac{1}{7\,6}$ of 1 per cent.

Table 31 shows the quantity and value of domestic dried or cured codfish, etc., exported to each foreign country during each of the ten years ending June 30, 1894:

31. *Statement by countries of the domestic exports of dry-salted cod and other ground fish during each of the ten years ending June 30, 1894.*

| Countries to which exported. | 1885. | | 1886. | | 1887. | | 1888. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | | | |
| Azores | 78,378 | $2,584 | 214,957 | $6,718 | 151,259 | $4,202 | 21,080 | $855 |
| Denmark | | | | | 1,800 | 90 | 2,400 | 144 |
| England | 5,120 | 256 | 148 | 10 | | | | |
| France | | | | | 8,000 | 520 | 350 | 22 |
| Germany | 621 | 44 | 87 | 5 | 200 | 15 | | |
| Netherlands | 25,750 | 1,288 | | | | | | |
| Portugal | 1,055,356 | 33,125 | 12 | 1 | 36 | 5 | 60 | 3 |
| Spain | | | 20 | 3 | | | | |
| Total Europe | 1,165,225 | 37,297 | 215,224 | 6,737 | 161,295 | 4,832 | 24,790 | 1,024 |
| North America: | | | | | | | | |
| Canada— | | | | | | | | |
| Nova Scotia, New Brunswick, etc | 210,900 | 5,244 | | | | | 2,350 | 116 |
| Quebec, Ontario, etc | 34,042 | 1,830 | 18,606 | 1,209 | 6,955 | 425 | 5,100 | 307 |
| British Columbia | 41,515 | 1,833 | 38,501 | 2,214 | 34,110 | 1,865 | 14,312 | 904 |
| Mexico | 27,358 | 1,447 | 48,141 | 2,765 | 19,140 | 1,356 | 24,977 | 1,702 |
| Central America— | | | | | | | | |
| Costa Rica | 85,248 | 4,858 | 86,728 | 5,419 | 119,653 | 7,100 | 144,562 | 8,021 |
| Guatemala | 14,855 | 865 | 15,803 | 962 | 15,867 | 1,025 | 19,416 | 1,252 |
| Honduras | 8,915 | 520 | 9,315 | 520 | 19,717 | 1,046 | 26,523 | 1,593 |
| Nicaragua | 21,790 | 1,264 | 22,883 | 1,279 | 48,647 | 2,408 | 49,772 | 2,740 |
| San Salvador | 990 | 60 | 880 | 55 | 1,180 | 72 | 1,750 | 104 |
| British Honduras | 200,665 | 7,342 | 154,561 | 5,331 | 151,702 | 5,138 | 136,438 | 5,911 |
| West Indies— | | | | | | | | |
| British | 1,438,958 | 51,985 | 693,618 | 25,010 | 433,577 | 13,610 | 580,468 | 27,460 |
| Danish | 110,605 | 4,135 | 84,970 | 3,187 | 147,918 | 5,126 | 126,348 | 5,125 |
| Dutch | 72,692 | 3,186 | 69,480 | 2,932 | 91,333 | 3,376 | 87,350 | 4,540 |
| French | 132,452 | 5,283 | 274,245 | 9,100 | 60,197 | 1,716 | 112,416 | 4,882 |
| Haiti | 6,506,931 | 250,416 | 6,591,186 | 241,899 | 7,465,058 | 240,391 | 8,986,578 | 422,839 |
| Santo Domingo | 704,813 | 30,440 | 959,686 | 33,847 | 891,669 | 29,203 | 680,572 | 30,438 |
| Spanish— | | | | | | | | |
| Cuba | 1,813,571 | 73,197 | 1,359,449 | 48,938 | 2,042,434 | 61,541 | 1,079,373 | 40,836 |
| Puerto Rico | 213,333 | 8,003 | 10,076 | 430 | 11,350 | 384 | 45,534 | 2,156 |
| Total North America | 11,639,663 | 451,908 | 10,438,134 | 385,103 | 11,560,507 | 375,782 | 12,123,839 | 560,926 |
| South America: | | | | | | | | |
| Argentina | 100 | 7 | | | 10,000 | 300 | | |
| Brazil | 21,480 | 775 | 17,785 | 913 | 120,450 | 5,040 | 405,855 | 22,549 |
| Chile | 1,000 | 39 | 1,000 | 48 | 362 | 26 | 50 | 3 |
| Colombia | 1,547,328 | 97,601 | 1,670,638 | 101,386 | 1,953,465 | 107,596 | 1,803,520 | 100,794 |
| Ecuador | | | | | 7,765 | 425 | 1,250 | 85 |
| Guianas— | | | | | | | | |
| British | 181,903 | 6,187 | 62,072 | 2,119 | 123,542 | 3,681 | 23,000 | 800 |
| Dutch | 1,672,895 | 53,387 | 1,543,287 | 42,684 | 1,289,106 | 29,220 | 1,220,278 | 34,571 |
| French | 869,620 | 27,459 | 878,518 | 25,413 | 909,912 | 21,692 | 982,912 | 20,221 |
| Peru | 8,650 | 500 | | | 2,057 | 124 | 1,750 | 99 |
| Venezuela | 245,989 | 10,646 | 343,411 | 13,545 | 290,598 | 12,241 | 282,833 | 14,502 |
| Total South America | 4,548,965 | 196,607 | 4,516,711 | 186,108 | 4,707,257 | 180,345 | 4,721,448 | 202,624 |
| Asia and Oceanica: | | | | | | | | |
| China | 9,430 | 525 | 9,343 | 573 | 4,840 | 257 | 5,385 | 300 |
| Hongkong | 63,730 | 3,130 | 49,000 | 2,641 | 22,650 | 1,136 | 29,930 | 1,639 |
| Japan | 10,540 | 600 | 5,710 | 312 | 6,100 | 339 | 6,960 | 384 |
| British Australasia | 517,740 | 25,456 | 145,400 | 7,546 | 172,750 | 10,917 | 561,366 | 36,609 |
| British East Indies | | | | | 600 | 28 | 9,600 | 615 |
| Hawaiian Islands | 153,580 | 6,710 | 225,526 | 11,382 | 252,650 | 11,736 | 242,970 | 12,283 |
| Total Asia and Oceanica | 755,020 | 36,439 | 434,979 | 22,454 | 459,590 | 24,413 | 856,211 | 51,830 |
| Africa: | | | | | | | | |
| British Africa | 14,514 | 480 | 2,350 | 74 | 1,125 | 37 | 1,925 | 77 |
| French Africa | | | 50 | 4 | | | | |
| Liberia | 46,060 | 1,640 | 33,777 | 1,121 | 43,110 | 1,107 | 83,984 | 2,550 |
| Spanish Africa | | | 5,560 | 233 | | | | |
| Total Africa | 60,574 | 2,120 | 41,737 | 1,432 | 44,235 | 1,144 | 85,909 | 2,627 |
| All other islands and ports | 9,540 | 496 | 17,410 | 1,100 | 10,864 | 566 | 8,686 | 528 |
| Grand total | 18,178,987 | 724,858 | 15,664,195 | 602,934 | 16,943,748 | 587,082 | 17,820,883 | 819,559 |

31. *Statement by countries of the domestic exports of dry-salted cod and other ground fish during each of the ten years ending June 30, 1894*—Continued.

| Countries to which exported. | 1889. | | 1890. | | 1891. | | 1892. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | | | |
| Azores | 142,164 | $6,292 | 112,900 | $4,390 | 42,020 | $2,150 | 3,360 | $165 |
| Denmark | ..... | ..... | ..... | ..... | 1,125 | 45 | ..... | ..... |
| England | ..... | ..... | 1,000 | 30 | 3,140 | 149 | 22,757 | 1,238 |
| Germany | 350 | 22 | 400 | 14 | 2,000 | 66 | ..... | ..... |
| Portugal | ..... | ..... | 112 | 6 | ..... | ..... | ..... | ..... |
| Total Europe | 142,514 | 6,314 | 114,412 | 4,440 | 48,285 | 2,410 | 26,117 | 1,403 |
| North America: | | | | | | | | |
| Canada— | | | | | | | | |
| Nova Scotia, New Brunswick, etc. | 10,000 | 225 | ..... | ..... | ..... | ..... | ..... | ..... |
| Quebec, Ontario, etc. | 300 | 18 | 100 | 12 | ..... | ..... | ..... | ..... |
| British Columbia | 6,650 | 420 | 15,150 | 1,055 | 13,450 | 991 | 10,210 | 737 |
| Mexico | 35,997 | 2,160 | 44,974 | 2,512 | 71,733 | 4,020 | 18,731 | 1,120 |
| Cental America— | | | | | | | | |
| Costa Rica | 161,731 | 9,177 | 296,410 | 17,127 | 298,500 | 17,270 | 270,890 | 16,422 |
| Guatemala | 26,007 | 1,713 | 29,069 | 1,866 | 25,653 | 1,777 | 44,170 | 3,037 |
| Honduras | 16,925 | 928 | 18,082 | 1,036 | 20,300 | 1,248 | 23,335 | 1,389 |
| Nicaragua | 76,194 | 4,615 | 99,913 | 5,883 | 144,618 | 8,201 | 94,484 | 5,861 |
| San Salvador | 3,830 | 247 | 6,080 | 404 | 4,540 | 334 | 6,560 | 423 |
| British Honduras | 127,226 | 6,324 | 115,068 | 5,781 | 126,587 | 7,157 | 117,525 | 7,025 |
| Bermudas | ..... | ..... | ..... | ..... | ..... | ..... | 37,719 | 1,544 |
| West Indies— | | | | | | | | |
| British | 847,635 | 40,485 | 363,107 | 15,842 | 541,374 | 23,932 | 420,294 | 17,368 |
| Danish | 83,981 | 3,578 | 79,430 | 3,984 | 45,002 | 2,297 | 15,060 | 830 |
| Dutch | 125,762 | 6,194 | 81,243 | 4,316 | 78,035 | 4,697 | 72,724 | 4,393 |
| French | 235,428 | 11,065 | 72,040 | 3,872 | 141,019 | 7,444 | 47,400 | 2,600 |
| Haiti | 6,931,362 | 337,854 | 10,609,937 | 505,010 | 10,931,449 | 574,879 | 8,846,336 | 498,842 |
| Santo Domingo | 1,119,327 | 54,057 | 713,829 | 32,154 | 711,732 | 34,860 | 611,376 | 31,799 |
| Spanish— | | | | | | | | |
| Cuba | 1,184,759 | 54,277 | 644,244 | 24,007 | 552,440 | 23,595 | 639,206 | 29,826 |
| Puerto Rico | 4,620 | 224 | 5,000 | 284 | 16,115 | 1,151 | 43,736 | 2,313 |
| Total North America | 10,997,734 | 533,561 | 13,194,282 | 625,145 | 13,722,547 | 713,833 | 11,325,756 | 625,529 |
| South America: | | | | | | | | |
| Argentina | ..... | ..... | 22,400 | 800 | ..... | ..... | 600 | 40 |
| Brazil | 150,742 | 8,359 | 42,405 | 2,253 | 49,018 | 2,747 | 81,057 | 4,652 |
| Chile | 1,700 | 100 | 150 | 8 | ..... | ..... | 6,650 | 390 |
| Colombia | 1,318,951 | 79,246 | 627,203 | 37,593 | 609,418 | 37,732 | 391,504 | 25,077 |
| Ecuador | ..... | ..... | ..... | ..... | ..... | ..... | 525 | 28 |
| Guianas— | | | | | | | | |
| British | 62,666 | 2,393 | 56,652 | 2,880 | 113,115 | 4,143 | 29,294 | 1,223 |
| Dutch | 1,077,882 | 33,200 | 1,111,415 | 35,121 | 811,673 | 27,757 | 985,408 | 31,799 |
| French | 750,633 | 26,528 | 895,974 | 31,542 | 735,805 | 29,338 | 618,011 | 23,644 |
| Peru | ..... | ..... | 385 | 18 | 800 | 44 | ..... | ..... |
| Venezuela | 284,306 | 15,485 | 302,257 | 14,039 | 316,840 | 16,337 | 271,027 | 15,479 |
| Total South America | 3,646,880 | 165,311 | 3,058,841 | 124,260 | 2,636,675 | 118,098 | 2,384,130 | 102,332 |
| Asia and Oceanica: | | | | | | | | |
| China | 13,130 | 810 | 10,470 | 687 | 12,270 | 894 | 16,150 | 1,067 |
| Hongkong | 54,530 | 3,243 | 61,000 | 3,772 | 52,700 | 3,446 | 19,190 | 1,136 |
| Japan | 6,510 | 393 | 3,190 | 192 | 8,700 | 601 | 1,210 | 81 |
| British Australasia | 395,460 | 26,572 | 211,270 | 14,781 | 487,420 | 33,007 | 319,984 | 17,343 |
| British East Indies | 10,900 | 712 | 1,600 | 95 | 300 | 24 | 16,500 | 1,074 |
| French Oceanica | ..... | ..... | 10,150 | 650 | 8,910 | 611 | 8,220 | 503 |
| Hawaiian Islands | 291,090 | 14,948 | 296,478 | 16,602 | 246,410 | 14,196 | 269,960 | 13,257 |
| Total Asia and Oceanica | 771,620 | 46,678 | 594,158 | 36,779 | 816,710 | 52,779 | 651,194 | 34,461 |
| Africa: | | | | | | | | |
| British Africa | 13,350 | 512 | 56,910 | 2,071 | 30,610 | 966 | 10,400 | 170 |
| French Africa | 2,000 | 30 | ..... | ..... | 3,303 | 200 | ..... | ..... |
| Liberia | 39,200 | 1,476 | 10,016 | 421 | 49,612 | 1,691 | 36,675 | 1,205 |
| Spanish Africa | ..... | ..... | ..... | ..... | 1,650 | 58 | ..... | ..... |
| Total Africa | 54,550 | 2,018 | 66,926 | 2,492 | 85,175 | 2,915 | 47,075 | 1,375 |
| All other islands and ports | 12,630 | 737 | 1,400 | 70 | 3,778 | 242 | 1,600 | 99 |
| Grand total | 15,625,928 | 754,619 | 17,030,019 | 793,186 | 17,313,170 | 890,277 | 14,435,878 | 765,199 |

31. *Statement by countries of the domestic exports of dry-salted cod and other ground fish during each of the ten years ending June 30, 1894*—Continued.

| Countries to which exported. | 1893. | | 1894. | | Total. | |
|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | |
| Azores | 46,850 | $2,500 | 4,100 | $204 | 817,968 | $30,060 |
| Denmark | | | | | 5,325 | 279 |
| England | | | | | 32,165 | 1,083 |
| France | | | | | 8,350 | 542 |
| Germany | | | | | 3,658 | 166 |
| Netherlands | | | | | 25,750 | 1,288 |
| Portugal | | | | | 1,055,576 | 33,140 |
| Spain | 1,500 | 75 | | | 1,520 | 78 |
| Total Europe | 48,350 | 2,575 | 4,100 | 204 | 1,950,312 | 67,236 |
| North America: | | | | | | |
| Canada— | | | | | | |
| Nova Scotia, New Brunswick, etc | | | 270 | 21 | 223,520 | 5,606 |
| Quebec, Ontario, etc | 200 | 10 | 235,066 | 13,371 | 300,369 | 17,182 |
| British Columbia | 10,675 | 752 | 27,735 | 1,564 | 212,338 | 12,275 |
| Mexico | 26,647 | 1,594 | 20,675 | 1,269 | 337,773 | 19,945 |
| Central America— | | | | | | |
| Costa Rica | 264,890 | 15,324 | 211,985 | 11,660 | 1,946,603 | 112,378 |
| Guatemala | 51,673 | 3,305 | 54,510 | 3,405 | 297,623 | 19,207 |
| Honduras | 29,175 | 1,790 | 15,385 | 810 | 187,672 | 10,886 |
| Nicaragua | 78,141 | 4,591 | 47,937 | 2,816 | 684,379 | 39,658 |
| San Salvador | 8,970 | 546 | 7,200 | 459 | 41,980 | 2,704 |
| British Honduras | 95,761 | 5,496 | 81,171 | 4,480 | 1,300,704 | 59,965 |
| Bermudas | 10,720 | 530 | 7,995 | 419 | 56,434 | 2,493 |
| West Indies— | | | | | | |
| British | 435,214 | 20,250 | 735,635 | 36,006 | 6,489,880 | 271,948 |
| Danish | 8,150 | 442 | 7,800 | 417 | 709,270 | 29,121 |
| Dutch | 69,260 | 3,973 | 71,093 | 3,767 | 818,972 | 41,374 |
| French | 91,210 | 4,684 | 1,638 | 96 | 1,168,045 | 50,748 |
| Haiti | 8,524,820 | 434,996 | 8,922,079 | 432,573 | 84,315,736 | 3,039,699 |
| Santo Domingo | 607,716 | 28,934 | 1,038,927 | 47,281 | 8,039,647 | 353,013 |
| Spanish— | | | | | | |
| Cuba | 1,955,820 | 98,520 | 1,256,262 | 61,102 | 12,527,558 | 515,839 |
| Puerto Rico | 58,580 | 2,139 | 20,030 | 1,009 | 428,374 | 18,093 |
| Total North America | 12,327,622 | 627,882 | 12,762,793 | 622,465 | 120,092,877 | 5,522,134 |
| South America: | | | | | | |
| Argentina | 400 | 20 | 1,400 | 70 | 34,900 | 1,243 |
| Brazil | 100,500 | 5,502 | 57,920 | 3,155 | 1,047,212 | 55,945 |
| Chile | 1,750 | 96 | 3,300 | 165 | 15,962 | 875 |
| Colombia | 316,849 | 18,303 | 219,135 | 12,783 | 10,458,011 | 618,111 |
| Ecuador | 600 | 34 | 11,100 | 580 | 21,240 | 1,152 |
| Guianas— | | | | | | |
| British | 36,857 | 1,779 | 129,359 | 5,993 | 818,460 | 31,204 |
| Dutch | 891,570 | 25,436 | 737,278 | 22,181 | 11,340,852 | 335,356 |
| French | 445,524 | 13,160 | 228,562 | 6,697 | 7,315,471 | 234,703 |
| Peru | 300 | 21 | 560 | 35 | 14,502 | 847 |
| Venezuela | 287,515 | 14,312 | 270,453 | 14,251 | 2,895,235 | 140,837 |
| Total South America | 2,081,865 | 78,678 | 1,659,067 | 65,910 | 33,961,845 | 1,420,273 |
| Asia and Oceanica: | | | | | | |
| China | 15,670 | 1,010 | 14,510 | 950 | 111,198 | 7,073 |
| Hongkong | 19,050 | 1,019 | 20,600 | 1,181 | 392,380 | 22,343 |
| Japan | 1,810 | 98 | 750 | 48 | 51,480 | 3,048 |
| British Australasia | 81,000 | 4,386 | 63,480 | 3,442 | 2,955,850 | 180,059 |
| British East Indies | | | | | 39,500 | 2,548 |
| French Oceanica | 7,320 | 413 | 7,200 | 441 | 41,800 | 2,618 |
| Hawaiian Islands | 248,830 | 11,446 | 179,275 | 9,040 | 2,400,769 | 121,609 |
| Total Asia and Oceanica | 373,680 | 18,372 | 285,875 | 15,102 | 5,999,037 | 339,298 |
| Africa: | | | | | | |
| British Africa | 6,900 | 235 | 11,140 | 407 | 149,224 | 5,029 |
| French Africa | 2,000 | 48 | | | 7,353 | 282 |
| Liberia | 12,110 | 612 | 10,625 | 554 | 365,169 | 12,377 |
| Spanish Africa | | | | | 7,210 | 291 |
| Total Africa | 21,010 | 895 | 21,765 | 961 | 528,956 | 17,979 |
| All other islands and ports | 1,100 | 70 | 48 | 10 | 67,056 | 3,018 |
| Grand total | 14,853,627 | 728,472 | 14,733,648 | 704,652 | 162,600,083 | 7,370,838 |

*Import duties on cured cod, etc., in various countries.*—The following compilation shows, approximately, the average rates of duty exacted on dried cod, etc., imported into various foreign countries. It appears that France, Argentina, San Salvador, Mexico, Spain, Nicaragua, and New Zealand impose the highest duties, while in Great Britain and certain of her colonies, Sweden, Guatemala, Japan, China, Germany, and most of the West Indies the duties are of least moment. The rate in the United States is 75 cents for 100 pounds.

32. *Statement of the approximate rates of duty exacted on dried cod, etc., imported into various foreign countries.*

| Countries. | Duty per 100 lbs. | Countries. | Duty per 100 lbs. |
|---|---|---|---|
| Europe: | | North America—continued. | |
| Denmark | $0.17 | West Indies—continued. | |
| France | 4.20 | Santo Domingo | $0.85 |
| Germany | .32 | South America: | |
| Great Britain | Free. | Argentina | 3.92 |
| Greece | 1.36 | Brazil | 1.00 |
| Italy | .44 | British Guiana | .44 |
| Portugal | 1.91 | Chile | 1.72 |
| Spain | 1.58 | Colombia | 1.10 |
| Sweden | Free. | Ecuador | .44 |
| North America: | | Peru | .22 |
| Canada | .50 | Venezuela | 2.19 |
| Newfoundland | 1.34 | Africa: | |
| Mexico | 2.87 | Liberia | 1.00 |
| Central America— | | Mauritius | .11 |
| British Honduras | Free. | Asia and Oceanica: | |
| Costa Rica | 1.54 | China | .11 |
| Guatemala | Free. | Japan | 5 p. ct. ad val. |
| Honduras | .93 | New South Wales | 2.06 |
| Nicaragua | 2.33 | New Zealand | 2.17 |
| San Salvador | 3.31 | Queensland | 1.08 |
| West Indies— | | South Australia | 2.06 |
| Cuba | .76 | Tasmania | 2.06 |
| Dutch West Indies | 1¼ p. ct. ad val. | Victoria | 20 p. ct. ad val. |
| Guadaloupe | .26 | West Australia | 12 p. ct. ad val. |
| Haiti | 1.35 | French Oceanica | .73 |
| Jamaica | .74 | | |
| Martinique | .35 | | |
| Puerto Rico | .37 | | |

## V.—MACKEREL.

*General trade since 1884.*—Notwithstanding the large catch of mackerel in this country, the demand for this fish has for many years exceeded the domestic supply. During the last ten years the imports for consumption have been 739,536 barrels, valued at $7,898,911, while the exports have been only 89,528 barrels, worth $656,812, an average annual balance of 65,000 barrels and $724,210. During 1894 the product of salt mackerel in the United States was 46,321 barrels, while the excess of imports over exports amounted to 91,612 barrels, giving an aggregate consumption in this country of 137,933 barrels. This represents 41 per cent of the world's product, the latter approximating 338,880 barrels in 1894.

The annual imports of brine-salted mackerel since 1820 are shown in Tables 5, 6, and 10, on pages 441, 443, and 447; the exports for the same period are included in the classification "pickled or brine-salted," as given in Tables 20 and 23, on pages 464 and 467.

In addition to brine-salted mackerel, quantities of fresh and canned mackerel are imported. The value of the former ranges from $20,000 to $80,000 annually, and the latter from $1,000 to $6,000. For a statement of the quantities and values of each of these products imported for consumption during a series of years, see pages 445 and 448.

The following table shows for the ten years ending June 30, 1894, the quantity and value of brine-salted mackerel imported for consumption, the quantity and value of domestic mackerel exported, the balance of trade, and average value per barrel of imported and exported mackerel:

33. *Statement of the foreign trade in brine-salted mackerel during the ten years ending June 30, 1894.*

| Year ending June 30— | Imports for consumption. | | Domestic exports. | | Excess of imports over exports. | | Average values per barrel. | |
|---|---|---|---|---|---|---|---|---|
| | Barrels. | Values. | Barrels. | Values. | Barrels. | Dollars. | Imports. | Exports. |
| 1885 | 92,147 | $702,030 | 24,512 | $139,663 | 67,635 | 562,367 | $7.62 | $5.70 |
| 1886 | 31,848 | 222,716 | 28,505 | 143,847 | 3,343 | 78,869 | 6.99 | 5.05 |
| 1887 | 64,925 | 563,855 | 15,760 | 106,967 | 49,165 | 456,888 | 8.69 | 6.79 |
| 1888 | 56,646 | 548,973 | 7,036 | 71,149 | 49,610 | 476,024 | 9.68 | 10.11 |
| 1889 | 42,394 | 574,722 | 1,303 | 18,876 | 41,091 | 555,846 | 13.56 | 14.49 |
| 1890 | 71,038 | 1,011,921 | 948 | 15,512 | 70,090 | 996,409 | 14.24 | 16.36 |
| 1891 | 113,276 | 1,356,113 | 2,295 | 37,128 | 110,981 | 1,318,985 | 11.97 | 16.18 |
| 1892 | 88,209 | 863,191 | 3,490 | 47,108 | 84,719 | 816,083 | 9.79 | 13.50 |
| 1893 | 84,217 | 960,588 | 2,455 | 33,480 | 81,762 | 927,108 | 11.41 | 14.45 |
| 1894 | 94,836 | 1,095,702 | 3,224 | 43,082 | 91,612 | 1,052,620 | 11.55 | 13.37 |
| Total | 739,536 | 7,898,911 | 89,528 | 656,812 | 650,008 | 7,242,099 | 10.68 | 7.34 |

Table 34 exhibits the extent of trade in brine-salted mackerel with each foreign country during the ten years ending June 30, 1894, and the average value per barrel of imported and of exported mackerel. The imports from Europe during this period amounted to 201,869 barrels, and from the British North American Provinces, 592,306 barrels. The exports are sent principally to Haiti, British West Indies, and the United States of Colombia. During the ten years in question the average value of the imported mackerel was $10.38, and of the exported

mackerel $7.18 per barrel. The most valuable mackerel are received from Norway and Sweden, averaging $16.39 per barrel during the last ten years; those from Ireland rank next, averaging $12.04 per barrel. The mackerel received from the British North American Provinces average only $9.42 per barrel.

31. *Statement by countries of the total imports and exports of brine-salted mackerel and the average value per barrel during the ten years ending June 30, 1894.*

| Countries. | Foreign imports. | | Domestic exports. | | Average values per barrel. | |
|---|---|---|---|---|---|---|
| | Barrels. | Values. | Barrels. | Values. | Imports. | Exports. |
| Europe: | | | | | | |
| France | 4,829 | $51,585 | 3 | $43 | $10.68 | $14.33 |
| Germany | 2 | 21 | 20 | 168 | 10.50 | 8.40 |
| Italy | 47 | 648 | 7 | 70 | 13.80 | 10.00 |
| Netherlands | 331 | 3,351 | ..... | ..... | 10.12 | ..... |
| Portugal | 13 | 125 | 50 | 200 | 9.61 | 4.00 |
| Sweden and Norway | 55,296 | 906,650 | ..... | ..... | 16.39 | ..... |
| United Kingdom | 141,290 | 1,701,515 | 701 | 6,242 | 12.04 | 8.90 |
| Others | 61 | 633 | 91 | 466 | 10.37 | 5.12 |
| Total Europe | 201,869 | 2,664,528 | 872 | 7,189 | 13.20 | 8.24 |
| North America: | | | | | | |
| Canada— | | | | | | |
| Nova Scotia, New Brunswick, etc. | 586,761 | 5,531,689 | 1,040 | 3,759 | 9.44 | 3.61 |
| Quebec, Ontario, etc | 4,819 | 44,300 | 99 | 819 | 9.19 | 8.17 |
| British Columbia | ..... | ..... | 42 | 584 | ..... | 13.90 |
| Newfoundland and Labrador | 726 | 6,184 | ..... | ..... | 8.52 | ..... |
| Mexico | ..... | ..... | 82 | 1,088 | ..... | 13.27 |
| Central America— | | | | | | |
| Costa Rica | ..... | ..... | 356 | 4,990 | ..... | 14.02 |
| Guatemala | ..... | ..... | 61 | 767 | ..... | 12.57 |
| Honduras | ..... | ..... | 99 | 1,087 | ..... | 10.97 |
| Nicaragua | ..... | ..... | 581 | 7,885 | ..... | 13.57 |
| British Honduras | ..... | ..... | 651 | 7,164 | ..... | 11.00 |
| Bermuda | ..... | ..... | 42 | 600 | ..... | 14.29 |
| West Indies— | | | | | | |
| British | ..... | ..... | 11,670 | 72,167 | ..... | 6.18 |
| Danish | ..... | ..... | 452 | 2,517 | ..... | 5.57 |
| Dutch | ..... | ..... | 928 | 9,333 | ..... | 10.06 |
| French | ..... | ..... | 4,234 | 23,587 | ..... | 5.57 |
| Haiti | ..... | ..... | 42,906 | 296,748 | ..... | 6.92 |
| Santo Domingo | ..... | ..... | 7,918 | 58,944 | ..... | 7.44 |
| Spanish— | | | | | | |
| Cuba | ..... | ..... | 1,410 | 12,849 | ..... | 9.11 |
| Puerto Rico | ..... | ..... | 2,191 | 15,883 | ..... | 7.25 |
| Total North America | 592,306 | 5,582,173 | 74,762 | 520,771 | 9.42 | 6.97 |
| South America: | | | | | | |
| Argentina | ..... | ..... | 20 | 144 | ..... | 7.20 |
| Brazil | ..... | ..... | 36 | 478 | ..... | 13.28 |
| Chile | ..... | ..... | 12 | 138 | ..... | 11.50 |
| Colombia | ..... | ..... | 8,915 | 94,122 | ..... | 10.56 |
| Ecuador | ..... | ..... | 6 | 79 | ..... | 13.17 |
| Guianas— | | | | | | |
| British | ..... | ..... | 1,388 | 7,664 | ..... | 5.52 |
| Dutch | ..... | ..... | 348 | 2,228 | ..... | 6.40 |
| French | ..... | ..... | 816 | 5,660 | ..... | 6.94 |
| Peru | ..... | ..... | 15 | 133 | ..... | 8.87 |
| Venezuela | ..... | ..... | 501 | 4,931 | ..... | 9.84 |
| Total South America | ..... | ..... | 12,057 | 115,577 | ..... | 9.59 |
| Asia and Oceanica: | | | | | | |
| British Australasia | ..... | ..... | 264 | 2,540 | ..... | 9.64 |
| Africa: | | | | | | |
| British | 71 | 406 | 210 | 1,741 | 5.72 | 8.20 |
| French | ..... | ..... | 3 | 17 | ..... | 5.67 |
| Spanish | ..... | ..... | 5 | 40 | ..... | 8.00 |
| Liberia | ..... | ..... | 1,340 | 8,819 | ..... | 6.58 |
| Total Africa | 71 | 406 | 1,558 | 10,617 | 5.72 | 6.81 |
| All other | ..... | ..... | 15 | 112 | ..... | 7.47 |
| Grand total | 794,246 | 8,247,107 | *89,528 | 656,812 | 10.38 | 7.34 |

*Imports of mackerel, by countries.*—Prior to 1888 almost the entire supply of brine-salted mackerel imported into the United States was received from Nova Scotia, but the recent decrease of this fish on the American coasts has resulted in large importations from Norway, England, Ireland, and, to a less extent, from other European countries. Of the imports during the last ten years, 586,761 barrels, worth $5,531,689, came from Nova Scotia and New Brunswick; 141,290 barrels, worth $1,701,515, came from England, Scotland, and Ireland; and 55,296 barrels, worth $906,650, from Sweden and Norway.

In 1890, 1891, 1892, and 1893 the receipts from France were comparatively large, aggregating 4,826 barrels, but the quantity received from that country during the remaining six of the last ten years was but 3 barrels.

Table 35 shows, for each of the ten years ending June 30, 1894, the quantity and value of salted mackerel imported from the various foreign countries, the imports for consumption, and the amount of duties paid thereon. Of the 794,246 barrels imported during that period, about 81 per cent came from the British North American Provinces, nearly 18 per cent from the British Isles, 7 per cent from Sweden and Norway, and less than 1 per cent from France. During these years, however, 54,710 barrels of foreign mackerel were exported, leaving 739,536 barrels, valued at $7,898,911, as the quantity of foreign mackerel imported for consumption. The duties paid on these imports amounted to $1,294,775.

35. *Statement of the brine-salted mackerel imported into the United States during the ten years ending June 30, 1894.*

| Countries from which imported. | 1885. | | 1886. | | 1887. | | 1888. | |
|---|---|---|---|---|---|---|---|---|
| | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. |
| Europe: | | | | | | | | |
| Sweden and Norway | | | | | | | 131 | $1,300 |
| Turkey | | | | | | | 58 | 597 |
| United Kingdom— | | | | | | | | |
| England | | | | | | | 1,875 | 14,602 |
| Scotland | | | | | | | 2 | 20 |
| Total Europe | | | | | | | 2,066 | 16,519 |
| North America: | | | | | | | | |
| Nova Scotia, New Brunswick, etc | 83,601 | $673,705 | 50,497 | $304,987 | 78,580 | $635,028 | 62,608 | 597,061 |
| Quebec, Ontario, etc | 3,079 | 25,117 | 343 | 2,542 | 339 | 2,084 | 236 | 1,419 |
| Newfoundland and Labrador | | | 49 | 335 | 253 | 2,230 | 77 | 762 |
| Total North America | 91,680 | 698,822 | 50,889 | 307,864 | 79,172 | 640,542 | 62,921 | 599,242 |
| Grand total | 91,680 | 698,822 | 50,889 | 307,864 | 79,172 | 640,542 | 64,987 | 615,761 |
| Total entered for consumption | 92,147 | 702,030 | 31,848 | 222,716 | 64,925 | 563,855 | 56,646 | 548,073 |
| Amount of duty | | | | 63,695 | | 129,849 | | 113,292 |

35. *Statement of the brine-salted mackerel imported into the United States during the ten years ending June 30, 1894*—Continued.

| Countries from which imported. | 1889. | | 1890. | | 1891. | | 1892. | |
|---|---|---|---|---|---|---|---|---|
| | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. |
| Europe: | | | | | | | | |
| Denmark | 1 | $16 | | | | | | |
| France | | | 627 | $3,651 | 977 | $9,587 | 1,977 | $24,041 |
| Germany | | | | | 2 | 21 | | |
| Italy | | | | | 2 | 11 | 23 | 420 |
| Netherlands | | | | | 65 | 1,049 | | |
| Portugal | | | | | 13 | 125 | | |
| Russia | | | | | 1 | 11 | | |
| Sweden and Norway | 637 | 5,732 | 3,045 | 48,465 | 11,493 | 180,210 | 12,075 | 177,996 |
| Turkey | | | | | 1 | 9 | | |
| United Kingdom— | | | | | | | | |
| England | 10,429 | 123,147 | 22,359 | 297,270 | 33,060 | 431,014 | 6,744 | 84,864 |
| Scotland | 50 | 730 | 1,008 | 14,260 | | | 546 | 6,251 |
| Ireland | | | 545 | 5,393 | | | 1,079 | 9,536 |
| Total Europe | 11,117 | 129,625 | 27,584 | 369,069 | 46,514 | 622,037 | 22,444 | 303,108 |
| North America: | | | | | | | | |
| Nova Scotia, New Brunswick, etc | 30,780 | 437,279 | 42,838 | 641,369 | 71,585 | 788,572 | 69,334 | 579,973 |
| Quebec, Ontario, etc | 410 | 7,375 | | | 195 | 2,860 | 28 | 380 |
| Newfoundland and Labrador | 87 | 960 | 15 | 232 | | | 2 | 12 |
| Total North America | 31,277 | 445,614 | 42,853 | 641,601 | 71,780 | 791,432 | 69,364 | 580,365 |
| Africa: | | | | | | | | |
| British Africa | | | | | 71 | 406 | | |
| Grand total | 42,394 | 575,239 | 70,437 | 1,010,670 | 118,365 | 1,413,875 | 91,808 | 883,473 |
| Total entered for consumption | 42,394 | 574,722 | 71,038 | 1,011,921 | 113,276 | 1,356,113 | 88,209 | 863,191 |
| Amount of duty | | 84,788 | | 142,075 | | 226,551 | | 176,419 |

| Countries from which imported. | 1893. | | 1894. | | Total. | |
|---|---|---|---|---|---|---|
| | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. |
| Europe: | | | | | | |
| Denmark | | | | | 1 | $16 |
| France | 1,245 | $14,282 | 3 | $24 | 4,829 | 51,585 |
| Germany | | | | | 2 | 21 |
| Italy | 3 | 25 | 19 | 192 | 47 | 648 |
| Netherlands | 264 | 2,283 | 2 | 19 | 331 | 3,351 |
| Portugal | | | | | 13 | 125 |
| Russia | | | | | 1 | 11 |
| Sweden and Norway | 11,138 | 212,560 | 16,777 | 280,381 | 55,296 | 906,650 |
| Turkey | | | | | 59 | 606 |
| United Kingdom— | | | | | | |
| England | 12,520 | 148,525 | 27,078 | 323,954 | 141,290 | 1,701,515 |
| Scotland | 984 | 11,091 | 3,975 | 38,345 | | |
| Ireland | 7,135 | 81,282 | 11,001 | 111,201 | | |
| Total Europe | 33,289 | 470,054 | 58,855 | 754,116 | 201,869 | 2,664,528 |
| North America: | | | | | | |
| Nova Scotia, New Brunswick, etc | 52,610 | 494,643 | 39,528 | 378,472 | 586,761 | 5,531,089 |
| Quebec, Ontario, etc | 98 | 1,035 | 91 | 888 | 4,819 | 44,300 |
| Newfoundland and Labrador | 239 | 1,620 | 4 | 33 | 726 | 6,184 |
| Total North America | 52,947 | 497,298 | 39,423 | 379,393 | 592,306 | 5,582,173 |
| Africa: | | | | | | |
| British Africa | | | | | 71 | 406 |
| Grand total | 86,236 | 967,352 | 98,278 | 1,133,509 | 794,246 | 8,247,107 |
| Total entered for consumption | 84,217 | 960,588 | 94,836 | 1,095,702 | 739,536 | 7,698,911 |
| Amount of duty | | 168,434 | | 189,672 | | 1,294,775 |

*Exports of mackerel, by countries.*—Comparatively few choice mackerel are exported from this country, and the export trade is practically confined to the West Indies. Of the 89,528 barrels exported during

the last ten years, the West Indies received 71,709 barrels, Colombia 8,915, the Guianas 2,552, and Liberia 1,340, leaving 5,012 barrels as the quantity shipped to all the remaining countries. In 1893 over 99 per cent, and in 1894 about 90 per cent of the exports of domestic mackerel went to the West Indies. From 1880 to 1886, when mackerel were abundant on the United States coasts, quantities were exported to European countries, but this has not been done during recent years.

36. *Statement by countries of the domestic exports of brine-salted mackerel during the ten years ending June 30, 1894.*

| Countries to which exported. | 1885. | | 1886. | | 1887. | | 1888. | |
|---|---|---|---|---|---|---|---|---|
| | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. |
| Europe: | | | | | | | | |
| Azores | 33 | $141 | 50 | $215 | ..... | ..... | 2 | $27 |
| England | 532 | 4,677 | 79 | 753 | 72 | $623 | 12 | 115 |
| France | ..... | ..... | ..... | ..... | ..... | ..... | 1 | 8 |
| Germany | 5 | 35 | 11 | 75 | 2 | 20 | ..... | ..... |
| Italy | 7 | 70 | ..... | ..... | ..... | ..... | ..... | ..... |
| Portugal | ..... | ..... | 50 | 200 | ..... | ..... | ..... | ..... |
| Total Europe | 577 | 4,923 | 190 | 1,243 | 74 | 643 | 15 | 150 |
| North America: | | | | | | | | |
| Canada— | | | | | | | | |
| Nova Scotia, New Brunswick, etc | 937 | 2,938 | ..... | ..... | ..... | ..... | 58 | 406 |
| Quebec, Ontario, etc | ..... | ..... | 68 | 389 | 5 | 44 | ..... | ..... |
| British Columbia | 3 | 24 | 7 | 86 | 1 | 12 | ..... | ..... |
| Mexico | 9 | 84 | 4 | 26 | 3 | 36 | 5 | 59 |
| Central America— | | | | | | | | |
| Costa Rica | 26 | 257 | 24 | 203 | 24 | 255 | 36 | 527 |
| Guatemala | 6 | 35 | ..... | ..... | 3 | 25 | 1 | 19 |
| Honduras | 13 | 107 | 17 | 174 | 10 | 112 | 31 | 308 |
| Nicaragua | 70 | 676 | 33 | 272 | 63 | 728 | 51 | 635 |
| British Honduras | 151 | 1,223 | 130 | 989 | 74 | 659 | 51 | 636 |
| West Indies— | | | | | | | | |
| British | 3,588 | 18,874 | 5,142 | 24,823 | 1,556 | 10,435 | 272 | 2,646 |
| Danish | 59 | 355 | 159 | 652 | 177 | 997 | 47 | 385 |
| Dutch | 161 | 1,103 | 215 | 1,300 | 211 | 1,920 | 100 | 1,387 |
| French | 1,574 | 6,483 | 1,657 | 8,246 | 412 | 2,207 | 188 | 1,454 |
| Haiti | 11,468 | 61,013 | 12,851 | 57,410 | 8,646 | 51,207 | 3,910 | 37,566 |
| Santo Domingo | 1,512 | 7,698 | 2,838 | 13,942 | 1,269 | 9,396 | 525 | 5,186 |
| Spanish— | | | | | | | | |
| Cuba | 273 | 1,661 | 359 | 2,032 | 157 | 1,018 | 64 | 631 |
| Puerto Rico | 576 | 2,570 | 613 | 2,994 | 369 | 2,008 | 8 | 100 |
| Total North America | 20,426 | 105,101 | 24,123 | 113,538 | 12,980 | 81,059 | 5,356 | 51,945 |
| South America: | | | | | | | | |
| Argentina | 15 | 60 | ..... | ..... | ..... | ..... | ..... | ..... |
| Brazil | 2 | 30 | ..... | ..... | 3 | 31 | 7 | 68 |
| Chile | ..... | ..... | ..... | ..... | 4 | 41 | 4 | 35 |
| Colombia | 1,698 | 20,666 | 2,757 | 21,805 | 2,006 | 19,594 | 1,331 | 15,373 |
| Guianas— | | | | | | | | |
| British | 478 | 1,787 | 381 | 1,504 | 162 | 904 | 52 | 211 |
| French | 253 | 1,264 | 280 | 1,568 | 154 | 1,130 | 42 | 429 |
| Dutch | 210 | 1,160 | 106 | 571 | ..... | ..... | 5 | 60 |
| Peru | 13 | 103 | ..... | ..... | 1 | 12 | ..... | ..... |
| Venezuela | 211 | 1,142 | 42 | 285 | 53 | 481 | 50 | 650 |
| Total South America | 2,880 | 26,212 | 3,566 | 25,733 | 2,383 | 22,193 | 1,491 | 16,826 |
| Asia and Oceanica: | | | | | | | | |
| British Australasia | 30 | 300 | 134 | 805 | ..... | ..... | 73 | 1,000 |
| Africa: | | | | | | | | |
| British Africa | 101 | 569 | 20 | 87 | 10 | 60 | 60 | 745 |
| French Africa | ..... | ..... | 3 | 17 | ..... | ..... | ..... | ..... |
| Liberia | 494 | 2,532 | 457 | 2,349 | 312 | 3,002 | 40 | 471 |
| Spanish Africa | 2 | 11 | 1 | 7 | 1 | 10 | 1 | 12 |
| Total Africa | 597 | 3,112 | 481 | 2,460 | 323 | 3,072 | 101 | 1,228 |
| All other islands and ports | 2 | 15 | 11 | 68 | ..... | ..... | ..... | ..... |
| Grand total | 24,512 | 139,663 | 28,505 | 143,847 | 15,760 | 106,967 | 7,036 | 71,149 |

36. *Statement by countries of the domestic exports of brine-salted mackerel during the ten years ending June 30, 1894*—Continued.

| Countries to which exported. | 1889. | | 1890. | | 1891. | | 1892. | |
|---|---|---|---|---|---|---|---|---|
| | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. |
| Europe: | | | | | | | | |
| Azores | ..... | ..... | 5 | $68 | 1 | $15 | ..... | ..... |
| England | ..... | ..... | ..... | ..... | 6 | 74 | ..... | ..... |
| France | ..... | ..... | ..... | ..... | 1 | 18 | 1 | $17 |
| Germany | ..... | ..... | ..... | ..... | 2 | 38 | ..... | ..... |
| Total Europe | ..... | ..... | 5 | 68 | 10 | 145 | 1 | 17 |
| North America: | | | | | | | | |
| Canada— | | | | | | | | |
| Nova Scotia, New Brunswick, etc | ..... | ..... | 1 | 12 | ..... | ..... | 4 | 67 |
| Quebec, Ontario, etc | ..... | ..... | 3 | 57 | ..... | ..... | ..... | ..... |
| British Columbia | ..... | ..... | 2 | 30 | 1 | 13 | ..... | ..... |
| Mexico | 9 | $92 | 7 | 124 | 4 | 73 | 20 | 286 |
| Central America— | | | | | | | | |
| Costa Rica | 48 | 760 | 54 | 818 | 42 | 664 | 53 | 824 |
| Guatemala | 1 | 13 | 3 | 49 | 27 | 328 | 1 | 11 |
| Honduras | 11 | 147 | 2 | 34 | 2 | 34 | 5 | 72 |
| Nicaragua | 62 | 853 | 41 | 772 | 124 | 2,029 | 44 | 671 |
| British Honduras | 50 | 838 | 23 | 439 | 19 | 288 | 60 | 836 |
| Bermuda | ..... | ..... | ..... | ..... | ..... | ..... | 13 | 177 |
| West Indies— | | | | | | | | |
| British | 184 | 2,312 | 153 | 2,186 | 97 | 1,707 | 225 | 3,127 |
| Danish | ..... | ..... | ..... | ..... | 2 | 33 | ..... | ..... |
| Dutch | 27 | 406 | 36 | 619 | 35 | 557 | 48 | 701 |
| French | 43 | 483 | 50 | 451 | 129 | 1,944 | 151 | 1,997 |
| Haiti | 128 | 1,784 | 306 | 5,423 | 1,143 | 19,188 | 1,515 | 21,591 |
| Santo Domingo | 31 | 506 | 34 | 637 | 142 | 2,525 | 445 | 5,466 |
| Spanish— | | | | | | | | |
| Cuba | 18 | 270 | 5 | 92 | 59 | 1,013 | 241 | 3,177 |
| Puerto Rico | 12 | 190 | 25 | 431 | 94 | 1,454 | 349 | 4,374 |
| Total North America | 624 | 8,654 | 745 | 12,183 | 1,920 | 31,850 | 3,174 | 43,377 |
| South America: | | | | | | | | |
| Argentina | 3 | 53 | 2 | 31 | ..... | ..... | ..... | ..... |
| Brazil | 2 | 29 | ..... | ..... | ..... | ..... | 3 | 40 |
| Chile | ..... | ..... | 1 | 18 | 3 | 44 | ..... | ..... |
| Colombia | 629 | 9,405 | 79 | 1,288 | 130 | 2,274 | 144 | 1,718 |
| Ecuador | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Guianas— | | | | | | | | |
| British | ..... | ..... | 22 | 274 | 172 | 1,826 | 90 | 870 |
| French | 4 | 75 | 20 | 430 | 16 | 242 | 32 | 359 |
| Dutch | 10 | 161 | 15 | 250 | ..... | ..... | ..... | ..... |
| Peru | ..... | ..... | ..... | ..... | ..... | ..... | 1 | 18 |
| Venezuela | 27 | 434 | 30 | 633 | 38 | 643 | 18 | 277 |
| Total South America | 675 | 10,157 | 175 | 2,924 | 359 | 5,029 | 288 | 3,282 |
| Asia and Oceanica: | | | | | | | | |
| British Australasia | ..... | ..... | ..... | ..... | 2 | 36 | 25 | 405 |
| Africa: | | | | | | | | |
| British Africa | 3 | 45 | 12 | 195 | ..... | ..... | ..... | ..... |
| Liberia | 1 | 20 | 11 | 142 | 4 | 68 | 2 | 27 |
| Total Africa | 4 | 65 | 23 | 337 | 4 | 68 | 2 | 27 |
| Grand total | 1,303 | 18,876 | 948 | 15,512 | 2,295 | 37,128 | 3,490 | 47,108 |

36. *Statement by countries of the domestic exports of brine-salted mackerel during the ten years ending June 30, 1894*—Continued.

| Countries to which exported. | 1893. | | 1894. | | Total. | |
|---|---|---|---|---|---|---|
| | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. |
| Europe: | | | | | | |
| Azores | | | | | 91 | $466 |
| England | | | | | 701 | 6,242 |
| France | | | | | 3 | 43 |
| Germany | | | | | 20 | 168 |
| Italy | | | | | 7 | 70 |
| Portugal | | | | | 50 | 200 |
| Total Europe | | | | | 872 | 7,189 |
| North America: | | | | | | |
| Canada— | | | | | | |
| Nova Scotia, New Brunswick, etc. | 8 | $80 | 32 | $256 | 1,040 | 3,759 |
| Quebec, Ontario, etc | 8 | 137 | 15 | 192 | 99 | 819 |
| British Columbia | 15 | 150 | 13 | 260 | 42 | 684 |
| Mexico | 13 | 181 | 8 | 127 | 82 | 1,088 |
| Central America— | | | | | | |
| Costa Rica | 24 | 305 | 25 | 317 | 356 | 4,990 |
| Guatemala | 12 | 189 | 7 | 98 | 61 | 767 |
| Honduras | 7 | 82 | 1 | 17 | 99 | 1,087 |
| Nicaragua | 50 | 735 | 43 | 514 | 581 | 7,885 |
| British Honduras | 54 | 700 | 33 | 466 | 651 | 7,164 |
| Bermuda | 18 | 248 | 11 | 175 | 42 | 600 |
| West Indies— | | | | | | |
| British | 177 | 2,369 | 276 | 3,688 | 11,670 | 72,167 |
| Danish | 3 | 35 | 5 | 60 | 452 | 2,517 |
| Dutch | 37 | 525 | 58 | 815 | 928 | 0,333 |
| French | 19 | 190 | 11 | 132 | 4,234 | 23,587 |
| Haiti | 1,172 | 16,849 | 1,758 | 24,717 | 42,906 | 296,748 |
| Santo Domingo | 487 | 6,071 | 635 | 7,517 | 7,918 | 58,944 |
| Spanish— | | | | | | |
| Cuba | 134 | 1,705 | 100 | 1,250 | 1,410 | 12,849 |
| Puerto Rico | 111 | 1,284 | 34 | 478 | 2,191 | 15,883 |
| Total North America | 2,349 | 31,985 | 3,065 | 41,079 | 74,762 | 520,771 |
| South America: | | | | | | |
| Argentina | | | | | 20 | 144 |
| Brazil | 11 | 168 | 8 | 112 | 36 | 478 |
| Chile | | | | | 12 | 138 |
| Colombia | 65 | 935 | 70 | 1,064 | 8,015 | 94,122 |
| Ecuador | 1 | 18 | 5 | 66 | 6 | 79 |
| Guianas— | | | | | | |
| British | | | 31 | 288 | 1,388 | 7,064 |
| Dutch | 2 | 26 | | | 348 | 2,228 |
| French | 5 | 48 | 10 | 115 | 816 | 5,660 |
| Peru | | | | | 15 | 133 |
| Venezuela | 11 | 167 | 15 | 219 | 501 | 4,031 |
| Total South America | 95 | 1,357 | 145 | 1,864 | 12,057 | 115,577 |
| Asia and Oceanica: | | | | | | |
| British Australasia | | | | | 204 | 2,546 |
| Africa: | | | | | | |
| British Africa | 4 | 40 | | | 210 | 1,741 |
| French Africa | | | | | 3 | 17 |
| Liberia | 5 | 69 | 14 | 139 | 1,340 | 8,819 |
| Spanish Africa | | | | | 5 | 40 |
| Total Africa | 9 | 109 | 14 | 139 | 1,558 | 10,617 |
| All other islands and ports | 2 | 29 | | | 15 | 112 |
| Grand total | 2,455 | 33,480 | 3,224 | 43,082 | 89,528 | 656,812 |

*Import duties on salt mackerel.*—In the following table the approximate rates of import duty levied on brine-salted mackerel in various foreign countries are shown, the unit being a barrel of 200 pounds. The rate in the United States is $2 per barrel.

37. *Statement of the approximate rates of duty exacted in various foreign countries on pickled or brine-salted mackerel imported therein.*

| Countries. | Duty per barrel, or 200 pounds. | Countries. | Duty per barrel, or 200 pounds. |
|---|---|---|---|
| Europe: | | North America—continued. | |
| France | $4.38 | West Indies—continued. | |
| Germany | .644 | Martinique | $2.80 |
| Great Britain | Free. | Puerto Rico | .76 |
| Italy | 1.05 | Santo Domingo | 2.54 to 3.80 |
| Portugal | 1.96 | South America: | |
| North America: | | Argentina | 8.40 |
| Canada | 2.00 | Brazil | 2.00 |
| Mexico | 5.74 | British Guiana | 1.00 |
| Central America— | | Chile | 3.43 |
| Costa Rica | 3.08 | Colombia | 2.20 |
| Guatemala | 6.62 | Peru | .44 |
| Honduras | 1.86 | Venezuela | 4.38 |
| Nicaragua | 6.52 | Africa: | |
| British Honduras | Free. | Liberia | 1.00 |
| West Indies— | | Mauritius | .26 |
| Bahamas | .98 | Asia and Oceanica: | |
| Barbados | .10 | New South Wales | 4.12 |
| Cuba | 1.52 | New Zealand | 4.34 |
| Dutch West Indies | 1¼ p. c. ad val. | Queensland | 2.16 |
| Guadaloupe | 6 p. c. ad val. | Tasmania | 12½ p. c. ad val. |
| Haiti | 1.50 | South Australia | 12 p. c. ad val. |
| Jamaica | .98 | | |

## VI.—HERRING AND SARDINES.

*Branches of the trade.*—The extensive herring fisheries of this country do not suffice to furnish the markets with sufficient products of this species, and the imports of herring and sardines greatly exceed the exports in value. In fact, these constitute the most important fishery imports of the United States. The imports are in the form of sardines, pickled herring, smoked herring, and small quantities of fresh herring for bait and for food. The exports are smoked herring and small quantities of pickled herring.

The following table shows the value of the several varieties of herring products imported and exported during the seven years ending June 30, 1894, and the total balance of trade during each year:

38. *Condensed statement of the foreign trade in herring and sardines during the seven years ending June 30, 1894.*

| Year ending June 30— | Imports for consumption. | | | | | Domestic exports. | | | Excess of imports over exports. |
|---|---|---|---|---|---|---|---|---|---|
| | Fresh herring. | Smoked herring. | Pickled herring. | Sardines. | Total. | Smoked herring. | Pickled herring. | Total. | |
| 1888 | (a) | $88,607 | $826,251 | $940,036 | $1,854,894 | $79,539 | $22,146 | $101,685 | $1,753,209 |
| 1889 | (a) | 122,027 | 796,651 | 806,077 | 1,724,755 | 80,281 | 17,756 | 98,037 | 1,626,718 |
| 1890 | (a) | 99,362 | 880,238 | 764,507 | 1,744,107 | 103,091 | 9,614 | 112,705 | 1,631,402 |
| 1891 | $11,589 | 91,032 | 954,697 | 1,008,843 | 2,076,161 | 105,260 | 12,352 | 117,612 | 1,958,549 |
| 1892 | 4,894 | 52,442 | 1,167,376 | 1,175,892 | 2,400,604 | 82,772 | 11,481 | 94,253 | 2,306,351 |
| 1893 | 10,262 | 33,815 | 1,151,112 | 1,258,158 | 2,453,347 | 93,412 | 8,660 | 102,072 | 2,351,275 |
| 1894 | 5,919 | 23,570 | 950,260 | 900,780 | 1,880,529 | 123,882 | 13,457 | 137,339 | 1,743,180 |
| Total | 32,664 | 510,855 | 6,726,585 | 6,854,293 | 14,134,397 | 668,237 | 95,466 | 763,703 | 13,370,684 |
| Average per year. | 8,166 | 72,979 | 960,941 | 979,185 | 2,019,200 | 95,462 | 13,638 | 109,100 | 190,097 |

*a* No information.

## FRESH HERRING, FOR BAIT AND FOR FOOD.

During each year a quantity of bait fish is imported for use in the winter bank fisheries. All of it is received from the British North American Provinces, chiefly from Newfoundland, and consists almost entirely of frozen herring. The following statement shows the quantities and values of bait herring imported during the last four years. The small quantities of fresh or frozen herring imported for food during the same period are also shown in this table.

39. *Statement of fresh or frozen herring imported for bait and for food by foreign vessels.*

| Year ending June 30— | Herring for bait. | | Herring for food. | | Total. | |
|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| 1891 | 350,000 | $3,418 | 966,954 | $8,171 | 1,316,954 | $11,589 |
| 1892 | 502,032 | 2,636 | 160,868 | 2,258 | 662,900 | 4,894 |
| 1893 | 574,500 | 5,325 | 383,619 | 4,937 | 958,119 | 10,262 |
| 1894 | 391,892 | 2,829 | 211,991 | 3,090 | 603,883 | 5,919 |
| Total | 1,818,424 | 14,208 | 1,723,432 | 18,456 | 3,541,856 | 32,664 |

The foregoing table does not include all the herring received in this country from the British North American Provinces during those years, but only those brought in by foreign vessels. It has been the practice of the customs officials to admit free of duty the frozen herring brought in by United States vessels as product of the domestic fisheries. All the frozen herring used in this country are received from foreign countries, and about one-third are used for bait. The receipts of frozen herring from the Provinces range from 5,000,000 to 15,000,000 pounds annually.

## SMOKED OR CURED HERRING.

*Balance of trade in smoked herring.*—During the last eight years the exports of smoked or cured herring have about equaled the imports. During the seven years ending June 30, 1894, the exports amounted to 25,277,958 pounds, worth $668,237, while the imports during the same period were 31,806,495 pounds, worth $732,029. The imports for consumption during that period, however, were but 21,626,128 pounds, worth $508,855. The terms of the Washington treaty had a very depressing effect on the smoked-herring industry of the United States. During 1885, the last year of that treaty, the imports for consumption of foreign smoked herring amounted to 10,441,355 pounds, while in the year following they were but 4,246,970 pounds. The imports for consumption have continued to decrease up to the present time, the quantity in 1894 being only 852,480 pounds, the smallest for twenty years. The exports have shown a correspondingly large increase. In 1888 they were but 2,948,620 pounds, worth $79,539; while in 1894 the exports of domestic smoked herring were 5,118,025 pounds, valued at $123,882. Table 40 shows the imports for consumption and the exports

during each of the seven years ending in 1894, and the annual average value per 100 pounds of each class. The imports for consumption from 1874 to 1894, inclusive, as shown in Table 9 on page 446, amount to 74,548,529 pounds, worth $1,638,295.

40. *Statement of foreign trade in smoked herring during seven years ending June 30, 1894.*

| Year ending June 30— | Imports for consumption. | | Domestic exports. | | Balance of trade. | | Average values per 100 pounds. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Imports. | Exports. |
| 1888 | 3,994,101 | $86,607 | 2,948,620 | $79,539 | +1,045,481 | + $7,068 | $2.17 | $2.70 |
| 1889 | 4,226,839 | 122,027 | 2,404,433 | 80,281 | +1,822,406 | + 41,746 | 2.89 | 3.34 |
| 1890 | 4,824,261 | 99,362 | 3,664,704 | 103,091 | +1,159,557 | — 3,729 | 2.06 | 2.81 |
| 1891 | 3,723,654 | 91,032 | 3,777,535 | 105,260 | — 53,881 | — 14,228 | 2.44 | 2.79 |
| 1892 | 2,294,159 | 52,442 | 3,279,263 | 82,772 | — 985,104 | — 30,330 | 2.29 | 2.52 |
| 1893 | 1,710,634 | 33,815 | 4,085,378 | 93,412 | —2,374,744 | — 59,597 | 1.98 | 2.29 |
| 1894 | 852,480 | 23,570 | 5,118,025 | 123,882 | —4,265,545 | —100,312 | 2.76 | 2.42 |
| Total | 21,626,128 | 508,855 | 25,277,958 | 668,237 | —3,651,830 | —159,382 | 2.35 | 2.64 |

NOTE.—The + indicates excess of imports over exports; — indicates excess of exports over imports.

*Imports of smoked herring by countries.*—Nearly all of the smoked herring imported into the United States is from Nova Scotia and New Brunswick, the remainder coming principally from Sweden, England, the Netherlands, and Newfoundland. Of the 53,685,414 pounds imported during the ten years ending June 30, 1894, 48,041,778 pounds, or 90 per cent, came from Nova Scotia and New Brunswick; 1,900,142 from Sweden; 1,486,403 from Newfoundland; 747,904 from England; and 1,509,187 pounds from all the remaining countries. The accompanying tabulation indicates the receipts of smoked or cured herring from each foreign country during each of the ten years ending June 30, 1894:

41. *Statement by countries of the imports of smoked or cured herring into the United States during the ten years ending June 30, 1894.*

| Countries from which imported. | 1885. | | 1886. | | 1887. | | 1888. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | | | |
| Germany | | | 8,394 | $111 | 5,952 | $147 | | |
| Italy | | | | | | | 4,915 | $256 |
| Netherlands | | | 33,464 | 2,105 | 166,586 | 9,305 | 40,100 | 2,031 |
| Sweden and Norway | | | 5,826 | 241 | 53,371 | 1,966 | 184,451 | 7,409 |
| United Kingdom— | | | | | | | | |
| England | | | 34 | 2 | 32,410 | 1,126 | 84,031 | 4,096 |
| Ireland | | | | | | | 25,830 | 1,109 |
| Total Europe | | | 47,718 | 2,459 | 258,328 | 12,544 | 339,327 | 14,901 |
| North America: | | | | | | | | |
| Canada— | | | | | | | | |
| Nova Scotia, New Brunswick, etc | 10,138,618 | $122,379 | 4,602,498 | 75,302 | 5,325,520 | 76,246 | 5,100,002 | 101,366 |
| Quebec, Ontario, etc | 419,697 | 8,301 | 23,500 | 418 | 21,060 | 532 | 89,015 | 2,164 |
| Newfoundland and Labrador | | | 1,038,879 | 19,825 | 2,431 | 102 | 20,000 | 280 |
| Total North America | 10,558,315 | 130,680 | 5,664,877 | 95,545 | 5,349,011 | 76,880 | 5,209,917 | 103,810 |
| Other islands and ports | | | 130 | 17 | 540 | 29 | | |
| Grand total | 10,558,315 | 130,680 | 5,712,725 | 98,021 | 5,607,879 | 89,453 | 5,549,244 | 118,711 |
| Total entered for consumption | 10,441,355 | 129,034 | 4,240,970 | 64,457 | 5,533,802 | 86,390 | 3,994,101 | 86,607 |
| Amount of duty | | | | 21,235 | | 27,660 | | 19,971 |

41. *Statement by countries of the imports of smoked or cured herring into the United States during the ten years ending June 30, 1894*—Continued.

| Countries from which imported. | 1889. | | 1890. | | 1891. | | 1892. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | | | |
| Germany | 229,418 | $8,111 | 26,189 | $697 | 6,748 | $321 | ..... | ..... |
| Italy | ..... | ..... | 2,132 | 102 | ..... | ..... | ..... | ..... |
| Netherlands | 28,148 | 2,239 | 96,670 | 2,854 | 48,416 | 1,880 | 2,646 | $252 |
| Sweden and Norway | 329,668 | 16,677 | 701,288 | 27,373 | 317,730 | 10,298 | 35,510 | 1,075 |
| United Kingdom— | | | | | | | | |
| England | 108,275 | 3,053 | 10,130 | 448 | 94,166 | 3,836 | 153,141 | 6,576 |
| Ireland | 144,625 | 5,751 | ..... | ..... | ..... | ..... | 4,031 | 179 |
| Scotland | 20,000 | 730 | ..... | ..... | ..... | ..... | 4,032 | 170 |
| Total Europe | 860,134 | 36,561 | 836,409 | 31,474 | 467,060 | 16,335 | 200,260 | 8,852 |
| North America: | | | | | | | | |
| Canada— | | | | | | | | |
| Nova Scotia, New Brunswick, etc | 4,884,013 | 128,762 | 5,608,944 | 107,010 | 3,791,091 | 84,443 | 2,900,092 | 57,460 |
| Quebec, Ontario, etc | 16,055 | 593 | 20 | 1 | 1,010 | 27 | ..... | ..... |
| Newfoundland and Labrador | 326,623 | 6,718 | 57,200 | 1,059 | 40,200 | 687 | 70 | 4 |
| Total North America | 5,229,291 | 136,073 | 5,666,164 | 108,070 | 3,832,301 | 85,157 | 2,900,162 | 57,464 |
| All other islands and ports | 4,012 | 27 | ..... | ..... | 12 | 1 | 3,506 | 140 |
| Grand total | 6,093,437 | 172,661 | 6,502,573 | 140,144 | 4,299,373 | 101,493 | 3,103,928 | 66,456 |
| Total entered for consumption | 4,226,839 | 122,027 | 4,824,261 | 99,362 | 3,723,654 | 91,032 | 2,294,159 | 52,442 |
| Amount of duty | ..... | 21,134 | ..... | 24,121 | ..... | 23,412 | ..... | 17,206 |

| Countries from which imported. | 1893. | | 1894. | | Total. | |
|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | |
| Germany | 2,750 | $70 | 1,090 | $35 | 280,541 | $9,492 |
| Italy | ..... | ..... | ..... | ..... | 7,047 | 358 |
| Netherlands | 2,846 | 161 | 7,227 | 341 | 426,103 | 21,108 |
| Sweden and Norway | 51,925 | 1,786 | 220,373 | 6,961 | 1,900,142 | 74,386 |
| United Kingdom— | | | | | | |
| England | 155,394 | 6,544 | 110,314 | 4,804 | 747,904 | 30,545 |
| Ireland | ..... | ..... | 10,296 | 752 | 185,682 | 7,791 |
| Scotland | ..... | ..... | ..... | ..... | 24,032 | 900 |
| Total Europe | 212,915 | 8,561 | 349,300 | 12,953 | 3,571,451 | 144,640 |
| North America: | | | | | | |
| Canada— | | | | | | |
| Nova Scotia, New Brunswick, etc | 2,815,352 | 47,853 | 2,875,648 | 63,939 | 48,041,778 | 865,360 |
| Quebec, Ontario, etc | ..... | ..... | 1,800 | 160 | 575,057 | 12,196 |
| Newfoundland and Labrador | ..... | ..... | 1,000 | 16 | 1,486,403 | 28,601 |
| Total North America | 2,815,352 | 47,853 | 2,878,448 | 64,115 | 50,103,838 | 906,247 |
| All other islands and ports | 1,865 | 71 | 60 | 11 | 10,125 | 296 |
| Grand total | 3,030,132 | 56,485 | 3,227,808 | 77,079 | 53,685,414 | 1,051,183 |
| Total entered for consumption | 1,710,634 | 33,815 | 852,480 | 23,570 | 41,848,255 | 788,736 |
| Amount of duty | ..... | 12,830 | ..... | 6,394 | ..... | 173,972 |

*Exports of smoked herring by countries.*—The exports of domestic smoked herring are confined almost exclusively to the West Indies and the Central and South American countries. More than one-half are sent to Haiti, with Santo Domingo, Cuba, Jamaica, Puerto Rico, and Venezuela ranking next in order.

Of the 25,277,958 pounds exported during the last seven years, Haiti received 15,566,663 pounds and Santo Domingo and Cuba 3,364,038 and 2,026,087 pounds, respectively. The American continent and adjacent islands received 24,881,338 pounds, or almost 99 per cent of the total exports, Africa 367,400, and Europe only 25,135 pounds.

The following table shows these exports in detail:

42. *Statement by countries of the quantities and values of domestic smoked herring exported from the United States during the seven years ending June 30, 1894.*

| Countries to which exported. | 1888. | | 1889. | | 1890. | | 1891. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | | | |
| Azores, and Madeira Islands | 3,150 | $98 | 850 | $25 | 7,100 | $248 | 3,210 | $97 |
| England | ..... | ..... | ..... | ..... | ..... | ..... | 2,000 | 65 |
| Total Europe | 3,150 | 98 | 850 | 25 | 7,100 | 248 | 5,210 | 162 |
| North America: | | | | | | | | |
| Canada— | | | | | | | | |
| Nova Scotia, etc | ..... | ..... | ..... | ..... | 2,500 | 60 | ..... | ..... |
| Quebec, Ontario, etc | 315 | 15 | ..... | ..... | ..... | ..... | 270 | 12 |
| Mexico | 1,323 | 49 | 793 | 27 | 1,720 | 47 | 3,190 | 103 |
| Central America— | | | | | | | | |
| Costa Rica | 3,082 | 104 | 1,839 | 71 | 5,690 | 162 | 3,255 | 100 |
| Guatemala | 67 | 4 | 64 | 2 | 360 | 11 | 150 | 5 |
| Honduras | 108 | 6 | 549 | 28 | 742 | 43 | 100 | 3 |
| Nicaragua | 640 | 19 | 1,860 | 91 | 3,500 | 104 | 4,532 | 137 |
| British Honduras | 3,336 | 97 | 6,502 | 246 | 6,804 | 300 | 5,524 | 186 |
| West Indies— | | | | | | | | |
| British | 58,759 | 1,764 | 164,703 | 4,862 | 121,717 | 3,447 | 80,877 | 2,038 |
| Danish | 16,025 | 414 | 19,700 | 526 | 9,910 | 273 | 15,240 | 449 |
| Dutch | 41,483 | 1,081 | 22,249 | 833 | 27,721 | 796 | 33,674 | 1,000 |
| French | 77,050 | 1,901 | 87,639 | 2,596 | 137,944 | 3,969 | 160,876 | 4,211 |
| Haiti | 1,832,143 | 51,046 | 1,237,419 | 42,589 | 2,391,372 | 65,027 | 2,401,490 | 63,975 |
| Santo Domingo | 272,315 | 7,464 | 385,710 | 12,806 | 418,729 | 13,006 | 613,310 | 18,973 |
| Spanish— | | | | | | | | |
| Cuba | 173,883 | 4,292 | 172,814 | 5,713 | 228,566 | 6,989 | 207,514 | 6,492 |
| Puerto Rico | 65,738 | 1,686 | 82,133 | 2,721 | 132,390 | 4,018 | 66,856 | 2,141 |
| Total North America | 2,547,467 | 69,942 | 2,183,974 | 73,111 | 3,489,665 | 98,252 | 3,596,864 | 99,836 |
| South America: | | | | | | | | |
| Colombia | 119,169 | 3,039 | 86,011 | 2,843 | 20,700 | 665 | 42,220 | 1,308 |
| Guianas— | | | | | | | | |
| British | ..... | ..... | 1,100 | 36 | 14,580 | 453 | 2,590 | 80 |
| Dutch | 9,555 | 207 | 10,360 | 304 | 17,375 | 472 | 11,105 | 328 |
| French | 40,955 | 803 | 26,410 | 668 | 32,700 | 909 | 35,915 | 1,041 |
| Venezuela | 41,999 | 1,203 | 33,290 | 1,236 | 48,371 | 1,146 | 50,398 | 1,413 |
| Total South America | 211,678 | 5,252 | 157,171 | 5,087 | 133,726 | 3,645 | 142,138 | 4,170 |
| Africa: | | | | | | | | |
| British Africa | 10,500 | 225 | 4,000 | 170 | 14,728 | 440 | ..... | ..... |
| French Africa | 15,400 | 252 | 4,500 | 81 | ..... | ..... | 700 | 16 |
| Liberia | 142,800 | 3,196 | 42,418 | 1,414 | 15,630 | 389 | 20,632 | 702 |
| Spanish Africa | 17,500 | 569 | 10,015 | 343 | 3,180 | 98 | 11,991 | 374 |
| Total Africa | 186,200 | 4,242 | 60,933 | 2,008 | 33,538 | 927 | 33,323 | 1,092 |
| All other islands and ports | 125 | 5 | 1,505 | 50 | 675 | 19 | ..... | ..... |
| Grand total | 2,948,620 | 79,539 | 2,404,433 | 80,281 | 3,664,704 | 103,091 | 3,777,535 | 105,260 |

42. *Statement by countries of the quantities and values of domestic smoked herring exported from the United States during the seven years ending June 30, 1894*—Continued.

| Countries to which exported. | 1892. | | 1893. | | 1894. | | Total. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | | | |
| Azores, and Madeira Islands | | | | | | | 14,310 | $468 |
| United Kingdom— | | | | | | | | |
| England | 1,600 | $56 | | | | | 3,600 | 121 |
| Scotland | 2,675 | 54 | 4,550 | $138 | | | 7,225 | 192 |
| Total Europe | 4,275 | 110 | 4,550 | 138 | | | 25,135 | 781 |
| North America: | | | | | | | | |
| Canada— | | | | | | | | |
| Nova Scotia, New Brunswick, etc | | | | | 280 | $20 | 2,780 | 80 |
| Quebec, Ontario, etc | | | 100 | 2 | 2,086 | 132 | 2,771 | 101 |
| British Columbia | | | 75 | 5 | 560 | 29 | 635 | 34 |
| Mexico | 10,132 | 248 | 11,532 | 327 | 2,176 | 63 | 30,866 | 864 |
| Central America— | | | | | | | | |
| Costa Rica | 4,116 | 131 | 5,158 | 121 | 8,083 | 202 | 31,223 | 891 |
| Guatemala | 75 | 2 | 880 | 43 | | | 1,596 | 67 |
| Honduras | 2,427 | 27 | 25 | 1 | 305 | 13 | 4,256 | 121 |
| Nicaragua | 1,519 | 49 | 1,513 | 47 | 924 | 32 | 14,488 | 470 |
| British Honduras | 5,284 | 154 | 5,847 | 149 | 4,391 | 118 | 37,088 | 1,252 |
| Bermuda | 585 | 16 | 105 | 3 | 420 | 12 | 1,110 | 31 |
| West Indies— | | | | | | | | |
| British | 84,176 | 1,773 | 105,840 | 2,102 | 197,590 | 4,423 | 813,662 | 20,400 |
| Danish | 4,389 | 125 | 1,400 | 35 | 1,050 | 24 | 68,314 | 1,846 |
| Dutch | 34,883 | 932 | 53,904 | 1,300 | 45,380 | 1,157 | 259,294 | 7,114 |
| French | 77,040 | 1,940 | 22,050 | 564 | 212,540 | 4,989 | 775,739 | 20,170 |
| Haiti | 2,006,370 | 46,868 | 2,564,410 | 52,630 | 3,133,453 | 74,877 | 15,566,663 | 397,012 |
| Santo Domingo | 303,454 | 9,250 | 581,135 | 15,950 | 789,385 | 18,475 | 3,364,038 | 95,924 |
| Spanish— | | | | | | | | |
| Cuba | 499,869 | 14,657 | 369,109 | 11,006 | 374,332 | 10,347 | 2,026,087 | 59,496 |
| Puerto Rico | 82,554 | 2,463 | 69,407 | 2,026 | 135,554 | 3,784 | 634,632 | 18,839 |
| Total North America | 3,116,873 | 78,635 | 3,792,400 | 86,317 | 4,908,509 | 118,697 | 23,635,842 | 624,700 |
| South America: | | | | | | | | |
| Colombia | 13,732 | 447 | 18,219 | 537 | 31,016 | 863 | 331,007 | 9,702 |
| Guianas— | | | | | | | | |
| British | 24,850 | 458 | 2,780 | 75 | 27,000 | 548 | 72,810 | 1,050 |
| Dutch | 19,940 | 460 | 36,370 | 817 | 28,300 | 619 | 133,005 | 3,207 |
| French | 27,580 | 777 | 17,950 | 385 | 16,310 | 341 | 197,820 | 4,924 |
| Venezuela | 54,803 | 1,365 | 190,471 | 4,507 | 91,562 | 2,398 | 510,894 | 13,268 |
| Total South America | 140,905 | 3,507 | 265,790 | 6,321 | 194,188 | 4,769 | 1,245,596 | 32,751 |
| Africa: | | | | | | | | |
| British Africa | 2,940 | 98 | 7,418 | 198 | 2,914 | 80 | 42,500 | 1,211 |
| Canary Islands | 1,240 | 38 | 700 | 20 | 3,654 | 95 | 5,594 | 153 |
| French Africa | | | | | | | 20,000 | 349 |
| Liberia | 12,280 | 361 | 14,430 | 418 | 7,830 | 212 | 256,020 | 6,692 |
| Spanish Africa | | | | | | | 42,686 | 1,384 |
| Total Africa | 16,460 | 497 | 22,548 | 636 | 14,398 | 387 | 367,400 | 9,789 |
| All other islands and ports | 750 | 23 | | | 930 | 29 | 3,985 | 120 |
| Grand total | 3,279,263 | 82,772 | 4,085,378 | 93,412 | 5,118,025 | 123,882 | 25,277,958 | 668,237 |

*Import duties in various countries on smoked herring.*—The approximate rates of duty levied on smoked herring imported into various foreign countries are indicated in comparative form in the following statement. The present rate in the United States is 75 cents per 100 pounds.

43. *Approximate rates of duty on smoked herring imported into various foreign countries.*

| Countries. | Duty per 100 pounds. | Countries. | Duty per 100 pounds. |
|---|---|---|---|
| Europe: | | North America—continued. | |
| Austria-Hungary | $0.43 | West Indies— | |
| Denmark | .17 | Cuba | $0.76 |
| France | 1.32 | Guadaloupe | 6 p. c. |
| Germany | .32 | Haiti ..... per box | .06 |
| Great Britain | Free. | Jamaica | .50 |
| Greece | 2.04 | Puerto Rico | .38 |
| Italy | .44 | Santo Domingo | .85 |
| Portugal | .98 | South America: | |
| Russia | .29 | Bolivia | .66 |
| North America: | | Colombia | 1.10 |
| Canada | 1.00 | British Guiana | .50 |
| Mexico | 2.87 | Peru | .44 |
| Central America— | | Venezuela | 2.19 |
| Costa Rica | 1.54 | Africa: | |
| Honduras | .93 | British Cape Colony | 2.00 |
| Nicaragua | 2.33 | French Gaboon | .05 |
| British Honduras | 10 p. c. | Liberia | 1.00 |

## BRINE-SALTED OR PICKLED HERRING.

*General trade in pickled herring.*—While the United States exports as well as imports pickled or brine-salted herring, yet the exports are vastly exceeded by the imports, the former averaging about 3,000 barrels while the latter average 135,000 barrels per annum. The average value of those imported has been about $7.12 and of those exported about $4.72 per barrel. Table 44 shows the extent of the foreign trade in pickled herring during the seven years ending June 30, 1894. It is impracticable to show the extent of the exports of pickled herring prior to 1888, as they were not separately classified, being included with all other pickled or brine-salted fish. The imports of pickled herring since 1820 are included in Tables 5, 6, and 10, on pages 441, 443, 447.

During the twenty-six years ending June 30, 1894, the imports for consumption were 2,831,992 barrels, worth $16,978,802, as shown in Table 10.

44. *Statement of the foreign trade in pickled or brine-salted herring during the seven years ending June 30, 1894.*

| Year ending June 30— | Imports for consumption. | | Domestic exports. | | Excess of imports over exports. | | Average value per barrel. | |
|---|---|---|---|---|---|---|---|---|
| | Barrels. | Values. | Barrels. | Values. | Barrels. | Dollars. | Imports. | Exports. |
| 1888 | 126,104 | $826,251 | 3,068 | $22,146 | 122,436 | 804,105 | $6.55 | $6.04 |
| 1889 | 112,453 | 796,651 | 3,221 | 17,756 | 109,232 | 778,895 | 7.08 | 5.52 |
| 1890 | 123,831 | 880,238 | 2,267 | 9,614 | 121,564 | 870,624 | 7.11 | 4.24 |
| 1891 | 128,303 | 954,697 | 3,013 | 12,352 | 125,351 | 942,345 | 7.44 | 4.10 |
| 1892 | 150,603 | 1,167,376 | 2,700 | 11,481 | 147,903 | 1,155,895 | 7.75 | 4.25 |
| 1893 | 163,050 | 1,151,112 | 1,862 | 8,660 | 161,188 | 1,142,452 | 7.06 | 4.65 |
| 1894 | 141,476 | 950,268 | 3,501 | 13,457 | 137,975 | 936,811 | 6.71 | 3.84 |
| Total | 945,880 | 6,726,593 | 20,231 | 95,466 | 925,649 | 6,631,127 | ..... | ..... |

The extent of the imports of pickled herring from and the exports to each foreign country during the seven years ending June 30, 1894, is shown in Table 45. It appears that during this period the imports from Europe aggregated 689,445 barrels, or 71.72 per cent of the total imports.

The receipts from the British North American provinces were 270,840 barrels, or 28.17 per cent. Exports are principally to British West Indies, Haiti, Santo Domingo, and other islands of the West Indies.

45. *Statement by countries of the foreign trade in salted or pickled herring during the seven years ending June 30, 1894.*

| Countries. | Imports. | | Exports. | | Average values per barrel. | |
|---|---|---|---|---|---|---|
| | Barrels. | Values. | Barrels. | Values. | Imports. | Exports. |
| Europe: | | | | | | |
| Germany | 74,566 | $554,089 | | | $7.44 | |
| Netherlands | 202,064 | 3,352,666 | | | 11.48 | |
| Sweden and Norway | 198,224 | 955,736 | | | 5.02 | |
| United Kingdom— | | | | | | |
| England | 14,140 | 96,205 | 150 | $570 | 6.79 | |
| Scotland | 109,322 | 790,568 | | | 7.23 | $3.80 |
| Ireland | 642 | 4,316 | | | 6.72 | |
| Others | 487 | 4,088 | | | 8.40 | |
| Total Europe | 689,445 | 5,758,568 | 150 | 570 | 8.36 | 3.80 |
| North America: | | | | | | |
| Nova Scotia and New Brunswick | 170,766 | 545,047 | 313 | 1,280 | 3.19 | 4.09 |
| Quebec, Ontario, etc | 29,224 | 148,759 | 61 | 303 | 5.08 | 5.00 |
| British Columbia | | | 6 | 54 | | 9.00 |
| Newfoundland | 70,850 | 298,447 | | | 4.21 | |
| Miquelon, Langley, etc | 1,034 | 3,487 | | | 3.37 | |
| Bermuda | | | 6 | 30 | | 5.00 |
| Central America— | | | | | | |
| Costa Rica | | | 57 | 285 | | 5.00 |
| Honduras | | | 7 | 54 | | 7.71 |
| Nicaragua | | | 39 | 241 | | 6.27 |
| British Honduras | | | 112 | 556 | | 4.93 |
| West Indies— | | | | | | |
| British | | | 7,811 | 31,017 | | 3.97 |
| Danish | | | 1,266 | 6,531 | | 5.16 |
| Dutch | | | 1,429 | 6,900 | | 4.89 |
| French | | | 883 | 4,922 | | 5.57 |
| Haiti | | | 5,039 | 28,137 | | 5.58 |
| Santo Domingo | | | 1,550 | 6,981 | | 4.50 |
| Cuba and Puerto Rico | | | 328 | 1,464 | | 4.46 |
| Total North America | 271,874 | 995,740 | 18,908 | 88,845 | 3.61 | 4.69 |
| South America: | | | | | | |
| Colombia | | | 463 | 2,151 | | 4.86 |
| Guianas— | | | | | | |
| British | | | 134 | 797 | | 5.95 |
| Dutch | | | 76 | 410 | | 5.40 |
| French | | | 49 | 322 | | 6.55 |
| Venezuela | | | 68 | 368 | | 5.41 |
| Total South America | | | 790 | 4,048 | | 5.15 |
| Africa: | | | | | | |
| British | | | 183 | 833 | | 4.55 |
| Liberia | | | 129 | 795 | | 6.17 |
| Total Africa | | | 312 | 1,628 | | 5.22 |
| All other islands and ports | 50 | 242 | 72 | 375 | 4.84 | 5.14 |
| Grand total | 961,369 | 6,754,550 | 20,231 | 95,466 | 7.03 | 4.72 |

*Imports of pickled herring by countries.*—Pickled herring are received principally from Netherlands, Canada, Norway, Germany, Scotland, and Newfoundland. During the ten years ending June 30, 1894, the imports from the Netherlands amounted to 377,480 barrels, worth $4,379,171; from Canada 372,755 barrels, valued at $1,240,293; from Norway 231,098 barrels, worth $1,125,838; from Germany 112,250 barrels, from Scotland 111,198 barrels, from Newfoundland 94,187 barrels, and from all the remaining countries 22,052 barrels, worth $141,740;

making a grand total of 1,321,020 barrels, worth $8,983,326. The imports from the continent of Europe were 852,987 barrels, worth $7,357,293, and from North American provinces 467,976 barrels, worth $1,625,723.

The Netherlands herring are the most valuable, averaging $11.48 per barrel; those from Germany and Scotland rank next, with averages of $7.44 and $7.23, respectively. The cheaper herring are received from Nova Scotia and Newfoundland, their average value being $3.19 and $4.21, respectively, per barrel.

Notwithstanding the greater value of the Dutch herring as compared with those from England and Scotland, they are caught almost on the same ground. The difference in value (about $4.50 per barrel) is due entirely to the greater care exercised in preservation. The Dutch bleed each fish, use the best quality of salt, and take the greatest care in the manipulation. During recent years, however, the herring received from the Netherlands have not been entirely free from complaint, some New York importers claiming that the quality is not what it was formerly. This complaint is lodged against the consignments rather than the direct purchases. The imports and sales of Scotch herring are on the increase, brought about principally on account of better selection and more uniformity in quality.

46. *Statement by countries of the imports of pickled herring during the ten years ending June 30, 1894.*

| Countries from which imported. | 1885. | | 1886. | | 1887. | | 1888. | |
|---|---|---|---|---|---|---|---|---|
| | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. |
| Europe: | | | | | | | | |
| Austria-Hungary | | | | | 1 | $6 | | |
| Belgium | 129 | $1,252 | 26 | $299 | | | | |
| Denmark | 19 | 134 | 6 | 28 | 1 | 11 | 20 | $107 |
| France | 62 | 434 | 50 | 316 | | | | |
| Germany | 11,381 | 116,989 | 11,797 | 115,020 | 14,506 | 124,289 | 16,327 | 118,877 |
| Italy | 2 | 20 | | | 45 | 401 | 42 | 455 |
| Netherlands | 32,441 | 392,964 | 22,117 | 273,914 | 30,858 | 359,627 | 37,400 | 422,926 |
| Sweden and Norway | 4,218 | 29,474 | 9,024 | 46,303 | 19,632 | 94,325 | 22,237 | 100,124 |
| United Kingdom— | | | | | | | | |
| England | 640 | 5,389 | 2,783 | 14,473 | 1,928 | 10,562 | 1,271 | 7,568 |
| Scotland | 186 | 1,708 | 814 | 5,048 | 876 | 5,721 | 1,943 | 12,767 |
| Total Europe | 49,078 | 548,373 | 46,617 | 455,410 | 67,847 | 594,942 | 79,240 | 657,824 |
| North America: | | | | | | | | |
| Canada— | | | | | | | | |
| Nova Scotia, New Brunswick, etc | 91,171 | 259,783 | 30,223 | 88,848 | 22,599 | 79,202 | 36,712 | 114,733 |
| Quebec, Ontario, etc | 9,271 | 40,961 | 8,216 | 28,347 | 11,285 | 49,256 | 7,174 | 32,350 |
| Newfoundland and Labrador | 4,864 | 14,800 | 12,824 | 44,764 | 5,649 | 23,932 | 8,241 | 36,067 |
| Total North America | 105,306 | 315,544 | 51,263 | 161,959 | 39,533 | 152,480 | 52,127 | 183,150 |
| All other islands and ports | 1 | 5 | | | 6 | 63 | 1 | 4 |
| Grand total | 154,385 | 863,922 | 97,880 | 617,369 | 107,386 | 747,485 | 131,368 | 840,978 |
| Total entered for consumption | 183,818 | 858,249 | 92,660 | 617,035 | 107,189 | 748,321 | 126,104 | 826,251 |
| Amount of duty | | 49,088 | | 92,660 | | 107,189 | | 126,104 |

46. *Statement by countries of the imports of pickled herring during the ten years ending June 30, 1894*—Continued.

| Countries from which imported. | 1889. | | 1890. | | 1891. | | 1892. | |
|---|---|---|---|---|---|---|---|---|
| | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. |
| Europe: | | | | | | | | |
| Austria-Hungary | ..... | ..... | 4 | $23 | 50 | $279 | ..... | ..... |
| Belgium | ..... | ..... | 174 | 1,571 | ..... | ..... | ..... | ..... |
| Denmark | 15 | $63 | 1 | 9 | 3 | 28 | ..... | ..... |
| France | ..... | ..... | ..... | ..... | 1 | 8 | 6 | $49 |
| Germany | 10,609 | 74,229 | 10,791 | 73,107 | 13,283 | 109,042 | 11,303 | 95,741 |
| Italy | 26 | 283 | 53 | 488 | 5 | 35 | 28 | 371 |
| Netherlands | 34,249 | 420,071 | 39,466 | 470,133 | 35,616 | 407,040 | 30,553 | 481,021 |
| Sweden and Norway | 22,994 | 110,046 | 27,709 | 117,100 | 21,849 | 130,531 | 32,161 | 190,842 |
| United Kingdom— | | | | | | | | |
| England | 2,907 | 19,838 | 3,731 | 24,300 | ..... | ..... | 3,655 | 29,013 |
| Scotland | 3,791 | 23,842 | 6,374 | 48,375 | 19,027 | 133,990 | 24,250 | 215,769 |
| Ireland | 190 | 794 | 70 | 438 | ..... | ..... | 151 | 1,591 |
| Total Europe | 74,781 | 658,166 | 88,373 | 735,544 | 89,834 | 780,953 | 111,107 | 1,014,097 |
| North America: | | | | | | | | |
| Canada— | | | | | | | | |
| Nova Scotia, New Brunswick, etc | 24,262 | 80,342 | 17,645 | 61,612 | 23,322 | 69,669 | 23,377 | 83,833 |
| Quebec, Ontario, etc | 5,370 | 28,094 | 5,389 | 26,606 | 5,264 | 31,299 | 3,091 | 15,827 |
| Newfoundland and Labrador | 9,044 | 37,266 | 14,033 | 58,056 | 9,707 | 40,139 | 15,212 | 63,817 |
| Total North America | 38,676 | 145,702 | 37,067 | 146,274 | 38,293 | 141,107 | 41,680 | 163,477 |
| All other islands and ports | 7 | 20 | ..... | ..... | 8 | 39 | 10 | 40 |
| Grand total | 113,464 | 803,888 | 125,440 | 881,818 | 128,135 | 922,099 | 152,797 | 1,178,514 |
| Total entered for consumption | 112,453 | 796,051 | 123,831 | 880,238 | 128,363 | 954,697 | 150,603 | 1,167,376 |
| Amount of duty | ..... | 112,453 | ..... | 123,831 | ..... | 128,363 | ..... | 150,603 |

| Countries from which imported. | 1893. | | 1894. | | Total. | |
|---|---|---|---|---|---|---|
| | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. |
| Europe: | | | | | | |
| Austria-Hungary | ..... | ..... | ..... | ..... | 55 | $308 |
| Belgium | 14 | $86 | ..... | ..... | 343 | 3,208 |
| Denmark | 13 | 81 | 24 | $70 | 102 | 531 |
| France | ..... | ..... | ..... | ..... | 110 | 807 |
| Germany | 7,844 | 57,855 | 4,409 | 31,138 | 112,250 | 911,296 |
| Italy | 1 | 10 | 7 | 66 | 209 | 2,144 |
| Netherlands | 58,788 | 643,780 | 46,992 | 498,095 | 377,480 | 4,379,171 |
| Sweden and Norway | 32,521 | 155,100 | 38,753 | 151,993 | 231,098 | 1,125,838 |
| United Kingdom— | | | | | | |
| England | 1,398 | 8,886 | 1,178 | 6,600 | 10,491 | 126,629 |
| Scotland | 22,809 | 155,301 | 31,128 | 200,524 | 111,198 | 803,045 |
| Ireland | 191 | 1,217 | 40 | 276 | 642 | 4,316 |
| Total Europe | 123,579 | 1,022,322 | 122,531 | 888,762 | 852,987 | 7,357,293 |
| North America: | | | | | | |
| Canada— | | | | | | |
| Nova Scotia, New Brunswick, etc | 28,675 | 87,002 | 16,773 | 47,856 | 314,759 | 972,970 |
| Quebec, Ontario, etc | 2,712 | 13,726 | 224 | 857 | 57,996 | 207,323 |
| Newfoundland and Labrador | 9,293 | 41,853 | 5,320 | 21,249 | 91,187 | 381,043 |
| Miquelon, Langley, etc | ..... | ..... | 1,034 | 3,487 | 1,034 | 3,487 |
| Total North America | 40,680 | 142,581 | 23,351 | 73,449 | 467,976 | 1,625,723 |
| All other islands and ports | 3 | 39 | 21 | 100 | 57 | 310 |
| Grand total | 164,262 | 1,164,942 | 145,903 | 962,311 | 1,321,020 | 8,983,326 |
| Total entered for consumption | 163,050 | 1,151,112 | 141,476 | 950,268 | 1,304,547 | 8,950,198 |
| Amount of duty | ..... | 163,050 | ..... | 141,476 | ..... | 1,194,817 |

*Exports of pickled herring by countries.*—The exports of domestic pickled herring are principally to the West Indies and the Central and South American States. The customs returns do not separately classify

the exports of these fish prior to 1888, but during the seven years beginning July 1, 1888, and ending June 30, 1894, the exports to the West Indies aggregated 18,306 barrels, worth $86,042; to the South American countries, 790 barrels, worth $4,048, and to all other countries, 1,135 barrels, worth $5,376; a total of 20,231 barrels, valued at $95,466, or an annual average of 2,890 barrels and $13,638.

47. *Statement by countries of the domestic exports of pickled herring during the seven years ending June 30, 1894.*

| Countries to which exported. | 1888. | | 1889. | | 1890. | | 1891. | |
|---|---|---|---|---|---|---|---|---|
| | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. |
| North America: | | | | | | | | |
| Canada— | | | | | | | | |
| Nova Scotia, etc | 101 | $507 | ..... | ..... | ..... | ..... | ..... | ..... |
| Quebec, Ontario, etc | ..... | 2 | ..... | ..... | ..... | ..... | ..... | ..... |
| Central America— | | | | | | | | |
| Costa Rica | ..... | ..... | 3 | $15 | 7 | $34 | 4 | $18 |
| Honduras | 3 | 18 | 2 | 25 | 2 | 11 | ..... | ..... |
| Nicaragua | 23 | 156 | 2 | 16 | 7 | 32 | 4 | 20 |
| British Honduras | 9 | 54 | 26 | 154 | 15 | 70 | 2 | 11 |
| West Indies— | | | | | | | | |
| British | 273 | 1,495 | 1,424 | 6,836 | 1,485 | 5,898 | 1,705 | 6,021 |
| Danish | 367 | 1,874 | 314 | 1,817 | 306 | 1,472 | 151 | 800 |
| Dutch | 129 | 759 | 50 | 269 | 169 | 834 | 232 | 1,061 |
| French | 213 | 1,404 | 95 | 517 | 60 | 285 | 400 | 1,932 |
| Haiti | 2,185 | 13,386 | 1,047 | 6,841 | 170 | 775 | 150 | 734 |
| Santo Domingo | 55 | 558 | 192 | 946 | 8 | 35 | 146 | 715 |
| Spanish— | | | | | | | | |
| Cuba | 22 | 140 | ..... | ..... | 8 | 40 | 1 | 4 |
| Puerto Rico | ..... | ..... | 32 | 130 | 6 | 30 | 40 | 201 |
| Total North America | 3,380 | 20,353 | 3,187 | 17,566 | 2,243 | 9,516 | 2,835 | 11,517 |
| South America: | | | | | | | | |
| Colombia | 72 | 452 | 2 | 11 | 15 | 60 | 22 | 94 |
| Guianas— | | | | | | | | |
| British | 9 | 63 | ..... | ..... | ..... | ..... | 6 | 20 |
| Dutch | 20 | 120 | 6 | 32 | ..... | ..... | ..... | ..... |
| French | 11 | 92 | 20 | 107 | 1 | 5 | ..... | ..... |
| Venezuela | 34 | 204 | ..... | ..... | 5 | 21 | 4 | 20 |
| Total South America | 146 | 931 | 28 | 150 | 21 | 86 | 32 | 134 |
| Africa: | | | | | | | | |
| British Africa | 30 | 103 | ..... | ..... | ..... | ..... | 100 | 500 |
| Liberia | 97 | 669 | ..... | ..... | ..... | ..... | ..... | ..... |
| Total Africa | 127 | 772 | ..... | ..... | ..... | ..... | 100 | 500 |
| All other islands and ports | 15 | 90 | 6 | 40 | 3 | 12 | 45 | 201 |
| Grand total | 3,668 | 22,146 | 3,221 | 17,756 | 2,267 | 9,614 | 3,012 | 11,517 |

| Countries to which exported. | 1892. | | 1893. | | 1894. | | Total. | |
|---|---|---|---|---|---|---|---|---|
| | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. |
| Europe: | | | | | | | | |
| England | 50 | $220 | ..... | ..... | 100 | $350 | 150 | $570 |
| North America: | | | | | | | | |
| Canada— | | | | | | | | |
| Nova Scotia, New Brunswick, etc | 150 | 525 | 62 | $248 | ..... | ..... | 313 | 1,280 |
| Quebec, Ontario, etc | 31 | 175 | 5 | 21 | 25 | 105 | 61 | 303 |
| British Columbia | 3 | 31 | 1 | 9 | 2 | 14 | 6 | 54 |
| Central America— | | | | | | | | |
| Costa Rica | 22 | 109 | 8 | 41 | 13 | 68 | 57 | 285 |
| Honduras | ..... | ..... | ..... | ..... | ..... | ..... | 7 | 54 |
| Nicaragua | 3 | 17 | ..... | ..... | ..... | ..... | 39 | 241 |
| British Honduras | 21 | 91 | 19 | 85 | 20 | 91 | 112 | 556 |
| Bermuda | 4 | 17 | ..... | ..... | 2 | 13 | 6 | 30 |

47. *Statement by countries of the domestic exports of pickled herring during the seven years ending June 30, 1894*—Continued.

| Countries to which exported. | 1892. | | 1893. | | 1894. | | Total. | |
|---|---|---|---|---|---|---|---|---|
| | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. | Barrels. | Values. |
| North America—Continued. | | | | | | | | |
| West Indies— | | | | | | | | |
| British | 529 | $1,856 | 533 | $2,358 | 1,871 | $6,553 | 7,811 | $31,017 |
| Danish | 81 | 365 | 42 | 183 | 5 | 20 | 1,266 | 6,531 |
| Dutch | 280 | 1,431 | 270 | 1,265 | 299 | 1,371 | 1,429 | 6,990 |
| French | 100 | 715 | 13 | 59 | 2 | 10 | 883 | 4,022 |
| Haiti | 926 | 3,654 | 199 | 1,225 | 362 | 1,522 | 5,039 | 28,187 |
| Santo Domingo | 370 | 1,615 | 352 | 1,404 | 427 | 1,708 | 1,550 | 6,981 |
| Spanish— | | | | | | | | |
| Cuba | 11 | 51 | 28 | 115 | 6 | 32 | 76 | 382 |
| Puerto Rico | 82 | 363 | 92 | 358 | ..... | ..... | 252 | 1,082 |
| Total North America | 2,604 | 11,015 | 1,624 | 7,371 | 3,034 | 11,507 | 18,907 | 88,845 |
| South America: | | | | | | | | |
| Colombia | 17 | 76 | 73 | 309 | 262 | 1,149 | 463 | 2,151 |
| Guianas— | | | | | | | | |
| British | ..... | ..... | 105 | 656 | 14 | 58 | 134 | 797 |
| Dutch | ..... | ..... | 50 | 258 | ..... | ..... | 76 | 410 |
| French | 17 | 118 | ..... | ..... | ..... | ..... | 49 | 322 |
| Venezuela | 5 | 24 | 7 | 34 | 13 | 65 | 68 | 368 |
| Total South America | 39 | 218 | 235 | 1,257 | 289 | 1,272 | 790 | 4,048 |
| Africa: | | | | | | | | |
| British Africa | ..... | ..... | ..... | ..... | 53 | 230 | 183 | 833 |
| Liberia | 7 | 28 | ..... | ..... | 25 | 98 | 129 | 795 |
| Total Africa | 7 | 28 | ..... | ..... | 78 | 328 | 312 | 1,628 |
| All other islands and ports | ..... | ..... | 3 | 32 | ..... | ..... | 72 | 375 |
| Grand total | 2,700 | 11,481 | 1,862 | 8,660 | 3,501 | 13,457 | 20,231 | 95,466 |

*Import duties in various countries on pickled herring.*—The following compilation shows in comparative form (in some instances approximately) the rates of duty imposed on pickled herring imported into the various foreign countries. The rate in the United States is $1 per barrel of 200 pounds.

48. *Statement showing approximately the rates of duty imposed in various countries on pickled herring imported therein.*

| Countries. | Duty per barrel, or 200 pounds. | Countries. | Duty per barrel, or 200 pounds. |
|---|---|---|---|
| Europe: | | North America—continued. | |
| Austria-Hungary | $0.86 | West Indies—continued. | |
| Denmark | .34 | Guadaloupe | 6 p. c. ad val. |
| France | 2.64 | Haiti | 1.41 |
| Germany | .64 | Jamaica | .60 |
| Great Britain | Free. | Martinique | 2.80 |
| Italy | 1.05 | Puerto Rico | .76 |
| Russia | .58 | Santo Domingo | 2.54 |
| Sweden | Free. | Central America— | |
| Switzerland | .17 | Honduras | 1.86 |
| North America: | | British Honduras | Free. |
| Canada | 1.00 | South America: | |
| West Indies— | | Brazil | 2.00 |
| Bahamas | .98 | Colombia | 2.20 |
| Barbados | .10 | Guiana, British | .25 |
| Cuba | 1.52 | Peru | .44 |
| Dutch West Indies | 1¼ p. c. ad val. | Venezuela | 4.38 |

## SARDINES.

*Sardine imports.*—The importation of sardines into this country was begun about 1835, since which time they have been the principal fishery product imported. From 1858 to 1894, inclusive, the value of the sardines imported for consumption has amounted to $26,567,457. During each of four years, 1880, 1891, 1892, and 1893, the value has exceeded $1,000,000, the trade in 1893 surpassing that of any previous year. The smallest importations since 1872 have been $610,705 in 1875; $587,880 in 1876; and $677,068 in 1885.

Table 49 shows the value of the sardines imported during each of the thirty-seven years ending June 30, 1894. The custom-house returns do not indicate the quantity imported prior to 1876.

49. *Statement of the sardines imported for consumption into the United States from 1858 to 1894, inclusive.*

| Year ending June 30— | Whole boxes. | | Half boxes. | | Quarter boxes. | | In any other form. | Total values. |
|---|---|---|---|---|---|---|---|---|
| | Boxes. | Values. | Boxes. | Values. | Boxes. | Values. | Values. | |
| 1858 | | | | | | | | $274,137 |
| 1859 | | | | | | | | 251,278 |
| 1860 | | | | | | | | 299,679 |
| 1861 | | | | | | | | 226,624 |
| 1862 | | | | | | | | 186,417 |
| 1863 | | | | | | | | 383,223 |
| 1864 | | | | | | | | 504,079 |
| 1865 | | | | | | | | 304,713 |
| 1866 | | | | | | | | 937,920 |
| 1867 | | | | | | | | 478,619 |
| 1868 | | | | | | | | 471,707 |
| 1869 | | | | | | | | 640,159 |
| 1870 | | | | | | | | 980,989 |
| 1871 | | | | | | | | 912,555 |
| 1872 | | | | | | | | 683,095 |
| 1873 | | | | | | | | 986,769 |
| 1874 | | | | | | | | 886,677 |
| 1875 | | | | | | | | 610,705 |
| 1876 | 5,382 | $2,253 | 412,374 | $64,885 | 6,297,945 | $506,150 | $14,592 | 587,880 |
| 1877 | 5,813 | 2,338 | 264,285 | 48,044 | 7,985,401 | 661,507 | 11,018 | 722,997 |
| 1878 | 7,182 | 2,615 | 184,539 | 35,801 | 7,175,982 | 631,736 | 11,521 | 681,673 |
| 1879 | 2,424 | 1,010 | 117,320 | 23,865 | 9,875,048 | 798,563 | 9,864 | 833,302 |
| 1880 | 4,792 | 1,805 | 263,728 | 52,549 | 13,378,244 | 1,048,536 | 12,772 | 1,115,652 |
| 1881 | 2,834 | 982 | 131,533 | 31,543 | 10,028,535 | 913,057 | 10,440 | 956,022 |
| 1882 | 2,554 | 1,351 | 51,340 | 13,435 | 8,405,836 | 767,352 | 14,141 | 796,279 |
| 1883 | 2,446 | 1,447 | 180,415 | 47,901 | 6,250,832 | 710,311 | 13,970 | 773,629 |
| 1884 | 5,515 | 2,421 | 503,334 | 114,403 | 9,501,850 | 837,674 | 22,256 | 976,754 |
| 1885 | 7,910 | 2,834 | 235,526 | 51,130 | 6,805,187 | 599,518 | 23,586 | 677,068 |
| 1886 | 5,279 | 2,248 | 241,356 | 55,250 | 7,418,010 | 677,919 | 27,462 | 762,879 |
| 1887 | 3,010 | 1,117 | 209,765 | 48,203 | 8,617,967 | 739,256 | 29,099 | 817,675 |
| 1888 | 5,999 | 2,510 | 406,930 | 92,014 | 9,606,262 | 815,357 | 30,155 | 940,036 |
| 1889 | 4,330 | 1,458 | 606,333 | 117,825 | 8,782,343 | 657,435 | 29,359 | 806,077 |
| 1890 | 3,782 | 1,387 | 343,536 | 63,600 | 10,031,656 | 662,775 | 36,654 | 764,506 |
| 1891 | 4,517 | 1,271 | 408,064 | 72,087 | 12,213,829 | 879,477 | 47,108 | 1,000,843 |
| 1892 | 5,841 | 1,967 | 362,253 | 79,562 | 13,237,725 | 1,049,060 | 44,703 | 1,175,802 |
| 1893 | 6,353 | 2,100 | 569,607 | 126,981 | 13,454,536 | 1,083,824 | 45,244 | 1,258,158 |
| 1894 | 9,985 | 2,793 | 471,995 | 91,254 | 9,365,021 | 766,037 | 40,096 | 900,780 |
| Total | 95,948 | 35,916 | 5,964,233 | 1,231,322 | 178,432,809 | 14,806,834 | 474,040 | 26,567,457 |

The packing of sardines began in this country about 1875 and has gradually increased in importance, though it was confined within comparatively narrow limits until 1880. Since 1886 the value of the annual output of domestic sardines has averaged about $2,000,000, nearly all of which are consumed in this country. There is some foreign trade in

domestic sardines; the United States canneries market a large quantity in Canada and ship several thousand cases to South America each year. The half-pound can of sardines in mustard is the most popular in the Canadian market. Several shipments have been sent to Australia, but considerable competition exists in that market with the English sprats, the preparation of which was begun at Dover, England, about 1883. It is not possible to show the extent of the export trade in this product, as it is not separately listed in the customs returns

While the sardines of the Maine coast differ from those occurring along the French and Portuguese coasts, yet, when carefully prepared, they are scarcely inferior to the general run of the latter. There are many consumers, however, who prefer French brands to the domestic goods. For this reason the importation of the French sardines continues to increase, and among them are large quantities of cheaper grades, which are readily marketed because they come from France.

By far the greater portion of the sardines imported into the United States are received from France, Portugal supplying the next largest quantity. Of the $9,355,286 worth received during the ten years ending June 30, 1894, $7,633,485 worth came directly from France and $589,805 from Portugal; from England direct were received $475,309 worth; from Germany, $112,412; from Sweden and Norway, $198,950; from Belgium, $93,616; and from all other countries, $251,709. However, nearly the whole of those imported into this country are the product of the French, Portuguese, and Norwegian fisheries.

The following table shows the value of sardines imported from each foreign country, the value of the imports for consumption, and amount of duty paid thereon, during the ten years ending June 30, 1894:

50. *Statement by countries of the imports of anchovies or sardines into the United States during each of the ten years ending June 30, 1894.*

| Countries from which imported. | 1885. | 1886. | 1887. | 1888. | 1889. | 1890. |
|---|---|---|---|---|---|---|
| Europe: | | | | | | |
| Austria-Hungary | $6,442 | $30,354 | $18,729 | $7,336 | $7 | $26 |
| Belgium | 62 | 202 | 3,355 | 4,129 | 8,652 | 11,953 |
| Denmark | 417 | 89 | 158 | 24 | 91 | 7 |
| England | 56,506 | 40,782 | 56,213 | 76,996 | 31,073 | 34,843 |
| France | 489,553 | 708,840 | 619,801 | 792,820 | 699,121 | 625,109 |
| Germany | 4,025 | 8,331 | 6,102 | 7,244 | 6,405 | 5,004 |
| Italy | 2,275 | 4,095 | 5,360 | 5,303 | 4,744 | 7,007 |
| Netherlands | 8,263 | 7,024 | 6,013 | 8,543 | 6,058 | 5,037 |
| Portugal | 7 | 5,375 | 59,545 | 40,499 | 19,742 | 20,060 |
| Spain | 1,254 | 3,968 | 8,686 | 19,147 | 3,857 | ..... |
| Sweden and Norway | 9,054 | 11,883 | 14,419 | 22,554 | 11,926 | 14,415 |
| Total Europe | 577,858 | 820,943 | 798,387 | 990,595 | 791,676 | 724,721 |
| North America: | | | | | | |
| Nova Scotia, New Brunswick, etc. | ..... | 1,086 | 267 | ..... | ..... | ..... |
| Quebec, Ontario, etc | 2 | 19 | 1,334 | 241 | 88 | 1,154 |
| Cuba | 454 | 887 | 1,193 | 1,961 | 1,789 | 1,534 |
| Total North America | 456 | 1,992 | 2,794 | 2,202 | 1,877 | 2,688 |
| All other islands and ports | 1,413 | 765 | ..... | 762 | 416 | 699 |
| Grand total | 579,727 | 823,700 | 801,181 | 993,559 | 793,969 | 728,108 |
| Total entered for consumption | 677,068 | 762,879 | 817,675 | 940,036 | 806,077 | 764,506 |
| Amount of duty | 192,131 | 209,030 | 237,878 | 273,166 | 202,052 | 283,008 |

50. *Statement by countries of the imports of anchovies or sardines into the United States during each of the ten years ending June 30, 1894*—Continued.

| Countries from which imported. | 1891. | 1892. | 1893. | 1894. | Total. |
|---|---|---|---|---|---|
| Europe: | | | | | |
| Austria-Hungary | $9 | $1,564 | $54 | $22 | $64,543 |
| Belgium | 9,052 | 13,569 | 20,834 | 21,808 | 93,616 |
| Denmark | 6 | ..... | 715 | ..... | 1,507 |
| England | 65,540 | 52,889 | 30,441 | 21,026 | 475,309 |
| France | 883,321 | 888,780 | 1,084,763 | 841,377 | 7,633,485 |
| Germany | 9,998 | 44,742 | 17,998 | 1,903 | 112,412 |
| Italy | 10,725 | 8,864 | 11,081 | 9,497 | 68,957 |
| Netherlands | 1,915 | 318 | 652 | ..... | 44,423 |
| Portugal | 80,310 | 156,162 | 154,631 | 47,474 | 589,805 |
| Spain | 179 | 4,669 | 2,438 | 1,022 | 45,220 |
| Sweden and Norway | 25,565 | 26,481 | 32,226 | 30,427 | 198,950 |
| Total Europe | 1,086,620 | 1,198,038 | 1,364,833 | 974,556 | 9,328,227 |
| North America: | | | | | |
| Nova Scotia, New Brunswick, etc | ..... | ..... | ..... | ..... | 1,353 |
| Quebec, Ontario, etc | 1,539 | 571 | 613 | 767 | 6,328 |
| Cuba | 1,735 | 2,383 | 1,371 | 1,340 | 14,647 |
| Total North America | 3,274 | 2,954 | 1,984 | 2,107 | 22,328 |
| All other islands and ports | 81 | 157 | 149 | 239 | 4,731 |
| Grand total | 1,089,975 | 1,201,149 | 1,366,966 | 976,952 | 9,355,286 |
| Total entered for consumption | 1,000,843 | 1,175,892 | 1,258,158 | 900,779 | 9,103,914 |
| Amount of duty | 345,044 | 367,521 | 383,577 | 274,762 | 2,828,169 |

During the last few years the sardine fishery along both the French and Portuguese coasts is reported to have been poor, the run of fish being small and of inferior quality. It is further stated that there is a growing habit in those countries of catching and preserving a fish that somewhat resembles the true sardine, but which appears to be inferior to the average quarter-oil sardine packed on the Maine coast.

It is clear that this is an opportune time for the American canners, by strict attention to the quality of their output, to make special efforts to capture trade that the French and Portuguese are likely to lose in the event of placing poor sardines upon the market. Aside from this, the conditions existing in Europe should tend, in some measure, to aid the sale of American fish, since, according to late accounts, many canners in France and Portugal have not attempted to pack during the last two years on account of the scarcity of the sardines.[1]

*Import duties on sardines.*—The customs law of August 30, 1842, imposed a duty of 20 per cent ad valorem on sardines imported into the United States. This rate was doubled by the law of July 30, 1846, but the customs enactment of March 3, 1857, reduced the rate to 30 per cent. The act of July 30, 1864, raised the duty to 50 per cent ad valorem; but in 1872 it was again reduced to 30 per cent, where it remained until February 8, 1875, when specific duties were imposed. These were as follows: On boxes measuring not over 5 by 4 by 3½ inches, 15 cents per box; those measuring not over 5 by 4 by 1⅛ inches, 7½ cents each; measuring not over 4¾ by 3½ by 1¼ inches, 4 cents per box; and for sardines in any other form, an ad valorem duty of 60 per cent. The customs

[1] See New York Commercial Bulletin, July 24, 1894.

law of March 3, 1883, reduced these duties to 10 cents, 5 cents, 2½ cents, and 40 per cent ad valorem, respectively, at which rate they remain at the present time. The duties imposed in the principal foreign countries on imported sardines are shown in the accompanying compilation:

51. *Statement showing approximately the rates of duty on sardines imported into various foreign countries.*

| Countries. | Duty per 100 pounds. | Countries. | Duty per 100 pounds. |
|---|---|---|---|
| Europe: | | North America—continued. | |
| Austria-Hungary | $5.80 | Central America— | |
| Belgium | Free. | British Honduras | 10 per cent ad val. |
| Denmark | 1.70 | Costa Rica | $1.54 |
| France | 2.19 | Guatemala | 5.51 |
| Germany | 6.48 | Honduras | 1.86 |
| Great Britain | Free. | Nicaragua | 3.26 |
| Greece | 13.59 | Salvador | 4.40 |
| Italy | 2.63 | West Indies— | |
| Netherlands | 4.56 | Cuba | 5.04 |
| Norway | 2.40 | Haiti— | |
| Portugal | .24 | Whole boxes | .10 per box. |
| Russia | 5.38 | Half boxes | .06 per box. |
| Sweden | 2.43 | Quarter boxes | .04 per box. |
| Switzerland | 1.39 | Santo Domingo | 9.50 |
| North America: | | South America: | |
| Canada— | | Argentina | 13.13 |
| Whole boxes | .05 per box. | Bolivia | 1.92 |
| Half boxes | .025 per box. | Brazil | 11.88 |
| Quarter boxes | .02 per box | Chile | 5.10 |
| Others | 30 per cent. ad val. | Guiana, British | 1.00 |
| Mexico | 3.59 | Peru | 2.20 |
| | | Uruguay | 14.10 |

## VII.—SALMON.

*Branches of trade.*—The foreign trade in salmon is in fresh, salted, and canned salmon imported, and canned and salted salmon exported. A considerable trade is being developed in shipping fresh salmon to Europe, principally to Hamburg and London, the fish being first frozen. These shipments are made via New York and via New Zealand. The following statement shows briefly the extent of trade in these products during a series of ten years ending in 1894:

52. *Statement of the foreign trade in salmon during a series of ten years ending in 1894.*

| Year ending June 30— | Imports for consumption. | | | | Domestic exports. | | | Excess of exports over imports. |
|---|---|---|---|---|---|---|---|---|
| | Fresh salmon. | Salted salmon. | Canned salmon. | Total. | Salted salmon. | Canned salmon. | Total. | |
| 1885..... | $152,822 | $73,000 | $9 | $225,831 | $82,114 | $2,260,567 | $2,342,681 | $2,116,850 |
| 1886..... | 144,719 | 46,073 | 3,503 | 194,295 | 43,450 | 1,875,109 | 1,918,559 | 1,724,264 |
| 1887..... | 119,361 | 67,092 | 719 | 187,172 | 78,208 | 1,719,685 | 1,797,893 | 1,610,721 |
| 1888..... | 77,726 | 68,916 | 1,109 | 147,751 | 61,046 | 1,608,815 | 1,669,861 | 1,522,110 |
| 1889..... | 104,875 | 77,070 | 2,193 | 184,138 | 54,173 | 3,364,560 | 3,418,733 | 3,234,595 |
| 1890..... | 91,022 | 68,102 | 479 | 159,603 | 69,042 | 3,259,344 | 3,328,386 | 3,168,783 |
| 1891..... | 80,649 | 79,959 | 388 | 160,996 | 83,993 | 2,096,957 | 2,180,950 | 2,019,954 |
| 1892..... | 105,565 | 60,918 | 88 | 166,571 | 78,680 | 1,738,465 | 1,817,145 | 1,650,574 |
| 1893..... | 116,124 | 63,722 | 56 | 179,902 | 49,230 | 2,279,625 | 2,328,855 | 2,148,953 |
| 1894..... | 156,163 | 84,442 | 620 | 241,225 | 58,659 | 1,026,197 | 1,084,856 | 843,631 |
| Total .. | 1,149,026 | 689,294 | 9,164 | 1,847,484 | 658,595 | 21,229,324 | 21,887,919 | 20,040,435 |

*Imports of fresh salmon.*—The principal supply of fresh salmon in the eastern markets is obtained from New Brunswick and other Canadian Provinces. The fish thus imported is the Atlantic salmon (*Salmo salar*). A few Pacific salmon, principally the chinook or quinnat salmon (*Oncorhynchus tschawytscha*), are imported from British Columbia. These imports are received principally by rail, the largest supplies entering the Maine and New York customs ports.

Prior to 1890 fresh salmon were imported free of duty, but the customs act of that year taking effect October 6, 1890, imposed a duty of three-quarters of 1 cent per pound. This duty had no appreciable effect on the quantity imported, the imports for consumption during the three years following the act averaging 1,457,702 pounds, against an average of 884,399 pounds during the three years immediately preceding it.

Table 53 shows the whole quantity and value of fresh salmon imported annually into the United States from various countries during the series of ten years ending June 30, 1894, the quantity and value entered for consumption, and the amount of duty collected during the period in which this commodity was dutiable.

According to this account, during the ten years here reported there were 12,123,613 pounds of fresh salmon, worth $1,175,645, entered at the United States customs ports. Of these, 9,644,990 pounds, worth $963,169, came from New Brunswick and Nova Scotia; 2,390,300 pounds, worth $207,625, from Quebec and Ontario; 84,581 pounds, worth $4,570, from British Columbia, and 3,635 and 107 pounds from Newfoundland and England, respectively. The total amount entered for consumption in

this country was 12,109,853 pounds, worth $1,149,026, the duty on which during the four years in which the customs act of 1890 was operative amounted to $36,579. The largest quantity entered for consumption during any one year was 1,891,742 pounds in 1894, and the smallest was 768,727 pounds in 1888.

53. *Statement by countries of the imports of fresh salmon into the United States during each of the ten years ending June 30, 1894.*

| Countries from which imported. | 1885. | | 1886. | | 1887. | | 1888. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| North America: | | | | | | | | |
| Nova Scotia and New Brunswick | 1,081,922 | $125,459 | 1,118,933 | $115,563 | 844,392 | $81,433 | 993,897 | $98,187 |
| Quebec, Ontario | 254,569 | 27,353 | 303,687 | 29,216 | 259,698 | 25,120 | 230,078 | 21,365 |
| Newfoundland and Labrador | 50 | 10 | 100 | 10 | ..... | ..... | ..... | ..... |
| Total | 1,336,541 | 152,822 | 1,422,720 | 144,789 | 1,104,090 | 106,553 | 1,223,975 | 119,552 |
| Total entered for consumption | 1,336,541 | 152,822 | 1,303,704 | 144,719 | 1,583,464 | 119,361 | 768,727 | 77,726 |

| Countries from which imported. | 1889. | | 1890. | | 1891. | | 1892. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| North America: | | | | | | | | |
| Nova Scotia and New Brunswick | 865,531 | $89,727 | 644,120 | $67,476 | *235,361<br>†490,482 | $22,710<br>47,338 | 1,103,806 | $98,000 |
| Quebec and Ontario | 151,491 | 14,951 | 205,183 | 20,931 | *101,939<br>16,066 | 9,522<br>894 | 75,863 | 6,249 |
| British Columbia | ..... | ..... | 4,660 | 241 | *3,700<br>11,250 | 95<br>75 | 6,288 | 301 |
| Newfoundland and Labrador | 3,485 | 209 | ..... | ..... | ..... | ..... | ..... | ..... |
| Total | 1,020,507 | 104,887 | 853,963 | 88,648 | 844,798 | 80,634 | 1,186,017 | 105,450 |
| Total entered for consumption | 1,011,456 | 104,875 | 873,014 | 91,022 | *341,000<br>†503,940 | 32,327<br>48,322 | 1,242,760 | 105,565 |
| Amount of duty | ..... | ..... | ..... | ..... | ..... | 3,780 | ..... | 9,321 |

| Countries from which imported. | 1893. | | 1894. | | Total. | |
|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | |
| England | 107 | $52 | ..... | ..... | 107 | $52 |
| North America: | | | | | | |
| Nova Scotia and New Brunswick | 1,017,846 | 100,405 | 1,242,640 | $115,971 | 9,644,990 | 963,169 |
| Quebec and Ontario | 155,902 | 12,028 | 645,824 | 39,996 | 2,390,300 | 207,625 |
| British Columbia | 64,811 | 3,639 | 3,872 | 219 | 84,581 | 4,570 |
| Newfoundland and Labrador | ..... | ..... | ..... | ..... | 3,635 | 229 |
| Total | 1,238,666 | 116,124 | 1,892,336 | 156,186 | 12,123,013 | 1,175,645 |
| Total entered for consumption | 1,238,605 | 116,124 | 1,891,742 | 156,163 | 12,109,853 | 1,149,026 |
| Amount of duty | ..... | 9,290 | ..... | 14,188 | ..... | 36,579 |

* Free of duty. † Dutiable.

*Trade in salted salmon.*—Little difference exists between the quantity of pickled or salted salmon imported for consumption and the extent of the domestic exports. The value of the former during the ten years ending June 30, 1894, was $689,294, and the domestic exports during the same period were valued at $658,595. A statement of the imports for consumption of salted salmon from 1869 to 1894, inclusive, is given in Table 10, on page 447, and the exports since 1883 are noted in Table 24, on page 468.

The pickled or salted salmon imported into the United States come principally from Nova Scotia, New Brunswick, Quebec, and Newfoundland. Smaller quantities are received from British Columbia, the Netherlands, England, Asiatic Russia, etc.

The accompanying table shows by countries the extent of these imports during each of the last ten years, the imports for consumption during the same period, and the duty collected thereon.

54. *Statement by countries of the imports of pickled salmon into the United States during each of the ten years ending June 30, 1894.*

| Countries from which imported. | 1885. | | 1886. | | 1887. | | 1888. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | | | |
| Italy | | | 200 | $8 | | | | |
| Sweden and Norway | | | 200 | 10 | | | | |
| North America: | | | | | | | | |
| Nova Scotia, New Brunswick, etc | 668,600 | $43,909 | 580,200 | 33,456 | 580,000 | $42,771 | 665,600 | $50,652 |
| Quebec, Ontario, etc | 169,400 | 9,491 | 78,200 | 3,726 | 25,600 | 1,918 | 82,800 | 5,118 |
| British Columbia | | | 5,600 | 224 | 200 | 4 | 86,000 | 4,031 |
| Newfoundland and Labrador | 336,400 | 22,589 | 248,000 | 11,390 | 335,600 | 24,305 | 178,400 | 13,610 |
| Total | 1,174,400 | 75,989 | 912,400 | 48,814 | 941,400 | 68,998 | 1,012,800 | 73,411 |
| Total entered for consumption | 1,124,254 | 73,000 | 879,510 | 46,073 | 917,560 | 67,092 | 934,615 | 68,916 |
| Amount of duty | | 22 | | 8,795 | | 9,176 | | 9,346 |

| Countries from which imported. | 1889. | | 1890. | | 1891. | | 1892. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | | | |
| England | 2,800 | $195 | | | 2,000 | $178 | | |
| Italy | | | | | | | 406 | $27 |
| Netherlands | 12,600 | 924 | | | | | | |
| North America: | | | | | | | | |
| Nova Scotia, New Brunswick, etc | 580,200 | 47,123 | 350,600 | $32,074 | 451,400 | 41,405 | 481,000 | 34,114 |
| Quebec, Ontario, etc | 7,600 | 583 | 44,200 | 2,203 | 38,839 | 2,479 | 15,941 | 1,031 |
| British Columbia | 18,200 | 860 | 600 | 36 | 200 | 5 | | |
| Newfoundland and Labrador | 406,200 | 28,731 | 393,800 | 32,836 | 461,480 | 36,245 | 362,600 | 24,646 |
| Total | 1,027,600 | 78,416 | 789,200 | 67,149 | 953,919 | 80,312 | 860,847 | 60,418 |
| Total entered for consumption | 992,505 | 77,070 | 797,850 | 68,102 | 967,094 | 79,959 | 878,362 | 60,918 |
| Amount of duty | | 9,925 | | 7,979 | | 9,671 | | 8,784 |

| Countries from which imported. | 1893. | | 1894. | | Total. | |
|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | |
| England | | | | | 4,800 | $373 |
| Italy | 69 | $5 | 11 | $1 | 686 | 41 |
| Netherlands | | | | | 12,600 | 924 |
| Sweden and Norway | 35 | 8 | | | 235 | 18 |
| North America: | | | | | | |
| Nova Scotia, New Brunswick, etc | 467,057 | 36,095 | 536,520 | 36,182 | 5,362,077 | 397,781 |
| Quebec, Ontario, etc | 44,000 | 2,768 | 2,658 | 217 | 509,238 | 30,134 |
| British Columbia | 5,478 | 291 | 149,410 | 17,592 | 265,688 | 23,043 |
| Newfoundland and Labrador | 358,428 | 24,055 | 405,407 | 30,396 | 3,486,315 | 248,803 |
| Asia: | | | | | | |
| Hongkong | | | 1,200 | 29 | 1,200 | 29 |
| Russia | | | 11,875 | 298 | 11,875 | 298 |
| Total | 875,067 | 63,222 | 1,107,081 | 84,715 | 9,654,714 | 701,444 |
| Total entered for consumption | 908,113 | 63,722 | 1,101,502 | 84,442 | 9,501,355 | 680,204 |
| Amount of duty | | 9,081 | | 11,015 | | 83,794 |

*Trade in canned salmon.*—Practically all the canned salmon of the world are produced on the Pacific Coast of the North American continent. The extent of the product along each section of that coast for the four years, 1889, 1890, 1891, and 1892 is shown in the following table:

55. *Statement of the yield of canned salmon on the west coast of North America during the years 1889, 1890, 1891, and 1892.*

| Localities. | 1889. | | 1890. | | 1891. | | 1892. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Alaska | 28,770,912 | $2,996,070 | 30,779,552 | $2,629,491 | 38,827,584 | $3,235,632 | 22,510,360 | $1,969,674 |
| British Columbia | 20,122,128 | 2,414,655 | 19,895,992 | 2,387,519 | 15,170,592 | 1,517,061 | 11,928,576 | 1,043,750 |
| Washington | 10,129,584 | 1,050,790 | 8,094,288 | 874,784 | 8,957,130 | 951,999 | 11,460,384 | 1,163,590 |
| Oregon | 11,874,192 | 1,372,670 | 15,612,624 | 1,743,111 | 13,827,792 | 1,596,904 | 18,835,328 | 2,985,072 |
| California | 3,708,960 | 361,934 | 1,465,920 | 141,690 | 599,004 | 58,090 | 762,432 | 75,696 |
| Total | 74,605,776 | 8,197,028 | 75,848,376 | 8,528,470 | 77,383,008 | 7,360,586 | 65,497,080 | 7,237,782 |

The principal markets for canned salmon are San Francisco and London, the former being the general shipping port, while London is the center of distribution throughout the world. Of the 28,781,661 pounds of canned salmon exported from this country in 1890, 23,740,740 pounds were sent to England for distribution. The shipments from the principal customs districts were as follows: San Francisco, 21,638,144 pounds; Oregon, 6,382,272 pounds; New York, 627,623 pounds; Puget Sound, 85,930 pounds; the shipments from all the remaining ports aggregating only 47,692 pounds. Of the 10,727,010 pounds exported in 1894, England received 7,720,747 pounds, the shipments from the principal ports being as follows: San Francisco, 6,770,108 pounds; Puget Sound, 1,325,326 pounds; Philadelphia, 1,038,087 pounds; New York, 746,581 pounds, and Oregon, 622,848 pounds.

Small quantities of canned salmon are each year imported into this country for consumption. The extent of these imports is so inconsiderable that they have no effect on the canned-salmon trade in the United States. During the ten years ending June 30, 1894, the value of these imports amounted to only $9,157, as shown in Table 11.

Table 56 shows the exports of canned salmon to various countries during the ten years ending June 30, 1894. Of the $21,229,324 worth of salmon exported during this period, $17,152,152, or 81 per cent, went to England; $2,587,972, or 12 per cent, to Australia; the exports to all other ports being only $1,489,200, or 7 per cent. It appears that the exports reached a maximum in 1889 and 1890, when they exceeded 28,000,000 pounds each year. The extensive product during these and the preceding years resulted in overstocking the market to such an extent that at the opening of the fishing season of 1891 it was reported that 400,000 cases of canned salmon were in London warehouses. This naturally resulted in decreasing the product of the canneries and the exports during the following years; and to the overstocked condition of the markets is almost entirely due the small quantity exported in 1894.

56. *Statement by countries of the exports of canned salmon during the ten years ending June 30, 1894.*

| Countries to which exported. | 1885. | | 1886. | | 1887. | | 1888. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | | | |
| Belgium | | $12,745 | | | 72 | $6 | 48 | $9 |
| France | | 24,058 | | $4,541 | 3,128 | 330 | | |
| Germany | | 317 | | 471 | 2,608 | 353 | 6,384 | 981 |
| Italy | | 51 | | 130 | 162 | 22 | | |
| Netherlands | | | | | 92 | 15 | | |
| United Kingdom— | | | | | | | | |
| England | | 1,086,375 | | 1,441,456 | 11,995,345 | 1,254,875 | 10,282,760 | 1,218,956 |
| Scotland | | 2 | | 288 | 12,082 | 1,696 | | |
| Total Europe | | 1,723,548 | | 1,446,886 | 12,014,089 | 1,257,207 | 10,289,212 | 1,219,946 |
| North America: | | | | | | | | |
| Canada— | | | | | | | | |
| Quebec, Ontario, etc | | 24,897 | | 23,980 | 16,250 | 1,625 | 327,225 | 34,100 |
| British Columbia | | | | 51 | 108,142 | 10,584 | 858 | 81 |
| Mexico | | 6,334 | | 4,160 | 56,940 | 6,466 | 69,403 | 8,175 |
| Central America— | | | | | | | | |
| Costa Rica | | 1,030 | | 912 | 18,213 | 2,064 | 34,134 | 4,268 |
| Guatemala | | 1,350 | | 1,193 | 2,612 | 335 | 3,188 | 384 |
| Honduras | | 630 | | 558 | 1,212 | 146 | 3,011 | 400 |
| Nicaragua | | 1,050 | | 920 | 16,750 | 1,975 | 24,266 | 3,136 |
| Salvador | | 85 | | 75 | | | 1,777 | 205 |
| British Honduras | | 722 | | 994 | 7,780 | 1,047 | 5,130 | 783 |
| West Indies— | | | | | | | | |
| British | | 4,775 | | 5,400 | 83,925 | 10,653 | 65,750 | 9,078 |
| Danish | | 210 | | 171 | 2,537 | 324 | 3,072 | 483 |
| Dutch | | 1,213 | | 1,032 | 9,651 | 1,237 | 7,110 | 1,043 |
| French | | 47 | | 150 | 162 | 22 | 348 | 52 |
| Haiti | | 577 | | 132 | 304 | 34 | 806 | 122 |
| Santo Domingo | | 231 | | 234 | 1,572 | 217 | 480 | 76 |
| Spanish— | | | | | | | | |
| Cuba | | 841 | | 224 | 2,676 | 334 | 912 | 149 |
| Puerto Rico | | 200 | | 470 | 144 | 17 | 432 | 73 |
| Total North America | | 44,192 | | 40,665 | 328,909 | 37,080 | 547,962 | 62,608 |
| South America: | | | | | | | | |
| Argentina | | 2,894 | | 998 | 21,716 | 2,696 | 30,702 | 5,116 |
| Bolivia | | | | | | | 960 | 168 |
| Brazil | | 147 | | 432 | 7,354 | 892 | 8,108 | 1,167 |
| Chile | | 11,703 | | 8,374 | 41,720 | 5,291 | 33,676 | 4,920 |
| Colombia | | 18,542 | | 17,165 | 185,754 | 22,183 | 120,627 | 16,034 |
| Ecuador | | | | | 26,968 | 3,404 | 25,928 | 4,246 |
| Guianas— | | | | | | | | |
| British | | 2,843 | | 1,811 | 54,832 | 6,854 | 30,480 | 4,371 |
| Dutch | | 90 | | 169 | 1,248 | 175 | | |
| French | | 116 | | 188 | 240 | 31 | 912 | 130 |
| Peru | | 800 | | 3,528 | 9,600 | 1,080 | 7,864 | 1,163 |
| Uruguay | | 80 | | 129 | 480 | 72 | 336 | 42 |
| Venezuela | | 4,277 | | 3,113 | 25,119 | 3,260 | 40,485 | 5,622 |
| Total South America | | 41,642 | | 35,907 | 375,031 | 45,938 | 300,078 | 42,979 |
| Asia and Oceanica: | | | | | | | | |
| China | | 3,035 | | 1,770 | 2,100 | 216 | 3,876 | 446 |
| Hongkong | | 8,039 | | 6,869 | 57,744 | 6,418 | 93,220 | 11,445 |
| Japan | | 2,480 | | 4,044 | 9,700 | 1,035 | 8,104 | 910 |
| British Australasia | | 383,992 | | 290,857 | 3,030,453 | 327,180 | 2,008,145 | 242,509 |
| British East Indies | | 2,824 | | 856 | 11,048 | 1,341 | 3,520 | 514 |
| Hawaiian Islands | | 20,724 | | 21,575 | 111,953 | 11,787 | 110,121 | 12,362 |
| Total Asia and Oceanica | | 421,094 | | 325,971 | 3,222,998 | 347,977 | 2,227,046 | 268,186 |
| Africa: | | | | | | | | |
| British Africa | | 585 | | 2,983 | 27,280 | 3,580 | 39,665 | 5,741 |
| Liberia | | 57 | | 24 | 96 | 11 | 436 | 60 |
| Spanish Africa | | 30 | | 90 | | | | |
| Total Africa | | 672 | | 3,097 | 27,376 | 3,591 | 40,101 | 5,801 |
| All other islands and ports | | 29,419 | | 22,583 | 260,760 | 27,802 | 80,167 | 9,295 |
| Grand total | 20,550,609 | 2,260,567 | 17,046,445 | 1,875,109 | 16,229,163 | 1,719,685 | 13,484,566 | 1,608,815 |

56. *Statement by countries of the exports of canned salmon during the ten years ending June 30, 1894*—Continued.

| Countries to which exported. | 1889. | | 1890. | | 1891. | | 1892. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Pounds. | Values |
| Europe: | | | | | | | | |
| Azores, and Madeira Islands | | | 96 | $5 | | | | |
| Belgium | | | | | 900 | $119 | 1,850 | $245 |
| France | 9,000 | $1,500 | 12,950 | 1,971 | 152,178 | 17,099 | 37,300 | 4,150 |
| Germany | 8,040 | 1,079 | 25,560 | 3,217 | 14,178 | 1,794 | 10,896 | 1,259 |
| Italy | 1,240 | 184 | 48 | 10 | 144 | 20 | 2,280 | 318 |
| Netherlands | | | | | | | 1,248 | 143 |
| United Kingdom— | | | | | | | | |
| England | 24,841,304 | 2,942,937 | 23,740,740 | 2,678,691 | 19,397,441 | 1,792,938 | 15,452,993 | 1,465,738 |
| Scotland | | | 0 | 1 | | | 135 | 19 |
| Total | 24,860,244 | 2,945,700 | 23,779,400 | 2,683,895 | 19,564,841 | 1,811,970 | 15,506,702 | 1,471,872 |
| North America: | | | | | | | | |
| Canada— | | | | | | | | |
| British Columbia | 119,550 | 5,300 | 75,970 | 6,092 | 7,200 | 750 | 300 | 24 |
| Newfoundland and Labrador | 300 | 45 | | | | | | |
| Mexico | 61,518 | 7,376 | 59,250 | 6,749 | 47,031 | 5,402 | 73,489 | 8,091 |
| Central America— | | | | | | | | |
| Costa Rica | 34,286 | 4,223 | 39,960 | 4,668 | 96,966 | 10,282 | 16,813 | 1,816 |
| Guatemala | 8,086 | 964 | 6,275 | 711 | 5,646 | 625 | 12,454 | 1,324 |
| Honduras | 4,305 | 562 | 2,339 | 299 | 4,400 | 475 | 3,670 | 422 |
| Nicaragua | 16,491 | 2,156 | 13,784 | 1,640 | 32,510 | 3,904 | 14,827 | 1,441 |
| Salvador | 1,950 | 220 | 2,856 | 320 | 1,943 | 219 | 3,500 | 365 |
| British Honduras | 11,787 | 1,604 | 5,640 | 706 | 12,760 | 1,488 | 13,177 | 1,567 |
| Bermuda | | | | | | | 20,685 | 2,519 |
| West Indies— | | | | | | | | |
| British | 88,592 | 13,053 | 77,792 | 10,223 | 112,521 | 13,669 | 79,791 | 9,251 |
| Danish | 2,889 | 432 | 1,095 | 170 | 2,765 | 368 | 1,810 | 212 |
| Dutch | 5,304 | 755 | 5,298 | 763 | 7,687 | 970 | 8,281 | 1,016 |
| French | 1,402 | 225 | 264 | 34 | 5,213 | 552 | 1,226 | 137 |
| Haiti | 482 | 77 | 1,700 | 253 | 989 | 139 | 936 | 107 |
| Santo Domingo | 1,104 | 174 | 1,440 | 229 | 2,192 | 366 | 1,200 | 159 |
| Spanish— | | | | | | | | |
| Cuba | 3,024 | 482 | 5,616 | 903 | 5,148 | 779 | 19,184 | 2,292 |
| Puerto Rico | 624 | 98 | 4,002 | 643 | 528 | 85 | 2,160 | 270 |
| Total | 361,694 | 37,746 | 303,287 | 34,403 | 345,499 | 40,073 | 273,503 | 31,013 |
| South America: | | | | | | | | |
| Argentina | 39,008 | 6,113 | 49,715 | 7,245 | 6,884 | 995 | 600 | 70 |
| Bolivia | | | 1,200 | 145 | | | | |
| Brazil | 2,172 | 321 | 3,098 | 528 | 6,240 | 824 | 3,854 | 422 |
| Chile | 67,716 | 9,602 | 86,952 | 10,598 | 189,672 | 18,911 | 219,208 | 21,363 |
| Colombia | 75,860 | 10,425 | 14,042 | 1,947 | 20,237 | 2,952 | 24,332 | 2,869 |
| Ecuador | 16,852 | 2,286 | 35,094 | 4,198 | 102,690 | 8,229 | 7,782 | 880 |
| Guianas— | | | | | | | | |
| British | 39,768 | 5,721 | 43,263 | 5,633 | 43,020 | 4,781 | 36,288 | 3,834 |
| Dutch | 1,460 | 215 | 3,853 | 542 | 3,216 | 438 | 4,944 | 551 |
| French | 1,884 | 239 | 1,260 | 140 | 280 | 30 | 432 | 42 |
| Peru | 18,389 | 2,824 | 13,698 | 2,089 | 19,320 | 2,419 | 53,540 | 4,917 |
| Uruguay | 2,446 | 394 | 624 | 100 | 3,600 | 555 | 96 | 14 |
| Venezuela | 35,717 | 5,581 | 45,041 | 6,376 | 44,924 | 5,774 | 43,013 | 4,891 |
| Total | 300,778 | 43,721 | 298,740 | 39,541 | 440,089 | 45,908 | 394,089 | 39,889 |
| Asia and Oceanica: | | | | | | | | |
| China | 5,080 | 573 | 2,660 | 293 | 4,030 | 441 | 3,210 | 337 |
| Hongkong | 135,423 | 16,349 | 194,530 | 21,380 | 141,405 | 14,561 | 81,440 | 8,308 |
| Japan | 19,929 | 2,429 | 7,500 | 828 | 11,950 | 1,269 | 3,740 | 382 |
| British Australasia | 2,322,468 | 270,316 | 3,768,460 | 429,367 | 1,479,470 | 140,855 | 1,636,200 | 152,979 |
| British East Indies | 53,430 | 6,594 | 28,000 | 3,176 | 18,280 | 1,801 | 19,680 | 1,959 |
| French Oceanica | | | 48,800 | 5,530 | 44,755 | 4,743 | 65,918 | 6,758 |
| Hawaiian Islands | 139,184 | 15,278 | 191,690 | 20,435 | 239,830 | 25,408 | 173,860 | 17,975 |
| Total | 2,675,514 | 311,539 | 4,241,700 | 481,009 | 1,939,780 | 189,078 | 1,984,048 | 198,698 |
| Africa: | | | | | | | | |
| British Africa | 102,832 | 15,234 | 87,735 | 13,477 | 41,508 | 6,429 | 39,193 | 5,238 |
| Liberia | 336 | 44 | 96 | 11 | 48 | 8 | 96 | 14 |
| Spanish Africa | 240 | 44 | 144 | 27 | 768 | 107 | | |
| Total | 103,408 | 15,322 | 87,975 | 13,515 | 42,324 | 6,544 | 39,289 | 5,252 |
| All other islands and ports | 91,502 | 10,532 | 70,559 | 6,981 | 34,692 | 3,384 | 17,394 | 1,741 |
| Grand total | 28,393,140 | 3,364,560 | 28,781,601 | 3,259,344 | 22,367,225 | 2,096,957 | 18,215,025 | 1,738,465 |

56. *Statement by countries of the exports of canned salmon during the ten years ending June 30, 1894*—Continued.

| Countries to which exported. | 1893. | | 1894. | | Total. | |
|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | |
| Azores, and Madeira Islands | | | 144 | $18 | | $23 |
| Belgium | 2,890 | $324 | 540 | 61 | | 13,509 |
| France | 4,550 | 480 | 280 | 28 | | 54,157 |
| Germany | 1,082 | 158 | 8,445 | 1,218 | | 10,847 |
| Italy | 2,800 | 325 | 3,264 | 384 | | 1,444 |
| Netherlands | 48 | 7 | | | | 165 |
| United Kingdom— | | | | | | |
| England | 18,867,748 | 1,958,169 | 7,720,747 | -712,017 | | 17,152,152 |
| Scotland | 12,000 | 1,400 | 1,440 | 179 | | 3,585 |
| Total Europe | 18,891,118 | 1,960,863 | 7,734,860 | 713,905 | | 17,235,882 |
| North America: | | | | | | |
| Canada— | | | | | | |
| Quebec, Ontario, etc | | | | | | 84,602 |
| British Columbia | 270,480 | 15,080 | 24,150 | 1,506 | | 30,468 |
| Miquelon, Langley, etc | | | 1,600 | 175 | | 175 |
| Newfoundland and Labrador | | | 288 | 28 | | 73 |
| Mexico | 83,759 | 9,024 | 59,625 | 5,986 | | 67,763 |
| Central America— | | | | | | |
| Costa Rica | 38,748 | 4,313 | 37,271 | 3,791 | | 37,367 |
| Guatemala | 15,178 | 1,597 | 10,015 | 1,047 | | 9,530 |
| Honduras | 2,722 | 293 | 2,743 | 279 | | 4,064 |
| Nicaragua | 11,403 | 1,166 | 13,255 | 1,329 | | 18,726 |
| Salvador | 6,840 | 699 | 2,730 | 284 | | 2,472 |
| British Honduras | 14,699 | 1,548 | 9,791 | 1,019 | | 11,478 |
| Bermuda | 22,975 | 2,800 | 20,759 | 2,504 | | 7,823 |
| West Indies— | | | | | | |
| British | 113,456 | 12,380 | 185,459 | 19,199 | | 107,681 |
| Danish | 5,266 | 572 | 4,404 | 469 | | 3,411 |
| Dutch | 5,832 | 677 | 5,265 | 612 | | 9,318 |
| French | 3,390 | 364 | 1,110 | 117 | | 1,700 |
| Haiti | 648 | 85 | 660 | 78 | | 1,604 |
| Santo Domingo | 944 | 110 | 2,048 | 212 | | 2,008 |
| Spanish— | | | | | | |
| Cuba | 13,872 | 1,630 | 12,596 | 1,418 | | 9,052 |
| Puerto Rico | 1,004 | 128 | 1,248 | 137 | | 2,121 |
| Total North America | 611,216 | 52,466 | 395,017 | 40,190 | | 420,436 |
| South America: | | | | | | |
| Argentina | 36,030 | 3,984 | 30,010 | 3,283 | | 33,394 |
| Bolivia | | | | | | 313 |
| Brazil | 84,461 | 9,497 | 89,759 | 9,501 | | 23,731 |
| Chile | 135,420 | 14,201 | 43,984 | 4,575 | | 109,598 |
| Colombia | 33,548 | 3,818 | 25,352 | 2,958 | | 98,893 |
| Ecuador | 45,975 | 5,124 | 19,499 | 2,084 | | 30,457 |
| Guianas— | | | | | | |
| British | 87,020 | 9,232 | 111,070 | 11,184 | | 56,264 |
| Dutch | 5,068 | 589 | 10,176 | 1,033 | | 3,802 |
| French | | | | | | 916 |
| Peru | 7,200 | 899 | 11,528 | 1,435 | | 21,274 |
| Uruguay | 1,584 | 190 | 12,520 | 1,486 | | 3,062 |
| Venezuela | 47,736 | 5,126 | 31,577 | 3,291 | | 47,311 |
| Total South America | 485,932 | 52,660 | 385,475 | 40,830 | | 429,015 |
| Asia and Oceanica: | | | | | | |
| China | 7,256 | 708 | 4,305 | 448 | | 8,327 |
| Hongkong | 95,430 | 9,805 | 85,520 | 8,681 | | 111,855 |
| Japan | 1,700 | 180 | 8,870 | 915 | | 14,472 |
| British Australasia | 1,048,770 | 170,428 | 1,707,810 | 179,489 | | 2,587,972 |
| British East Indies | 30,170 | 3,130 | 49,200 | 5,056 | | 27,251 |
| French Oceanica | 57,465 | 5,893 | 80,650 | 8,323 | | 31,247 |
| Hawaiian Islands | 151,380 | 15,561 | 199,469 | 20,364 | | 181,469 |
| Total Asia and Oceanica | 1,992,171 | 205,765 | 2,135,824 | 223,276 | | 2,962,593 |
| Africa: | | | | | | |
| British Africa | 37,386 | 4,480 | 19,142 | 2,126 | | 59,873 |
| Liberia | | | 760 | 78 | | 307 |
| Spanish Africa | | | | | | 298 |
| Total Africa | 37,386 | 4,480 | 19,902 | 2,204 | | 60,478 |
| All other islands and ports | 34,220 | 3,391 | 55,932 | 5,792 | | 120,920 |
| Grand total | 22,052,043 | 2,279,625 | 10,727,010 | 1,026,197 | 197,846,887 | 21,229,324 |

*Import duties on canned salmon.*—The rates of duty imposed in various foreign countries on canned salmon imported therein are shown in the appended compilation. The rate in the United States is 20 per cent ad valorem.

57. *Statement showing approximately the rates of import duty in various countries on canned salmon.*

| Countries. | Duty per 100 pounds. | Countries. | Duty per 100 pounds. |
|---|---|---|---|
| Europe: | | West Indies—Continued. | |
| Austria-Hungary | $5.80 | Haiti | $9.65 |
| Belgium | Free. | Jamaica | 8 p. ct. ad val. |
| Denmark | 3.96 | Martinique | 1.40 |
| France | 2.19 | San Domingo | 0.33 |
| Germany | 6.48 | South America: | |
| Great Britain | Free. | Argentina | 13.13 |
| Italy | 2.63 | Bolivia | 1.10 |
| Netherlands | 4.56 | Brazil | 11.88 |
| Norway | 4.80 | Chile | 3.19 |
| Sweden | 3.65 | Colombia | 4.41 |
| Switzerland | 1.39 | British Guiana | Free. |
| North America: | | Peru | 2.64 |
| Canada | 25 p. ct. ad val. | Uruguay | 14.10 |
| Mexico | 3.59 | Venezuela | 6.57 |
| Central America: | | Africa: | |
| Costa Rica | 1.54 | Cape Colony | 2.00 |
| Guatemala | 5.51 | Asia and Oceanica: | |
| Honduras | 3.73 | Japan | 5 p. ct. ad val. |
| Nicaragua | 3.26 | New South Wales | 2.06 |
| Salvador | 4.40 | New Zealand | 4.12 |
| British Honduras | 10 p. ct. ad val. | Queensland | 4.12 |
| West Indies: | | Tasmania | 12½ p. ct. ad val. |
| Cuba | .76 | South Australia | 4.12 |
| Dutch West Indies | 1¼ p. ct. ad val. | Victoria | 20 p. ct. ad val. |
| Guadaloupe | 3.48 | French Oceanica | .73 |

## VIII.—OYSTERS.

*Origin and extent of export trade.*—In this branch of trade with foreign countries the United States acts as a producer entirely, no oysters whatever being imported into this country. The exported product is probably about evenly divided between fresh and canned oysters, although the form of the customs returns does not permit a separation of the two classes.

The export trade is divided into three branches, viz, the shipment (1) of canned oysters, (2) of shucked oysters in tubs, etc., and (3) of barreled oysters.

The exportation of canned oysters began about 1864, and increased until about 1875, since which year it has been quite constant.

The foreign trade in shucked oysters in kegs and barrels has been confined largely to Canada, Mexico, Cuba, and other countries conveniently located, and originated with the development of the oyster trade in this country and the establishment of facilities for shipping to those countries.

The barrel trade in shell oysters has been almost entirely from New York to Liverpool, only those oysters produced between New Haven, Conn., and Barnegat, N. J., being utilized. This trade began about

1870, and the returns made by the English brokers permit the presentation of the following compilation, showing the number of barrels of shell oysters shipped from the United States to Europe each season since 1878:

58. *Statement of the exports of American oysters in barrels to Europe during each year from 1879 to 1894, inclusive.*

| Year ending June 30— | Barrels. |
|---|---|
| 1879 | 50,063 |
| 1880 | 67,116 |
| 1881 | 70,768 |
| 1882 | 65,012 |
| 1883 | 64,437 |
| 1884 | 71,021 |
| 1885 | 98,802 |
| 1886 | 98,997 |
| 1887 | 100,906 |
| 1888 | 99,123 |
| 1889 | 103,109 |
| 1890 | 122,163 |
| 1891 | 98,802 |
| 1892 | 109,657 |
| 1893 | 68,066 |
| 1894 | 75,428 |

The customs returns show the domestic value of the oysters exported from 1864 to 1894, inclusive, to have been $13,768,267. During the last ten years little variation has occurred, as may be observed in the statement showing the value of the oysters exported annually since 1863, as given in Table 20 on pages 464–465.

The principal exports of oysters are made to England, Quebec, and Ontario, those countries receiving about nine-tenths of the total quantity exported. The shipments are made chiefly from the customs districts of New York, Buffalo, Champlain, Baltimore, and Vermont. Of the $688,653 worth exported in 1894, $440,130 were consigned to England and $159,920 to Quebec and Ontario. The shipments through New York aggregated $459,048; Buffalo, $91,435; Champlain, $40,125, and through Baltimore, $38,413.

Table 59 gives the values of oysters exported to the various countries during a series of ten years ending June 30, 1894. This table shows that during the period indicated the exports to Europe were valued at $5,520,830, or 73 per cent of the whole; to British North America, $1,204,743, or 16 per cent; to the remaining portions of the American continent, $622,731, or 8 per cent, and all other countries, $238,480, or 3 per cent. The value of the exported oysters was greatest in 1888, reaching a total of $858,652; the smallest value during any year herein reported was $625,079 in 1893.

59. *Statement by countries of the exports of oysters during each of the ten years ending June 30, 1894.*

| Countries to which exported. | 1885. | 1886. | 1887. | 1888. | 1889. |
|---|---|---|---|---|---|
| *Europe:* | | | | | |
| Belgium | $91 | $6 | $20 | $86 | $366 |
| Denmark | 31 | ..... | 5 | 49 | 55 |
| France | 525 | 599 | 412 | 537 | 4,866 |
| Germany | 12,506 | 10,619 | 14,873 | 23,221 | 4,149 |
| Italy | ..... | 37 | 128 | ..... | ..... |
| Netherlands | 723 | 39 | 30 | 9 | 8 |
| Portugal | ..... | ..... | ..... | 24 | 282 |
| Spain | ..... | 4 | 94 | 36 | 63 |
| Sweden and Norway | ..... | ..... | ..... | 34 | ..... |
| United Kingdom— | | | | | |
| England | 512,115 | 518,469 | 533,471 | 585,792 | 570,836 |
| Scotland | 9,103 | 7,838 | 8,751 | 16,177 | 9,517 |
| Total Europe | 535,094 | 537,611 | 557,784 | 625,965 | 590,142 |
| *North America:* | | | | | |
| Canada— | | | | | |
| Nova Scotia, New Brunswick, etc | 5,294 | 3,581 | 3,717 | 3,427 | 3,064 |
| Quebec, Ontario, etc | 101,507 | 96,762 | 86,199 | 116,235 | 113,939 |
| British Columbia | 6,081 | 4,980 | 5,574 | 5,941 | 7,405 |
| Newfoundland and Labrador | 176 | 434 | 126 | 196 | 209 |
| Mexico | 6,766 | 5,928 | 7,861 | 9,785 | 8,580 |
| Central America— | | | | | |
| Costa Rica | 750 | 803 | 684 | 2,523 | 1,585 |
| Guatemala | 780 | 845 | 398 | 613 | 765 |
| Honduras | 302 | 323 | 62 | 382 | 285 |
| Nicaragua | 187 | 200 | 911 | 1,416 | 2,700 |
| San Salvador | 97 | 104 | 33 | 461 | 501 |
| British Honduras | 619 | 472 | 639 | 441 | 590 |
| West Indies— | | | | | |
| British | 2,368 | 2,884 | 3,967 | 3,629 | 2,449 |
| Danish | 221 | 243 | 342 | 362 | 413 |
| Dutch | 394 | 493 | 396 | 479 | 360 |
| French | 28 | 43 | 10 | 4 | 2 |
| Haiti | 260 | 381 | 324 | 312 | 239 |
| Santo Domingo | 643 | 138 | 232 | 194 | 436 |
| Spanish— | | | | | |
| Cuba | 5,146 | 5,358 | 5,986 | 4,447 | 4,646 |
| Puerto Rico | 219 | 367 | 257 | 301 | 550 |
| Total North America | 131,838 | 124,339 | 117,718 | 151,148 | 148,718 |
| *South America:* | | | | | |
| Argentina | 14,120 | 9,768 | 14,398 | 21,105 | 27,673 |
| Bolivia | ..... | ..... | ..... | 72 | ..... |
| Brazil | 1,371 | 892 | 2,513 | 1,097 | 957 |
| Chile | 2,502 | 5,079 | 5,033 | 5,503 | 6,229 |
| Colombia | 3,822 | 3,993 | 4,361 | 3,460 | 3,030 |
| Ecuador | ..... | ..... | 1,421 | 2,601 | 2,552 |
| Guianas— | | | | | |
| British | 294 | 582 | 539 | 711 | 223 |
| French | ..... | 16 | ..... | ..... | ..... |
| Peru | 670 | 494 | 67 | 827 | 817 |
| Uruguay | 5,530 | 3,385 | 4,682 | 6,034 | 7,110 |
| Venezuela | 2,760 | 2,829 | 2,384 | 2,600 | 3,819 |
| Total South America | 31,069 | 27,038 | 35,398 | 44,010 | 52,410 |
| *Asia and Oceanica:* | | | | | |
| China | 70 | 87 | ..... | 11 | 84 |
| Hongkong | 167 | 672 | 290 | 152 | 148 |
| Japan | 30 | 217 | ..... | 83 | 131 |
| British Australasia | 11,043 | 29,977 | 11,638 | 26,558 | 32,859 |
| British East Indies | 37 | 29 | 25 | 90 | ..... |
| Hawaiian Islands | 4,512 | 7,990 | 9,394 | 5,735 | 7,183 |
| Total Asia and Oceanica | 15,865 | 38,972 | 21,347 | 32,629 | 40,403 |
| *Africa:* | | | | | |
| British Africa | 317 | 402 | 1,287 | ..... | 1,720 |
| Liberia | ..... | 8 | ..... | 6 | 10 |
| Spanish Africa | 30 | ..... | 20 | 3,570 | 17 |
| Total Africa | 347 | 410 | 1,307 | 3,576 | 1,747 |
| All other islands and ports | 1,406 | 3,649 | 419 | 1,324 | 751 |
| Grand total | 715,619 | 732,019 | 733,973 | 858,652 | 834,171 |

59. *Statement by countries of the exports of oysters during each of the ten years ending June 30, 1894*—Continued.

| Countries to which exported. | 1890. | 1891. | 1892. | 1893. | 1894. | Total. |
|---|---|---|---|---|---|---|
| Europe: | | | | | | |
| Belgium | $739 | $464 | $218 | $120 | $490 | $2,600 |
| Denmark | ..... | 342 | 371 | 30 | 565 | 1,448 |
| France | 326 | 208 | 822 | 533 | 406 | 9,234 |
| Germany | 5,727 | 8,623 | 6,204 | 5,820 | 6,452 | 98,194 |
| Italy | ..... | ..... | 87 | 8 | ..... | 260 |
| Netherlands | 46 | 812 | 151 | 65 | 58 | 1,941 |
| Portugal | 109 | 24 | ..... | ..... | ..... | 439 |
| Spain | 12 | ..... | ..... | ..... | ..... | 209 |
| Sweden and Norway | ..... | 312 | 80 | ..... | 119 | 545 |
| United Kingdom— | | | | | | |
| England | 614,006 | 612,659 | 550,490 | 391,623 | 440,130 | 5,329,600 |
| Scotland | 8,321 | ..... | 5,081 | 3,794 | 5,858 | 74,440 |
| Ireland | ..... | ..... | 1,920 | ..... | ..... | 1,920 |
| Total Europe | 629,286 | 623,444 | 565,433 | 401,993 | 454,078 | 5,520,830 |
| North America: | | | | | | |
| Canada— | | | | | | |
| Nova Scotia, New Brunswick, etc. | 4,593 | 5,734 | 6,169 | 7,947 | 6,767 | 50,293 |
| Quebec, Ontario, etc | 112,767 | 96,339 | 78,190 | 118,891 | 159,920 | 1,080,749 |
| British Columbia | 9,646 | 13,899 | 6,952 | 4,370 | 6,794 | 71,642 |
| Newfoundland and Labrador | 170 | 114 | 334 | 95 | 205 | 2,059 |
| Mexico | 8,543 | 15,729 | 9,701 | 7,337 | 13,344 | 93,574 |
| Central America— | | | | | | |
| Costa Rica | 1,502 | 1,295 | 1,082 | 1,550 | 944 | 12,718 |
| Guatemala | 662 | 558 | 1,205 | 729 | 369 | 6,984 |
| Honduras | 116 | 345 | 200 | 179 | 325 | 2,528 |
| Nicaragua | 1,807 | 2,254 | 691 | 550 | 957 | 11,673 |
| San Salvador | 461 | 392 | 812 | 508 | 160 | 3,529 |
| British Honduras | 221 | 224 | 87 | 208 | 119 | 3,620 |
| Bermuda | ..... | ..... | 975 | 1,147 | 647 | 2,769 |
| West Indies— | | | | | | |
| British | 1,857 | 2,525 | 2,135 | 1,954 | 2,041 | 25,809 |
| Danish | 389 | 191 | 187 | 215 | 276 | 2,839 |
| Dutch | 318 | 537 | 518 | 427 | 228 | 4,150 |
| French | 47 | 102 | 32 | 6 | 7 | 281 |
| Haiti | 340 | 449 | 394 | 442 | 303 | 3,444 |
| Santo Domingo | 652 | 427 | 174 | 108 | 258 | 3,262 |
| Spanish— | | | | | | |
| Cuba | 4,331 | 5,150 | 13,635 | 11,841 | 9,248 | 69,788 |
| Puerto Rico | 272 | 414 | 513 | 342 | 412 | 3,647 |
| Total North America | 148,694 | 146,678 | 124,055 | 158,846 | 203,324 | 1,455,358 |
| South America: | | | | | | |
| Argentina | 12,800 | 5,264 | 2,084 | 12,842 | 4,799 | 124,853 |
| Bolivia | 100 | ..... | ..... | 250 | ..... | 422 |
| Brazil | 1,319 | 1,351 | 615 | 1,615 | 3,345 | 15,075 |
| Chile | 3,553 | 1,965 | 3,510 | 4,016 | 800 | 38,190 |
| Colombia | 955 | 1,595 | 893 | 1,187 | 649 | 23,945 |
| Ecuador | 1,066 | 1,244 | 1,028 | 1,143 | 1,194 | 12,249 |
| Guianas— | | | | | | |
| British | 916 | 1,564 | 571 | 719 | 385 | 6,504 |
| Dutch | 6 | ..... | ..... | 111 | 61 | 178 |
| French | ..... | ..... | ..... | ..... | ..... | 16 |
| Peru | 1,013 | 647 | 522 | 583 | 647 | 6,587 |
| Uruguay | 4,750 | 2,659 | 943 | 3,939 | 657 | 39,689 |
| Venezuela | 3,819 | 6,460 | 2,767 | 2,823 | 1,821 | 31,582 |
| Total South America | 30,297 | 22,749 | 12,933 | 29,228 | 14,158 | 299,290 |
| Asia and Oceanica: | | | | | | |
| China | 116 | ..... | 142 | 15 | 1,073 | 1,598 |
| Hongkong | 395 | 24 | 31 | ..... | ..... | 1,877 |
| Japan | 46 | 59 | ..... | ..... | ..... | 572 |
| British Australasia | 15,446 | 11,723 | 32,996 | 28,823 | 10,163 | 211,226 |
| British East Indies | 44 | ..... | 90 | 7 | ..... | 322 |
| French Oceanica | 279 | 162 | 138 | 59 | ..... | 638 |
| Hawaiian Islands | 9,751 | 9,959 | 7,910 | 5,186 | 5,206 | 72,826 |
| Total Asia and Oceanica | 26,077 | 21,927 | 41,307 | 34,090 | 16,442 | 289,059 |
| Africa: | | | | | | |
| British Africa | 2,586 | 1,050 | 427 | 866 | 608 | 9,263 |
| Liberia | 15 | 10 | 106 | ..... | ..... | 155 |
| Spanish Africa | 4 | 132 | ..... | ..... | ..... | 3,773 |
| Total Africa | 2,605 | 1,192 | 533 | 866 | 608 | 13,191 |
| All other islands and ports | 280 | 1,118 | 10 | 56 | 43 | 9,056 |
| Grand total | 837,239 | 817,108 | 744,271 | 625,079 | 688,653 | 7,586,784 |

*Import duties on oysters in various countries.*—The following compilation shows approximately the rates of duty exacted in various foreign countries on oysters imported therein:

60. *Comparative statement of the approximate rates of duty exacted in various countries on oysters imported therein.*

| Countries. | Condition. | Duty per 100 pounds. |
|---|---|---|
| Europe: | | |
| Austria-Hungary | Not prepared | $3.62 |
| | In cans, hermetically sealed | 5.80 |
| Belgium | | Free. |
| Denmark | Fresh | Free. |
| | Preserved or spiced | 1.70 |
| | In cans, hermetically sealed | 3.96 |
| France | Fresh, young | Free. |
| | Fresh, other | $0.29 per 1,000 in number. |
| | Pickled or preserved | .44 |
| Germany | Fresh | 5.39 |
| | Preserved | 6.48 |
| Great Britain | All kinds | Free. |
| Greece | Fresh | Free. |
| | Preserved | 3.40 |
| Italy | Fresh | Free. |
| | Preserved | 2.63 |
| Netherlands | Preserved in tins | 4.56 |
| Portugal | Shellfish | .29 |
| Russia | Hermetically sealed | 5.38 |
| Spain | Cultivated | .26 |
| | Uncultivated | .70 |
| Sweden | | Free. |
| Switzerland | Fresh | 2.62 |
| North America: | | |
| Canada | Opened, in bulk | $0.10 per gallon. |
| | In the shell | 25 p. ct. ad val. |
| | Canned, 1-pint cans | $0.03 per can. |
| | Canned, 1-quart cans | $0.05 per can. |
| Newfoundland | In the shell | Free. |
| Mexico | Fresh | Free. |
| | Canned | 3.59 |
| Central America: | | |
| Costa Rica | Preserved in cans or otherwise | 1.54 |
| Guatemala | Preserved in any form | 5.29 |
| Honduras | Canned | 3.73 |
| Nicaragua | Preserved | 1.86 |
| Salvador | Canned | 4.40 |
| British Honduras | Fresh | Free. |
| West Indies: | | |
| Barbados | Fresh or in cans | Free. |
| Cuba | Fresh or canned | .76 |
| Dutch West Indies | All forms | 1¼ p. ct. ad val. |
| Guadaloupe | | 1.31 |
| Haiti | Pickled, in kegs or pots | $0.18 per keg. |
| Jamaica | Canned | 8 p. ct. ad val. |
| | Fresh | Free. |
| Puerto Rico | Fresh or preserved | .38 |
| Santo Domingo | However packed | 2.82 |
| South America: | | |
| Argentina | | 3.04 |
| Bolivia | Canned | 1.10 |
| Brazil | Fresh | 1.00 |
| | Canned | 17.33 |
| Chile | In water, in tin, etc | 3.60 |
| Colombia | Fresh | 1.10 |
| | Canned | 4.41 |
| Guiana, British | Fresh and canned | Free. |
| Peru | Canned | 2.64 |
| Uruguay | Including packages | 14.10 |
| Venezuela | Canned | 6.57 |
| Africa: | | |
| Cape Colony | | Free. |
| Asia and Oceanica: | | |
| Japan | | 5 p. ct. ad val. |
| Ceylon | | 1.03 |
| New South Wales | | Free. |
| New Zealand | Preserved | 4.12 |

## IX.—LOBSTERS AND OTHER CRUSTACEANS.

*Imports of canned lobsters.*—The foreign trade in lobsters consists entirely of imports, no domestic lobsters being exported from this country. The imports comprise canned and fresh lobsters, nearly all of which come from the British North American Provinces.

Prior to 1870 almost the entire product of canned lobsters was prepared in the United States, but the growing scarcity and increased price of these crustacea on the Maine coast resulted during 1870 in the establishment of numerous canneries in the British Provinces by New England capitalists. The number of these canneries has greatly increased, and they now furnish nearly the whole supply of this product, the present yield of canned lobsters in the Dominion of Canada being equivalent to about 13,000,000 one-pound cans, with a valuation of $1,800,000. The annual product in the United States is only about 1,250,000 one-pound cans, worth $180,000. As the consumption is about 5,250,000 cans each year, the importation of 4,000,000 cans is necessary to supply the markets.

Table 61 shows the quantities and values of canned lobsters imported and the quantities and values imported for consumption during a series of ten years ending June 30, 1894, and the average value per pound of those entered for consumption, the difference between the imports and the imports for consumption representing exports of foreign canned lobsters from this country:

61. *Table of the imports, imports for consumption, and average value per pound of canned lobsters during a series of years.*

| Year ending June 30— | Imports. | | Imports for consumption. | | |
|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Average values per pound. |
| 1885 | 4,212,745 | $429,700 | 3,523,032 | $357,730 | $0.102 |
| 1886 | 3,350,257 | 338,982 | 2,487,045 | 252,054 | .101 |
| 1887 | 4,434,829 | 337,047 | 3,549,197 | 267,901 | .076 |
| 1888 | 4,827,730 | 429,668 | 4,511,153 | 412,863 | .089 |
| 1889 | 5,390,970 | 517,534 | 5,457,862 | 522,547 | .096 |
| 1890 | 4,940,434 | 568,150 | 4,934,649 | 568,150 | .115 |
| 1891 | 7,324,106 | 966,782 | 7,309,122 | 966,008 | .132 |
| 1892 | 4,107,632 | 604,052 | 3,883,248 | 561,778 | .145 |
| 1893 | 4,113,913 | 589,909 | 4,212,968 | 609,741 | .145 |
| 1894 | 3,898,582 | 549,049 | 4,071,397 | 574,710 | .141 |
| Total | 46,697,207 | 5,330,873 | 43,940,273 | 5,093,482 | .116 |

By far the greater portion of canned lobsters imported into the United States are received from Nova Scotia. Of the 3,898,442 pounds imported during the year 1894, 3,862,162 came from Nova Scotia and New Brunswick, 35,560 from Quebec and Ontario, and 720 and 140 pounds from Newfoundland and Germany, respectively. Sometimes the Newfoundland receipts are quite large; in 1891, for instance, their value was $87,386.

Table 62 shows the quantities and values of lobsters received from each foreign country during the ten years ending in 1894:

62. *Statement of the imports of canned lobsters into the United States during each of the ten years ending June 30, 1894.*

| Countries from which imported. | 1885. | 1886. | 1887. | 1888. | 1889. | 1890. | 1891. |
|---|---|---|---|---|---|---|---|
| | Values. | Values. | Values. | Values. | Values. | Values. | Values. |
| Europe: | | | | | | | |
| England | | | | | $4 | $691 | |
| Germany | | | | | | | $4 |
| Netherlands | | | | | | 131 | |
| Total Europe | | | | | 4 | 822 | 4 |
| North America: | | | | | | | |
| Nova Scotia, New Brunswick, etc | $416,163 | $336,728 | $327,992 | $403,757 | 488,709 | 486,591 | 832,921 |
| Quebec, Ontario, etc | 13,537 | 2,254 | 9,055 | 12,694 | 2,135 | 4,691 | 40,471 |
| Newfoundland and Labrador | | | | 13,217 | 26,686 | 76,046 | 87,386 |
| Total North America | 429,700 | 338,982 | 337,047 | 429,668 | 517,530 | 567,328 | 966,778 |
| Grand total | 429,700 | 338,982 | 337,047 | 429,668 | 517,534 | 568,150 | 966,782 |

| Countries from which imported. | 1892. | | 1893. | | 1894. | | Total. |
|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Values. |
| Europe: | | | | | | | |
| England | 4,800 | $881 | 36,806 | $5,324 | | | $6,700 |
| Germany | | | | | 140 | $22 | 26 |
| Italy | 450 | 39 | | | | | 39 |
| Netherlands | | | | | | | 131 |
| Total Europe | 5,250 | 720 | 36,806 | 5,324 | 140 | 22 | 6,896 |
| North America: | | | | | | | |
| Nova Scotia, New Brunswick, etc | 3,974,304 | 570,133 | 3,962,674 | 568,841 | 3,862,162 | 543,830 | 4,975,665 |
| Quebec, Ontario, etc | 28,478 | 4,468 | 58,300 | 6,368 | 35,560 | 5,122 | 106,795 |
| Newfoundland and Labrador | 189,600 | 28,731 | 56,124 | 9,376 | 720 | 75 | 241,517 |
| Total North America | 4,192,382 | 603,332 | 4,077,107 | 584,585 | 3,898,442 | 549,027 | 5,323,977 |
| Grand total | 4,197,632 | 604,052 | 4,113,913 | 589,909 | 3,898,582 | 549,049 | 5,330,873 |

It is much cheaper to can lobsters in the British North American Provinces than in the United States. In this country the 9-inch lobsters cost about $1.25 per 100; the wages of men in canneries range from $1.50 to $2 per day, and women and boys receive from 75 cents to $1 per day. In the Provinces the lobsters cost about 75 cents per 100; the men's wages are about $1, while women and boys receive only about 50 cents per day. In addition to this, there is a duty on the tin in the United States, while that article is free of duty in the Provinces.

Fifteen years ago London was the principal market of the world for canned lobsters, England, France, and Germany receiving about three-fourths of the entire product. At that time the world's output amounted to about 400,000 cases of 48 one-pound cans. Comparatively few were then consumed in the United States; but the consumption has steadily increased in this country, so that while the total pack has now decreased to about 250,000 cases a year, the United States consumes about 110,000 cases, or 44 per cent of the entire yield.

*Import duties in various countries.*—Canned lobsters have at all times been imported into the United States free of duty, but by the tariff act of 1874 a tax of 1½ cents was imposed on each can containing this product. In 1890 this duty was reduced to 8 cents per dozen cans, to take effect July 1, 1891. The customs law of 1894 did not provide for this duty.

63. *Statement of the approximate rates of duty imposed upon canned lobsters imported into various foreign countries.*

| Countries. | Duty per 100 pounds. | Countries. | Duty per 100 pounds. |
|---|---|---|---|
| Europe: | | West Indies—Continued. | |
| Austria-Hungary | $5.80 | Haiti | $9.65 |
| Belgium | Free. | Martinique | 1.40 |
| Denmark | 3.96 | South America: | |
| France | 2.19 | Argentina | 13.13 |
| Germany | 5.39 | Brazil | 11.88 |
| Great Britain | Free. | Colombia | 4.40 |
| Greece | 13.59 | Guiana, British | 1.00 |
| Italy | 2.63 | Peru | 2.64 |
| Netherlands | 4.56 | Venezuela | 6.57 |
| Norway | 4.80 | Asia and Oceanica: | |
| Portugal | 9.79 | Japan | 5 p. ct. ad val. |
| Russia | 5.38 | Philippine Islands | 2.27 |
| Sweden | 4.08 | Queensland | 4.12 |
| North America: | | South Australia | 4.12 |
| Dominion of Canada | 25 p. ct. ad val. | West Australia | 12 p. ct. ad val. |
| Mexico | 3.59 | Victoria | 20 p. ct. ad val. |
| Central America: | | New Zealand | 4.12 |
| Costa Rica | 1.54 | Tasmania | 12½ p. ct. ad val. |
| Guatemala | 5.51 | French Oceanica | 2.13 |
| Nicaragua | 1.86 | Africa: | |
| Salvador | 4.40 | Mauritius | 7½ p. ct. ad val. |
| West Indies: | | Cape Verde Islands | 20 p. ct. ad val. |
| Cuba | .76 | Cape Colony, Orange Free-State, and British Bechuanaland | 2.00 |
| Dutch West Indies | 1¼ p. ct. ad val. | | |
| Guadaloupe | 3.48 | | |

*Fresh lobsters and shrimp and turtles.*—A considerable trade has been built up during the last fifteen years in the importation of fresh lobsters from New Brunswick, Nova Scotia, and Newfoundland. These are received alive in bulk and in packages holding about 140 pounds, Boston being the principal port of entry.

The customs returns do not permit an exact statement of the importation of fresh lobsters, but combine these with fresh and dried shrimp, crawfish, and turtles. The total value of these products imported amounts to about $210,000 annually, of which about $185,000 represents fresh lobsters; $20,000 shrimp, and the remaining $5,000 turtles. The shrimp come principally from China and Hongkong, the turtles from Mexico and the West Indies. The value of the fresh lobsters and shrimp and turtles imported for consumption during each year from 1876 to 1894, inclusive, is shown in Table 7 on page 444.

Table 64 shows the value of the fresh lobsters and shrimp and turtles imported from each country during the nine years ending June 30, 1894, and the value of those imported for consumption.

64. *Statement by countries of the imports of fresh lobsters and of shrimp and turtles into the United States during each of the ten years ending June 30, 1894.*

| Countries from which imported. | 1886. | 1887. | 1888. | 1889. | 1890. |
|---|---|---|---|---|---|
| Europe: | | | | | |
| England | $47 | $65 | $5 | $78 | ..... |
| France | 26 | 63 | 128 | 14 | $48 |
| Germany | ..... | ..... | ..... | 53 | ..... |
| All others | 4 | ..... | 2 | 9 | 3 |
| Total Europe | 77 | 128 | 135 | 154 | 51 |

64. *Statement by countries of the imports of fresh lobsters and of shrimp and turtles into the United States during each of the ten years ending June 30, 1894*—Continued.

| Countries from which imported. | 1886. | 1887. | 1888. | 1889. | 1890. |
|---|---|---|---|---|---|
| North America: | | | | | |
| Canada— | | | | | |
| Nova Scotia, New Brunswick, etc | $61,669 | $62,974 | $100,315 | $112,914 | $109,176 |
| Quebec, Ontario, etc | | | 3 | 79 | 30 |
| British Columbia | 25 | | 137 | 12 | 33 |
| Newfoundland and Labrador | | | | 7,027 | |
| Mexico | 305 | 679 | 668 | 647 | 1,420 |
| Costa Rica | | 10 | 10 | | 472 |
| West Indies— | | | | | |
| British | 613 | 1,187 | 2,154 | 2,239 | 2,179 |
| Dutch | 460 | 542 | 582 | 287 | 50 |
| Spanish— | | | | | |
| Cuba | 653 | 404 | 710 | 353 | 6,095 |
| Santo Domingo | 65 | 83 | 55 | 20 | |
| Total North America | 63,790 | 65,879 | 104,634 | 123,578 | 119,455 |
| South America: | | | | | |
| Colombia | | 30 | 130 | 160 | 3 |
| Venezuela | 834 | 1,121 | 142 | | |
| Total South America | 834 | 1,151 | 272 | 160 | 3 |
| Asia: | | | | | |
| China | 1,031 | 1,594 | 3,296 | 3,691 | 10,015 |
| Hongkong | 225 | 184 | 121 | 151 | 1,540 |
| Japan | | | 38 | | 11 |
| Total Asia | 2,156 | 1,778 | 3,455 | 3,842 | 11,566 |
| All other countries | 250 | 25 | 719 | | |
| Grand total | 67,107 | 68,961 | 109,215 | 127,734 | 131,075 |
| Total entered for consumption | 64,632 | 76,452 | 105,161 | 123,093 | 125,831 |

| Countries from which imported. | 1891. | 1892. | 1893. | 1894. | Total. |
|---|---|---|---|---|---|
| Europe: | | | | | |
| Austria-Hungary | | $1,037 | | | $1,037 |
| England | $22 | 49 | $101 | $51 | 418 |
| France | 69 | 536 | 199 | 144 | 1,227 |
| Germany | 120 | 5 | 100 | | 278 |
| All others | | | 22 | | 40 |
| Total Europe | 211 | 1,627 | 422 | 195 | 3,000 |
| North America: | | | | | |
| Canada— | | | | | |
| Nova Scotia, New Brunswick, etc | 146,944 | 174,995 | 226,551 | 180,177 | 1,175,715 |
| Quebec, Ontario, etc | 13 | 65 | 173 | 429 | 792 |
| British Columbia | 37 | 6 | | | 250 |
| Newfoundland and Labrador | | 4 | 5 | | 7,036 |
| Mexico | 3,618 | 2,155 | 2,035 | 2,825 | 14,352 |
| Costa Rica | | | 970 | | 1,462 |
| West Indies— | | | | | |
| British | 3,045 | 1,421 | 2,054 | 2,217 | 17,709 |
| Dutch | | | 67 | 85 | 2,073 |
| Spanish— | | | | | |
| Cuba | 1,510 | 2,541 | 1,347 | 850 | 14,463 |
| Santo Domingo | | | | | 223 |
| Total North America | 155,167 | 181,187 | 233,802 | 186,583 | 1,234,075 |
| South America: | | | | | |
| Colombia | | | | | 323 |
| Venezuela | | | 45 | 75 | 2,217 |
| Total South America | | | 45 | 75 | 2,540 |
| Asia: | | | | | |
| China | 21,126 | 14,910 | 10,491 | 13,325 | 86,379 |
| Hongkong | 2,725 | 4,828 | 3,518 | 3,483 | 16,775 |
| Japan | 195 | 241 | 241 | 370 | 1,096 |
| Total Asia | 24,046 | 19,979 | 20,250 | 17,178 | 104,250 |
| All other countries | 470 | 545 | | | 2,009 |
| Grand total | 179,894 | 203,338 | 254,519 | 204,031 | 1,345,874 |
| Total entered for consumption | 180,783 | 207,221 | 255,780 | 199,109 | 1,338,152 |

## X.—MARINE OILS.

*General foreign trade in marine oils.*—The decrease in exports of marine oils is largely responsible for the falling off in the extent of our foreign trade in fishery products, and the decrease in oil exports is a necessary consequence of the decline in the whale fishery. In 1876 the value of the domestic marine oil exported was $1,802,318; in 1894 it was only $140,851. The total value of fishery products exported during the former year was $5,806,445, and in the latter it was but $4,258,30 i. A large quantity of menhaden oil is now exported for use as a lubricant and in dressing leather, etc.

The following compilation shows for a series of twenty-six years ending June 30, 1894, the quantity and value of foreign marine oil imported into the United States, the domestic oil exported, the excess of each item over the other, and the average value per gallon of each class:

65. *Statement of the foreign trade in marine oils during the twenty-six years ending in 1894.*

| Years ending June 30— | Imports for consumption. | | Domestic exports. | | Balance of trade. | | Average value per gallon. | |
|---|---|---|---|---|---|---|---|---|
| | Gallons. | Values. | Gallons. | Values. | Gallons. | Dollars. | Imports. | Exports. |
| 1869..... | 897,388 | $426,874 | 811,533 | $1,443,248 | + 85,855 | —$1,016,374 | $0.476 | $1.778 |
| 1870..... | 723,620 | 369,167 | 810,675 | 1,022,710 | — 87,049 | — 653,543 | .510 | 1.262 |
| 1871..... | 397,386 | 204,228 | 1,402,016 | 1,145,406 | — 1,004,630 | — 941,178 | .514 | .817 |
| 1872..... | 346,183 | 158,504 | 1,865,320 | 1,532,438 | — 1,519,137 | — 1,373,934 | .458 | .822 |
| 1873..... | 261,314 | 119,788 | 1,044,569 | 1,250,074 | — 783,255 | — 1,130,286 | .458 | 1.197 |
| 1874..... | 301,585 | 163,046 | 1,103,678 | 1,108,741 | — 802,093 | — 945,695 | .541 | 1.005 |
| 1875..... | 334,495 | 185,404 | 1,387,037 | 1,260,425 | — 1,052,542 | — 1,075,021 | .554 | .909 |
| 1876..... | 202,192 | 151,249 | 1,960,277 | 1,802,318 | — 1,758,085 | — 1,651,069 | .748 | .919 |
| 1877..... | 188,736 | 119,340 | 1,661,029 | 1,322,030 | — 1,472,293 | — 1,202,690 | .632 | .796 |
| 1878..... | 377,898 | 211,847 | 1,628,386 | 1,212,026 | — 1,250,488 | — 1,000,179 | .561 | .744 |
| 1879..... | 246,749 | 125,547 | 3,059,193 | 1,476,079 | — 2,812,444 | — 1,350,532 | .509 | .483 |
| 1880..... | 495,775 | 223,139 | 1,505,042 | 836,113 | — 1,009,267 | — 612,974 | .450 | .556 |
| 1881..... | 787,264 | 361,956 | 912,380 | 532,839 | — 125,116 | — 170,883 | .460 | .584 |
| 1882..... | 553,641 | 270,250 | 1,623,989 | 971,942 | — 1,070,348 | — 701,692 | .488 | .598 |
| 1883..... | 483,710 | 280,575 | 502,004 | 405,907 | — 18,294 | — 125,332 | .580 | .809 |
| 1884..... | 782,301 | 373,773 | 831,984 | 516,089 | — 49,683 | — 142,316 | .478 | .620 |
| 1885..... | 402,503 | 209,845 | 1,187,614 | 504,726 | — 785,111 | — 294,881 | .521 | .425 |
| 1886..... | 183,599 | 88,811 | 1,364,679 | 511,107 | — 1,181,080 | — 422,296 | .484 | .375 |
| 1887..... | 187,577 | 85,839 | 1,505,973 | 471,381 | — 1,318,396 | — 385,542 | .458 | .313 |
| 1888..... | 55,705 | 92,515 | 1,496,501 | 409,845 | — 1,440,796 | — 317,330 | 1.661 | .274 |
| 1889..... | 387,021 | 105,938 | 582,040 | 197,040 | — 195,019 | — 91,102 | .274 | .339 |
| 1890..... | 305,591 | 95,947 | 2,006,606 | 565,374 | — 1,701,015 | — 469,427 | .314 | .282 |
| 1891..... | 300,159 | 113,775 | 1,467,321 | 401,203 | — 1,167,162 | — 287,428 | .379 | .273 |
| 1892..... | 329,945 | 151,000 | 969,828 | 337,968 | — 639,883 | — 186,968 | .458 | .348 |
| 1893..... | 922,107 | 285,593 | 205,800 | 92,028 | + 716,307 | + 192,665 | .310 | .452 |
| 1894..... | 588,978 | 184,510 | 294,371 | 140,851 | + 294,607 | + 43,659 | .313 | .478 |
| Total. | 11,043,428 | 5,158,460 | 33,189,845 | 21,470,808 | —22,146,417 | —16,312,348 | ..... | ..... |

The sign + indicates excess of imports over exports; — indicates excess of exports over imports.

66. *Statement by countries of the foreign trade in marine oils during the ten years ending June 30, 1894.*

| Countries. | Imports. | | Exports. | | Balance of trade. | | Average value per gallon. | |
|---|---|---|---|---|---|---|---|---|
| | Gallons. | Values. | Gallons. | Values. | Gallons. | Dollars. | Imports. | Exports. |
| Europe: | | | | | | | | |
| Azores, and Madeira Islands | 22,733 | $5,408 | | | + 22,733 | + 5,408 | $0.238 | |
| Belgium | 1,125 | 584 | 37,089 | $14,253 | — 35,964 | — 13,669 | .519 | $0.384 |
| France | 8,136 | 3,353 | 1,310,334 | 438,721 | —1,302,198 | — 435,368 | .412 | .335 |
| Germany | 226,992 | 107,677 | 454,648 | 130,179 | — 227,656 | — 22,502 | .474 | .286 |
| Italy | | | 3,000 | 1,100 | — 3,000 | — 1,100 | | .367 |
| Netherlands | 1,651 | 571 | 15,062 | 7,017 | — 13,411 | — 6,446 | .346 | .466 |
| Sweden and Norway | 1,337,077 | 686,161 | | | +1,337,077 | + 686,161 | .513 | |
| United Kingdom— | | | | | | | | |
| England | 84,305 | 47,780 | 3,505,300 | 1,331,719 | —3,420,995 | —1,283,939 | .567 | .380 |
| Scotland | 7,168 | 2,669 | 4,748,433 | 1,335,450 | —4,741,265 | —1,332,781 | .372 | .281 |
| Total Europe | 1,689,187 | 854,203 | 10,073,866 | 3,258,439 | —8,384,179 | —2,404,236 | .506 | .323 |
| North America: | | | | | | | | |
| Canada— | | | | | | | | |
| Nova Scotia and New Brunswick | 977,184 | 252,745 | 10,749 | 2,577 | + 966,435 | + 250,168 | .259 | .240 |
| Quebec and Ontario | 47,597 | 18,796 | 18,990 | 12,123 | + 28,607 | + 6,673 | .397 | .638 |
| British Columbia | 134,685 | 38,373 | 72,263 | 22,007 | + 62,422 | + 16,366 | .284 | .304 |
| Newfoundland | 571,600 | 180,243 | | | + 571,600 | + 180,243 | .315 | |
| Miquelon and Langley | 15,431 | 3,501 | | | + 15,431 | + 3,501 | .227 | |
| Mexico | | | 88,452 | 37,311 | — 88,452 | — 37,311 | | .422 |
| Central America | | | 3,775 | 2,339 | — 3,775 | — 2,339 | | .619 |
| West Indies | 10,011 | 5,324 | 30,900 | 19,699 | — 29,889 | — 14,375 | .532 | .495 |
| Total North America | 1,756,508 | 498,982 | 234,129 | 96,056 | +1,522,379 | + 402,926 | .284 | .410 |
| South America: | | | | | | | | |
| Argentina | | | 185 | 138 | — 185 | —138 | | .746 |
| Brazil | | | 3,127 | 1,839 | — 3,128 | — 1,839 | | .588 |
| Chile | | | 2,543 | 2,076 | — 2,543 | — 2,076 | | .816 |
| Colombia | | | 5,252 | 3,274 | — 5,252 | — 3,274 | | .623 |
| Peru | | | 12,086 | 4,039 | — 12,086 | — 4,039 | | .334 |
| Uruguay | | | 2,216 | 528 | — 2,216 | — 528 | | .238 |
| Venezuela | | | 4,378 | 1,244 | — 4,378 | — 1,244 | | .284 |
| Total South America | | | 29,787 | 13,138 | — 29,787 | — 13,138 | | .441 |
| Asia and Oceanica: | | | | | | | | |
| China | 5,430 | 1,000 | | | + 5,430 | + 1,000 | .184 | |
| Hongkong | 2,293 | 594 | 118,616 | 44,526 | — 116,323 | — 43,932 | .259 | .376 |
| Japan | 473,549 | 84,881 | | | + 473,549 | + 84,881 | | .180 |
| British Australasia | 10,153 | 2,914 | 612,335 | 215,677 | — 602,182 | — 212,763 | .287 | .352 |
| Hawaiian Islands | | | 7,796 | 3,376 | — 7,796 | — 3,376 | | .433 |
| Total Asia and Oceanica | 491,425 | 89,389 | 738,747 | 263,579 | — 247,322 | — 184,190 | .182 | .343 |
| All other islands and ports | 470 | 367 | 4,204 | 1,211 | — 3,734 | — 844 | .781 | .288 |
| Grand total | 3,937,590 | 1,442,941 | 11,080,733 | 3,632,423 | —7,143,143 | —2,189,482 | .366 | .328 |

NOTE.—In balance of trade, + indicates excess of imports over exports; — indicates excess of exports over imports.

*Imports of marine oils.*—The marine oils imported consist of three classes, viz, cod-liver oil, seal oil, and whale and fish oil. Of the imports during the last ten years, the first-named comprised 53 per cent, the seal oil 3 per cent, and the whale and fish oil the remaining 44 per cent. The following compilation shows the quantity and value of each class imported for consumption during the twenty-six years ending in 1894 and the average value per gallon.

67. *Statement of the quantities and values of marine oils imported for consumption into the United States during each year from 1869 to 1894, inclusive.*

| Year ending June 30— | Cod-liver oil. | | | Seal oil. | | |
|---|---|---|---|---|---|---|
| | Gallons. | Values. | Average values per gallon. | Gallons. | Values. | Average values per gallon. |
| 1869 | 2,682 | $1,234 | $0.460 | 429,432 | $242,937 | $0.566 |
| 1870 | 158,739 | 73,020 | .460 | 477,050 | 251,929 | .528 |
| 1871 | 44,513 | 20,476 | .460 | 188,076 | 100,994 | .537 |
| 1872 | 249,934 | 114,870 | .460 | 308 | 254 | .825 |
| 1873 | 198,856 | 94,862 | .477 | 10 | 2 | .200 |
| 1874 | 181,759 | 105,595 | .581 | 354 | 173 | .489 |
| 1875 | 236,579 | 142,319 | .602 | 220 | 156 | .695 |
| 1876 | 108,798 | 71,920 | .661 | 20,954 | 23,216 | 1.108 |
| 1877 | 141,995 | 97,041 | .683 | 410 | 80 | .195 |
| 1878 | 207,269 | 179,534 | .604 | 24,282 | 11,369 | .468 |
| 1879 | 172,176 | 94,671 | .550 | 218 | 89 | .408 |
| 1880 | 315,910 | 152,441 | .483 | 4,287 | 1,938 | .452 |
| 1881 | 516,657 | 236,763 | .459 | 100 | 72 | .720 |
| 1882 | 302,137 | 162,563 | .538 | 76,380 | 30,861 | .404 |
| 1883 | 218,716 | 159,271 | .733 | 612 | 550 | .899 |
| 1884 | 412,135 | 275,078 | .667 | 14,868 | 7,719 | .519 |
| 1885 | 221,030 | 153,945 | .696 | 2,423 | 1,087 | .449 |
| 1886 | 115,454 | 67,652 | .586 | 2,561 | 943 | .368 |
| 1887 | 130,296 | 69,326 | .532 | 4,728 | 2,586 | .547 |
| 1888 | 165,633 | 78,233 | .472 | 1,216 | 573 | .471 |
| 1889 | 287,183 | 81,589 | .284 | 1,338 | 670 | .501 |
| 1890 | 267,555 | 86,476 | .323 | 2,574 | 758 | .294 |
| 1891 | 248,894 | 98,865 | .397 | 250 | 97 | .388 |
| 1892 | 202,959 | 115,577 | .569 | 27,712 | 9,046 | .326 |
| 1893 | 190,432 | 99,709 | .524 | 54,821 | 18,706 | .341 |
| 1894 | 209,865 | 99,318 | .473 | 7,869 | 2,956 | .376 |
| Total | 5,598,156 | 2,932,348 | ..... | 1,343,053 | 709,761 | ..... |

| Year ending June 30— | Whale and fish oils. | | | Total. | | |
|---|---|---|---|---|---|---|
| | Gallons. | Values. | Average values per gallon. | Gallons. | Values. | Average values per gallon. |
| 1869 | 465,274 | $182,703 | $0.393 | 897,388 | $426,874 | $0.476 |
| 1870 | 87,837 | 44,218 | .503 | 723,626 | 369,167 | .510 |
| 1871 | 146,797 | 82,758 | .564 | 397,386 | 204,228 | .514 |
| 1872 | 95,941 | 43,380 | .452 | 346,183 | 158,504 | .458 |
| 1873 | 62,448 | 24,924 | .399 | 261,314 | 119,788 | .458 |
| 1874 | 119,472 | 57,278 | .479 | 301,585 | 163,046 | .541 |
| 1875 | 97,696 | 42,929 | .439 | 334,495 | 185,404 | .554 |
| 1876 | 72,440 | 56,114 | .775 | 202,192 | 151,249 | .748 |
| 1877 | 46,331 | 22,219 | .479 | 188,736 | 119,340 | .632 |
| 1878 | 56,347 | 20,944 | .372 | 377,898 | 211,847 | .561 |
| 1879 | 74,355 | 30,787 | .414 | 246,749 | 125,547 | .509 |
| 1880 | 175,578 | 68,760 | .392 | 495,775 | 223,139 | .450 |
| 1881 | 270,507 | 125,121 | .463 | 787,264 | 361,956 | .460 |
| 1882 | 175,122 | 76,826 | .439 | 553,641 | 270,250 | .488 |
| 1883 | 204,382 | 120,754 | .457 | 483,710 | 280,575 | .580 |
| 1884 | 355,298 | 90,976 | .256 | 782,301 | 373,773 | .478 |
| 1885 | 179,050 | 54,813 | .306 | 402,503 | 209,845 | .521 |
| 1886 | 65,584 | 20,216 | .308 | 183,599 | 88,811 | .484 |
| 1887 | 52,553 | 13,927 | .265 | 187,577 | 85,839 | .458 |
| 1888 | 54,489 | 13,709 | .252 | 55,705 | 92,515 | 1.661 |
| 1889 | 98,500 | 23,679 | .240 | 387,021 | 105,938 | .274 |
| 1890 | 35,462 | 8,713 | .246 | 305,591 | 95,947 | .314 |
| 1891 | 51,015 | 14,813 | .290 | 300,159 | 113,775 | .379 |
| 1892 | 99,274 | 26,377 | .266 | 329,945 | 151,000 | .458 |
| 1893 | 676,854 | 167,178 | .247 | 922,107 | 285,593 | .310 |
| 1894 | 371,244 | 82,236 | .222 | 588,978 | 184,510 | .313 |
| Total | 4,249,850 | 1,516,352 | ..... | 11,043,428 | 5,158,460 | ..... |

These oils are received principally from Norway, Nova Scotia, Newfoundland, Japan, and Germany. During the last ten years the imports from Norway and Sweden have amounted to 1,337,077 gallons, worth $686,161; from Nova Scotia and New Brunswick, 977,184 gallons, worth $252,745; from Newfoundland, 571,600 gallons, worth $180,243;

from Japan, 473,549 gallons; and from all other countries combined, 580,180 gallons, making a grand total of 3,937,590 gallons, the value of which was $1,442,941, exclusive of import duties. The European continent furnished 1,689,187 gallons, worth $854,203; the American continent, 1,756,508 gallons, valued at $498,982; and Asia and Australasia, 491,425 gallons, worth $89,389.

The greatest annual receipt during this period was 967,438 gallons in 1893, and the smallest was 181,835 in 1886, the annual average for the period being 393,759 gallons. The receipts from Europe are quite constant, none of the last eight years varying more than 35 per cent from the annual average. The imports from the British Provinces are far less regular, sometimes varying over 200 per cent from the annual average. The receipts from the Provinces in 1892 were 99,299 gallons, while in 1893 they reached 548,181 gallons, an increase of 554 per cent. In 1894 they decreased to 160,960 gallons.

Table 68 shows the imports from each country, the imports for consumption, and the amount of duties paid thereon during each of the ten years ending June 30, 1894.

68. *Statement by countries of the imports of marine oils into the United States during the ten years ending June 30, 1894.*

| Countries from which imported. | 1885. | | 1886. | | 1887. | | 1888. | |
|---|---|---|---|---|---|---|---|---|
| | Gallons. | Values. | Gallons. | Values. | Gallons. | Values. | Gallons. | Values. |
| Europe: | | | | | | | | |
| Azores, and Madeira Islands | 5,974 | $1,501 | 12,007 | $2,718 | 1,875 | $375 | 1,217 | $384 |
| Belgium | ..... | ..... | ..... | ..... | 50 | 26 | ..... | ..... |
| France | ..... | ..... | 1,250 | 587 | 688 | 246 | ..... | ..... |
| Germany | 15,852 | 14,061 | 12,036 | 7,568 | 14,494 | 7,569 | 20,038 | 10,994 |
| Netherlands | ..... | ..... | 39 | 18 | 25 | 20 | 34 | 13 |
| Sweden and Norway | 46,857 | 45,283 | 73,795 | 50,510 | 99,974 | 53,621 | 116,854 | 66,177 |
| United Kingdom— | | | | | | | | |
| England | 5,444 | 6,071 | 9,704 | 6,881 | 3,921 | 2,961 | 13,382 | 8,560 |
| Scotland | ..... | ..... | 360 | 115 | ..... | ..... | ..... | ..... |
| Total Europe | 74,127 | 66,916 | 109,191 | 68,406 | 121,027 | 64,818 | 151,525 | 86,128 |
| North America: | | | | | | | | |
| Canada— | | | | | | | | |
| Nova Scotia, New Brunswick, etc | 148,966 | 60,837 | 31,108 | 8,548 | 14,078 | 3,384 | 77,468 | 16,427 |
| Quebec, Ontario, etc | 9,704 | 5,470 | 1,763 | 898 | 1,071 | 696 | 1,347 | 346 |
| British Columbia | 46,348 | 13,932 | 32,175 | 8,578 | 34,051 | 9,067 | 9,002 | 2,800 |
| Newfoundland and Labrador | 62,011 | 50,912 | 2,585 | 1,568 | 1,888 | 867 | 1,034 | 347 |
| Miquelon, Langley, etc | ..... | ..... | ..... | ..... | ..... | ..... | 2,064 | 479 |
| British West Indies | 8,216 | 4,941 | ..... | ..... | ..... | ..... | ..... | ..... |
| Total North America | 275,335 | 136,092 | 67,631 | 19,592 | 51,088 | 14,014 | 90,915 | 20,399 |
| Asia: | | | | | | | | |
| China | ..... | ..... | 2 | 1 | 760 | 389 | ..... | ..... |
| Hongkong | ..... | ..... | ..... | ..... | 1,243 | 281 | 10 | 23 |
| Japan | 101,265 | 24,832 | 5,010 | 786 | 170 | 151 | ..... | ..... |
| Total Asia | 101,265 | 24,832 | 5,012 | 787 | 2,163 | 821 | 10 | 23 |
| All other islands and ports | 453 | 323 | 1 | 17 | ..... | ..... | ..... | ..... |
| Grand total | 451,180 | 228,163 | 181,835 | 88,802 | 174,278 | 79,653 | 242,450 | 106,550 |
| Total entered for consumption | *224,030 | *120,168 | 183,599 | 88,811 | 187,577 | 85,839 | 221,077 | 92,514 |
| | 178,473 | 89,676 | ..... | 22,203 | ..... | 21,459 | ..... | 23,128 |
| Amount of duty | ..... | 22,418 | | | | | | |

* Free of duty.

68. *Statement by countries of the imports of marine oils into the United States during the ten years ending June 30, 1894*—Continued.

| Countries from which imported. | 1889. | | 1890. | | 1891. | | 1892. | |
|---|---|---|---|---|---|---|---|---|
| | Gallons. | Values. | Gallons. | Values. | Gallons. | Values. | Gallons. | Values. |
| Europe: | | | | | | | | |
| Azores, and Madeira Islands | ..... | ..... | 1,660 | $430 | ..... | ..... | ..... | ..... |
| Belgium | ..... | ..... | ..... | ..... | ..... | ..... | 625 | $364 |
| England | 5,020 | $2,258 | 4,293 | 1,602 | 16,183 | $7,182 | 1,538 | 863 |
| France | ..... | ..... | ..... | ..... | 30 | 117 | 100 | 90 |
| Germany | 14,471 | 5,008 | 26,397 | 8,541 | 20,674 | 8,398 | 39,375 | 20,573 |
| Netherlands | 35 | 15 | 1,480 | 471 | 17 | 13 | 14 | 11 |
| Sweden and Norway | 109,532 | 44,458 | 147,824 | 56,977 | 218,881 | 93,616 | 161,949 | 95,298 |
| Total Europe | 129,658 | 51,739 | 181,654 | 68,021 | 255,785 | 109,326 | 203,601 | 117,199 |
| North America: | | | | | | | | |
| Canada— | | | | | | | | |
| Nova Scotia, New Brunswick, etc | 164,185 | 29,084 | 67,578 | 12,725 | 35,890 | 7,383 | 90,960 | 24,601 |
| Quebec, Ontario, etc | 83 | 50 | 269 | 132 | 14,705 | 4,495 | ..... | ..... |
| British Columbia | 9,805 | 2,994 | ..... | ..... | 450 | 112 | 184 | 46 |
| Newfoundland and Labrador | 130,367 | 27,212 | 11,578 | 2,730 | 13,027 | 3,767 | 8,155 | 1,975 |
| Miquelon, Langley, etc | 950 | 190 | ..... | ..... | ..... | ..... | ..... | ..... |
| British West Indies | 210 | 84 | ..... | ..... | 216 | 107 | 1,369 | 192 |
| Total North America | 305,600 | 59,614 | 79,425 | 15,587 | 64,288 | 15,864 | 100,668 | 26,814 |
| Asia: | | | | | | | | |
| British East Indies | 10,153 | 2,914 | ..... | ..... | ..... | ..... | ..... | ..... |
| China | ..... | ..... | ..... | ..... | ..... | ..... | 10 | 3 |
| Hongkong | 606 | 194 | ..... | ..... | 192 | 39 | 132 | 32 |
| Japan | 9,848 | 1,401 | 6,300 | 1,828 | 250 | 55 | 2,398 | 426 |
| Total Asia | 20,607 | 4,509 | 6,300 | 1,827 | 442 | 94 | 2,540 | 461 |
| All other islands and ports | ..... | ..... | ..... | ..... | ..... | ..... | 6 | 20 |
| Grand total | 455,865 | 115,862 | 267,379 | 85,436 | 320,515 | 125,284 | 306,815 | 144,494 |
| Total entered for consumption | 387,020 | 105,937 | 305,591 | 95,947 | 300,159 | 113,775 | 329,944 | 151,000 |
| Amount of duty | ..... | 26,483 | ..... | 23,987 | ..... | 33,299 | ..... | 40,603 |

| Countries from which imported. | 1893. | | 1894. | | Total. | |
|---|---|---|---|---|---|---|
| | Gallons. | Values. | Gallons. | Values. | Gallons. | Values. |
| Europe: | | | | | | |
| Azores, and Madeira Islands | ..... | ..... | ..... | ..... | 22,733 | $5,408 |
| Belgium | ..... | ..... | 450 | $194 | 1,125 | 584 |
| France | 6,008 | $2,313 | ..... | ..... | 8,136 | 3,353 |
| Germany | 39,542 | 13,920 | 24,113 | 11,045 | 226,992 | 107,677 |
| Netherlands | 7 | 10 | ..... | ..... | 1,051 | 571 |
| Sweden and Norway | 165,209 | 87,123 | 196,202 | 93,089 | 1,337,077 | 686,161 |
| United Kingdom— | | | | | | |
| England | 13,017 | 5,879 | 11,203 | 5,523 | 84,305 | 47,780 |
| Scotland | 3,452 | 1,296 | 3,356 | 1,258 | 7,168 | 2,669 |
| Total Europe | 227,295 | 110,541 | 235,324 | 111,109 | 1,689,187 | 854,203 |
| North America: | | | | | | |
| Canada— | | | | | | |
| Nova Scotia, New Brunswick, etc | 242,515 | 64,683 | 104,436 | 25,073 | 977,184 | 252,745 |
| Quebec, Ontario, etc | 18,023 | 6,476 | 542 | 233 | 47,597 | 18,796 |
| British Columbia | 2,041 | 690 | 629 | 154 | 134,685 | 38,373 |
| Newfoundland and Labrador | 285,602 | 75,980 | 55,353 | 14,885 | 571,600 | 180,243 |
| Miquelon, Langley, etc | ..... | ..... | 12,417 | 2,832 | 15,431 | 3,501 |
| British West Indies | ..... | ..... | ..... | ..... | 10,011 | 5,324 |
| Total North America | 548,181 | 147,829 | 173,377 | 43,177 | 1,756,508 | 498,982 |
| Asia: | | | | | | |
| British East Indies | ..... | ..... | ..... | ..... | 10,153 | 2,914 |
| China | ..... | ..... | 4,668 | 607 | 5,430 | 1,000 |
| Hongkong | 110 | 25 | ..... | ..... | 2,293 | 594 |
| Japan | 191,852 | 30,746 | 156,456 | 24,656 | 473,549 | 84,881 |
| Total Asia | 191,962 | 30,771 | 161,124 | 25,263 | 491,425 | 89,389 |
| All other islands and ports | ..... | ..... | 10 | 7 | 470 | 367 |
| Grand total | 967,438 | 289,141 | 569,835 | 179,556 | 3,937,590 | 1,442,941 |
| Total entered for consumption | 922,105 | 285,592 | 588,977 | 184,510 | 3,828,552 | 1,413,609 |
| Amount of duty | ..... | 87,099 | ..... | 61,810 | ..... | 362,489 |

*Exports of marine oils.*—The marine oils exported are classified as sperm oil and whale and fish oil. The extent of the export trade from 1790 to 1820 is given in Table 19. The exports since 1820 are shown in Table 20, on pp. 464–465. During recent years the exports have been principally to Scotland, England, France, Australia, and Germany, those five countries receiving over 95 per cent of the total quantity exported. The remaining exports are sent to Hongkong, Mexico, British Columbia, Belgium, etc. During the last ten years the exports to Scotland have aggregated 4,748,433 gallons; to England, 3,505,300; to France, 1,310,334; to Australia, 612,335; to Germany, 454,648, and to all other countries combined only 449,683, making a grand total of 11,080,733 gallons.

Table 69 shows by countries the quantity and value of the marine oils exported during each of the ten years ending June 30, 1894:

69. *Statement by countries of the exports of marine oils from the United States during the ten years ending June 30, 1894.*

| Countries to which exported. | 1885. | | 1886. | | 1887. | | 1888. | |
|---|---|---|---|---|---|---|---|---|
| | Gallons. | Values. | Gallons. | Values. | Gallons. | Values. | Gallons. | Values. |
| Europe: | | | | | | | | |
| Belgium | 1,030 | $1,070 | 4,000 | $3,470 | | | | |
| France | 231,694 | 90,722 | 468,617 | 154,649 | 143,579 | $44,482 | 244,327 | $58,501 |
| Germany | 63,974 | 20,633 | 76,523 | 21,977 | 145,784 | 38,085 | 87,007 | 22,872 |
| Italy | | | 3,000 | 1,100 | | | | |
| Netherlands | 491 | 413 | 7,400 | 3,352 | 532 | 406 | 993 | 741 |
| United Kingdom— | | | | | | | | |
| England | 507,747 | 207,365 | 386,255 | 165,333 | 535,819 | 198,321 | 430 934 | 156,833 |
| Scotland | 219,610 | 115,729 | 317,335 | 117,043 | 584,372 | 156,955 | 589,183 | 127,023 |
| Total Europe | 1,024,546 | 435,932 | 1,263,730 | 466,924 | 1,410,086 | 438,249 | 1,352,404 | 365,970 |
| North America: | | | | | | | | |
| Canada— | | | | | | | | |
| Nova Scotia, New Brunswick, etc | 350 | 272 | 148 | 46 | 128 | 97 | 4,860 | 1,204 |
| Quebec, Ontario, etc | 4,200 | 1,502 | 9,402 | 8,671 | | | | |
| British Columbia | 13,186 | 3,708 | 1,875 | 787 | 505 | 137 | 2,934 | 816 |
| Mexico | 5,025 | 1,943 | 7,055 | 3,326 | 5,375 | 2,234 | 7,914 | 2,388 |
| Central America— | | | | | | | | |
| Costa Rica | 579 | 377 | 963 | 538 | 117 | 98 | 126 | 72 |
| Guatemala | 3 | 6 | 6 | 8 | 30 | 10 | 203 | 148 |
| Honduras | 72 | 45 | 121 | 64 | | | 145 | 60 |
| Nicaragua | 60 | 45 | 101 | 64 | 25 | 11 | 53 | 20 |
| San Salvador | 36 | 44 | 60 | 62 | 50 | 60 | 10 | 8 |
| West Indies— | | | | | | | | |
| British | 1,715 | 917 | 2,589 | 1,023 | 901 | 306 | 795 | 324 |
| Danish | | | | | | | 20 | 16 |
| Dutch | | | 101 | 44 | 60 | 31 | 112 | 69 |
| French | 900 | 710 | | | | | | |
| Haiti | 271 | 107 | 493 | 345 | 297 | 187 | 751 | 462 |
| Santo Domingo | 187 | 112 | 188 | 123 | 524 | 196 | 388 | 209 |
| Spanish—Cuba | 739 | 457 | 1,281 | 869 | 517 | 891 | 386 | 302 |
| Puerto Rico | | | 214 | 210 | 30 | 15 | | |
| Total North America | 27,323 | 10,245 | 24,597 | 16,180 | 8,559 | 4,282 | 18,697 | 6,098 |
| South America: | | | | | | | | |
| Argentina | | | 52 | 35 | 53 | 34 | | |
| Brazil | 426 | 338 | 720 | 520 | 20 | 15 | 498 | 350 |
| Chile | 73 | 90 | 1,516 | 1,417 | | | 30 | 28 |
| Colombia | 4 | 7 | 182 | 116 | 827 | 312 | 283 | 196 |
| Peru | 329 | 183 | 506 | 253 | 346 | 136 | 782 | 266 |
| Venezuela | 10 | 14 | | | | | | |
| Total South America | 842 | 632 | 2,976 | 2,341 | 1,246 | 497 | 1,593 | 840 |
| Asia and Oceanica: | | | | | | | | |
| Hongkong | 13,635 | 5,701 | 15,430 | 5,688 | 16,787 | 6,091 | 14,521 | 4,199 |
| British Australasia | 120,024 | 51,664 | 54,032 | 18,585 | 68,729 | 22,075 | 107,540 | 31,971 |
| Hawaiian Islands | 862 | 392 | 1,749 | 919 | 467 | 124 | 1,461 | 628 |
| Total Asia and Oceanica | 134,521 | 57,757 | 71,211 | 25,192 | 85,983 | 28,290 | 123,522 | 36,798 |
| All other islands and ports | 382 | 160 | 2,165 | 470 | 99 | 63 | 195 | 139 |
| Grand total | 1,187,614 | 504,726 | 1,364,679 | 511,107 | 1,505,973 | 471,381 | 1,496,501 | 409,845 |

69. *Statement by countries of the exports of marine oils from the United States during the ten years ending June 30, 1894*—Continued.

| Countries to which exported. | 1889. | | 1890. | | 1891. | | 1892. | |
|---|---|---|---|---|---|---|---|---|
| | Gallons. | Values. | Gallons. | Values. | Gallons. | Values. | Gallons. | Values. |
| Europe: | | | | | | | | |
| Belgium | 200 | $65 | 15,967 | $3,839 | 85 | $30 | 15,207 | $5,779 |
| France | 10,484 | 3,694 | 99,134 | 41,383 | 3 | 1 | 30,668 | 11,083 |
| Germany | 2,595 | 1,670 | 15,786 | 5,813 | 49,008 | 13,654 | 11,349 | 3,422 |
| Netherlands | ..... | ..... | 490 | 135 | ..... | ..... | ..... | ..... |
| United Kingdom— | | | | | | | | |
| England | 351,189 | 112,303 | 537,403 | 177,889 | 383,600 | 141,240 | 220,250 | 102,992 |
| Scotland | 153,463 | 56,150 | 1,210,048 | 293,728 | 919,559 | 204,731 | 609,240 | 181,124 |
| Total Europe | 517,931 | 173,882 | 1,878,828 | 522,787 | 1,352,255 | 359,656 | 886,714 | 305,000 |
| North America: | | | | | | | | |
| Canada— | | | | | | | | |
| Nova Scotia, New Brunswick, etc. | 50 | 22 | ..... | ..... | 4,910 | 667 | ..... | ..... |
| Quebec, Ontario, etc. | ..... | ..... | 220 | 96 | ..... | ..... | 90 | 78 |
| British Columbia | 9 | 9 | 35,581 | 9,086 | 10,291 | 4,315 | 4,797 | 1,946 |
| Mexico | 5,232 | 3,006 | 4,105 | 1,258 | 7,194 | 3,536 | 18,375 | 7,716 |
| Central America— | | | | | | | | |
| Costa Rica | 50 | 16 | 20 | 36 | ..... | ..... | ..... | ..... |
| Guatemala | 10 | 8 | ..... | ..... | ..... | ..... | ..... | ..... |
| Honduras | 98 | 34 | 122 | 42 | ..... | ..... | ..... | ..... |
| Nicaragua | 71 | 52 | 5 | 6 | 24 | 52 | 15 | 30 |
| San Salvador | 25 | 19 | ..... | ..... | 35 | 26 | ..... | ..... |
| West Indies— | | | | | | | | |
| British | 1,321 | 521 | 1,502 | 561 | 966 | 340 | 740 | 304 |
| Danish | 39 | 18 | ..... | ..... | ..... | ..... | 26 | 14 |
| Dutch | 65 | 43 | 5 | 2 | 26 | 17 | 82 | 64 |
| Haiti | 655 | 571 | 231 | 82 | 130 | 75 | 374 | 234 |
| Santo Domingo | 188 | 73 | 998 | 563 | 299 | 153 | 294 | 144 |
| Spanish— | | | | | | | | |
| Cuba | 792 | 794 | 2,101 | 500 | 417 | 163 | 4,055 | 1,078 |
| Puerto Rico | 50 | 20 | ..... | ..... | ..... | ..... | ..... | ..... |
| Total North America | 8,655 | 5,206 | 44,899 | 12,232 | 24,292 | 9,344 | 28,848 | 12,508 |
| South America: | | | | | | | | |
| Argentina | 50 | 55 | ..... | ..... | ..... | ..... | ..... | ..... |
| Brazil | ..... | ..... | 314 | 162 | ..... | ..... | 108 | 82 |
| Chile | 128 | 91 | 60 | 62 | 60 | 59 | 560 | 250 |
| Colombia | 599 | 287 | 281 | 133 | 134 | 97 | 244 | 128 |
| Peru | 1,677 | 673 | 3,763 | 1,046 | 1,662 | 460 | 2,021 | 641 |
| Uruguay | 2,216 | 528 | ..... | ..... | ..... | ..... | ..... | ..... |
| Venezuela | 35 | 20 | 4,223 | 1,141 | 30 | 20 | 50 | 30 |
| Total South America | 4,705 | 1,654 | 8,641 | 2,544 | 1,886 | 636 | 2,983 | 1,131 |
| Asia and Oceanica: | | | | | | | | |
| Hongkong | 12,357 | 4,072 | 11,006 | 4,630 | 9,644 | 4,110 | 11,126 | 4,585 |
| British Australasia | 85,527 | 11,210 | 63,076 | 23,131 | 78,708 | 27,211 | 40,157 | 14,744 |
| Hawaiian Islands | 2,218 | 832 | ..... | ..... | 506 | 225 | ..... | ..... |
| Total Asia and Oceanica | 50,102 | 16,114 | 74,082 | 27,761 | 88,858 | 31,546 | 51,283 | 19,329 |
| All other islands and ports | 647 | 184 | 156 | 49 | 30 | 21 | ..... | ..... |
| Grand total | 582,040 | 197,040 | 2,006,606 | 565,374 | 1,467,321 | 401,203 | 969,828 | 337,968 |

69. *Statement by countries of the exports of marine oils from the United States during the ten years ending June 30, 1894*—Continued.

| Countries to which exported. | 1893. | | 1894. | | Total. | |
|---|---|---|---|---|---|---|
| | Gallons. | Values. | Gallons. | Values. | Gallons. | Values. |
| Europe: | | | | | | |
| Belgium | ..... | ..... | ..... | ..... | 37,089 | $14,253 |
| France | 33,406 | $14,750 | 48,422 | $18,856 | 1,310,334 | 438,721 |
| Germany | 348 | 270 | 2,274 | 1,783 | 454,648 | 130,179 |
| Italy | ..... | ..... | ..... | ..... | 3,000 | 1,100 |
| Netherlands | 156 | 120 | 5,000 | 1,850 | 15,062 | 7,017 |
| United Kingdom— | | | | | | |
| England | 73,588 | 25,071 | 78,465 | 44,372 | 3,505,300 | 1,331,719 |
| Scotland | 41,792 | 31,900 | 103,831 | 51,067 | 4,748,433 | 1,335,450 |
| Total Europe | 149,290 | 72,111 | 237,992 | 117,928 | 10,073,866 | 3,258,439 |
| North America: | | | | | | |
| Canada— | | | | | | |
| Nova Scotia, New Brunswick, etc | ..... | ..... | 303 | 269 | 10,749 | 2,577 |
| Quebec, Ontario, etc | 2,344 | 481 | 2,734 | 1,295 | 18,990 | 12,123 |
| British Columbia | 1,044 | 402 | 2,041 | 800 | 72,263 | 22,007 |
| Mexico | 12,934 | 5,976 | 15,243 | 5,928 | 88,452 | 37,311 |
| Central America— | | | | | | |
| Costa Rica | 108 | 47 | 102 | 44 | 2,074 | 1,228 |
| Guatemala | 103 | 40 | 200 | 100 | 555 | 320 |
| Honduras | ..... | ..... | ..... | ..... | 558 | 245 |
| Nicaragua | ..... | ..... | 18 | 38 | 372 | 318 |
| San Salvador | ..... | ..... | ..... | ..... | 216 | 228 |
| West Indies— | | | | | | |
| British | 965 | 388 | 2,881 | 1,155 | 14,375 | 5,839 |
| Danish | ..... | ..... | ..... | ..... | 85 | 48 |
| Dutch | ..... | ..... | 100 | 47 | 551 | 317 |
| French | ..... | ..... | ..... | ..... | 900 | 710 |
| Haiti | 278 | 140 | 380 | 271 | 3,860 | 2,474 |
| Santo Domingo | 89 | 40 | ..... | ..... | 3,155 | 1,613 |
| Spanish— | | | | | | |
| Cuba | 1,750 | 734 | 4,512 | 1,686 | 16,550 | 8,374 |
| Puerto Rico | 80 | 56 | 50 | 23 | 424 | 324 |
| Total North America | 19,695 | 8,304 | 28,564 | 11,656 | 234,129 | 96,056 |
| South America: | | | | | | |
| Argentina | 30 | 14 | ..... | ..... | 185 | 138 |
| Brazil | 1,021 | 357 | 20 | 15 | 8,127 | 1,839 |
| Chile | 100 | 70 | 16 | 9 | 2,543 | 2,076 |
| Colombia | 103 | 41 | 2,595 | 1,957 | 5,252 | 3,274 |
| Peru | ..... | ..... | 1,000 | 381 | 12,086 | 4,039 |
| Uruguay | ..... | ..... | ..... | ..... | 2,216 | 528 |
| Venezuela | 20 | 12 | 10 | 7 | 4,378 | 1,244 |
| Total South America | 1,274 | 494 | 3,641 | 2,369 | 29,787 | 13,138 |
| Asia and Oceanica: | | | | | | |
| Hongkong | 5,993 | 2,315 | 8,117 | 3,135 | 118,616 | 44,526 |
| British Australasia | 29,523 | 9,684 | 15,019 | 5,402 | 612,335 | 215,677 |
| Hawaiian Islands | ..... | ..... | 533 | 256 | 7,796 | 3,376 |
| Total Asia and Oceanica | 35,516 | 11,999 | 23,669 | 8,793 | 738,747 | 263,579 |
| All other islands and ports | 25 | 20 | 505 | 105 | 4,204 | 1,211 |
| Grand total | 205,800 | 92,928 | 294,371 | 140,851 | 11,080,733 | 3,632,423 |

*Import duties on marine oils.*—From the organization of the United States Government to the present time foreign fish and whale oils have been subject to duties when imported into this country, except as affected by the reciprocity treaties of 1854 and 1873. The first duty imposed (taking effect August 1, 1789) was 5 per cent ad valorem, and this was increased in 1812 to 10 per cent. The customs law of 1816 imposed specific duties of 25 cents per gallon on sperm, and 15 cents per gallon on all other whale or fish oils. These remained constant until 1846, when a return was made to ad valorem duties, 20 per cent being imposed. A reduction of 5 per cent was made in 1857, but in 1861 a return was made to 20 per cent, and this rate remained until 1883, when it was increased 5 per cent. In 1890 specific duties were again imposed, 15 cents on cod-liver oil and 8 cents on seal, whale, herring, and other fish oils; but in 1894 a return was made to ad valorem duties, 20 per cent being imposed on cod-liver oil and 25 per cent on other fish oils.

The following statement shows approximately the rates of duty exacted in various foreign countries on marine oils imported therein.

70. *Statement of the approximate rates of duty imposed in various foreign countries on fish and whale oils imported therein.*

| Countries. | Duty per 100 lbs. | Countries. | Duty per 100 lbs. |
|---|---|---|---|
| Europe: | | West Indies—continued. | |
| Belgium | Free. | Guadaloupe | $1.31 |
| Denmark | $1.13 | Puerto Rico | 1.89 |
| France | .53 | Santo Domingo— | |
| Germany | .32 | Sperm | 1.58 |
| Great Britain | Free. | Fish | 1.27 |
| Greece | 3.52 | South America: | |
| Italy: | | Argentina: | |
| Sperm | 1.31 | Fish and whale | .14 |
| Fish and whale | .52 | Cod-liver | 2.19 |
| Netherlands | .10 | Bolivia: | |
| Russia | .65 | Crude | .80 |
| Spain | .09 | Refined | 1.32 |
| Norway | .48 | Brazil: | |
| Sweden | Free. | Crude | 3.70 |
| Switzerland | .04 | Refined | 12.38 |
| North America: | | Cod-liver | 15.84 |
| Canada | 20 per ct. ad val. | Chile: | |
| Mexico | 2.40 | Crude | 1.35 |
| Central America: | | Refined | 2.27 |
| Costa Rica | 2.42 | Cod-liver | 7.20 |
| Guatemala: | | Venezuela: | |
| Fish and whale | 2.20 | Fish and whale | 6.57 |
| Cod-liver | 4.41 | Cod-liver | 10.94 |
| Nicaragua | 1.40 | Asia and Oceanica: | |
| Salvador: | | China | 5 per ct. ad val. |
| Fish and whale | 1.76 | Japan | 5 per ct. ad val. |
| Cod-liver | 6.60 | New South Wales | 1.21 |
| Honduras | .03 | New Zealand | Free. |
| British Honduras | .60 | Queensland and Victoria | 1.21 |
| West Indies: | | Tasmania | 3.03 |
| Bahamas | 2.43 | West Australia | 1.21 |
| Cuba | 2.19 | | |

## XI.—SPERMACETI.

*Exports of spermaceti.*—The exports of spermaceti vary little from year to year, averaging about 300,000 pounds, with a valuation of about $100,000. It is sent principally to England, Germany, and Scotland, with smaller quantities to France, Italy, and Spain. Of the exports during the last ten years, 50 per cent went to England, 28 per cent to Germany, and 13 per cent to France.

The quantity and value exported during each of the last twenty-six years and the average value per pound are shown in Table 71. A statement of the annual exports since 1821 is given in Table 20, on pages 464–465, and the exports from 1790 to 1820, inclusive, are shown in Table 19, on page 462. From these compilations it appears that from 1790 to 1894, inclusive, 41,813,490 pounds of spermaceti have been exported from the United States.

Small quantities of spermaceti are imported into the United States in the form of candles. The imports during each year from 1869 to 1883 are shown in Table 12, on page 449. The customs returns do not indicate the imports during later years.

71. *Statement of the exports of domestic spermaceti during each year from 1869 to 1894, inclusive.*

| Year ending June 30— | Exports. | | Average values per pound. |
|---|---|---|---|
| | Pounds. | Values. | |
| | | | *Cents.* |
| 1869 | 253,445 | $88,706 | 35.0 |
| 1870 | 82,520 | 27,172 | 32.9 |
| 1871 | 157,263 | 42,170 | 26.8 |
| 1872 | 190,736 | 56,996 | 29.9 |
| 1873 | 197,671 | 55,815 | 28.2 |
| 1874 | 304,865 | 78,340 | 25.7 |
| 1875 | 238,641 | 61,725 | 25.8 |
| 1876 | 141,157 | 35,915 | 25.4 |
| 1877 | 153,552 | 41,027 | 26.7 |
| 1878 | 228,276 | 58,302 | 25.5 |
| 1879 | 147,503 | 35,489 | 24.1 |
| 1880 | 197,847 | 45,018 | 22.8 |
| 1881 | 214,205 | 40,945 | 19.1 |
| 1882 | 265,593 | 48,721 | 18.3 |
| 1883 | 396,869 | 66,651 | 16.8 |
| 1884 | 259,947 | 48,553 | 18.7 |
| 1885 | 277,271 | 63,683 | 22.9 |
| 1886 | 334,918 | 125,840 | 37.5 |
| 1887 | 336,222 | 139,656 | 41.5 |
| 1888 | 226,576 | 84,018 | 37.1 |
| 1889 | 425,479 | 111,386 | 26.2 |
| 1890 | 449,384 | 116,757 | 26.0 |
| 1891 | 207,574 | 71,202 | 34.3 |
| 1892 | 273,981 | 90,842 | 33.2 |
| 1893 | 340,192 | 105,012 | 30.9 |
| 1894 | 342,786 | 99,467 | 29.0 |
| Total | 6,644,473 | 1,750,708 | ..... |
| Average per year | 255,557 | 67,335 | 26.4 |

Table 72 shows the quantity and value of domestic spermaceti exported to each foreign country during each of the ten years ending June 30, 1894. It appears that Europe received 3,157,181 pounds, or over 97 per cent; American countries, 21,391 pounds, or less than 1 per cent; and all other countries, 35,811 pounds, or less than 2 per cent.

72. *Statement by countries of the domestic exports of spermaceti during the ten years ending June 30, 1894.*

| Countries to which exported. | 1885. | | 1886. | | 1887. | | 1888. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | | | |
| Austria-Hungary | 1,415 | $311 | | | | | | |
| Belgium | | | | | 610 | $256 | 1,850 | $650 |
| France | | | 3,160 | $1,250 | 9,556 | 4,128 | 7,556 | 2,852 |
| Germany | 87,645 | 21,723 | 71,657 | 27,780 | 88,191 | 38,292 | 52,364 | 19,595 |
| Italy | | | | | 2,421 | 1,050 | 3,188 | 991 |
| Netherlands | | | | | 922 | 410 | | |
| Portugal | | | | | 957 | 416 | | |
| Spain | | | | | 7,821 | 3,220 | 3,565 | 1,273 |
| United Kingdom— | | | | | | | | |
| England | 113,432 | 24,638 | 146,776 | 53,851 | 219,122 | 89,140 | 138,645 | 50,511 |
| Scotland | 63,824 | 14,907 | 112,929 | 42,777 | 6,246 | 2,580 | 18,690 | 7,860 |
| Total Europe | 266,316 | 61,579 | 334,522 | 125,658 | 335,846 | 139,492 | 225,858 | 83,732 |
| America: | | | | | | | | |
| Mexico | | | 396 | 182 | 70 | 29 | 618 | 256 |
| Central America | 5,617 | 1,024 | | | 180 | 83 | | |
| Brazil | 5,338 | 1,080 | | | | | | |
| Total America | 10,955 | 2,104 | 396 | 182 | 250 | 112 | 618 | 256 |
| All other islands and ports | | | | | 126 | 52 | 100 | 30 |
| Grand total | 277,271 | 63,683 | 334,918 | 125,840 | 336,222 | 139,656 | 226,576 | 84,018 |

| Countries to which exported. | 1889. | | 1890. | | 1891. | | 1892. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | | | |
| Belgium | 1,550 | $460 | 4,977 | $1,125 | 4,640 | $1,206 | 1,521 | $500 |
| France | 17,763 | 5,226 | 16,535 | 4,519 | 63 | 25 | 16,147 | 5,634 |
| Germany | 140,371 | 39,227 | 110,120 | 27,137 | 1,958 | 682 | 71,967 | 27,237 |
| Italy | 18,156 | 4,776 | 25,883 | 7,390 | 17,271 | 6,503 | 3,143 | 1,108 |
| Netherlands | 6,331 | 1,600 | | | | | | |
| Portugal | 945 | 220 | | | 50 | 18 | 806 | 107 |
| Spain | 7,968 | 2,339 | 3,802 | 898 | | | 1,855 | 568 |
| United Kingdom— | | | | | | | | |
| England | 173,497 | 42,966 | 254,178 | 66,630 | 183,033 | 62,556 | 117,608 | 37,667 |
| Scotland | 54,928 | 13,341 | 33,504 | 8,960 | | | 60,905 | 17,832 |
| Total Europe | 421,509 | 110,155 | 448,999 | 116,659 | 207,015 | 70,990 | 273,452 | 90,053 |
| America: | | | | | | | | |
| Mexico | 3,458 | 1,079 | 241 | 59 | | | 160 | 55 |
| Central America | | | | | | | 206 | 74 |
| Brazil | | | | | 509 | 195 | | |
| Total America | 3,458 | 1,079 | 241 | 59 | 509 | 195 | 366 | 129 |
| Asia and Australasia: | | | | | | | | |
| British Australasia | 113 | 37 | | | | | | |
| All other islands and ports | 399 | 115 | 144 | 39 | 50 | 17 | 163 | 60 |
| Grand total | 425,479 | 111,386 | 449,384 | 116,757 | 207,574 | 71,202 | 273,981 | 90,842 |

72. *Statement by countries of the domestic exports of spermaceti during the ten years ending June 30, 1894*—Continued.

| Countries to which exported. | 1893. | | 1894. | | Total. | |
|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | |
| Austria-Hungary | ..... | ..... | ..... | ..... | 1,415 | $311 |
| Belgium | 3,402 | $1,050 | 3,381 | $1,020 | 21,931 | 6,267 |
| Denmark | ..... | ..... | 309 | 87 | 309 | 87 |
| France | 11,594 | 3,734 | 7,255 | 2,196 | 89,629 | 29,564 |
| Germany | 111,137 | 35,791 | 157,331 | 46,311 | 892,741 | 283,775 |
| Italy | 7,449 | 2,338 | 2,831 | 825 | 80,342 | 24,981 |
| Netherlands | ..... | ..... | 1,658 | 400 | 8,811 | 2,410 |
| Portugal | ..... | ..... | ..... | ..... | 2,258 | 761 |
| Russia | ..... | ..... | 4,708 | 1,280 | 4,708 | 1,280 |
| Spain | 7,397 | 2,133 | 6,694 | 1,922 | 39,102 | 12,353 |
| United Kingdom— | | | | | | |
| England | 170,698 | 51,544 | 79,125 | 22,646 | 1,596,114 | 502,149 |
| Scotland | 26,486 | 7,715 | 42,309 | 12,054 | 419,821 | 128,026 |
| Total Europe | 338,163 | 104,305 | 305,501 | 88,741 | 3,157,181 | 991,964 |
| America: | | | | | | |
| Quebec and Ontario | ..... | ..... | 1,092 | 255 | 1,092 | 255 |
| Mexico | 1,854 | 637 | 1,477 | 87 | 8,274 | 2,384 |
| Central America | 175 | 70 | ..... | ..... | 6,178 | 1,251 |
| Brazil | ..... | ..... | ..... | ..... | 5,847 | 1,275 |
| Total America | 2,029 | 707 | 2,569 | 342 | 21,391 | 5,165 |
| Asia and Australasia: | | | | | | |
| British Australasia | ..... | ..... | 34,654 | 10,364 | 34,707 | 10,401 |
| All other islands and ports | ..... | ..... | 62 | 20 | 1,044 | 333 |
| Grand total | 340,192 | 105,012 | 342,786 | 99,467 | 3,214,383 | 1,007,863 |

*Import duties on spermaceti.*—The import duties exacted on spermaceti in various foreign countries are set forth in comparative form in the appended compilation. The tariff rate in the United States is 25 per cent ad valorem.

73. *Statement of the approximate rates of duty exacted on spermaceti imported into various foreign countries.*

| Countries. | Duty per 100 lbs. | Countries. | Duty per 100 lbs. |
|---|---|---|---|
| Europe: | | North America—continued. | |
| Austria-Hungary | $0.58 | Mexico | $7.99 |
| Belgium | Free. | Central America— | |
| France— | | Costa Rica | 1.54 |
| Crude | .439 | Guatemala | 5.51 |
| Pressed | .875 | Honduras | 1.86 |
| Refined | 1.317 | Salvador | 4.40 |
| Germany | .322 | West Indies— | |
| Great Britain | Free. | Haiti | 0.65 |
| Greece | 13.59 | Puerto Rico | 1.89 |
| Italy | Free. | South America: | |
| Netherlands | 5 p. ct. ad val. | Argentina | 8.75 |
| | | Bolivia— | |
| Norway | .485 | Crude | 4.03 |
| Portugal | 1.079 | Refined | 6.61 |
| Russia | 1.29 | Brazil | 9.90 |
| Spain | 1.75 | Chile— | |
| Switzerland | .04 | Crude | 8.30 |
| North America: | | Refined | 14.40 |
| Canada | 20 p. ct. ad val. | Venezuela | 6.57 |

## XII.—WHALEBONE.

*General trade.*—The foreign trade in whalebone is almost entirely of an export nature, only a small quantity being imported into this country. During recent years the quantity exported has averaged about 150,000 pounds annually, with a valuation of about $4 per pound. During the twenty-six years ending June 30, 1894, the exports aggregated 5,307,203 pounds, valued at $10,295,706. The largest quantity exported in any one of those years was 405,396 pounds in 1869, but the greatest value was $799,042 in 1888. From 1821 to 1894, inclusive, 55,215,494 pounds of whalebone, valued at $31,803,573, have been exported, as shown in Table 20, on page 464–465. The exports were most extensive from 1844 to 1860, the quantity exceeding 1,000,000 pounds annually. The exports in 1853 were 2,825,069 pounds, valued at $1,063,705, and in 1857, 2,042,390 pounds, worth $1,307,322. The exports from 1791 to 1820, inclusive, as compiled from Pitkin's Statistics, and shown in Table 19, on page 462, amounted to 2,942,848 pounds, with an estimated value, at 20 cents per pound, of $588,570. This gives a total of 58,158,342 pounds, worth $32,392,143 of domestic wholebone exported from 1791 to 1894, inclusive.

Table 74 shows in detail the extent of the whalebone trade during the twenty-six years ending in 1894.

74. *Statement of the foreign trade in whalebone during each year from 1869 to 1894, inclusive.*

| Year ending June 30— | Imports for consumption. | | | | | Domestic exports. | | | Excess of exports over imports. |
|---|---|---|---|---|---|---|---|---|---|
| | Unmanufactured. | | | Manufactures of. | Total. | | | | |
| | Pounds. | Values. | Average value per pound. | Values. | Values. | Pounds. | Values. | Average value per pound. | |
| 1869 | 3,030 | $962 | $0.32 | $381 | $1,343 | 405,396 | $384,435 | $0.95 | $383,092 |
| 1870 | 1,135 | 332 | .29 | ..... | 332 | 386,728 | 343,937 | .89 | 343,605 |
| 1871 | 748 | 309 | .41 | ..... | 309 | 353,742 | 251,562 | .71 | 251,253 |
| 1872 | 20,635 | 1,416 | .07 | 1,644 | 3,060 | 172,889 | 137,855 | .80 | 134,795 |
| 1873 | 9,000 | 4,622 | .51 | 418 | 5,040 | 324,653 | 329,214 | 1.01 | 324,174 |
| 1874 | 8,700 | 4,921 | .57 | 829 | 5,750 | 114,630 | 115,098 | 1.00 | 109,348 |
| 1875 | 3,247 | 2,034 | .63 | 1,638 | 3,672 | 251,572 | 291,165 | 1.16 | 287,493 |
| 1876 | 10,673 | 10,598 | .99 | 79 | 10,677 | 154,500 | 215,327 | 1.39 | 204,650 |
| 1877 | 1,880 | 1,379 | .73 | 851 | 2,230 | 71,708 | 160,666 | 2.24 | 158,436 |
| 1878 | 1,982 | 666 | .34 | 734 | 1,400 | 154,016 | 264,980 | 1.72 | 263,580 |
| 1879 | 2,823 | 3,355 | 1.19 | 741 | 4,096 | 78,322 | 199,753 | 2.55 | 195,657 |
| 1880 | 10,506 | 13,337 | 1.27 | 190 | 13,527 | 131,332 | 255,847 | 1.95 | 242,320 |
| 1881 | 5,620 | 5,507 | .98 | 107 | 5,614 | 227,117 | 326,400 | 1.44 | 320,786 |
| 1882 | 10,892 | 2,822 | .26 | 9 | 2,831 | 220,787 | 325,333 | 1.47 | 322,502 |
| 1883 | 3,657 | 1,824 | .50 | 2,863 | 4,687 | 326,835 | 599,550 | 1.83 | 594,863 |
| 1884 | 32,709 | 20,438 | .90 | 902 | 30,340 | 92,653 | 319,508 | 3.45 | 289,168 |
| 1885 | 18,787 | 32,568 | 1.73 | 1,144 | 33,712 | 188,482 | 470,039 | 2.49 | 436,327 |
| 1886 | 14,696 | 12,614 | .86 | 2,069 | 14,683 | 165,436 | 385,058 | 2.33 | 370,375 |
| 1887 | 10,172 | 6,579 | .65 | 1,126 | 7,705 | 173,452 | 523,267 | 3.02 | 515,562 |
| 1888 | 215 | 382 | 1.78 | 1,326 | 1,708 | 318,056 | 799,042 | 2.51 | 797,334 |
| 1889 | 11,029 | 19,179 | 1.74 | 402 | 19,581 | 261,555 | 762,464 | 2.92 | 742,883 |
| 1890 | 19,097 | 23,295 | 1.22 | 33 | 23,328 | 190,484 | 705,500 | 3.70 | 682,172 |
| 1891 | 75 | 168 | 2.24 | 1,341 | 1,509 | 159,322 | 717,230 | 4.50 | 715,721 |
| 1892 | 608 | 563 | .93 | 3,017 | 3,580 | 82,797 | 427,462 | 5.16 | 423,882 |
| 1893 | 11 | 25 | 2.27 | 4,756 | 4,781 | 148,130 | 543,045 | 3.67 | 538,264 |
| 1894 | 640 | 669 | 1.04 | 1,523 | 2,192 | 152,709 | 441,969 | 2.89 | 439,777 |
| Total... | 202,567 | 179,564 | ..... | 28,123 | 207,687 | 5,307,203 | 10,295,706 | ..... | 10,088,019 |

Notwithstanding the large domestic product of whalebone, small quantities are imported into this country each year, being entered free of duty. The whalebone imported is not so good in quality as that exported, the average value per pound of the former being only about one-half the latter. The imports of whalebone during the twenty-six years ending in 1894 amounted to 202,567 pounds, worth $179,564, or less than 4 per cent of the domestic exports.

*Exports of whalebone by countries.*—The exports of whalebone are principally to Germany, France, and England, the Netherlands and Belgium receiving smaller quantities. Of the 1,840,423 pounds exported during the ten years ending June 30, 1894, 973,001 pounds, or over 50 per cent, went to Germany; 620,785 pounds, or 34 per cent, to France; while all the countries of Europe received 1,838,947 pounds, or 99.92 per cent. The following statement shows the exports to each foreign country during the ten years ending June 30, 1894:

75. *Statement by countries of the domestic exports of whalebone during the ten years ending June 30, 1894.*

| Countries to which exported. | 1885. | | 1886. | | 1887. | | 1888. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | | | |
| Belgium | ..... | ..... | ..... | ..... | ..... | ..... | 125 | $350 |
| Denmark | ..... | ..... | 294 | $763 | ..... | ..... | 77 | 261 |
| England | 20,330 | $40,408 | 6,840 | 15,702 | 14,688 | $44,776 | 28,344 | 67,108 |
| France | 85,198 | 231,118 | 77,816 | 189,374 | 75,379 | 231,450 | 109,281 | 276,225 |
| Germany | 82,767 | 197,924 | 80,286 | 178,719 | 82,207 | 243,005 | 108,594 | 427,459 |
| Netherlands | 157 | 459 | 200 | 500 | 1,065 | 3,195 | 10,704 | 25,178 |
| Total Europe | 188,452 | 469,909 | 165,436 | 385,058 | 173,399 | 523,026 | 317,125 | 796,581 |
| America: | | | | | | | | |
| Nova Scotia, New Brunswick, etc | ..... | ..... | ..... | ..... | ..... | ..... | 9 | 27 |
| Quebec, Ontario, etc | 5 | 30 | ..... | ..... | ..... | ..... | ..... | ..... |
| Cuba | ..... | ..... | ..... | ..... | 53 | 241 | 922 | 2,434 |
| Colombia | 25 | 100 | ..... | ..... | ..... | ..... | ..... | ..... |
| Total America | 30 | 130 | ..... | ..... | 53 | 241 | 931 | 2,461 |
| Grand total | 188,482 | 470,039 | 165,436 | 385,058 | 173,452 | 523,267 | 318,056 | 799,042 |

| Countries to which exported. | 1889. | | 1890. | | 1891. | | 1892. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | | | |
| Belgium | 2,190 | $6,272 | 3,124 | $11,345 | 3,429 | $18,800 | 1,190 | $4,350 |
| England | 43,198 | 113,407 | 2,936 | 9,975 | 16,974 | 67,086 | 3,365 | 14,863 |
| France | 63,085 | 202,847 | 46,828 | 180,363 | 35,957 | 163,902 | 27,183 | 145,691 |
| Germany | 140,637 | 400,574 | 126,519 | 464,951 | 95,631 | 434,672 | 47,234 | 242,065 |
| Netherlands | 12,263 | 38,869 | 11,052 | 38,806 | 7,275 | 32,516 | 3,782 | 20,278 |
| Total Europe | 261,379 | 761,969 | 190,459 | 705,440 | 159,266 | 716,976 | 82,754 | 427,247 |
| America: | | | | | | | | |
| Nova Scotia, New Brunswick, etc | ..... | ..... | ..... | ..... | ..... | ..... | 5 | 19 |
| Mexico | ..... | ..... | ..... | ..... | ..... | ..... | 6 | 30 |
| Santo Domingo | 6 | 13 | ..... | ..... | ..... | ..... | ..... | ..... |
| Cuba | 160 | 442 | 25 | 60 | 56 | 254 | 20 | 110 |
| Brazil | 10 | 40 | ..... | ..... | ..... | ..... | 12 | 56 |
| Total America | 176 | 495 | 25 | 60 | 56 | 254 | 43 | 215 |
| Grand total | 261,555 | 762,464 | 190,484 | 705,500 | 159,322 | 717,230 | 82,797 | 427,462 |

75. *Statement by countries of the domestic exports of whalebone during the ten years ending June 30, 1894*—Continued.

| Countries to which exported. | 1893. | | 1894. | | Total. | |
|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | |
| Belgium | 1,565 | $5,846 | 1,157 | $3,600 | 12,786 | $50,563 |
| Denmark | | | | | 371 | 1,024 |
| England | 15,065 | 61,032 | 3,002 | 9,091 | 154,742 | 443,448 |
| France | 44,635 | 104,595 | 55,423 | 156,359 | 620,785 | 1,941,924 |
| Germany | 76,905 | 278,114 | 72,161 | 215,750 | 973,001 | 3,083,833 |
| Netherlands | 9,940 | 33,349 | 20,824 | 56,558 | 77,262 | 249,708 |
| Total Europe | 148,110 | 542,936 | 152,567 | 441,358 | 1,838,947 | 5,770,500 |
| America: | | | | | | |
| Nova Scotia, New Brunswick, etc. | 4 | 18 | | | 18 | 64 |
| Quebec, Ontario, etc. | 16 | 91 | 108 | 492 | 129 | 613 |
| Mexico | | | 8 | 25 | 14 | 55 |
| Santo Domingo | | | | | 6 | 13 |
| Cuba | | | 26 | 94 | 1,262 | 3,635 |
| Brazil | | | | | 22 | 96 |
| Colombia | | | | | 25 | 100 |
| Total America | 20 | 109 | 142 | 611 | 1,476 | 4,576 |
| Grand total | 148,130 | 543,045 | 152,709 | 441,969 | 1,840,423 | 5,775,076 |

*Import duties.*—The import duties exacted on whalebone in various foreign countries are shown in Table 76. This article has been admitted free of duty into the United States since 1873, previous to which time a duty of 20 per cent ad valorem was imposed.

76. *Statement of the approximate rates of duty exacted on whalebone imported into various foreign countries.*

| Countries. | Duty per 100 lbs. | Countries. | Duty per 100 lbs. |
|---|---|---|---|
| Europe: | | North America: | |
| Austria-Hungary | $0.725 | Canada | 20 p. ct. ad val. |
| Belgium | 5 p. ct. ad val. | Mexico | $2.40 |
| Denmark | 9.006 | Central America: | |
| France: | | Costa Rica | 11.90 |
| Uncut | Free. | Guatemala | 6.53 |
| Prepared | 8.75 | Nicaragua | 18.64 |
| Germany | Free. | Salvador | 12.04 |
| Great Britain | Free. | West Indies: | |
| Italy: | | Cuba— | |
| Unmanufactured | Free. | Rough | 63.00 |
| Manufactured | 7.003 | Polished | 109.20 |
| Netherlands | 5 p. ct. ad val. | Puerto Rico | 63.00 |
| Norway | Free. | Santo Domingo | 7.92 |
| Russia | 2.85 | South America: | |
| Switzerland: | | Bolivia— | |
| Raw or stripped | .344 | Rough | 2.64 |
| Polished | 1.403 | Manufactured | 16.53 |
| | | Brazil | 6.44 |

## XIII.—FISH SOUNDS AND ISINGLASS.

*Imports.*—Large quantities of fish sounds are used in the United States for clarifying beers, wines, etc., for the best grades of mucilage, and to a small extent for food purposes; but only during the last thirty years has any use been made of the domestic product. Isinglass is now made from the sounds of many varieties of American fishes, but principally from hake, sturgeon, cod, and squeteague or sea trout. The domestic yield of fish sounds amounts to about 200,000 pounds annually, but the market requires over twice this amount, necessitating a large importation each year. This importation ranges from 200,000 pounds to over 425,000 pounds annually. During the ten years ending June 30, 1894, the smallest imports were 199,571 pounds in 1894, and the largest 442,229 pounds in 1891. The total imports for consumption during that period amounted to 3,402,769 pounds, an annual average of 340,277 pounds. These figures do not include the imports of fish sounds in the form of glue, of which from 5,000 to 100,000 pounds are received annually. The quantity and value of fish sounds and glue imported for consumption during the twenty-six years ending in 1894 are shown in the following table:

77. *Statement of the imports for consumption of fish sounds and fish glue into the United States from 1869 to 1894, inclusive.*

| Year ending June 30— | Fish sounds or fish bladders. | | | Fish glue or isinglass. | | | Total. | | |
|---|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Average value per pound. | Pounds. | Values. | Average value per pound. | Pounds. | Values. | Average value per pound. |
| 1869 | | | | | | | a 17,438 | $8,719 | a $0.50 |
| 1870 | | | | | | | a 16,178 | 8,089 | a .50 |
| 1871 | | | | | | | a 13,084 | 6,542 | a .50 |
| 1872 | | | | | | | a 56,874 | 28,437 | a .50 |
| 1873 | | | | | | | a 247,500 | 123,750 | a .50 |
| 1874 | | | | | | | 187,384 | 96,244 | .46 |
| 1875 | | | | | | | 117,909 | 52,401 | .51 |
| 1876 | | | | | | | 73,552 | 42,322 | .44 |
| 1877 | | | | | | | 75,267 | 32,236 | .58 |
| 1878 | | | | | | | 159,344 | 104,552 | .43 |
| 1879 | | | | | | | 287,625 | 202,765 | .06 |
| 1880 | | | | | | | 330,719 | 198,025 | .71 |
| 1881 | | | | | | | 393,801 | 243,239 | .60 |
| 1882 | | | | | | | 289,165 | 169,148 | .62 |
| 1883 | | | | | | | 304,991 | 180,575 | .59 |
| 1884 | 270,822 | $92,914 | $0.34 | 72,504 | $36,310 | $0.50 | 343,326 | 129,224 | .38 |
| 1885 | 341,483 | 121,201 | .36 | 59,178 | 45,104 | .76 | 400,661 | 166,305 | .42 |
| 1886 | 424,430 | 144,052 | .34 | 57,483 | 37,132 | .65 | 481,913 | 181,784 | .38 |
| 1887 | 380,445 | 124,050 | .33 | 132,176 | 61,612 | .47 | 512,621 | 185,662 | .36 |
| 1888 | 434,440 | 141,388 | .33 | 78,370 | 35,455 | .45 | 512,810 | 176,843 | .34 |
| 1889 | 356,740 | 93,626 | .26 | 18,757 | 18,676 | 1.00 | 375,497 | 112,302 | .30 |
| 1890 | 279,932 | 51,202 | .18 | 6,306 | 11,984 | 1.90 | 286,238 | 63,186 | .22 |
| 1891 | 442,229 | 94,130 | .21 | 18,222 | 17,976 | .99 | 460,451 | 112,106 | .24 |
| 1892 | 300,283 | 62,351 | .21 | 13,957 | 13,742 | .98 | 314,240 | 76,093 | .24 |
| 1893 | 243,216 | 57,884 | .24 | 36,890 | 16,314 | .44 | 280,106 | 74,198 | .26 |
| 1894 | 199,571 | 36,375 | .18 | 5,352 | 5,934 | 1.11 | 204,923 | 42,309 | .21 |
| Total | 3,673,591 | 1,019,773 | | 499,204 | 300,239 | | 6,743,626 | 2,826,056 | |

a Estimated.

It appears from the foregoing table that the average value per pound of imported fish bladders, or sounds, has decreased almost constantly. In 1885 it was 36 cents; in 1889 it had decreased to 26 cents, and in 1894 it was only 18 cents per pound.

*Imports of sounds by countries.*—The largest imports of fish sounds are from Nova Scotia and New Brunswick; England, Venezuela, Denmark, Brazil, Russia, and India also supply sounds for the United States market. Comparatively few of the sounds from England are obtained in the fisheries of that country, the bulk of the shipments coming from Russia, India, and other countries. The following table shows the imports from each country during the four years ending June 30, 1894, the custom-house returns not showing by countries the quantity imported prior to July 1, 1891:

78. *Statement by countries of the imports of fish sounds into the United States during the four years ending June 30, 1894.*

| Countries from which imported. | 1891. | | 1892. | | 1893. | | 1894. | |
|---|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. | Pounds. | Values. |
| Europe: | | | | | | | | |
| Denmark | 55,188 | $5,679 | 33,077 | $4,135 | 4,101 | $530 | 11,527 | $1,191 |
| England | 98,582 | 26,350 | 71,130 | 17,238 | 63,798 | 13,730 | 55,896 | 17,464 |
| France | | | 396 | 97 | | | | |
| Germany | 6,034 | 1,374 | 1,711 | 231 | 2,546 | 398 | 173 | 14 |
| Italy | 84 | 18 | | | 7 | 2 | 219 | 10 |
| Netherlands | | | 466 | 57 | | | | |
| Russia | 55,994 | 12,045 | 11,197 | 2,827 | 216 | 349 | | |
| Sweden and Norway | 495 | 96 | | | 449 | 89 | 214 | 38 |
| Total Europe | 216,377 | 45,562 | 117,977 | 24,585 | 71,207 | 15,098 | 68,029 | 18,717 |
| North America: | | | | | | | | |
| Nova Scotia, New Brunswick, etc | 120,128 | 21,637 | 126,754 | 26,946 | 82,049 | 14,704 | 87,601 | 10,306 |
| Quebec, Ontario, etc | 535 | 366 | 360 | 188 | 31 | 36 | 45 | 23 |
| Mexico | 356 | 111 | | | | | 530 | 104 |
| Haiti | | | 3,411 | 829 | | | | |
| Cuba | | | 20 | 5 | 225 | 22 | 1,664 | 82 |
| South America: | | | | | | | | |
| Brazil | 15,533 | 3,653 | 3,180 | 735 | 37,444 | 16,496 | 9,604 | 1,266 |
| Venezuela | 83,432 | 21,520 | 34,948 | 7,817 | 42,344 | 9,923 | 33,437 | 5,912 |
| Total America | 219,984 | 47,287 | 168,673 | 36,520 | 162,093 | 41,181 | 132,941 | 17,693 |
| Asia and Oceanica: | | | | | | | | |
| Hongkong | 20 | 4 | 50 | 8 | 451 | 107 | | |
| British East Indies | 8,044 | 1,774 | 5,020 | 1,196 | 8,587 | 1,498 | | |
| Total Asia and Oceanica | 8,064 | 1,778 | 5,070 | 1,204 | 9,038 | 1,605 | | |
| Grand total | 444,425 | 94,627 | 291,720 | 62,309 | 242,338 | 57,884 | 200,970 | 36,410 |

| Countries from which imported. | Total. | | Average value per pound. |
|---|---|---|---|
| | Pounds. | Values. | |
| Europe: | | | |
| Denmark | 103,983 | $11,535 | $0.110 |
| England | 289,406 | 74,782 | .259 |
| France | 396 | 97 | .245 |
| Germany | 10,464 | 2,017 | .193 |
| Italy | 310 | 30 | .097 |
| Netherlands | 466 | 57 | .122 |
| Russia (Baltic and White seas) | 67,407 | 15,221 | .226 |
| Sweden and Norway | 1,158 | 223 | .184 |
| Total Europe | 473,590 | 103,962 | .220 |

78. *Statement by countries of the imports of fish sounds into the United States during the four years ending June 30, 1894*—Continued.

| Countries from which imported. | Total. | | Average value per pound. |
|---|---|---|---|
| | Pounds. | Values. | |
| North America: | | | |
| Nova Scotia, New Brunswick, etc. | 416,532 | $73,593 | $0.177 |
| Quebec, Ontario, etc. | 971 | 613 | .631 |
| Mexico | 886 | 215 | .243 |
| Haiti | 3,411 | 829 | .243 |
| Cuba | 1,909 | 109 | .057 |
| South America: | | | |
| Brazil | 65,821 | 22,150 | .337 |
| Venezuela | 194,161 | 45,172 | .233 |
| Total America | 683,691 | 142,681 | .209 |
| Asia and Oceanica: | | | |
| Hongkong | 521 | 119 | .228 |
| British East Indies | 21,651 | 4,468 | .206 |
| Total Asia and Oceanica | 22,172 | 4,587 | .207 |
| Grand total | 1,179,453 | 251,230 | .214 |

*Import duties on fish sounds and isinglass.*—Crude or unmanufactured fish sounds are admitted free of duty into the United States, but a rate of 25 per cent ad valorem is exacted on the manufactured product. On fish glue or isinglass the rate is 1½ cents per pound on all valued at not above 7 cents per pound, 25 per cent ad valorem when valued at above 7 cents and not above 30 cents per pound, and 30 per cent when valued at above 30 cents per pound.

The following compilation shows, in some cases approximately, the present rates of duty imposed on fish sounds or isinglass imported into various foreign countries:

79. *Statement of approximate rates of duty exacted on fish sounds, etc., imported into various foreign countries.*

| Countries. | Designation. | Duty on 100 pounds. | Countries. | Designation. | Duty on 100 pounds. |
|---|---|---|---|---|---|
| Europe: | | | North America—continued. | | |
| Austria-Hungary | Fish glue | $0.87 | Honduras | Fish glue | $8.39 |
| France | Fish bladders, raw or dried. | Free. | Nicaragua | do | 2.80 |
| | Fish glue or isinglass | 3.501 | Salvador | do | 2.20 |
| Italy | Fish glue | 1.313 | South America: | | |
| Great Britain | | Free. | Bolivia | Isinglass | 3.96 |
| Greece | Fish glue, common | 2.72 | | Fish glue | 19.84 |
| | Fish glue, refined | 6.80 | British Guiana | Isinglass | 5.00 |
| Norway | Isinglass or fish glue | 18.23 | Chile | Fish glue | 2.57 |
| Russia | Fish glue | 6.46 | Colombia | do | 4.41 |
| Sweden | Sturgeon sounds | 20.67 | Peru | do | .22 |
| | Fish glue | 2.43 | Asia and Oceanica: | | |
| Switzerland | do | .61 | British New Guinea | | 2.06 |
| North America: | | | Fiji | | 6.18 |
| Haiti | Fish glue | 4.82 | Japan | | 5 p. ct. |
| Mexico | do | 3.59 | | | |
| Costa Rica | do | 2.42 | | | |

## XIV.—SPONGES.

*General trade since 1868.*—The foreign trade in sponges is of considerable importance. The typical forms of commercial sponges are essentially confined to the waters of the southern and western coasts of Florida, and the waters of the Bahama Archipelago in the Western Hemisphere, and to the Mediterranean and Red seas in the Eastern Hemisphere. The importation of sponges is of growing importance in the United States, and the domestic exports have decreased considerably since 1885, as indicated in the following table, showing for the 26 years ending in 1894 the value of the foreign sponges imported for consumption, the domestic exports, and the excess of the imports over the exports:

80. *Statement of the foreign trade in sponges from 1869 to 1894, inclusive.*

| Year ending June 30— | Imports for consumption. | Domestic exports. | | | Excess of imports over exports. |
|---|---|---|---|---|---|
| | | Pounds. | Values. | Average values per pound. | |
| 1869 | $74,731 | ..... | ..... | ..... | $74,731 |
| 1870 | 93,952 | ..... | $5,500 | ..... | 88,452 |
| 1871 | 113,127 | ..... | 1,546 | ..... | 111,581 |
| 1872 | 153,443 | ..... | ..... | ..... | 153,443 |
| 1873 | 189,986 | ..... | ..... | ..... | 189,986 |
| 1874 | 121,798 | ..... | ..... | ..... | 121,798 |
| 1875 | 110,440 | ..... | ..... | ..... | 110,440 |
| 1876 | 87,621 | ..... | ..... | ..... | 87,621 |
| 1877 | 88,798 | ..... | 396 | ..... | 88,402 |
| 1878 | 90,127 | ..... | 8,000 | ..... | 82,127 |
| 1879 | 130,515 | ..... | 16,313 | ..... | 114,202 |
| 1880 | 183,690 | ..... | 4,141 | ..... | 179,549 |
| 1881 | 229,292 | ..... | 6,736 | ..... | 222,556 |
| 1882 | 293,621 | ..... | 4,111 | ..... | 289,510 |
| 1883 | 270,462 | ..... | 7,518 | ..... | 262,944 |
| 1884 | 241,874 | 17,400 | 9,472 | $0.544 | 232,402 |
| 1885 | 235,519 | 30,006 | 23,480 | .782 | 212,039 |
| 1886 | 296,963 | 44,839 | 25,607 | .571 | 271,356 |
| 1887 | 302,510 | 59,106 | 37,586 | .636 | 264,924 |
| 1888 | 268,651 | 55,903 | 36,581 | .654 | 232,070 |
| 1889 | 277,373 | 37,119 | 20,971 | .565 | 256,402 |
| 1890 | 352,885 | 45,222 | 25,293 | .559 | 327,592 |
| 1891 | 381,879 | 36,966 | 20,821 | .564 | 361,058 |
| 1892 | 331,241 | ..... | 10,320 | ..... | 320,921 |
| 1893 | 365,249 | 15,891 | 8,858 | .557 | 356,391 |
| 1894 | 217,456 | 18,329 | 8,497 | .463 | 208,959 |
| Total | 5,503,203 | ..... | 281,747 | ..... | 5,221,456 |

*Imports by countries.*—These sponges are received principally from the British West Indies, Cuba, Great Britain, Greece, and Austria. During the ten years ending June 30, 1894, the receipts from the British West Indies amounted in value to $1,736,332; from Cuba, $479,961; from Great Britain, $933,154, and from Greece, $244,851. The imports from countries on the American Continent amounted to $2,233,002; from Europe, $1,379,494; and from Asia and Oceanica, $9,080. Table 81 shows, by countries, the receipts during each year from 1885 to 1894, inclusive:

81. *Statement by countries of the imports of sponges during the ten years ending June 30, 1894.*

| Countries from which imported. | 1885. | 1886. | 1887. | 1888. | 1889. | 1890. |
|---|---|---|---|---|---|---|
| Europe: | | | | | | |
| Austria-Hungary | $8,578 | $15,247 | $12,757 | $9,247 | $4,830 | $5,467 |
| Belgium | 342 | 1,019 | 1,375 | 3,623 | 1,656 | 330 |
| France | 7,308 | 6,028 | 10,093 | 3,019 | 3,813 | 1,586 |
| Germany | 1,954 | 2,234 | 3,209 | 6,818 | 8,200 | 1,912 |
| Greece | ..... | 6,961 | 10,192 | 16,452 | 22,646 | 48,131 |
| Italy | 2,870 | ..... | 5,016 | ..... | 2,866 | 1,367 |
| Netherlands | 125 | 1,225 | ..... | ..... | ..... | ..... |
| United Kingdom | 100,089 | 100,372 | 103,132 | 101,626 | 82,740 | 115,205 |
| Total Europe | 121,266 | 133,086 | 145,774 | 140,785 | 126,751 | 173,998 |
| America: | | | | | | |
| Mexico | ..... | 106 | 495 | 1,387 | 336 | 902 |
| Central America— | | | | | | |
| Honduras | ..... | 504 | 345 | 223 | 572 | ..... |
| Nicaragua | ..... | ..... | ..... | 27 | ..... | ..... |
| British Honduras | 250 | 2,854 | 1,458 | 2,150 | 355 | 165 |
| British West Indies | 130,035 | 189,511 | 151,512 | 169,591 | 162,688 | 214,883 |
| Cuba | 81,981 | 60,700 | 43,534 | 38,533 | 27,195 | 26,741 |
| Colombia | ..... | ..... | 5 | 12 | ..... | ..... |
| All others | 111 | ..... | 15 | 8 | 488 | ..... |
| Total America | 212,377 | 253,675 | 197,364 | 211,926 | 191,634 | 242,691 |
| Asia and Oceanica: | | | | | | |
| Japan | ..... | 1 | 108 | ..... | ..... | ..... |
| Turkey in Asia | 131 | ..... | 65 | 5,393 | ..... | 29 |
| Hawaiian Islands | ..... | 622 | ..... | ..... | ..... | ..... |
| Total Asia and Oceanica | 131 | 623 | 173 | 5,393 | ..... | 29 |
| Grand total | 333,774 | 387,384 | 343,311 | 358,104 | 318,385 | 416,718 |

| Countries from which imported. | 1891. | 1892. | 1893. | 1894. | Total. |
|---|---|---|---|---|---|
| Europe: | | | | | |
| Austria-Hungary | $14,517 | $12,329 | $9,118 | $7,730 | $99,820 |
| Belgium | ..... | 201 | 118 | ..... | 8,664 |
| France | 1,074 | 3,825 | 4,105 | 2,889 | 43,740 |
| Germany | 15 | 456 | 812 | 1,007 | 26,617 |
| Greece | 39,423 | 32,917 | 56,262 | 11,867 | 244,851 |
| Italy | 3,655 | 3,235 | 8 | 910 | 19,922 |
| Netherlands | ..... | ..... | 13 | 265 | 1,628 |
| United Kingdom | 121,136 | 69,283 | 80,798 | 58,773 | 933,154 |
| All others | ..... | 1,098 | ..... | ..... | 1,098 |
| Total Europe | 179,820 | 123,344 | 151,229 | 83,441 | 1,379,494 |
| America: | | | | | |
| Mexico | 326 | ..... | 6 | ..... | 3,558 |
| Central America— | | | | | |
| Honduras | ..... | ..... | ..... | 5 | 1,649 |
| Nicaragua | ..... | ..... | ..... | ..... | 27 |
| British Honduras | ..... | 112 | 3 | 82 | 7,429 |
| British West Indies | 190,943 | 170,722 | 216,298 | 140,149 | 1,736,332 |
| Cuba | 58,476 | 56,662 | 50,598 | 35,541 | 479,961 |
| Haiti | ..... | ..... | 11 | ..... | 11 |
| Colombia | ..... | ..... | ..... | ..... | 17 |
| All others | 502 | 2,899 | ..... | ..... | 4,018 |
| Total America | 250,247 | 230,395 | 266,916 | 175,777 | 2,233,002 |
| Asia and Oceanica: | | | | | |
| Japan | 897 | 30 | 19 | 148 | 1,203 |
| Turkey in Asia | 909 | 644 | ..... | 80 | 7,251 |
| Hawaiian Islands | ..... | ..... | ..... | ..... | 622 |
| All others | ..... | 3 | 1 | ..... | 4 |
| Total Asia and Oceanica | 1,806 | 677 | 20 | 228 | 9,080 |
| Grand total | 431,873 | 354,416 | 418,165 | 259,446 | 3,621,576 |

*Exports by countries.*—The domestic sponges exported are sent principally to England; yet France, Quebec, and a number of other countries receive small quantities. The customs returns do not show separately the extent of these exports prior to 1894, but the exports during that year were as follows:

82. *Statement of the exports of domestic sponges during the year ending June 30, 1894.*

| Countries. | Pounds. | Values. | Countries. | Pounds. | Values. |
|---|---|---|---|---|---|
| Europe: | | | North America—continued. | | |
| England | 12,239 | $4,573 | West Indies— | | |
| France | 1,485 | 940 | British | 11 | $7 |
| Italy | 115 | 70 | Haiti | 250 | 250 |
| Netherlands | 700 | 299 | Puerto Rico | 40 | 27 |
| Sweden and Norway | 724 | 398 | South America: | | |
| North America: | | | Brazil | 400 | 200 |
| Nova Scotia and New Brunswick | 90 | 74 | Chile | 505 | 286 |
| Quebec and Ontario | 931 | 966 | Colombia | 80 | 45 |
| British Columbia | 11 | 5 | Uruguay | 100 | 48 |
| Mexico | 528 | 235 | Venezuela | 120 | 74 |
| | | | Total | 18,329 | 8,497 |

*Rates of duty imposed on sponges.*—No special duty was imposed on sponges imported into the United States prior to 1842. From 1789 to 1832 they were classed with unenumerated articles, and from 1832 to 1842 they were admitted free of duty. The tariff law of 1842 (Laws Twenty-seventh Congress, second session, chapter 270) imposed a duty of 20 per cent ad valorem on all sponges imported after August 30, 1842. This rate remained operative until July 1, 1857, when it was reduced to 8 per cent (Laws Thirty-fourth Congress, third session, chapter 98); but in 1861 (Laws Thirty-sixth Congress, second session, chapter 68) it was increased to 10 per cent ad valorem, taking effect April 1, 1861. In 1862 the duty was increased to 20 per cent, and it remained at that rate until 1894 (Laws Fifty-third Congress, second session, chapter 349), when it was again reduced to 10 per cent ad valorem, taking effect August 28, 1894.

83. *Statement of the approximate rates of duty imposed on sponges imported into various foreign countries.*

| Countries. | Designation. | Duty per 100 pounds. |
|---|---|---|
| Europe: | | |
| Austria-Hungary | Bathing and horse | $2.17 |
| | Others | 8.71 |
| France | Raw | 3.04 |
| | Prepared, fine | 5.69 |
| Germany | Wash sponges | Free. |
| Great Britain | | Free. |
| Italy | Common, crude | Free. |
| | Common, cleaned | 3.50 |
| | Fine, crude | Free. |
| | Fine, cleaned | 17.51 |
| Norway | | 32.45 |
| Portugal | | 13.22 |
| Russia | Greek | 2.58 |
| Switzerland | | 1.75 |
| North America: | | |
| Canada | | 20 p. ct. ad val. |
| Mexico | Fine | 47.90 |
| | Common | 9.58 |
| Central America— | | |
| Guatemala | | 132.27 |
| Honduras | | 23.30 |
| Nicaragua | | 46.59 |
| Salvador | | 110.22 |

83. *Statement of the approximate rates of duty imposed on sponges imported into various foreign countries*—Continued.

| Countries. | Designation. | Duty per 100 pounds. |
|---|---|---|
| North America—continued. | | |
| West Indies— | | |
| Bahamas | | Free. |
| Guadaloupe | | 10 p. ct. ad val. |
| Haiti | Fine | $33.77 |
| | Common, for horses | 5.79 |
| South America: | | |
| Argentina | Fine, for toilet | 547.10 |
| | Fair, for toilet | 218.84 |
| | Bath and carriage | 87.54 |
| | For horses | 38.29 |
| | For scrubbing | 21.88 |
| Bolivia | Fine | 79.34 |
| | Common | 16.53 |
| Brazil | Fine | 346.71 |
| | Common | 74.30 |
| Venezuela | | 10.94 |
| Australasia and Oceanica: | | |
| Queensland | | 15 p. ct. ad val. |
| Tasmania | | 12½ p. ct. ad val. |
| Polynesia | | 10 p. ct. ad val. |
| French Oceanica | Fine | 4.40 |
| | Common | 1.13 |

## XV.—MARINE SHELLS.

*General trade since 1868.*—Among the miscellaneous fishery products that enter into our foreign trade, marine shells call for special notice. Of these there are several classes, viz, (1) shells, not cut or ground; (2) mother-of-pearl, not cut or ground; (3) shells and mother-of-pearl, manufactured, and (4) cuttlefish bone. The uncut shells imported into this country consist of ornamental shells, shells for manufacture of buttons, etc. They are received principally from England, French Oceanica, Colombia, Mexico, and France, but nearly all are originally obtained from tropical waters. Little variation exists in the quantity of cuttlefish bone imported during recent years, averaging about 150,000 pounds, worth 10 cents per pound.

An interesting feature of this shell trade is the large number of shells imported during recent years for use in the shell-button factories in the United States. During the last four years several of these factories have been established in the interior of this country, and in addition to the fresh-water shells of the adjacent regions, they utilize quantities from Japan, India, Australasia, and especially Tahiti.

The marine shells exported are not of great value, and consist largely of abalone shells.

Table 84 shows the extent of the foreign trade in marine shells during the twenty-six years ending in 1894. The imports have gradually increased since 1885, reaching a maximum value of $1,621,681 in 1893. The imports for 1894 show a considerable decrease, because of the general depression of business, which naturally affects the importation of ornamental articles more seriously than the more necessary ones. The value of domestic exports shows a very great fluctuation, ranging from $1,500 to $74,328 per year.

84. *Statement of the foreign trade in marine shells during the twenty-six years ending in 1894.*

| Year ending June 30— | Imports for consumption. | | | | | | Domestic exports. | Excess of imports over exports. | Excess of exports over imports. |
|---|---|---|---|---|---|---|---|---|---|
| | Shells, not cut or ground. | Mother-of-pearl, not cut or manufactured. | Cuttlefish bone. | | Shells and mother-of-pearl, manufactures of. | Total. | All kinds. | | |
| | | | Pounds. | Value. | | | | | |
| 1869 | $44 | ..... | 18,404 | $1,292 | $490 | $1,826 | $11,008 | ..... | $9,182 |
| 1870 | 9 | ..... | 32,911 | 2,112 | 6,320 | 8,441 | 2,100 | $6,341 | ..... |
| 1871 | 8,545 | ..... | 21,993 | 1,945 | 11,754 | 22,244 | ..... | 22,244 | ..... |
| 1872 | 163,027 | ..... | 28,504 | 2,286 | 22,970 | 188,283 | ..... | 188,283 | ..... |
| 1873 | 128,774 | ..... | 21,388 | 2,320 | 5,044 | 136,138 | ..... | 136,138 | ..... |
| 1874 | 121,640 | ..... | 46,586 | 5,178 | 3,069 | 129,887 | ..... | 129,887 | ..... |
| 1875 | 121,280 | ..... | 37,192 | 4,355 | 5 | 125,649 | ..... | 125,649 | ..... |
| 1876 | 251,424 | ..... | 49,736 | 5,817 | ..... | 257,241 | ..... | 257,241 | ..... |
| 1877 | 162,769 | ..... | 54,215 | 9,482 | ..... | 172,251 | 4,825 | 167,426 | ..... |
| 1878 | 177,492 | ..... | 101,518 | 10,015 | ..... | 187,507 | 9,172 | 178,335 | ..... |
| 1879 | 220,564 | ..... | 129,827 | 11,179 | ..... | 231,743 | 13,831 | 217,912 | ..... |
| 1880 | 283,088 | ..... | 129,398 | 11,642 | ..... | 294,730 | 69,107 | 225,623 | ..... |
| 1881 | 280,472 | ..... | 85,292 | 7,682 | ..... | 288,154 | 39,792 | 248,362 | ..... |
| 1882 | 218,383 | ..... | 124,269 | 20,848 | ..... | 239,231 | 46,341 | 192,890 | ..... |
| 1883 | 273,296 | ..... | 178,789 | 22,958 | ..... | 296,254 | 15,148 | 281,106 | ..... |
| 1884 | 220,316 | ..... | 163,344 | 22,455 | 15,868 | 258,639 | 25,311 | 233,328 | ..... |
| 1885 | 140,576 | ..... | 190,785 | 12,223 | 11,281 | 164,080 | 63,898 | 100,182 | ..... |
| 1886 | 207,966 | ..... | 161,696 | 15,232 | 22,650 | 245,848 | 8,133 | 237,715 | ..... |
| 1887 | 196,984 | ..... | 196,437 | 14,899 | 15,916 | 228,799 | 16,572 | 212,227 | ..... |
| 1888 | 149,539 | ..... | 114,457 | 10,824 | 18,476 | 178,839 | 11,136 | 167,703 | ..... |
| 1889 | 258,206 | ..... | 94,495 | 10,058 | 11,499 | 279,763 | 2,243 | 277,520 | ..... |
| 1890 | 288,885 | ..... | 166,778 | 17,162 | 34,607 | 340,654 | 4,635 | 336,019 | ..... |
| 1891 | 506,723 | $3,593 | 151,114 | 20,089 | 108,171 | 638,576 | 1,500 | 637,076 | ..... |
| 1892 | 886,191 | 11,372 | 220,131 | 23,869 | 195,104 | 1,116,536 | 12,609 | 1,103,927 | ..... |
| 1893 | 1,270,811 | 51,616 | 139,260 | 15,412 | 283,842 | 1,621,681 | 33,033 | 1,588,648 | ..... |
| 1894 | 643,251 | 2,507 | 140,708 | 13,013 | 378,381 | 1,037,152 | 74,328 | 962,824 | ..... |
| Total | 7,180,264 | 69,088 | 2,808,227 | 294,347 | 1,145,447 | 8,690,146 | 464,722 | 8,234,606 | 9,182 |

*Imports of shells by countries.*—Of the $643,349 worth of shells entered at United States custom-houses during the year ending June 30, 1894, $291,691, or 45 per cent, came from England; $224,757, or 35 per cent, from French Oceanica; $44,822, or 7 per cent, from Colombia; and $28,473 from Mexico. The inhabitants of some of the Pacific islands depend almost entirely on their export of marine shells.

The subjoined compilation shows in detail the value of the unmanufactured shells, other than mother-of-pearl, imported from each foreign country during the four years ending in 1894. The customs returns do not indicate the origin of the shells imported previous to 1891:

85. *Statement by countries of the value of unmanufactured shells, other than mother-of-pearl, imported into the United States during each of the four years ending June 30, 1894.*

| Countries from which imported. | 1891. | 1892. | 1893. | 1894. |
|---|---|---|---|---|
| Europe: | | | | |
| Austria-Hungary | $3,616 | $7,724 | $9,281 | $3,260 |
| England | 274,316 | 622,502 | 814,036 | 291,691 |
| France | 8,280 | 34,243 | 50,176 | 12,125 |
| Germany | 12,810 | 19,604 | 29,612 | 244 |
| Italy | 2 | 148 | 311 | 54 |
| Netherlands | 5,604 | 4,107 | 8,585 | 3,257 |
| Total Europe | 304,628 | 688,328 | 912,001 | 310,631 |
| North America: | | | | |
| Mexico | 5,819 | 46,286 | 30,256 | 28,473 |
| Central American States— | | | | |
| Costa Rica | 2,817 | 1,578 | 1,084 | 1,214 |
| Honduras | | | 613 | 172 |
| Nicaragua | | | 1,519 | 1,605 |

85. *Statement by countries of the value of unmanufactured shells, other than mother-of-pearl, imported into the United States during each of the four years ending June 30, 1894*—Cont'd.

| Countries from which imported. | 1891. | 1892. | 1893. | 1894. |
|---|---|---|---|---|
| North America—continued. | | | | |
| Bermuda | | $133 | $97 | $60 |
| West Indies— | | | | |
| British | $13,658 | 9,215 | 9,249 | 3,150 |
| Danish | 4,798 | 7,797 | 3,200 | 4,716 |
| French | | | | 100 |
| Cuba | 358 | 795 | 8,492 | |
| Haiti | 2,134 | 3,000 | 3,152 | 1,712 |
| Santo Domingo | 3,234 | 2,194 | 3,197 | 2,328 |
| Puerto Rico | | | | 411 |
| Total North America | 32,818 | 70,998 | 60,859 | 43,941 |
| South America: | | | | |
| Brazil | | 20 | | 19 |
| Colombia | 20,090 | 28,172 | 31,699 | 44,822 |
| Venezuela | | | | |
| Total South America | 20,090 | 28,192 | 31,699 | 44,841 |
| Asia and Oceanica: | | | | |
| China | | 281 | | 3 |
| East Indies— | | | | |
| British | 3,326 | 11,341 | 6,135 | 5,466 |
| Dutch | 8,746 | 11,650 | 5,352 | 167 |
| Hongkong | 123 | 156 | 18 | 320 |
| Japan | 891 | 1,349 | 3,514 | 1,488 |
| Turkey | | 2,491 | | 2,945 |
| British Australasia | | 154 | 2,780 | 3,304 |
| French Oceanica | 132,965 | 65,256 | 236,521 | 224,757 |
| Philippine Islands | | | | 479 |
| Hawaiian Islands | | | | 33 |
| Total Asia and Oceanica | 146,051 | 92,678 | 254,320 | 238,962 |
| Africa: | | | | |
| British | 9 | 24 | 999 | |
| French | | | | 100 |
| Other African ports | 2,708 | 3,763 | 811 | 2,065 |
| Total Africa | 2,717 | 3,787 | 1,810 | 2,165 |
| All other islands and ports | 932 | 2,300 | 8,830 | 2,809 |
| Grand total | 507,236 | 886,283 | 1,269,519 | 643,349 |
| Imports for consumption | 506,723 | 886,191 | 1,270,811 | 643,251 |

86. *Statement by countries of the imports of manufactures of shells, including mother-of-pearl, during each year from 1891 to 1894, inclusive.*

| Countries from which imported. | 1891. | 1892. | 1893. | 1894. |
|---|---|---|---|---|
| Europe: | | | | |
| Austria-Hungary | | $10,668 | $35,686 | $157,379 |
| Belgium | | 8 | 57 | 13 |
| England | $11,440 | 44,026 | 25,469 | 25,208 |
| France | | 109,800 | 177,473 | 136,487 |
| Germany | | 14,437 | 19,301 | 29,523 |
| Italy | | 1,367 | 1,706 | 11,340 |
| Netherlands | | 50 | 87 | 27 |
| Switzerland | | 2,511 | 2,745 | 3,223 |
| Turkey | | 23 | 836 | 45 |
| Total Europe | 11,440 | 182,890 | 263,420 | 363,245 |
| North America: | | | | |
| Canada | | 57 | 257 | 50 |
| Mexico | | 89 | 268 | 99 |
| Nicaragua | | 212 | 126 | |
| West Indies: | | | | |
| British | | 776 | 473 | 619 |
| Cuba | | 12 | 48 | |
| Haiti | | | 10 | |
| Total North America | | 1,146 | 1,182 | 768 |

86. *Statement by countries of the imports of manufactures of shells, including mother-of pearl, during each year from 1891 to 1894, inclusive*—Continued.

| Countries from which imported. | 1891. | 1892. | 1893. | 1894. |
|---|---|---|---|---|
| Asia and Oceanica: | | | | |
| China | | | | $16 |
| East Indies—British | | | | 670 |
| Hongkong | | $12 | $177 | 138 |
| Japan | | 779 | 625 | 1,896 |
| Turkey | | 987 | 1,608 | 2,976 |
| French Oceanica | | | 204 | |
| Total Asia and Oceanica | | 1,778 | 2,614 | 5,696 |
| All other islands and ports | | 69 | 30 | 127 |
| Grand total | $11,440 | 185,883 | 267,246 | 369,836 |

The imports of mother-of-pearl, not cut or manufactured, were first separately classified in 1891, and from the following table it appears that most of these are received from England, with occasionally large imports from the Netherlands, France, Germany, etc.

87. *Statement by countries of the imports of mother-of-pearl, not cut or manufactured, during each of the four years ending June 30, 1894.*

| Countries from which imported. | 1891. | 1892. | 1893 | 1894. |
|---|---|---|---|---|
| England | $2,177 | $4,641 | $27,014 | $2,507 |
| France | | 5,746 | | |
| Germany | | | 2,231 | |
| Netherlands | 1,600 | | 22,225 | |
| Quebec, Ontario, etc | | 853 | | |
| Total | 3,777 | 11,240 | 51,470 | 2,507 |

*Exports by countries.*—The shells exported consist largely of abalone shells from the Pacific coast, which are sent principally to England and France. Table 88 shows the value of those exported to each foreign country during the year ending June 30, 1894. The customs returns do not show similar data for preceding years.

88. *Statement by countries of the exports of unmanufactured shells from the United States during the year ending June 30, 1894.*

| Countries. | Value. |
|---|---|
| France | $14,080 |
| Germany | 5,504 |
| Spain | 25 |
| United Kingdom | 51,028 |
| Quebec | 137 |
| Mexico | 4 |
| British West Indies | 1,580 |
| Turkey in Asia | 643 |
| Egypt | 367 |
| Total | 74,328 |

## XVI.—MISCELLANEOUS ARTICLES.

In addition to the aforementioned articles, there are several fishery products that enter into our trade with foreign countries in small quantities. Among these are ambergris, ambergris oil, coral, fish skins, seal skins, seaweeds, etc. It remains to give a brief account of the extent of the trade in these articles.

*Ambergris and ambergris oil.*—The quantity of ambergris and ambergris oil placed on the world's markets annually is very small, rarely exceeding 1,000 pounds. It is obtained principally by whale fishermen, and probably 20 per cent is secured by American vessels. Only a small quantity is used in this country, most of the domestic production being sent to Europe. Each year, however, a small quantity specially prepared is imported for use in the preparation of choice perfumery and other purposes. The following table shows the imports for consumption of these products from 1869 to 1894, inclusive:

89. *Statement of the imports for consumption of ambergris and ambergris oil into the United States from 1869 to 1894, inclusive.*

| Year ending June 30— | Ambergris. | | | Ambergris oil. | | | Total values. |
|---|---|---|---|---|---|---|---|
| | Pounds. | Values. | Average values per pound. | Pounds. | Values. | Average values per pound. | |
| 1872 | | $1,328 | | | | | $1,328 |
| 1873 | | 1,110 | | 0.33 | $31 | $93.36 | 1,141 |
| 1874 | | 4,046 | | 1.62 | 322 | 198.16 | 4,368 |
| 1875 | | 5,217 | | | | | 5,217 |
| 1876 | | 1,700 | | 1.87 | 706 | 377.54 | 2,406 |
| 1877 | | 694 | | 3.90 | 745 | 191.03 | 1,439 |
| 1878 | | 93 | | 1 | 185 | 185.00 | 278 |
| 1879 | | 3,215 | | | | | 3,215 |
| 1880 | | | | 16.06 | 2,962 | 184.43 | 2,962 |
| 1881 | | 55 | | 6.50 | 2,462 | 378.77 | 2,517 |
| 1882 | | 5,408 | | | | | 5,408 |
| 1883 | | 2,715 | | .44 | 390 | 886.36 | 3,105 |
| 1884 | 18 | 4,015 | $226.20 | .25 | 92 | 369.84 | 4,107 |
| 1885 | 47 | 5,685 | 120.96 | | | | 5,085 |
| 1886 | 101 | 1,673 | 16.17 | .50 | 175 | 350.38 | 1,848 |
| 1887 | 23 | 2,649 | 117.42 | 6.13 | 542 | 88.49 | 3,191 |
| 1888 | 93 | 6,774 | 72.67 | | | | 6,774 |
| 1889 | 437 | 5,852 | 13.39 | | | | 5,852 |
| 1890 | 50 | 1,454 | 29.08 | 11.23 | 2,920 | 260.00 | 4,374 |
| 1891 | 71 | 3,731 | 52.55 | 8 | 1,509 | 188.63 | 5,240 |
| 1892 | 6 | 1,288 | 220.36 | 1.22 | 427 | 350.00 | 1,715 |
| 1893 | 26 | 6,667 | 256.42 | | | | 6,667 |
| 1894 | 37 | 5,112 | 138.16 | | | | 5,112 |
| Total | | 70,481 | | 59.05 | 13,468 | | 83,910 |

*Coral.*—Coral is obtained principally from the waters of the Mediterranean Sea and by Italian fishermen. The most extensive markets are Genoa, Leghorn, and Naples. No commercial coral is produced in the United States. Twenty-five years ago this article was in great demand for ornamental purposes, but at present it is not so highly esteemed in America.

The imports of coral for consumption from 1869 to 1894, inclusive, have been as follows:

90. *Statement of the imports for consumption of coral into the United States from 1869 to 1894, inclusive.*

| Year ending June 30— | Not cut, or unmanufactured. | Cut, or manufactured. | Total. | Year ending June 30— | Not cut, or unmanufactured. | Cut, or manufactured. | Total. |
|---|---|---|---|---|---|---|---|
| 1869 | | $22,417 | $22,417 | 1883 | $661 | $1,302 | $1,983 |
| 1870 | | 18,975 | 18,975 | 1884 | | | 158 |
| 1871 | | 37,877 | 37,877 | 1885 | | | 659 |
| 1872 | $83 | 59,598 | 59,681 | 1886 | | | 218 |
| 1873 | 230 | 63,805 | 64,035 | 1887 | | | 307 |
| 1874 | 528 | 28,152 | 28,680 | 1888 | | | 594 |
| 1875 | 1,278 | 33,567 | 34,845 | 1889 | | | 461 |
| 1876 | 109 | 33,559 | 33,668 | 1890 | | | 531 |
| 1877 | 718 | 28,650 | 29,368 | 1891 | | | 213 |
| 1878 | 1,252 | 12,667 | 13,919 | 1892 | 533 | 845 | 1,378 |
| 1879 | 147 | 11,327 | 11,474 | 1893 | 608 | 657 | 1,265 |
| 1880 | 62 | 5,492 | 5,554 | 1894 | 153 | 1,758 | 1,911 |
| 1881 | 89 | 2,502 | 2,591 | | | | |
| 1882 | 1,474 | 669 | 2,143 | Total | | | 374,905 |

*Fish skins.*—Skins of various fishes, but principally of sharks, are imported into the United States for use in arts and manufactures. They come principally from England, but are originally obtained largely from the Mediterranean Sea. The imports from 1869 to 1894, inclusive, amounting in value to $4,333 are shown in Table 12, on page 449.

A large quantity of skins produced in the fisheries of the United States are annually exported. Among these are alligator hides, porpoise skins, etc. The customs-house returns, however, do not indicate separately the quantity or value of these products exported. Small quantities of fish skins have been exported during recent years, a statement of the extent of which is given in Table 25, on page 468.

*Seal skins.*—Another important product of the United States fisheries dependent on foreign countries is seal skins. The customs returns do not classify this article separately, but the exports amount to at least 99 per cent of the domestic product. The San Francisco value of the undressed skins produced in the United States fisheries in 1895 approximated $659,000, and in 1894 about $600,000. Practically all of these skins are sent to London to be dressed, and doubtless a large portion of them are again imported into this country. When imported they are listed with other furs, both of land and marine animals, and a separate statement of the imports is impracticable.

*Seaweeds.*—The uses of marine plants as food and for manufacturing and agricultural purposes are of more value than is generally supposed, and doubtless capable of much greater development, especially in this country. In France, China, and Japan numbers of people find profitable employment in collecting and preparing them.

In the United States large quantities of seaweeds are gathered from along the shore for fertilizing the adjacent fields, but they are rarely carried into the interior of the country. Irish moss (*Chondrus crispus*) is gathered in small quantities on the coast of Massachusetts and sold for culinary purposes and for sizing calicoes, etc. Dulse (*Rhodymenia palmata*) is quite common on the New England coast, but is gathered

only to a very limited extent. Small quantities are imported each year from the British Provinces and sold rough-dried, principally in the sea-port towns. No doubt several important industries could be developed in this country in gathering and preparing seaweeds.

The imports of seaweed and seaweed preparations during each year from 1869 to 1894, inclusive, are shown in Table 12 on page 449.

## XVII.—APPENDIX.

A series of compilations is here presented, showing approximately the rates of duty exacted on fishery products and fishing appliances imported into various foreign countries. These data have been compiled from the publications of the Bureau of American Republics and the International Customs Journal, published by the International Customs Tariff Bureau, Brussels, Belgium. The figures in certain instances given in the first column are the numbers that the different items bear in the original tariff enactments. In reducing to American equivalents, the valuation on July 1, 1895, is adopted for fluctuating currencies.

### AUSTRIA-HUNGARY.

(General law of May 25, 1882, with alterations of law of May 21, 1887.)

[Florin = $0.32. Kilogram = 2.2046 pounds.]

| No. | Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|---|
| | | Unit. | Rate. | |
| | | | *Florins.* | |
| 51 | Fish, fresh; river and creek crawfish; snails, fresh (by convention, free) | 100 kilos | 2.00 | $0.29 |
| 52 | Shellfish from the sea (i. e., oysters, lobsters, crabs); turtles, not prepared | do | 25.00 | 3.62 |
| 59 | Sponges: | | | |
| | Bathing and horse | do | 15.00 | 2.17 |
| | Other | do | 60.00 | 8.71 |
| 68 | Spermaceti | do | 4.00 | .58 |
| | Fish oil | do | 1.00 | .15 |
| 86 | Herrings, salted or smoked | do | 3.00 | .43 |
| 87 | Fish, not otherwise provided for, salted, smoked or dried (by convention, 3 florins) | do | 5.00 | .72 |
| 88 | Fish, prepared (pickled or preserved in oil, etc.), in casks | do | 15.00 | 2.17 |
| 89 | Caviar | do | 50.00 | 7.24 |
| 92 | All eatables contained in boxes, jugs, cans, and bottles, hermetically sealed | do | 40.00 | 5.80 |
| 105 | Ambergris | do | 15.00 | 2.17 |
| 230 | Whalebone, split | do | 5.00 | .72 |
| 248 | Corals, prepared, i. e., ground, cut, or otherwise worked upon; genuine pearls, not set, if not coming under fancy goods | do | 24.00 | 3.48 |
| 272 | Fishing tackle | do | 50.00 | 7.24 |
| 326 | Glue of all kinds | do | 6.00 | .87 |
| 341 | Spermaceti candles | do | 11.00 | 1.60 |

### AZORES.

(The customs duties operative in the Azores are those of Portugal, in addition to which there are certain municipal import duties.)

### BELGIUM.

| No. | Items. | Duty. |
|---|---|---|
| 15 | Fish, including oysters and all preserved fish and shellfish | Free. |
| 21 | Nets and other articles for sea fishing (such as fishhooks, cutlasses, blocks, tubs, axes, etc., necessary to fishermen) | Do. |
| 30 | Fish oil | Do. |
| 33 | Whalebone and mother-of-pearl | 5 p.ct. |

## DENMARK.

(Revised to December, 1894.)

[Kroner = $0.268. Pound = $\frac{1000}{1101}$ United States pound.]

| No. | Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|---|
| | | Unit. | Rate. | |
| | | | *Kroner.* | |
| 2 | Turtles | 100 pounds | 0.50 | $0.14 |
| 6 | Bones (n. e. s.) | do | 33.33 | 0.06 |
| 22 | Fish: | | | |
| | Alive and fresh | | Free. | |
| | Dried, smoked, salted, preserved, or spiced— | | | |
| | Anchovies, lampreys, salmon, sardines, caviar, mussels, and oysters | 100 pounds | 6.25 | 1.70 |
| | Other sorts | do | .62 | .17 |
| | In hermetically closed cans | do | 14.58 | 3.96 |
| 47 | Oils, not otherwise specified | do | 4.16 | 1.13 |

## FRANCE.

(Tariff law of January 11, 1892.)

[Franc = $0.193. Kilogram = 2.2046 pounds.]

| No. | Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|---|
| | | Unit. | Rate. | |
| | | | *Francs.* | |
| 14 | Turtles | 100 kilos | 20.00 | $1.75 |
| 29 | Poil de messine (silk gut used only for fishing lines) | | Free. | |
| 44 | Fish: | | | |
| | Fresh, sea | 100 kilos | 20.00 | 1.75 |
| | Fresh, fresh-water of the salmonoid family | do | 10.00 | .875 |
| | Fresh water, other | do | 5.00 | .44 |
| 45 | Dried, salted, smoked, cod, or klipp fish | do | 48.00 | 4.20 |
| | stockfish and herrings | do | 15.00 | 1.32 |
| | Other dried, salted, or smoked | do | 25.00 | 2.19 |
| 46 | Preserved in oil or pickled | do | 25.00 | 2.19 |
| 47 | Oysters: | | | |
| | Fresh, seed | | Free. | |
| | Fresh, other | Per thousand | 1.50 | |
| | Pickled | 100 kilos | 5.00 | .44 |
| 48 | Lobsters: | | | |
| | Alive or fresh boiled | do | 15.00 | 1.32 |
| | Preserved or prepared | do | 25.00 | 2.19 |
| 49 | Mussels and other shellfish | | Free. | |
| 50 | Fish oils | 100 kilos | 6.00 | .526 |
| 51 | Whale oil, spermaceti: | | | |
| | Crude | do | 5.00 | .439 |
| | Pressed | do | 10.00 | .875 |
| | Refined | do | 15.00 | 1.317 |
| 52 | Roe, cod and mackerel | do | .60 | .053 |
| 53 | Whalebone, uncut | | Free. | |
| 54 | Seal skins, raw | | Free. | |
| 55 | Coral, rough, uncut | | Free. | |
| 56 | Pearls, fine (natural) | | Free. | |
| 57 | Fish bladders, raw or simply dried | | Free. | |
| 58 | Sponges, raw | 100 kilos | 35.00 | 3.045 |
| | prepared, fine | do | 65.00 | 5.687 |
| 62 | Turtle shell | | Free. | |
| 64 | Nacreous shells, mother-of-pearl, haliotis, and others for working | | Free. | |
| 321 | Spermaceti candles | 100 kilos | 10.00 | 1.40 |
| 324 | Fish glue or isinglass | do | 40.00 | 3.50 |
| 547 | Fishhooks | do | 100.00 | 8.75 |
| 530 | Fishing nets | do | 20.00 | 1.75 |
| 529 | Coral, cut, unset | | Free. | |
| 531 | Strips of whalebone, cut and prepared | 100 kilos | 100.00 | 8.75 |

## GERMANY.

(Tariff law of July 15, 1879, as amended May 22, 1885, and again December 21, 1887.)

[Mark = $0.238. Kilogram = 2.2046 pounds.]

| No. | Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|---|
| | | Unit. | Rate. | |
| | | | *Marks.* | |
| 2 | Cotton fish nets, new | 100 kilos | 3.00 | $0.32 |
| 5 | Sea grass and sea tangle | | Free. | |
| 12 | Seal skins and skins of fish, for leather | | Free. | |
| 20 | Wares partially or entirely of genuine pearls or corals | 100 kilos | 600.00 | 64.77 |
| 20 | Wares partially or entirely mother-of-pearl, or turtle shells | do | 200.00 | 21.59 |
| 25 | Fish: | | | |
| | Fresh | | Free. | |
| | Salt (with exception of herring), imported in barrels; dried, smoked, roasted, cooked. (Stockfish, dried cod.) | 100 kilos | 3.00 | .32 |
| | Preserved with vinegar, oil, or spices, imported in barrels | do | 12.00 | 1.30 |
| | Other prepared fish of all sorts, hermetically sealed | do | 60.00 | 6.48 |
| | Herring, salt | Per barrel | 3.00 | .16 |
| | Salt herring not in usual commercial packing | 100 kilos | 2.00 | .22 |
| | Salt herring intended for manure after denaturalization | | Free. | |
| | Caviar and caviar surrogate | 100 kilos | 150.00 | 16.19 |
| | Sea animals, and the like, preserved, steamed, or salted, in bottles, cans, and the like | do | 60.00 | 6.48 |
| | Other sea mussels, or shellfish | do | 24.00 | 2.59 |
| | Oysters, lobsters, and turtles | do | 50.00 | 5.39 |
| 33 | Pearls and coral, unset | do | 60.00 | 6.48 |
| 26 | Fish fat and fish oil | do | 3.00 | .32 |
| 37 | River crabs, fresh or cooked; wash sponges, and other fish products, mussels from the sea, fresh or cooked, unshelled, with exception of oysters | | Free. | |

## ITALY.

(Tariff law of January 1, 1892.)

[Lira = $0.193. Kilogram = 2.2046 pounds.]

| No. | Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|---|
| | | Unit. | Rate. | |
| | | | *Lira.* | |
| 6 | Fixed oils: | | | |
| | Mixed fish | 100 kilos | 6 | $0.525 |
| | Not otherwise mentioned | do | 15 | 1.31 |
| 102 | Fishing nets, as the material, and in addition thereto | 10 per cent | | |
| 306 | Fish: | | | |
| | Fresh of all kinds | | Free. | |
| | Dried or smoked | 100 kilos | 5 | .437 |
| | In brine | do | 6 | .525 |
| | Seasoned in oil or vinegar (including tunny fish) in boxes | do | 30 | 2.626 |
| | Seasoned in oil or vinegar (including tunny fish) otherwise preserved | do | 30 | 2.626 |
| 307 | Caviar and other prepared fish eggs | do | 30 | 2.626 |
| 320 | Fish glue or isinglass | do | 15 | 1.31 |
| 323 | Sponges: | | | |
| | Common— | | | |
| | Crude | | Free. | |
| | Cleaned | 100 kilos | 40 | 3.50 |
| | Fine— | | | |
| | Crude | | Free. | |
| | Cleaned | 100 kilos | 200 | 17.508 |
| 324 | Coral: | | | |
| | Not manufactured | | Free. | |
| | Manufactured, if not mounted with gold | Kilo | 1,000 | 87.54 |
| 325 | Mother-of-pearl: | | | |
| | Not manufactured | | Free. | |
| | Manufactured | 100 kilos | 150 | 13.13 |

## GREECE.

(Law of 1887, as amended to take effect 1st (13th) February, 1892.)

[Drachma = $0.193. Oke = 2.84 pounds.]

| No. | Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|---|
| | | Unit. | Rate. | |
| | | | *Drachma.* | |
| 12 | Candles, sperm | Oke | 2.00 | $13.59 |
| 22 | Fish: | | | |
| | Fresh fish in general, and sponge | | Free. | |
| | Salted, smoked, or dried, except following | Oke | .30 | 2.04 |
| | White mullet, sardines, tunny, lobsters, etc., in cans | do | 2.00 | 13.59 |
| | Inkfish, octopod, eels, oysters | do | .50 | 3.40 |
| | Codfish and stockfish | do | .20 | 1.36 |
| | Red caviar | do | .20 | 1.36 |
| | Black caviar | do | 3.00 | 20.39 |
| | Shellfish, except oysters | do | .05 | .35 |
| 28 | Fish glue: | | | |
| | Common | do | .40 | 2.72 |
| | Refined | do | 1.00 | 6.79 |
| 38 | Real pearls, prepared | | Free. | |
| | Coral | Oke | 1.00 | 6.79 |
| 47 | Fish oil | do | .50 | 3.40 |

## NETHERLANDS.

(Tariff law in effect July 1, 1895.)

[Florin = $0.402. Kilogram = 2.2046 pounds.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Florins.* | |
| Candles, sperm | | 5 per cent. | |
| Coral, manufactured | | do | |
| Fish, preserved in tins | 100 kilos | 25.00 | $4.56 |
| Mother of pearl shells, manufactured | | 5 per cent. | |
| Oil | 100 kilos | .55 | .10 |
| Whalebone (mercery) | | 5 per cent. | |

## NORWAY.

(Law as amended, to go into effect August 1, 1892.)

[Krone = $0.268. Kilogram = 2.2046 pounds.]

| Item. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Krone.* | |
| Coral, crude or unmanufactured | | Free. | |
| Cotton fish nets, as the material, and in addition thereto | | 10 per cent. | |
| Fish, pickled, spiced, or preserved in oil, smoked, and caviar | Kilogram | .40 | $1.80 |
| Other fish | | Free. | |
| Fishing rods | Kilogram | .35 | 4.25 |
| Fish and whale oil | do | .04 | .48 |
| Isinglass or fish glue | do | 1.50 | 18.23 |
| Linen fish nets, as the material, and in addition thereto | | 10 per cent. | |
| Pearls, natural, not set | | Free. | |
| Sardines or anchovies | Kilogram | .20 | 2.40 |
| Other canned fish | do | .40 | 4.80 |
| Seal skin, dressed, single or sewed together | do | 2.40 | 29.17 |
| Spermaceti oil | do | .04 | .48 |
| Sponges | do | 2.67 | 32.45 |
| Whalebone, cut | | Free. | |

## PORTUGAL.

(Tariff law of June 17, 1892.)

[1000 reis = $1.08. Kilogram = 2.2046 pounds.]

| No. | Item. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|---|
| | | Unit. | Rate. | |
| | | | *Reis.* | |
| 13 | Sponges | Kilogram | 270 | $13.22 |
| 26 | Fish oil | do | 10 | .49 |
| 38 | Pearls | | 3 per cent ad val. | |
| 152 | Wax, animal | Kilogram | 22 | 1.08 |
| 348 | Codfish | do | 39 | 1.91 |
| 349 | Shellfish | do | 6 | .29 |
| | Fish: | | | |
| 350 | Fresh, unprepared | do | 10 | .49 |
| 351 | Salted, pressed, smoked, or pickled | do | 20 | .98 |
| 352 | Sardines, fresh, salted, or pressed | do | 5 | .24 |
| 357 | Alimentary preserves | do | 200 | 9.79 |
| 404 | Fishing nets | do | 120 | 5.42 |
| 429 | Whalebone, prepared in the rough | do | 800 | 39.19 |
| 590 | Candles, sperm | do | 120 | 5.87 |

## RUSSIA.

(Revised to January, 1891.)

[Ruble = $0.389. Pound = 14 ounces avoirdupois. Pood = 36.112 English pounds.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Rubles.* | |
| Spermaceti | Pood | 1.20 | $1.29 |
| Whale and cod-liver oil, unpurified | do | .60 | .65 |
| Mother of pearl | do | 2.40 | 2.58 |
| Fish glue | do | 6.00 | 6.46 |
| Fish skins | do | 10.80 | 11.64 |
| Sponges | do | 2.40 | 2.58 |
| Whalebone of all kinds | do | 2.65 | 2.85 |
| Fish: | | | |
| Fresh— | | | |
| Turbot, soles, trout | do | 2.40 | 2.58 |
| All other kinds | do | .12 | .13 |
| Pickled and prepared in oil, also caviar | do | 5.00 | 5.38 |
| Salted and smoked, except herrings | do | 1.20 | 1.29 |
| Herrings, salted or smoked; cod and all other fish, kippered or air dried. | do | .27 | .29 |
| Oysters, lobsters, etc., in hermetically sealed vessels | do | 5.00 | 5.38 |
| Furs: | | | |
| Seal skins | do | 18.00 | 19.39 |
| Sea otter | do | 36.00 | 38.77 |

## SPAIN AND BALEARIC ISLANDS.

(Tariff law taking effect February 1, 1892, modified by law of July 16, 1892.)

[Peseta = $0.193. Kilogram = 2.2046 pounds.]

| No. | Item. | Duty. Unit. | Duty. Rate. | Rate per 100 pounds. |
|---|---|---|---|---|
| | | | *Pesetas.* | |
| 125 | Sperm of whale: | | | |
| | In mass | 100 kilos | 20.00 | $1.75 |
| | Manufactured | do | 25.00 | 2.19 |
| 250 | Animal fats | do | 1.00 | .09 |
| 290 | Codfish and stockfish | do | 18.00 | 1.58 |
| | Law of July, 1876—provisional duty | do | 3.00 | .26 |
| | Law of July, 1877—municipal duty | do | 3.00 | .26 |
| 291 | Fresh fish | do | 1.50 | .13 |
| 292 | Fish, salted, smoked, or pickled | do | 12.00 | 1.05 |
| 293 | Seed oysters and shellfish | do | 3.00 | .26 |
| 294 | Oysters and shellfish | do | 8.00 | .70 |
| 341 | Whalebone, shell, and coral, in the rough or cut in strips | Kilogram | .10 | .87 |
| 342 | Coral and mother-of-pearl, manufactured | do | 17.10 | 149.62 |
| 343 | Whalebone, manufactured | do | 2.50 | 21.88 |

## SWEDEN.

[Kroner = $0.268. Kilogram = 2.2046 pounds.]

| Items. | Duty. Unit. | Duty. Rate. | Rate per 100 pounds. |
|---|---|---|---|
| | | *Kroner.* | |
| Bones: | | | |
| Walrus teeth | 100 kilos | 118.00 | $14.35 |
| Other kinds | do | 35.00 | 4.26 |
| Fish: | | | |
| Anchovies and sardines, in oil or brine, hermetically sealed (weight of boxes included). | do | 20.00 | 2.43 |
| Other kinds preserved (weight of boxes included) | do | 30.00 | 3.65 |
| All other kinds of fish, fresh, dry or salted | | Free. | |
| Fish glue | 100 kilos | 20.00 | 2.43 |
| Oils | | Free. | |
| Otter skins, undressed | 100 kilos | 25.00 | 3.04 |
| Otter skins, dressed | do | 40.00 | 4.86 |
| Sturgeon sounds | do | 170.00 | 20.67 |

## SWITZERLAND.

(General tariff law of January 1, 1893.)

[Franc = $0.193. Kilogram = 2.2046 pounds.]

| Items. | Duty. Unit. | Duty. Rate. | Rate per 100 pounds. |
|---|---|---|---|
| | | *Francs.* | |
| Sponges | 100 kilos | 20.00 | $1.75 |
| Fish glue and isinglass | do | 7.00 | .61 |
| Fresh fish | do | 2.50 | .22 |
| Fish, dried, salted, pickled, smoked, or otherwise prepared: | | | |
| In receptacles of less than 5 kilograms weight | do | 16.00 | 1.40 |
| In receptacles of more than 5 kilograms weight | do | 1.00 | .09 |
| Shellfish: Oysters, lobsters, etc., fresh | do | 30.00 | 2.62 |
| Fish oil, in casks | do | .50 | .04 |
| Spermaceti | do | .50 | .04 |
| Whalebone: | | | |
| Raw or stripped | do | 4.00 | .34 |
| Polished | do | 16.00 | 1.40 |
| Mother-of-pearl | do | 10.00 | .87 |
| Pearls, not set | do | 50.00 | 4.38 |
| Coral, not set | do | 30.00 | 2.63 |

## UNITED KINGDOM.

(There are no customs duties on fishery products imported into Great Britain and Ireland.)

## DOMINION OF CANADA.

(Revised to November, 1895.)

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| Ambergris | | Free. | |
| Fish: | | | |
| Mackerel | Pound | 1 cent. | $1.00 |
| Herrings, pickled or salted | do | ½ cent. | .50 |
| Salmon, pickled or salted | do | 1 cent. | 1.00 |
| All other fish, pickled or salted, in barrels | do | 1 cent. | 1.00 |
| not in barrels | do | ½ cent. | .50 |
| Smoked and boneless fish, not in barrels | do | 1 cent. | 1.00 |
| Anchovies and sardines— | | | |
| In boxes, 5 by 4 by 3½ inches | Per box | 5 cents. | |
| 5 by 4 by 1⅝ inches | do | 2½ cents. | |
| 4¾ by 3½ by 1¼ inches | do | 2 cents. | |
| In any other form | | 30 per cent. | |
| Other fish, preserved in oil | | 30 per cent. | |
| Oysters— | | | |
| In the shell | | 25 per cent. | |
| Shelled, in bulk | Gallon | 10 cents. | |
| Canned, in cans not over 1 pint (including cans) | Can | 3 cents. | |
| in cans over 1 pint and not over 1 quart | do | 5 cents. | |
| All other fish | | 25 per cent. | |
| Fishhooks, nets and seines, and fishing lines and twines, but not to include sporting, fishing tackle, hooks and flies, trawling spoons, threads or twines used for sewing or manufacturing purposes | | Free. | |
| Fishing rods | | 30 per cent. | |
| Fish skins, for manufacture | | Free. | |
| Glue, sheet, broken sheet, and ground | Pound | 3 cents. | 3.00 |
| liquid, including mucilage | | 30 per cent. | |
| Kelp, seaweed, and sea grass | | Free. | |
| Mother-of-pearl, unmanufactured | | Free. | |
| Spermaceti, whale, and other fish oils | | 20 per cent. | |
| Tortoise and other shells, unmanufactured | | Free. | |
| Whalebone, unmanufactured | | Free. | |
| All other articles, the product of the fisheries, not specially provided for | | 20 per cent. | |

## NEWFOUNDLAND.

[Dollar = $1.014.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| Fish: | | | |
| Cod and haddock | Quintal | $1.50 | $1.34 |
| Oysters and clams in shells | | Free. | |
| Fish of British catch and cure, and oil, the produce of such fish | | Free. | |
| Fishing tackle (except fishing tackle for anglers) | | 7½ per cent. | |

## MEXICO.

(Law of May 15, 1891, modified by decree of April 30, 1894, to take effect July 1, 1894.)

[Peso = $0.528. Kilogram = 2.2046 pounds.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Pesos.* | |
| Candles, sperm | Kilogram | 0.20 | $4.79 |
| Coral, in the rough | do | .25 | 7.99 |
| Coral, wrought | do | 1.50 | 35.93 |
| Fish: Fresh and in ice | | Free. | |
| Fish and shellfish, dry, salted, smoked, or pickled | Kilogram | .12 | 2.87 |
| Preserved fish and shellfish | do | .15 | 3.59 |
| Fish glue | do | .15 | 3.59 |
| Mother-of-pearl, in the rough | do | .25 | 7.99 |
| Oil, cod liver | do | .10 | 2.40 |
| Oil, fish | do | .10 | 2.40 |
| Pearls, unset | Carat | .50 | ..... |
| Spermaceti | Kilogram | .25 | 7.99 |
| Sponges, fine | do | 2.00 | 47.90 |
| Sponges, common | do | .40 | 9.58 |
| Whalebone | do | .10 | 2.40 |

## COSTA RICA.

(Tariff law of September 7, 1885.)

[Peso = $0.486. Kilogram = 2.2046 pounds.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Pesos.* | |
| Fish: | | | |
| With or without oil, in tins or otherwise | Kilogram | 0.07 | $1.54 |
| Shellfish, preserved, with or without oil, or with condiments, in cans, or otherwise | do | .07 | 1.54 |
| Fishhooks | do | 1.09 | 24.03 |
| Glue | do | .11 | 2.42 |
| Mother-of-pearl, manufactured | do | 2.17 | 47.84 |
| Oil | do | .11 | 2.42 |
| Pearls, fine, unmounted | do | 100.00 | ..... |
| Spermaceti | do | .07 | 1.54 |
| Whalebone | do | .54 | 11.90 |

## GUATEMALA.

(Tariff promulgated November 4, 1893, and in force since January 1, 1894, and supplementary decree of December 20, 1893, reducing the additional duties imposed by former laws to 15 per cent.)

[Peso = $0.486. Kilogram = 2.2046 pounds.]

| No. | Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|---|
| | | Unit. | Rate. | |
| | | | *Pesos.* | |
| 47 | Cod, dried, salted, or smoked, in bulk | | Free. | ..... |
| 924 | Fishhooks, all kinds, with or without gut and float, including weight of container | Kilogram | .30 | $6.61 |
| 1701 | Coral, wrought, polished, or cut into beads, including weight of container | do | 2.00 | 44.09 |
| 1748 | Fish glue | do | .80 | 17.64 |
| 1861 | Spermaceti, in cakes, gross weight | do | .25 | 5.51 |
| 1862 | Spermaceti, in candles, gross weight | do | .30 | 6.61 |
| 1863 | Sponges | do | 6.00 | 132.27 |
| 1904 | Whalebone | do | .75 | 16.53 |
| 2038 | Caviar, gross weight | do | .25 | 5.51 |
| 2047 | Codfish and herring, dried, salt, smoked, or pickled, packed in wood or earthen vessels | do | .15 | 3.31 |
| 2048 | Canned, preserved, or in oil | do | .25 | 5.51 |
| 2075 | Lobsters, preserved | do | .25 | 5.51 |
| 2101 | Salmon, canned | do | .25 | 5.51 |
| 2102 | Sardines, smoked, salted, pickled, or dried, not in cans | do | .15 | 3.31 |
| 2103 | Sardines, in cans | do | .25 | 5.51 |
| 2113 | Shellfish, preserved in any package | do | .24 | 5.29 |
| 2114 | Shrimp, canned | do | .25 | 5.51 |
| 2174 | Ambergris, net weight | Gram | 1.00 | ..... |
| 2550 | Isinglass | Kilogram | .80 | 17.63 |
| 2639 | Fish oil | do | .10 | 2.20 |
| 2641 | Cod-liver oil | do | .20 | 4.41 |

## HONDURAS.

[Peso = $0.486. Libra = 1.043 pounds.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Pesos.* | |
| Candles, sperm | Libra | .04 | $1.86 |
| Coral in any form, except when set in gold or silver | do | .50 | 23.30 |
| Fish: | | | |
| Pickled, salted, or smoked | do | .02 | .93 |
| Canned | do | .08 | 3.73 |
| Sardines, in oil or otherwise | do | .04 | 1.86 |
| Fish glue | do | .18 | 8.39 |
| Mother-of-pearl | do | .24 | 11.18 |
| Oil, cod-liver | do | .02 | .93 |
| Oil, other | do | .02 | .93 |
| Spermaceti | do | .04 | 1.86 |
| Sponges | do | .50 | 23.30 |

## NICARAGUA.

(Tariff law of July 25, 1888.)

[Peso = $0.486. Libra = 1.043 pounds.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Pesos.* | |
| Candles, sperm | Libra | .05 | $2.33 |
| Coral, manufactured | do | 2.50 | 116.45 |
| Coral, mounted with gold or silver | do | 5.00 | 232.90 |
| Fish: | | | |
| Shellfish, all kinds, preserved in oil, vinegar, etc | do | .04 | 1.86 |
| Dried or smoked | do | .03 | 1.40 |
| Preserved in oil, vinegar, etc | do | .07 | 3.26 |
| Dried or smoked | do | .05 | 2.33 |
| Fish glue | do | .06 | 2.80 |
| Fishhooks | do | .20 | 9.32 |
| Oil, cod-liver, and other | do | .03 | 1.40 |
| Pearls, real, not set | do | 5.00 | 232.90 |
| Sponges of all kinds | do | 1.00 | 46.59 |
| Whalebone | do | .40 | 18.64 |

NOTE.—Decree of December 19, 1891, No. IV, increased above duties 100 per cent.

## SALVADOR.

(Law of March 24, 1888, revised to March 23, 1892.)

[Peso = $0.486. Kilogram = 2.2046 pounds.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Pesos.* | |
| Coral, unmanufactured | Kilogram | 5.00 | $110.22 |
| Fish: | | | |
| Herring, cod, and other fish, not further prepared than dried, salted, or smoked | do | .15 | 3.31 |
| Fish prepared in vessels of tin, glass, or earthenware | do | .20 | 4.40 |
| Fishhooks | do | .35 | 7.71 |
| Fish glue | do | .10 | 2.20 |
| Mother-of-pearl, unmanufactured | do | .20 | 4.40 |
| Oil, cod liver | do | .30 | 6.60 |
| whale | do | .08 | 1.76 |
| Pearls, fine | do | 10.00 | 220.45 |
| Spermaceti, in mass | do | .20 | 4.40 |
| manufactured in any form | do | .30 | 6.60 |
| Sponges of all kinds | do | 5.00 | 110.22 |
| Whalebone | do | 1.00 | 22.04 |

## BRITISH HONDURAS.

(Act of January 4, 1895.)

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| Candles, sperm | Pound | $0.02 | $2.00 |
| Fish, salted, dry, or wet | | Free. | |
| Fresh fish and fresh oysters | | Free. | |
| Oil | Gallon | .06 | |
| Turtle, live | | Free. | |
| Other products | | 10 per cent. | |

## BRITISH WEST INDIES—BAHAMAS.

[Shilling = $0.243.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | s. d. | |
| Candles, sperm | 100 pounds | 11 0 | $2.67 |
| Caviar and other fish ova | | Free. | |
| Fish: | | | |
| Dried or salted | 100 pounds | 2 6 | .50 |
| Pickled salmon, shad, and mackerel | Barrel | 4 6 | .49 |
| Pickled herring, alewives, and other kinds | do | 4 6 | .49 |
| Fresh | | Free. | |
| Sperm oil | Gallon | 1 0 | |
| Sponges | | Free. | |
| Turtle | | Free. | |

## BRITISH WEST INDIES—JAMAICA.

(Revised to January, 1893.)

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | s. d. | |
| Candles, sperm | Pound | 0 2 | $4.05 |
| Fish: | | | |
| Fresh fish and turtle | | Free. | |
| Canned | | 8 per cent. | |
| Dried or salted | 100 pounds | 3 6 | .74 |
| Smoked, not otherwise numerated or described | Pound | 0 0½ | 1.00 |
| Alewives, pickled | Bbl., 200 lbs | 2 6 | .30 |
| Herring, pickled | do | 2 6 | .30 |
| smoked | Pound | 0 0½ | .50 |
| Mackerel, pickled | Bbl., 200 lbs | 4 6 | .49 |
| Pickled, not otherwise enumerated or described | do | 4 6 | .49 |
| Salmon, smoked | Pound | 0 2 | 4.05 |
| wet or salted | Bbl., 200 lbs | 10 6 | 1.22 |
| All others | | 12½ per cent. | |

## BRITISH WEST INDIES—BARBADOS.

(Tariff of 1889.)

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| Blubber and heads and offal of fish | | Free. | |
| Fish: | | | |
| Dried, salted, or smoked | Quintal | $0.05 | $0.045 |
| Pickled | Barrel | .10 | .05 |
| Fresh fish and turtle | | Free. | |
| Fish on ice and salmon and oysters in cans | | Free. | |
| All others | | 8 per cent. | |
| Turtle-shells, unmanufactured | | Free. | |

## DUTCH WEST INDIES.

(All fishery products imported pay 1½ per cent ad valorem.)

## FRENCH WEST INDIES—GUADALOUPE.

[Franc = $0.193. Kilogram = 2.2046 pounds.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Francs.* | |
| Ambergris | | 10 per cent. | |
| Fish: | | | |
| Canned | 100 kilos | 40.00 | $3.48 |
| Codfish, dried, salted, or smoked | do | 3.00 | .26 |
| In oil | do | 21.00 | 1.83 |
| Oil: Cod liver | do | 15.00 | 1.32 |
| Fish | do | 15.00 | 1.32 |
| Oysters | do | 15.00 | 1.32 |
| Sponges | | 10 per cent. | |
| Turtles | | 5 per cent. | |
| All others | | 6 per cent. | |

## FRENCH WEST INDIES—MARTINIQUE.

[Franc = $0.193. Kilogram = 2.2046 pounds.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Francs.* | |
| Candles, sperm | 100 kilos | 4.30 | $0.38 |
| Fish: | | | |
| Dry, salted, or smoked codfish | do | 4.00 | .35 |
| Anchovies | do | 16.00 | 1.40 |
| In cans, natural state, pickled or otherwise prepared | do | 16.00 | 1.40 |
| Others | do | 2.70 | .24 |
| Fish fat | do | 3.75 | .33 |
| Turtles, sea | do | 6.46 | .57 |
| All others | | 5.35 per cent. | |

## CUBA.

[Peso = $0.926. Kilogram = 2.2046 pounds.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Pesos.* | |
| Fish: | | | |
| Live | | Free. | |
| Common sorts, smoked, dried, salted, or pickled, as Halifax and Newfoundland cod, herring, mackerel, skate, hake, haddock, pressed sardines, exclusive of weight of brine | 100 kilos | 1.80 | $0.76 |
| Superior sorts, dried or pickled, as anchovies, tunny fish, salmon, cod sounds, Norwegian, Swedish, and Scotch cod, stockfish, and other north European and all classes of live and dried shellfish, including weight of brine and package, if glass | do | 2.85 | 1.20 |
| Sardines preserved in tins, including package | do | 12.00 | 5.04 |
| Fish of other kinds preserved in oil, not specified above, pickled or otherwise prepared; fresh or canned oysters, including package | do | 1.80 | .76 |
| Oil, fish, liquid, including weight of interior package when of glass | do | 5.20 | 2.19 |
| Oil, solid, as spermaceti | do | 4.50 | 1.89 |
| Whalebone, coral, and mother-of-pearl, rough | Kilogram | 1.50 | 63.60 |
| Whalebone, cut and prepared to be used, but unpolished | do | 2.60 | 109.20 |
| Whalebone, polished and prepared for use | do | 2.60 | 109.20 |

## PUERTO RICO.

[Peso = $0.926. Kilogram = 2.2046 pounds.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Pesos.* | |
| Alimentary conserves | Kilogram | .01 | 4.20 |
| Coral and mother-of-pearl, not cut | do | 1.50 | 63.00 |
| Fish: | | | |
| Codfish and stockfish | 100 kilos | .90 | .38 |
| Fresh, salted, smoked, pickled, and shellfish | do | .90 | .38 |
| Live | | Free. | |
| Oils | 100 kilos | 4.50 | 1.89 |
| Whalebone | Kilogram | 1.50 | 63.00 |
| Spermaceti, manufactured or crude | 100 kilos | 4.50 | 1.89 |

## HAITI.

(Revised to September 1, 1893.)

[Gourde = $0.965.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Gourde.* | |
| Alimentary conserves | Can | .10 | $9.65 |
| Fish: | | | |
| Anchovies— | | | |
| In cases of 12 boxes | Dozen | .30 | |
| In pots | Pot | .15 | |
| Codfish | Cwt | 1.40 | 1.35 |
| Codfish tongues, in kegs or pots | Each | .12 | |
| Eels | Quintal | 2.00 | 1.93 |
| Alewives | Barrel | 1.50 | .72 |
| smoked | Box | .06 | |
| Herring | Barrel | 1.50 | .72 |
| smoked, in ¼ or ⅛ barrel or box | Each | .06 | |
| Mackerel | Barrel | 1.50 | .72 |
| Oysters, pickled in kegs or pots | Each | .18 | |
| Salmon— | | | |
| In barrels (200 pounds) | Barrel | 1.50 | .72 |
| In half barrels (100 pounds) | Half-barrel | .75 | .72 |
| In quarter barrels (50 pounds) | Quarter-barrel | .37 | .72 |
| Sardines— | | | |
| In barrels | Barrel | .50 | |
| In pots | Pot | .20 | |
| In oil, tin boxes | Box | .10 | |
| Same, half boxes | Half boxes | .08 | |
| Same, quarter boxes | Quarter box | .04 | |
| Fish glue | Pound | .05 | 4.82 |
| Fishhooks, assorted | Thousand | .50 | |
| Fishing lines | Pound | .04 | 3.86 |
| Pearls, fine | | 20 per cent. | |
| Spermaceti | Pound | .10 | 9.65 |
| Sponges, fine | do | .35 | 33.77 |
| common, for horses | do | .06 | 5.79 |

## SANTO DOMINGO.

[Mexican dollar = $0.528. Liter = 1.0567 quarts. Quintal = 112 pounds.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Mexican dollars.* | |
| Candles, sperm | Quintal | 24.00 | $11.32 |
| Coral, not made into ornaments | Pound | 3.60 | 190.08 |
| Fish: | | | |
| Anchovies | do | .18 | 9.50 |
| Cod, dry or salt | Quintal | 1.80 | .85 |
| Herring, smoked | do | 1.80 | .85 |
| pickled | Barrel | 4.80 | 1.27 |
| Mackerel, No. 1 | do | 7.20 | 1.90 |
| No. 2 | do | 6.00 | 1.58 |
| No. 3 | do | 4.80 | 1.27 |
| Oysters, however packed | Quintal | 6.00 | 2.82 |
| Salmon, pickled or unpickled | do | 7.20 | 3.39 |
| Sardines, salted | do | 4.80 | 2.26 |
| in oil, however packed | Pound | .18 | 9.50 |
| Tunny, in brine | do | .06 | 3.17 |
| in oil | do | .12 | 6.33 |
| Fishhooks | do | .90 | 47.52 |
| Fishing lines | Quintal | 7.20 | 3.39 |
| Oil, cod liver | Liter | .30 | ..... |
| 4 to 32 ounce phials | Pound | .24 | 12.67 |
| fish | Gallon | .24 | 1.27 |
| spermaceti or whale | do | .30 | 1.58 |
| Pearls | Ounce | 3.60 | ..... |
| Preserved food, in cans | Pound | .12 | 6.33 |
| Spermaceti, crude | Quintal | 15.00 | 7.07 |
| manufactured | do | 30.00 | 14.13 |
| Sponges, fine | Pound | 3.60 | 190.08 |
| common | do | 2.40 | 126.72 |
| Whalebone | do | .15 | 7.92 |

## ARGENTINA.

(January 1, 1893.)

[Peso = $0.965. Kilogram = 2.2046 pounds.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Pesos.* | |
| Ambergris | Gram | .25 | ..... |
| Caviar | Kilogram | .20 | $8.75 |
| Fish: | | | |
| Fresh | | Free | ..... |
| Cod and other similar fish | Kilogram | .09 | 3.92 |
| Same in pieces | do | .15 | 6.57 |
| Codfish tongues, wrapping or vessel included | do | .138 | 6.04 |
| Fish in brine or pressed, vessel included | do | .096 | 4.20 |
| Fish and shellfish, preserved in oil or natural | do | .30 | 13.13 |
| Herring— | | | |
| Smoked, in firkins | do | .144 | 6.29 |
| Smoked, in boxes | do | .24 | 10.51 |
| Oysters, including container | do | .09 | 3.94 |
| Shrimps, dry | do | .312 | 13.65 |
| Stockfish, in bundles, including wrapper | do | .12 | 5.26 |
| Fish glue | do | 1.00 | 43.77 |
| Fishhooks | do | .155 | 6.78 |
| Oils | 100 kilos | .32 | .14 |
| Oil, cod liver | Kilogram | .05 | 2.19 |
| Pearls | Gram | .36 | ..... |
| Spermaceti | Kilogram | .20 | 8.75 |
| Spermaceti candles, in packages, including wrapper | do | .225 | 9.85 |
| Sponges: | | | |
| Fine for toilet | do | 12.50 | 547.10 |
| Fair for toilet | do | 5.00 | 218.84 |
| Bath and carriage | do | 2.00 | 87.54 |
| For horses | do | .875 | 38.29 |
| Medicated, Bahama, for scrubbing | do | .50 | 21.88 |

## BOLIVIA.

(Law of November 25, 1893.)

[Boliviano = $0.486. Kilogram = 2.2046 pounds.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Bolivianos.* | |
| Ambergris | Kilogram | 18.00 | $396.72 |
| Caviar | do | .30 | 6.60 |
| Coral, in natural state | do | 1.50 | 33.06 |
| Fish: | | | |
| Codfish | do | .0375 | .83 |
| Dried, smoked; not canned | do | .03 | .66 |
| Canned | do | .05 | 1.10 |
| In brine, in wood | do | .025 | .55 |
| Fish or shellfish, in oil or water | do | .075 | 1.65 |
| Lobsters, shrimps, and oysters | do | .05 | 1.10 |
| Sardines, in oil | do | .0875 | 1.92 |
| Fish glue | do | .90 | 19.84 |
| Fishhooks, all sizes | do | .15 | 3.30 |
| Isinglass | do | .18 | 3.96 |
| Oil: | | | |
| Cod liver | do | .21 | 4.62 |
| Whale and seal, crude | do | .036 | .80 |
| refined | do | .06 | 1.32 |
| Sperm, crude | do | .06 | 1.32 |
| refined | do | .105 | 2.31 |
| Spermaceti, crude | do | .21 | 4.63 |
| refined | do | .30 | 6.61 |
| Sponges, fine | do | 3.60 | 79.34 |
| common | do | .75 | 16.53 |
| Whalebone, rough | do | .12 | 2.64 |
| manufactured | do | .75 | 16.53 |

## BRAZIL.

(Tariff promulgated by decree No. 836 of the Provisional Government on the 11th of October, 1890.)

[Milreis = $0.546. Kilogram = 2.2046 pounds. Gram = 15.432 grains.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Milreis.* | |
| Ambergris | Gram | .30 | ..... |
| Coral, branch or manufactured | Kilogram | 5.00 | $123.82 |
| Fish: | | | |
| Dried, salted, or pickled | do | .04 | 1.00 |
| Fresh or frozen | do | .04 | 1.00 |
| Sardines and other preserved fish | do | .48 | 11.88 |
| All others | do | .70 | 17.33 |
| Fishing nets | do | 2.40 | 59.42 |
| Mother-of-pearl, rough, sawed, or prepared | do | .64 | 15.84 |
| Oil, for lubricating | do | .15 | 3.70 |
| purified | do | .50 | 12.38 |
| cod liver | do | .64 | 15.84 |
| Shells, not classified | do | .30 | 7.43 |
| Spermaceti | do | .40 | 9.90 |
| Sponges: | | | |
| Fine | do | 14.00 | 346.71 |
| Common | do | 3.00 | 74.30 |
| Whalebone | do | .26 | 6.44 |

## CHILE.

[Peso = $0.912. Kilogram = 2.2046 pounds.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Pesos.* | |
| Ambergris | Kilogram | 15.00 | $620.50 |
| Coral, rough or unworked | | 15 per cent. | |
| Candles, spermaceti | Kilogram | .35 | 14.49 |
| Caviar, in wood, including package | do | .28 | 11.58 |
| Fish: | | | |
| Anchovies, sardines, etc., dried, smoked, or in brine— | | | |
| In wood, gross weight | do | .0595 | 2.40 |
| In tin, crockery, or glass, gross weight | do | .0875 | 3.60 |
| Codfish, mackerel, etc., dried, smoked, or in brine— | | | |
| In wood, gross weight | do | .042 | 1.72 |
| In tin, including package | do | .0595 | 2.40 |
| Fish tongues, in brine, gross weight | do | .105 | 4.30 |
| Large dogfish, in packing cloth, gross weight | do | .0525 | 2.17 |
| Lobsters and shrimps, in water, gross weight | do | .0875 | 3.60 |
| Oysters, in water, in tin, crockery, or glass, gross weight | do | .0875 | 3.60 |
| Salmon, in water, in tin, crockery, or glass, gross weight | do | .0875 | 3.60 |
| Salmon, dried, smoked, or in brine, in wood, gross weight | do | .0595 | 2.40 |
| in tin, including package | do | .077 | 3.19 |
| Sardines in oil, gross weight | do | .1225 | 5.10 |
| Fish glue | do | .0625 | 2.57 |
| Fishhooks, including wrapper | do | .15 | 6.20 |
| Fishing nets | | 15 per cent. | |
| Isinglass, shredded, including wrappings | Kilogram | .75 | 31.03 |
| Oil: | | | |
| Cod liver | do | .175 | 7.20 |
| Whale or seal, crude, gross weight | do | .0325 | 1.35 |
| refined, gross weight | do | .055 | 2.27 |
| Sperm, crude, gross weight | do | .06 | 2.47 |
| refined, gross weight | do | .105 | 4.35 |
| Spermaceti, crude | do | .20 | 8.30 |
| refined | do | .3125 | 14.40 |
| Sponges, fine, conical, sample No. 183 | do | 5.00 | 206.85 |
| medium, sample No. 184 | do | 2.50 | 103.42 |
| common, sample No. 185 | do | .75 | 31.03 |
| Whalebone, in the rough | do | .11 | 4.55 |

## COLOMBIA.

### (Revised to December, 1893.)

[Peso = $0.486. Kilogram = 2.2046 pounds.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Peso.* | |
| Codfish in brine, and all fresh fish | Kilogram | .05 | $1.10 |
| Salmon and other preserved fish | do | .20 | 4.41 |
| Fish glue | do | .20 | 4.41 |
| Spermaceti, not manufactured | do | .20 | 4.41 |
| in candles, etc | do | .30 | 6.62 |

## ECUADOR.

### (Law of September 4, 1890.)

[Peso = $0.486. Kilogram = 2.2046 pounds.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Pesos.* | |
| Candles, sperm | Kilogram | .05 | $1.10 |
| Coral | do | 1.50 | 33.07 |
| Fish, salted, like that imported from Peru | do | .02 | .44 |

NOTE.—A surcharge of 20 per cent for the distinct purposes specified by law went into effect after the signing of an agreement for the liquidation of the English debt; also an additional duty of 10 per cent for the liquidation of the national debt.

## BRITISH GUIANA.

(Ordinance 1892; revised to June, 1894.)

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| Fish: | | | |
| Dried | 112 pounds | $0.50 | $0.44 |
| Pickled— | | | |
| Mackerel | Barrel | 1.00 | .50 |
| Salmon | do | 2.00 | 1.00 |
| Others | do | .25 | .125 |
| Preserved in tins or bottles, except oysters and salmon | Pound | .01 | 1.00 |
| Salmon and oysters in cans | | Free. | |
| Smoked | Pound | .005 | .50 |
| Fresh fish, turtles and fish on ice | | Free. | |
| Fishing apparatus of all kinds | | do | |
| Isinglass | Pound | .05 | 5.00 |
| Oil | Gallon | .25 | |

## URUGUAY.

[Peso = $1.034. Kilogram = 2.2046 pounds.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Pesos.* | |
| Ambergris | Hectogram | 28.80 | |
| Candles, sperm, including package | Kilogram | .14 | $6.58 |
| Coral | do | 2.74 | 128.60 |
| Fish: | | | |
| Anchovies— | | | |
| In oil, including package | do | .30 | 14.10 |
| In brine, in flasks, tins, or crocks | do | .10 | 4.70 |
| In brine, in barrels or boxes, gross weight | do | .07 | 3.29 |
| Codfish, dry, and stockfish in general, gross weight | do | .09 | 4.23 |
| Codfish tongues, gross weight | do | .09 | 4.23 |
| Dried fish— | | | |
| In jars, cans, or crocks, including package | do | .30 | 14.10 |
| In casks or boxes, gross weight | do | .05 | 2.35 |
| Herrings dried, in boxes of one dozen | Dozen | .093 | |
| Oysters and lobsters, including packages | Kilogram | .30 | 14.10 |
| Fish pickled in boxes or casks | do | .07 | 3.29 |
| In jars or crocks, including package | do | .10 | 4.70 |
| Preserved fish, including package | do | .30 | 14.10 |
| Sardines— | | | |
| In oil, including packages | do | .30 | 14.10 |
| Pressed, gross weight | do | .05 | 2.35 |
| Pickled, in boxes or casks, gross weight | do | .07 | 3.29 |
| Pickled, in jars, cans, or crocks, including package | do | .30 | 14.10 |
| Fishhooks, not snedded | do | .31 | 14.57 |
| snedded | do | .62 | 29.14 |
| Horsehair fishing lines | Thousand | .62 | |
| Oil: | | | |
| Cod liver, in kegs or tins | Kilogram | .159 | 7.47 |
| Whale | Quart | .0465 | |
| Fish | Kilogram | .0558 | 2.63 |
| Sponges: | | | |
| Pressed | do | .31 | 14.57 |
| Washed, in general, with or without sand | do | 1.55 | 72.85 |
| Small, medium, and fine | do | 10.85 | 509.90 |
| Whalebone, smooth or rough | do | 1.86 | 87.42 |

## PERU.

[Sol = $0.486. Kilogram = 2.2046 pounds.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Sol.* | |
| Candles, sperm, in baskets, bales, or cases, gross | Kilogram | .1625 | $3.59 |
| Coral, in natural state | do | 2.00 | 44.08 |
| Fish: | | | |
| Dried or smoked, not in tins, gross weight | do | .01 | .22 |
| in tins, gross weight | do | .02 | .44 |
| In brine, in wooden packages | do | .01 | .22 |
| in tins or jars | do | .02 | .44 |
| Preserved fish and shellfish | do | .12 | 2.64 |
| Sardines in tins, gross weight | do | .10 | 2.20 |
| Fish glue | do | .01 | .22 |
| Fish hooks | do | .40 | 8.82 |
| Fishing lines | do | .10 | 2.20 |
| Oil cod lines | do | .18 | 3.97 |
| Pearls, unset | | 3 per cent | |
| Spermaceti, in cakes | Kilogram | .40 | 8.82 |
| Sponges: | | | |
| Fine | do | 4.00 | 88.18 |
| Common | do | 1.20 | 26.45 |

## VENEZUELA.

(Revised to October, 1895.)

[100 Centimos = 1 bolivar. Bolivar = $0.193. Kilogram = 2.2046 pounds.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Centimos.* | |
| Candles, sperm | Kilogram | 125 | $10.94 |
| Fish: | | | |
| In brine, salted, or smoked, not in tins | do | 25 | 2.10 |
| In cans, not specified | do | 75 | 6.57 |
| Sardines packed in oil or any other form | do | 25 | 2.19 |
| Fishhooks | | Free. | |
| Fishing lines of hair | Kilogram | 75 | 6.57 |
| Fishing nets of all kinds | do | 1,000 | 87.50 |
| Fishing twine of linen or flax for nets and lines | do | 75 | 6.57 |
| Isinglass | do | 125 | 10.94 |
| Oil: | | | |
| Cod liver | do | 125 | 10.94 |
| Fish | do | 75 | 6.57 |
| Pearls | do | 1,000 | 87.50 |
| Shells, loose or made up in pieces or ornaments | do | 250 | 21.88 |
| Spermaceti | do | 75 | 6.57 |
| Sponges | do | 125 | 10.94 |

## CAPE VERDE ISLANDS.

(All fishery products imported pay a duty of 20 per cent ad valorem.)

## EGYPT.

Commercial treaty with United States November 16, 1884. A duty of eight per cent ad valorem is imposed on all products from the United States, computed on the price at the port of discharge.

## LIBERIA.

(March 1, 1890.)

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| Fish, dried | Pound | $0.01 | $1.00 |
| pickled | Barrel | 1.00 | .50 |

## MAURITIUS.

(Law of January 1, 1894.)

[Rupee = $0.231. Kilogram = 2.2046 pounds. Hectoliter = 22 imperial or 26.417 U. S. standard gallons.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Rupees.* | |
| Fish: | | | |
| Dried or salted | 100 kilos | 1.08 | $0.113 |
| Pickled | do | 1.25 | .131 |
| Glue | do | 3.00 | .314 |
| Oil | Hectoliter | 2.50 | ..... |
| All other | | 7½ per cent. | ..... |

## CHINA.

[10 candarins = 1 mace. 10 mace = 1 tael. 1 tael = $0.89. 1 picul = 100 catties = 133⅓ pounds.]

| No. | Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|---|
| | | Unit. | Rate daily. | |
| | | | *t. m. c.* | |
| 12 | Candles, sperm | | Free. | ..... |
| 22 | Fish: | | | |
| | Dried | Picul | 5 | $0.30 |
| | Salt | do | 1 8 | .11 |
| | Fresh | | Free. | ..... |
| | Shellfish, caviar, etc | | do | ..... |
| 28 | Glue | Picul | 1 5 0 | .90 |
| 47 | Oil | | 5 per cent. | ..... |

## JAPAN.

(All fishery products imported pay a duty of 5 per cent ad valorem.)

## KOREA.

| Items. | Duty. |
|---|---|
| | *Per cent.* |
| Candles, sperm | 7½ |
| Coral | 10 |
| Fish, fresh | 5 |
| Fish, dried and salted | 7½ |
| Isinglass, all kinds | 7½ |
| Preserved goods | 7½ |
| Sea products, as seaweed, beche-de-mer, etc | 7½ |

## PHILIPPINE ISLANDS.

(Royal decree of January 8, 1891.)

[Kilogram = 2.2046 pounds.]

| No. | Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|---|
| | | Unit. | Rate. | |
| 96 | Spermaceti | 100 kilos | $3.30 | $1.50 |
| 236 | Salt codfish and stockfish | Kilogram | .04 | 1.81 |
| 237 | Fish, fresh | do | .01 | .45 |
| 238 | Fish, salted, pressed, smoked, or pickled | do | .06 | 2.72 |
| 239 | Shellfish | do | .05 | 2.27 |
| | Whalebone and mother-of-pearl: | | | |
| 274 | In rough or cut in strips or plates | do | .01 | .45 |
| 275 | In form of jewelry or ornament | do | .05 | 2.27 |
| 291 | Candles, sperm | do | .22 | 9.98 |

NOTE.—By decree of July 10, 1895, a transitory impost of 4 per cent on above was established.

## BRITISH EAST INDIES—CEYLON.

(Law of January, 1890.)

[Rupee = $0.231.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Rupees.* | |
| Candles, sperm | | 6½ per cent. | |
| Coral | | Free. | |
| Cowries and shells (not tortoise shell) | | Free. | |
| Fish, dried, salted, roes, fins, skins, and blood, the produce of creatures living in the sea. | Cwt | 0.50 | $0.103 |
| Fish oil | | Free. | |
| Fishermen's nets | | Free. | |
| Machinery for the manufacture of fish manures | | Free. | |
| Pearls | | Free. | |
| Pearl oysters | | Free. | |

## AUSTRALASIA—NEW SOUTH WALES.

(Act of March 2, 1892.)

[Shilling = $0.243.]

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Pence.* | |
| Candles, sperm | Pound | 1 | $2.06 |
| Fish, dried, preserved, or salted | do | 1 | 2.06 |
| Oil: | | | |
| Sperm, not in bottles | | Free. | |
| Black whale, not in bottles | | Free. | |
| Others | Gallon | 6 | 1.21 |
| Oysters | | Free. | |
| Pearl shell | | Free. | |
| Shark fins and beche-de-mer | | Free. | |

## AUSTRALASIA—NEW ZEALAND.

(Revised to November 30, 1891.)

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *s. d.* | |
| Candles, sperm | Pound | 0 2 | $1.12 |
| Fish: | | | |
| Dried, pickled, or salted | Cwt | 10 0 | 2.17 |
| Potted and preserved | Pound | 0 2 | 4.12 |
| Oysters, preserved | do | 0 2 | 4.12 |
| Sardines | do | 0 2 | 4.12 |
| Anchovies, salted in casks | | Free. | |
| Fishing lines | | 20 per cent. | |
| Isinglass | | 15 per cent. | |
| Fish glue | Pound | 1½ | 3.09 |
| Oil, cod liver, fish, whale, and seal | | Free. | |

## AUSTRALASIA.—QUEENSLAND.

(Revised to October 4, 1892.)

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *s. d.* | |
| Fish: | | | |
| In pickle or brine | Cwt | 5 0 | $1.08 |
| Dried and salted | do | 5 0 | 1.08 |
| Preserved, potted or paste | Pound | 2 | 4.12 |
| Sardines | 12 pounds | 2 0 | 4.05 |
| Fishing material | | 15 per cent. | |
| Oil: | | | |
| Cod liver, medicinal | Gallon | 1 0 | |
| Fish, seal, and whale | do | 6 | |
| Sponges | | 15 per cent. | |

## AUSTRALASIA—TASMANIA.

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *s. d.* | |
| Fish: | | | |
| In pickle or brine | | 12½ per cent. | |
| Dried and salted | Pound | 1 | $2.06 |
| Preserved, potted or paste | | 12½ per cent. | |
| Maws | | 12½ per cent. | |
| Sardines | | 12½ per cent. | |
| Fishing lines | | 12½ per cent. | |
| Fishing material, not cordage | | 12½ per cent. | |
| Oil: | | | |
| Cod liver, medicinal | | 12½ per cent. | |
| Fish, seal, and whale | Gallon | 1 3 | |
| Sponges | | 12½ per cent. | |

## AUSTRALASIA—SOUTH AUSTRALIA.

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Pence.* | |
| Fish: | | | |
| Dried and salted, and sardines (except in pickle or brine) | Pound | 1 | $2.06 |
| Preserved | do | 2 | 4.12 |
| Fish glue | do | 2 | 4.12 |
| Fishing nets | | Free. | |
| Oil | | Free. | |
| Pearls, unset | | Free. | |
| All others | | 12 per cent. | |

## AUSTRALASIA—VICTORIA.

(Revised to March, 1894.)

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Pence.* | |
| Candles, sperm | Pound | 2 | $4.12 |
| Fish | | 20 per cent. | |
| Oil, fish | Gallon | 6 | 1.22 |

## AUSTRALASIA—WEST AUSTRALIA.

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Pence.* | |
| Candles, sperm | Pound | 2 | $4.12 |
| Fish | | 12 per cent. | |
| Oil, fish | Gallon | 6 | 1.22 |
| cod liver | | Free. | |

## POLYNESIA—BRITISH NEW GUINEA.

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Pence.* | |
| Candles, sperm | Pound | 1 | $2.06 |
| Fish: | | | |
| Preserved | | 10 per cent. | |
| Dried or salted | | Free. | |
| Isinglass | Pound | 1 | 2.06 |
| Oils, except for medicinal use | do | 6 | 12.36 |
| Pearl shells | | Free. | |
| Sponges | | 10 per cent. | |

## POLYNESIA—FIJI.

| Items. | Duty. | | Rate per 100 pounds. |
|---|---|---|---|
| | Unit. | Rate. | |
| | | *Pence.* | |
| Beche-de-mer | | Free. | |
| Fish, dried, preserved, and salt | | 10 per cent. | |
| Fishing lines | | 10 per cent. | |
| Fishing nets | | Free. | |
| Glue | | 10 per cent. | |
| Isinglass | Pound | 3 | $6.18 |
| Live oysters | | Free. | |
| Oil, except cod liver | Gallon | 9 | 1.88 |
| Pearl shells | | Free. | |
| Sponges | | 10 per cent. | |
| All other | | 5 per cent. | |

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# 7.—REMARKS ON THE MOVEMENTS AND BREEDING-GROUNDS OF THE FUR-SEAL, BASED ON OBSERVATIONS MADE WHILE ON THE UNITED STATES NAVAL PATROL OF BERING SEA IN 1894.

By John J. Brice, *Commander, United States Navy.*

Under the terms of the award of the Bering Sea arbitration tribunal, as enacted into law by the act of Congress of April 6, 1894, the fur-seal received the following protection while absent from its breeding-grounds on the Pribilof Islands:

(1) Immunity from pursuit or capture at any time and in any manner in Bering Sea within a radius of 60 geographical miles of the seal islands.

(2) Further immunity from pursuit or capture in any manner between May 1 and July 31, inclusive, in that part of the Pacific Ocean, including Bering Sea, north of the thirty-fifth degree of north latitude and east of the one hundred and eightieth degree of longitude from Greenwich continued as far north as the sixtieth degree of latitude; thence the protected area is bounded by a line drawn northeast to the center of Bering Strait.

(3) Immunity from pursuit by any other than sailing vessels and canoes or undecked boats propelled by sails or oars.

(4) Immunity from capture by nets, firearms, air guns, or explosives, except that shotguns may be used outside of Bering Sea during the lawful season.

The migrations of the fur-seal are so regular and well marked that they are easily taken advantage of by sealers, who know where the seal herd may be looked for at any given time. The seal is thus differently, and much more unfavorably, placed as regards natural protection than are some other marine mammals that are sought by man, the whales, porpoises, and sea-otter, for instance, whose movements are either irregular or not fully understood by the hunters.

The movements of pelagic animals are influenced to a very great extent by the temperature of the water in which they exist. The migratory instinct, whether leading them to feeding-grounds or to breeding-grounds, appears to be dominated by the water temperature. In the case of oceanic fishes like the cod and mackerel, and of anadromous fishes like the salmon and shad, the determination of the time and general course of their migrations by the water temperature is

well recognized. This same influence is not less strikingly exemplified in the extensive migrations of the Alaskan fur-seal, which cover diagonally 25 degrees of latitude, and, following the route of the herds, embrace a distance of over 2,500 miles, which is traversed when the seals are bound north to their breeding-grounds in Bering Sea and again when they seek the coast of the United States after the breeding season.

The fur-seal, although usually described as having almost human intelligence, is really a rather stupid animal, whose reputation for intelligence is based largely upon appearances (especially its soft, beautiful eyes, which appeal to one in their apparent innocence) and upon the cleverness displayed in finding its way over immense distances in the ocean. Great stress has been laid on the latter faculty, which has been a matter of more or less speculation. In this and most other movements, however, the fur-seal is very largely governed by the temperature of the water, and is controlled by circumstances rather than guided by intelligence, as it requires but little mental capacity to carry out the laws that nature has provided for it by which it finds its way to distant points in the ocean. When compared with the subtle instinct displayed by many species of migratory birds on their way to and from the same regions resorted to by the fur-seal, the movements of the latter are rather commonplace. Combined with the directing influence of the temperature of the water is the wonderful rapidity of action which enables the animal to cover with little effort a vast area of ocean in a remarkably short time.

The lonely and remote islands of St. Paul and St. George are admirably adapted for the breeding purposes of the fur-seal, and are the only islands in the eastern part of Bering Sea or the North Pacific Ocean suited to the requirements of this animal. Owing to the stupidity of the seals they are almost defenseless when on shore, and many would fall an easy prey if the islands were infested with predatory mammals or birds, while their timidity would probably cause the eventual abandonment of the islands if, while on the rookeries, they were liable to the sights and sounds of modern civilization.

The seals leave the rookeries in the fall and are driven out of Bering Sea by the decreasing temperature of the water as winter approaches. They then seek the more genial waters off Vancouver and California. On withdrawing from Bering Sea, they follow its current south through the passes in the Aleutian Islands and then meet with the Japan current, which leads them to the coast of Alaska, where there is an abundance of food. Thence they follow the cold current down the coast to Vancouver, off which land the old male seals remain and disperse over the adjacent ocean, having found a temperature suited to their condition in a region well stocked with fish food.

The old male seal is six or eight times larger than the female, and, having a superabundance of fat, requires a lower temperature of water

in which to live than do the female and young male seals. This fact accounts for the separation of the old males from the rest of the herd. The females and small seals of both sexes continue their southward movement in the cold Humboldt current off the coast of California, where, having found the slightly higher water temperature adapted to their needs, they disperse over the ocean in search of food.

The same laws govern the seals on their way to the breeding-grounds, combined with the strongest instincts in all animals—propagation and care of the young. In spring the old males are the first to become uneasy under the increasing temperature of the water, which has risen from about 42° F. early in February to 50° late in April, the normal temperature sought by the seals being between 40° and 46°. To seek relief by reducing the temperature, they start toward the north (the only direction in which this object can be attained), and, guided by the cold stream which flows along the coast of Alaska and Vancouver, they are led in the direction of the rookeries.

The course of the seal herd to the Pribilof Islands, by the cold currents which flow from that direction through the passes in the Aleutian chain, is only interrupted near the "Fairweather Ground" off Sitka, where the influence of the warm water of the Japan current causes some confusion in the progress of the seals. This region is much resorted to by the pelagic hunters and is a vast slaughtering-ground. Off Sitka large portions of the herd are often found, in their bewilderment, heading in various ways, and sometimes they make considerable progress in the direction from which they have come; but finally the seals get within the influence of the cold stream in the vicinity of Kadiak and then, through the passes in the islands, they enter Bering Sea and are virtually on the breeding-grounds.

The females and young males are influenced in their northern movements by the same conditions which affect the old males. The females, however, on account of their being with young, make slower progress than the others, and are easily approached and killed when fatigue compels them to rest at the surface of the water. The presence of food off the coast and estuaries of the rivers also affects in some degree the course of the seals.

The feeding habits of the breeding males are similar to those of some fish, as, for instance, the salmon. During their absence from the rookeries they accumulate a vast amount of energy and food in the form of fat, which is deposited under the skin, in the muscles, and about the viscera; so that after the breeding season begins they abstain wholly from food and, during a period of more than three months, retain their vitality by assimilating the stored fat, while the other seals are obliged to make frequent excursions to the fishing banks. In like manner, after the salmon leave the ocean, enter the rivers, and commence their long journey to the spawning-grounds, they eat nothing, but maintain their strength on the fat with which they were fortifying themselves while at

sea, together with the supply of nourishment from the disintegration of the oil-bearing tissues surrounding the ovarian and spermatic parts, which begins as soon as the fish enter the streams.

Aside from the destruction of the females and young by sealing in Bering Sea, the animals are disturbed or harassed at a time when they have sought seclusion to rear their young. Already a restlessness and a change in the habits of the seals have been observed which are indications of the breaking up of the herd. The use of firearms for killing seals in Bering Sea being prohibited by law, the spear has been substituted. The silent destruction of the latter instrument does not frighten the seals, and its aim is more certain and deadly than the rifle or shotgun. The warning noise of the firearm renders the seals more shy and wary as the season progresses, but with the spear the slaughter of unsuspicious animals continues uninterruptedly from the commencement to the end of the season. As a proof of this, it is only necessary to cite the wonderful catch of the sealing schooners this year by means of the spear. Notwithstanding the comparative unfamiliarity of most of the crews with the use of the spear, the number of seals secured by the pelagic sealers was greater than ever before, and the catch is almost certain to increase year by year, as the men become more dexterous in handling the spear, provided the supply of seals holds out. Instead, therefore, of the prohibition of firearms in Bering Sea being a serious restriction on the depredations of the sealers, it really aids them and renders the rookeries even more liable to rapid decimation than they were under previous regulations.

It is reported that the catch of seals by predatory sealers in 1894 was in the neighborhood of 105,000. Of this number about 57,000 seals were taken from the herds belonging on the Asiatic shores of the North Pacific Ocean and the remainder, 48,000, from the Alaskan herd. In the previous year the seals secured from the herd rendezvousing at the Pribilof Islands numbered about 36,000, and in 1892 about 25,000. Of the seals from the Alaskan rookeries taken by pelagic sealers in 1894, about 80 per cent were killed by vessels clearing from Victoria, B. C., and 20 per cent by vessels from United States ports.

The prohibition of pelagic sealing between May 1 and July 31, during which time the seals are moving northward off the coasts of the United States, British Columbia, and southeast Alaska and entering Bering Sea, necessarily concentrated the operations of the sealers on Bering Sea—that is, during the breeding season. The numbers of seals killed beyond the 60-mile zone in Bering Sea between August 1 and August 15, 1894, were large, and perhaps 75 or 80 per cent were nursing females that had left their pups on the Pribilof Islands and gone for food to the cod banks lying from 75 to 200 miles from the rookeries. The death of a female seal under these circumstances meant also the death of her young by starvation. It is therefore evident that more harm is

done to the seal herd in the few weeks of sealing in August than at any other time.

Permission was given by the Treasury Department to the lessees of the seal islands to kill 20,000 young male seals in 1894. Notwithstanding that only 7,500 seals had been killed there during each of the preceding years and only 14,000 and 20,000, respectively, during the third and fourth years before (against 100,000 annually for many years without any detriment to the herd before the ravages of the poacher began), the lessees were able to obtain only 16,000 marketable skins of young male seals.

The preservation of the Alaskan fur-seal under existing conditions and regulations rests on the very slender contingency of the prevalence of tempestuous weather during the month of August. Two or three weeks of good weather at this time, by permitting the sealers to operate without interruption outside the 60-mile zone and on the feeding-grounds of the female seals, mean the ultimate and rapid destruction of the seal herd on the Pribilof Islands.

The Bering Sea question, when stripped of the maze of minor points and diplomatic usages incident to its discussion and adjustment, offers the following definite alternatives of settlement:

(1) Shall the United States Government effectually and forever terminate this international dispute by absolutely annihilating the Alaskan seal herd as the animals arrive on the seal islands? or

(2) Shall the United States permit the pelagic poachers of British Columbia to destroy the seals on their way to the rookeries and in the vicinity, and thus ultimately destroy the legitimate industry of killing selected seals on the islands? or

(3) Will the British Government enact laws to protect an industry which is now generally conceded in America to have from the outset been of more commercial interest to Great Britain than to the United States?

The first proposition may seem needlessly harsh and cruel, but the action indicated is indeed humane and is fully warranted by the facts that no amount of protection under existing regulations is adequate to preserve the seal herd and that the patrol of Bering Sea by American naval and revenue vessels does not prevent the havoc wrought by the pelagic hunters in killing annually 25,000 or 30,000 nursing female seals and leaving their pups to die of starvation, besides sacrificing the same number of unborn seals. No one who has had the opportunity to visit the seal islands during the breeding season and witness the distressing spectacle of thousands of young seals in various stages of starvation will fail to acknowledge the merciless barbarity of pelagic sealing and the humane principle involved in the proposition to wipe out the Alaskan seal herd at one blow.

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# 8.—AN ANNOTATED CATALOGUE OF THE FISHES KNOWN FROM THE STATE OF VERMONT.

By Barton W. Evermann and William C. Kendall.

This paper is based chiefly upon observations and collections made in July, 1894, by the senior author and Mr. Barton A. Bean, of the United States National Museum, while engaged in the investigation of the waters along the Canadian border of the United States under the direction of Mr. Richard Rathbun, the representative of the United States on the International Fishery Commission.

The report upon the special purpose of the investigation has been made to Mr. Rathbun. The present paper is a report upon the species of fishes collected or known to occur in the waters of Vermont. We have included not only the species obtained in 1894, but all others which have been recorded from that State by other writers.

The only ichthyologist who has written extensively upon the fishes of Vermont is the Rev. Zadock Thompson, of Burlington. In 1842 Mr. Thompson published his "History of Vermont, Natural, Civil, and Statistical, in three parts, with a new map of the State and 200 engravings." Twenty-five pages of this interesting and very creditable volume are devoted to the fishes of the State. Not only does he give a catalogue of the species known to him to occur in the State, but much interesting information concerning the habits of many of them. This list and the annotations are particularly valuable, as they are based almost wholly upon the personal observations of Mr. Thompson, who was for many years a careful and conscientious student of the natural history of the region in which he lived.

The total number of species of Vermont fishes listed by Mr. Thompson is 48; these represent 43 species as we now understand them. Among the species, listed the following were described as new: *Pimelodus vulgaris* (*Ameiurus vulgaris*), *Lepisosteus lineatus* (the young of *L. osseus*), *Esox nobilior* (*Lucius masquinongy*), and *Salmoperca pellucida* (*Percopsis guttatus*).

The following table gives the nominal species listed by Mr. Thompson, together with our identification of each and the water from which each was recorded.

*List of the fishes given in Thompson's Natural History of Vermont.*

| Page. | Nominal species. | Identification. | Locality. |
|---|---|---|---|
| 129 | Perca serrato-granulata .. | Perca flavescens..... | Lake Champlain basin. |
| 130 | Lucio-Perca americana.... | Stizostedion vitreum ..... | Do. |
| 130 | Pomotis vulgaris ..... | Lepomis gibbosus ..... | Do. |
| 131 | Pomotis megalotis ..... | Lepomis megalotis..... | Connecticut River at Barnet. |
| 131 | Centrarchus æneus..... | Ambloplites rupestris ..... | Lake Champlain basin. |
| 131 | Centrarchus fasciatus .... | Micropterus dolomieu ..... | Vermont. |
| 132 | Etheostoma caprodes ..... | Percina caprodes ..... | Lake Champlain basin. |
| 133 | Corvina oscula..... | Aplodinotus grunniens ..... | Lake Champlain. |
| 133 | Catostomus cyprinus ..... | Carpiodes thompsoni ..... | Vermont. |
| 134 | Catostomus oblongus ..... | Moxostoma aureolum..... | Lake Champlain basin. |
| 134 | Catostomus teres ..... | Catostomus commersonii ..... | Do. |
| 135 | Catostomus nigricans..... | Catostomus nigricans..... | Walpole, Mass. |
| 135 | Catostomus longirostrum. | Catostomus catostomus..... | Vermont. |
| 135 | Leuciscus pulchellus ..... | Semotilus corporalis..... | Lake Champlain basin. |
| 136 | Leuciscus cryseleucas.... | Abramis cryseleucas..... | Do. |
| 136 | Leuciscus atronasus..... | Rhinichthys atronasus ..... | Do. |
| 137 | Hydrargyra fusca ..... | Umbra limi ..... | Do. |
| 137 | Esox estor..... | Lucius lucius. ..... | Do. |
| 138 | Esox reticulatus..... | Lucius reticulatus ..... | Connecticut River basin. |
| 138 | Pimelodus vulgaris..... | Ameiurus vulgaris ..... | Lake Champlain. |
| 139 | Pimelodus nebulosus ..... | Ameiurus nebulosus..... | Connecticut River at Barnet. |
| 139 | Pimelodus sp.? ..... | Ameiurus lacustris..... | Winooski River; Lake Champlain. |
| 140 | Salmo salar..... | Salmo salar ..... | Lake Champlain and Connecticut River. |
| 140 | Salmo namaycush ..... | Cristivomer namaycush ..... | Lake Champlain; ponds in western part of State; Orleans County; Bellwater Pond in Barton; several ponds in Glover, Charleston, etc. |
| 141 | Salmo fontinalis ..... | Salvelinus fontinalis..... | Vermont. |
| 142 | Osmerus eperlanus ..... | Osmerus mordax..... | Lake Champlain. |
| 143 | Coregonus albus ..... | Coregonus clupeiformis..... | Do. |
| 144 | Alosa vulgaris..... | Alosa sapidissima ..... | Connecticut River. |
| 144 | Hiodon clodalus ..... | Hiodon tergisus ..... | Lake Champlain. |
| 145 | Lepisosteus oxyurus..... | Lepisosteus osseus ..... | Lake Champlain; Winooski River. |
| 145 | Lepisosteus lineatus..... | Lepisosteus osseus (young)... | Winooski River at Burlington. |
| 146 | Lota maculosa ..... | Lota lota maculosa..... | Lake Champlain basin. |
| 147 | Lota compressa..... | .....do ..... | Connecticut River basin. |
| 147 | Murænа vulgaris . .. .... | Anguilla chrysypa..... | Vermont. |
| 148 | Murænа bostoniensis..... | .....do ..... | Connecticut River basin. |
| 148 | Murænа argentea..... | .....do ..... | Vermont. |
| 149 | Acipenser rubicundus .... | Acipenser rubicundus..... | Lake Champlain. |
| 149 | Acipenser oxyrhynchus .. | Acipenser rubicundus (young) | Do. |
| 150 | Petromyzon nigricans .... | Petromyzon marinus..... | Vermont. |
| 150 | Ammocœtes concolor ..... | Ichyomyzon concolor ..... | Winooski River. |
| 30* | Lucio-perca canadensis ... | Stizostedion canadense ..... | Lake Champlain. |
| 31 | Boleosoma tessellatum.... | Boleosoma nigrum olmstedi .. | Vermont. |
| 31 | Cottus gobioides..... | Cottus gracilis gobioides ..... | River Lamoille, Johnson, Vt. |
| 32 | Leuciscus atromaculatus . | Semotilus atromaculatus..... | Western part of State. |
| 32 | Esox nobilior ..... | Lucius masquinongy..... | River Lamoille. |
| 33 | Salmoperca pellucida..... | Percopsis guttatus..... | Lake Champlain at Burlington and Winooski River. |
| 34 | Coregonus clupeiformis... | Argyrosoma artedi..... | Lake Champlain. |
| 35 | Amia ocellicauda ..... | Amia calva ..... | Lake Champlain at Whitehall and mouth of Otter Creek. |

* These references, pp. 30 to 35, indicate pages in the appendix.

A few other writers have mentioned one or more species each from waters of this State. In 1817, in the Journal of the Academy of Natural Sciences of Philadelphia (p. 102), LeSueur described as new *Catostomus longirostrum* (*Catostomus catostomus*) from the State of Vermont. In the same Journal for 1818 (p. 421) Rafinesque described as new *Exoglossum nigrescens* (*Exoglossum maxillingua*) from Lake Champlain.

In 1842, DeKay, in the volume on fishes of his Natural History of New York (p. 209), described as new *Leuciscus nitidus* (*Semotilus corporalis*) from Lake Champlain, and on page 383 of the same volume he describes as new *Ammocœtes unicolor* (*Petromyzon marinus unicolor*) from a specimen sent him from Lake Champlain by Zadock Thompson.

In 1850 Girard (Proc. Amer. Assoc. Adv. of Sci., II, 1850, 411, and Proc. Bost. Soc. Nat. Hist., III, 1850, 189; also monograph of Cottoids, in Smithsonian Contributions to Knowledge, 55, December, 1851) described as new *Cottus gobioides* from "a specimen of 4 inches that we have had figured [and for which] we are indebted to the kindness of Rev. Z. Thompson, of Burlington, to whom it was presented by Mr. Ransom Colberth, who caught it in June, 1844, while fishing for the brook trout in a branch of the Lamoille River, in the town of Johnson, Lamoille County."

He also describes as new *Cottus boleoides*, from a series of individuals collected by Ed. Cabot, esq., of Boston, at Windsor, Vt. In 1855 Agassiz gave the original description of *Carpiodes thompsoni* in the American Journal of Science and Arts (p. 76), the type locality being Lake Champlain; and in 1872 Duméril, in his Histoire Naturelle des Poissons (vol. II, p. 419), describes the bowfin (*Amia calva*) as new, giving it the name *Amia thompsoni*. The specimen described came from Lake Champlain, and was sent to the Paris Museum by Zadock Thompson.

The waters of Vermont are chiefly tributary either to the St. Lawrence or the Connecticut River. In the southwestern part of the State a small area has its drainage westward into the Hudson. About two-thirds of the western boundary of the State is formed by Lake Champlain, into which flow the principal rivers of Vermont, among them being the Missisquoi, Lamoille, Winooski, and Otter. The outlet of Lake Champlain is the Richelieu River, which joins the St. Lawrence at the head of Lake St. Peter. The northeastern portion of Lake Champlain is Missisquoi Bay, which is crossed by the international boundary, and lies, therefore, partly in Canada. This bay is important in that it contains extensive spawning beds of the wall-eyed pike and the shadwaiter, and more commercial fishing has been carried on here than elsewhere in the lake in recent years.

Just east of the middle of the northern boundary of the State is Lake Memphremagog, one of the most beautiful bodies of water to be found anywhere in America. It extends for 30 miles in a general north- and south direction, the international boundary line crossing it about 8 miles from the southern end. The greatest width of this lake is said to be about 6 miles, but the average probably does not exceed 2 miles. That portion of the lake lying in Vermont is comparatively shallow, the depth rarely exceeding 18 or 20 feet; near the State line it is probably 25 feet or even more. On the Canadian side the depth is much greater; at one place, near the Mountain House, about 8 miles north of the Vermont line, a depth of 700 feet is said to have been found. The south end of the lake has a sandy bottom in most places, with some gravel. At Horseneck Island is a ledge, apparently of limestone, which almost reaches the surface. The bottom on the Canadian side has more gravel and numerous rock ledges.

In most places the shores of the lake rise gently into low mountains, which are covered with forests of birch, maple, fir, pine, beech, cottonwood, and other hardwood trees. At several places on the Canadian side the shores are rocky and rise abruptly.

The outlet of Lake Memphremagog is the St. Francis River, which flows into that expansion of the St. Lawrence River known as Lake St. Peter.

The principal streams flowing into Lake Memphremagog are Black, Barton, and Clyde rivers, all of which enter near the south end of the lake. These are all clear and rather swift streams, but the water is not cold. The temperature in Clyde River in 2 feet of water at noon, July 23, was 79°. This stream was examined at various places in the last 4 miles of its course and was found to be quite rocky and full of snags in places.

Collections were made in the lake at the camp of Hon. L. D. Miles, about 4 miles down the east shore from Newport. A small stream flowing into the lake near here was much colder, and a spring near by had a temperature of 48°.

The Connecticut River forms the entire eastern boundary of Vermont. It receives a number of tributaries from Vermont, but the only ones from which collections have been made are Sleeper and Passumpsic rivers, near St. Johnsbury.

Sleeper River was examined July 25, through more than 2 miles of its course, near the United States fish-hatchery. At that time the stream was 30 to 50 feet wide and ½ to 2 feet deep, with occasional holes of considerable depth. The bed is mostly of rock, apparently a micaceous schist, with a thin coating of gravel, shingle, and sandy mud. The water was clear and apparently pure, but not cold.

The Passumpsic was examined July 26 about 4 or 5 miles above St. Johnsbury, near St. Johnsbury Center. This stream is larger than the Sleeper, but of the same general character. It is 40 to 60 feet wide and, at the time of our visit, 1 to 3 feet deep on the riffles, and deeper in the quiet reaches. The bed is of rock, gravel, or mud. A good many mills along this stream throw their refuse into it; sawdust was abundant in several places in the quiet portions of the stream.

Fishes are very scarce in both of these rivers.

The present list is only approximately complete for the State of Vermont; further investigations will doubtless add some species which are not now known from Vermont, and much remains to be learned regarding the migrations and spawning habits of even the most common and important species.

The specimens obtained by us in 1894 were collected in the following places: Missisquoi Bay at Alburg Springs and on the west shore of Hog Island, July 20; Clyde River near Newport, July 23; Lake Memphremagog at Miles's clubhouse, July 24; Sleeper River, near St. Johnsbury, July 25; Passumpsic River near St. Johnsbury Center, July 26.

For courtesies extended to us we are under especial obligations to the following gentlemen: Hon. L. D. Miles and Mr. Frank Biddell, of Newport; Mr. John W. Titcomb, superintendent United States fish-cultural station at St. Johnsbury; and Mr. Samuel Decker, of Hog Island. Each of these gentlemen did much to assist us in our investigations.

With the growth of population and the consequent cutting away of the forests, cultivation of the land, building of stream-polluting mills and factories, and destructive methods of fishing, a great change has taken place in the fish fauna of the State since the first settling of the country. The changes since Thompson's time have been very great, as may readily be seen by comparing present conditions with his remarks on various species. And Mr. Thompson calls attention to the serious decrease of several important species prior to 1842. He says:

In a country like Vermont, situated so remote from the ocean, and watered only by small fresh-water streams and lakes, a very great variety or abundance of fish is hardly to be expected; and yet it is a notorious fact that when the country was new all our waters swarmed with fishes of various kinds. Salmon and shad were taken in the greatest plenty and perfection in Connecticut River, and the former, together with the salmon trout, were abundant in Lake Champlain and in most of the streams connected with it. In the spring of the year, when these fishes were ascending our streams to their breeding-places, they could be taken at the falls and rapids in scoop nets, or in baskets fastened to poles, in almost any quantities desired. Brook trout, weighing from 1 to 3 pounds, were plentiful in nearly all our streams and ponds, but with the clearing and settling of the country these kinds of fishes have diminished till the three former have become extremely rare, and the latter, though still numerous in many parts, are seldom taken exceeding half a pound in weight. For the production of this state of things several other causes have operated besides their diminution by fishing. The salmon and shad have probably been driven from our waters chiefly by the erection of dams across nearly all our streams, which prevent their ascent to their favorite spawning-places. Freshets, also, which have become more sudden and violent since the country has become cleared, have swept out the logs and other obstructions which formed their places of resort and concealment, and have thus tended not only to diminish the number of our fishes but to prevent their attaining so great magnitude as formerly. Those fishes of our lakes which do not ascend far up our streams to deposit their spawn have not been so much affected by these causes. These, however, though still taken in considerable quantities, are not so abundant as formerly.

# LIST OF FISHES FOUND IN VERMONT.

## Family PETROMYZONIDÆ. The Lampreys.

**1. Petromyzon marinus** Linnæus. *Great Sea Lamprey; "Blue Lamprey."*

Recorded from Vermont by Thompson, who says:

"The fresh-water *lampreys*, or *lamprey-eels*, as they are more commonly called, resemble in their habits the blood-sucker much more than the ordinary fishes. They obtain their subsistence principally by attaching themselves by their mouths to the bodies of larger fishes, and drawing nourishment from them by suction; for this purpose their mouth and tongue are admirably adapted, the latter acting in the throat like the piston of a pump, while the circular lips of the former adhere closely to the side of the fish, and by these means the softer parts of the larger fish are drawn into the mouth and swallowed by the parasite. When a lamprey once fastens himself in this manner upon a large fish he adheres with such force as to baffle all the efforts of the fish to rid himself of his unwelcome incumbrance. Fishes are frequently taken in the seine with lampreys still adhering to them, and others with deep depressed wounds upon their sides, affording indubitable proof of their having been attached. The fresh-water lampreys seldom exceed 6 or 8 inches in length, and no account is made of them as an article of food."

**2. Ichthyomyzon concolor** (Kirtland). *Silver Lamprey; "Mud Lamprey."*

Recorded from Winooski River by Thompson:

"During the drought in September, 1841, I found large numbers of these fishes, which had buried themselves in the mud at the bottom of the small coves along the banks of Winooski River, from which the water had evaporated. This fish is known in many places by the name of *mud-eel*, or *blind-eel*."

## Family ACIPENSERIDÆ. The Sturgeons.

**3. Acipenser rubicundus** LeSueur. *Lake Sturgeon; "Rock Sturgeon."*

Mr. Thompson regarded the round-nosed sturgeon and the rock sturgeon as two different species, but we now know that the latter is simply the young of the former. Concerning the latter he says:

"This fish is occasionally taken in Lake Champlain, and is here known by the name of *rock sturgeon*. It seldom exceeds 3 feet in length or 20 pounds in weight, but is much more generally and highly esteemed as an article of food than the preceding species, some even ranking it as one of our best fishes for the table. This, like the preceding, should be skinned before it is cooked, and for the same reasons."

Sturgeon are still occasionally taken in Lake Champlain, according to Mr. A. S. Hilliker, of Alburg Springs. Fishermen are said to catch them sometimes with grappling hooks fastened to poles; these hooks are said to be most used in the rivers at the foot of the falls.

Mr. Titcomb says sturgeon weighing 75 pounds and over are often taken in Lake Champlain.

## Family LEPISOSTEIDÆ. The Gar Pikes.

**4. Lepisosteus osseus** (Linnæus). *Long-nosed Gar; "Billfish."*

Concerning this species Thompson has the following interesting remarks:

"This singular fish was described by Samuel Champlain as an inhabitant of the lake now bearing his name more than two hundred years ago. He called it *chausarou*, which was probably the Indian name. The Indians assured him they were often seen 8 or 10 feet long, but the largest he saw was only 5 feet long and about the thickness of a man's thigh. It is considered a very voracious fish, and when any of them are taken or seen in the water the fishermen calculate upon little success in taking other kinds.

"Charlevoix tells us that he preys not only upon other fishes, but upon birds also, and that he takes them by the following stratagem: Concealing himself among the reeds growing on the marshy borders of the lake, he thrusts his bill out of the water in an upright position. The bird, wanting the rest, takes this for a broken limb or dry reed, and perches upon it. The fish then opens his mouth and makes such a sudden spring that the bird seldom escapes him. Charlevoix also assures us that the Indians regarded the teeth of this fish as a sovereign remedy for the headache, and that pricking with it where the pain was sharpest took it away instantly. The scales with which this fish is covered are so thick and strong as to form a coat of mail which is not easily pierced with a spear. They are taken only occasionally in the seine at the present day, but are said to be sometimes seen in considerable numbers lying in the marshy coves. Its flesh is rank and tough and is not used for food. The usual length of those now taken is from 2½ to 3 feet, though they are often much longer. The specimen from which the preceding figure and description were made was taken at the mouth of Winooski River May 11, 1841. One of the largest specimens which I have seen was taken at the same place June 16, 1838, and is now in my possession. It is 46 inches long, and when caught weighed 9½ pounds. This species is found in the great western lakes and in the Ohio River, where this and several other species are known by the name of *gar fishes*."

This gar is still common in Lake Champlain. We obtained no specimens on the Vermont side of the lake, but secured some on the New York side near Rouses Point.

### Family AMIIDÆ. The Bowfins.

**5. Amia calva** Linnæus. *Mudfish; Bowfin.*

Recorded by Thompson from the mouth of Otter Creek and from Lake Champlain at Whitehall. He says:

"This fish abounds upon the muddy bottoms and the marshy coves of the southern part of Lake Champlain. It is very plentiful in the vicinity of Whitehall and also about the mouth of Otter Creek. From its partiality to muddy bottoms, it has acquired in many places the name of *mudfish*. From its resemblance in form to the ling, it is called in some places the *scaled ling*. But its more common appellation in Vermont is that of *bowfin*. It attains to considerable size, frequently exceeding 2 feet in length and weighing 10 or 12 pounds; but its flesh is soft and ill-flavored—very little esteemed as an article of food."

### Family SILURIDÆ. The Catfishes.

**6. Ameiurus lacustris** (Walbaum). *Great Lakes Catfish.*

This catfish, so common in the Great Lakes region, has apparently never been common in Vermont waters. Thompson speaks of it as being occasionally taken in the vicinity of Burlington, but in other parts of the lake it is reputed quite plentiful. He says it is a very good food-fish.

Among a fine lot of fresh specimens received by the Commission April 25, 1896, from Mr. A. L. Collins, Swanton, Vt., at the instance of Mr. John W. Titcomb, is one large example of this species. It, like all the specimens sent by Mr. Collins, came from Missisquoi Bay. It is a female with the ovaries but little developed. The stomach and intestines contained no food that could be identified. Total length of this specimen, 25 inches; weight, 7¼ pounds. Called "catfish" by Mr. Collins.

**7. Ameiurus vulgaris** (Thompson). *"Bullpout."*

This species was originally described from Lake Champlain. Thompson reported it quite plentiful in Lake Champlain, where it is generally known as bullpout. He says those taken from the lake are usually from 9 to 13 inches in length.

**8. Ameiurus nebulosus** (LeSueur). *"Horned Pout"; "Bullpout"; Bullhead.*

According to Thompson, common in Connecticut River and in many of its larger tributaries. It is undoubtedly an abundant species throughout the State. In Shelburn Pond it is said to be exceedingly abundant. In Lake Champlain the

bullhead is at present the most important commercial fish, larger amounts of it than of any other species being handled. The local fishermen say that they run from ½ to 1½ pounds dressed, which is probably an overestimate. Mr. Joseph Laundrie, of Rouses Point, says that it takes 500 to 600 dressed fish to make a barrel and that they sell for 6 cents a pound. They can be caught on mud bottom. According to Mr. Eli Cameron, of Rouses Point, the bullheads spawn in July. In the fall they "mud up" or bury themselves more or less. According to Mr. J. W. Titcomb the grass along the shores of some of the waters in the State is mown in the spring to allow seines to be hauled for bullheads. In Lake Memphremagog the bullhead is one of the most abundant species. Our collections contain two examples, 4 and 4½ inches long, respectively, from Clyde River at Newport, and one small specimen from Missisquoi Bay. The collection received from Mr. Collins contained two examples of this species, one 10½ inches long and weighing one-half pound, the other 11½ inches long and weighing three-fourths pound. The stomachs contained nothing identifiable.

### Family CATOSTOMIDÆ. The Suckers.

**9. Carpiodes thompsoni** Agassiz. *Lake Carp; "Buffalo"; "Carp Sucker"; "Drum."*

Lake Champlain is the type locality of this species. Thompson says it ranges from 1 to 4 pounds in weight, but it is not common. It is still taken by the local fishermen in some numbers. Among the fishes kindly sent us by Mr. Collins is a fine example of this species which he calls "drum." It is a nearly ripe female, 21 inches long and weighing 7 pounds. The roe alone weighed 2½ pounds.

The condition of this fish indicates that the spawning period begins as early as the last of April. The stomach contained nothing.

**10. Catostomus catostomus** (Forster). *Long-nosed Sucker, "Sucker."*

This sucker was found by us in abundance in Sleeper River It is doubtless a common species throughout the State, but Thompson states that he never met with it. On the other hand, LeSueur, in describing *C. longirostrum*, which he took to be different from this species, says: "This fish I discovered in the State of Vermont. I had not seen it in any other State."

**11. Catostomus commersonii** (Lacépède). *Common Sucker; "Sucker"; "Black Sucker"; "Black-fin Sucker."*

Said by Thompson to be quite common in Lake Champlain and in most of the large streams and ponds connected with it. Specimens were obtained by us in Passumpsic River near St. Johnsbury and in Clyde River and Lake Memphremagog near Newport. Two large examples were taken in a gill net at the Miles's clubhouse, Lake Memphremagog, July 24. A nearly ripe female, 18 inches long and weighing 3 pounds, received from Missisquoi Bay April 25. This fish would have spawned early in May. The stomach contained nothing.

In Shelburn Pond, a sucker, probably this species, is said to be very abundant.

**12. Catostomus nigricans** LeSueur. *Black Sucker.*

This species Thompson supposes to be common on the east side of the Green Mountains. It was seen by us only in Sleeper River at St. Johnsbury.

**13. Moxostoma aureolum** (LeSueur). *Redhorse Sucker; "Mullet."*

This is the common mullet or large-scaled sucker of Vermont, and seems to be common in Lake Champlain. It is one of the principal species taken in gill nets by the fishermen of Lake Champlain. It is said to be quite abundant in Missisquoi Bay. Our collections contain two large examples taken there in a seine July 20, and two large examples were received April 25 from Missisquoi Bay. One was a nearly ripe male 15 inches long and weighing 1½ pounds, the other a nearly ripe female 25½ inches long and weighing 7¼ pounds. They probably would have spawned in two or three weeks. The stomachs were empty. Mr. Collins called the smaller of these a "redfin sucker," the other a "mullet."

Concerning this species Thompson has the following:

"This fish is described by Dr. Mitchill under the name of the *chub of New York*. It is here very generally known by the name of *mullet*, under which name several species of lake suckers are confounded, although it belongs to a family of fishes entirely distinct from the real mullet. This is one of our most common fishes, and in the spring and early part of summer is caught with the seine in large quantities, both in Lake Champlain and in the mouths of its larger tributaries. The flesh of this fish is rather soft, and is considerably filled with the knots of fine bones so common to this family, and yet it is regarded as a very good fish for the table. There are various methods of cooking it, but it is generally most highly esteemed when baked. The fish grows to a larger size, and is taken in Lake Champlain in larger quantities than any other species of this family. Their usual length is from 15 to 20 inches, and their weight from 2 to 5 pounds. But individuals are often taken which are much larger, weighing, in some cases, 9 or 10 pounds. The usual price, when fresh, is from 3 to 4 cents a pound."

### Family CYPRINIDÆ. The Minnows.

**14. Pimephales notatus** (Rafinesque). *Blunt-nosed Minnow.*

Apparently not common; two specimens, 2 and 2¼ inches long, respectively, obtained by us in Missisquoi Bay.

**15. Semotilus corporalis** (Mitchill). *Fallfish; Silver Chub.*

Obtained by us in Clyde River at Newport and Passumpsic River near St. Johnsbury. It appears to be common in each of these streams, and, according to Mr. Titcomb, throughout the State and in Lake Champlain. According to Thompson "this fish is quite common in Lake Champlain and its tributaries. It is readily caught with the hook, and the flavor of its flesh is agreeable, but it is so soft and filled with small bones that it is not much valued as an article of food. The length of those usually taken varies from 5 to 12 inches, but they sometimes grow to the length of 20 inches."

**16. Semotilus atromaculatus** (Mitchill). *Horned Dace; Creek Chub.*

This chub was taken by us in Clyde River and in Lake Memphremagog near Newport, the specimens being 2½ to 5 inches long. It is probably not uncommon throughout the State. Mr. Thompson says:

"This is one of the most common fishes of this genus in the western part of Vermont. It abounds almost everywhere, both in the rivers and small streams. Its insipidity and small size prevent its being sought as an article of food; but, as it takes the hook with great readiness, it affords the boys an opportunity to indulge in the cruel sport of catching them for mere amusement. They are also caught to be used as bait in taking larger fishes."

Mr. Titcomb says;

"I have caught it quite frequently in a branch of East Creek, Rutland County, and it takes a fly readily and will fight well. Confined with trout of equal or larger size than itself, it will fight them and kill them."

**17. Abramis crysoleucas** (Mitchill). *Shiner; Roach.*

Not obtained by us, but Thompson says: "This fish is quite common, particularly in the small ponds and coves along the shore of Lake Champlain and about the mouths of our large streams, where it is found associated with perch, bullpouts, and mudfishes."

**18. Notropis hudsonius** (Clinton). *Shiner; Spot-tail Minnow.*

Probably common in most waters of the State, but it was taken by us only in Missisquoi Bay.

**19. Notropis cornutus** (Mitchill). *Shiner; Redfin Dace.*

Numerous examples were taken in Clyde River at Newport and Passumpsic River near St. Johnsbury. They vary in length from 1¾ to 3½ inches. Probably the most abundant and most generally distributed minnow in the State.

**20. Rhinichthys cataractæ** (Cuvier & Valenciennes). *Long-nosed Dace.*

Several specimens obtained by us near St. Johnsbury, in Sleeper and Passumpsic rivers; not seen elsewhere in Vermont by us, nor is it recorded by Mr. Thompson.

**21. Rhinichthys atronasus** (Mitchill). *Black-nosed Dace.*

Sleeper River at St. Johnsbury, 17 specimens 1½ to 2½ inches long; Passumpsic River at St. Johnsbury, 1 specimen 1¾ inches long; Clyde River at Newport, 18 specimens 2 to 2¾ inches long; Lake Memphremagog, 2 specimens 2 and 2¾ inches long. Next to *Notropis cornutus*, this is probably the most common minnow in Vermont. Concerning it Mr. Thompson says:

"This species is quite common in most of the streams in Vermont, and particularly so in those that fall directly into Lake Champlain. It is an active, lively little fish, and on account of the stripes on its sides, the colors of which are changeable, according to the direction of the light falling upon them, it is one of the most beautiful of fishes. When fully grown, this fish is only from 2½ to 3 inches long, and though found in great numbers, its diminutive size renders it of no account as an article of food. It is chiefly sought to be used as bait for pike and other large fishes."

**22. Couesius plumbeus** (Agassiz).

From Clyde River at Newport we obtained 11 specimens of this species, 2¾ to 4½ inches long. It was not seen by us elsewhere in the State, but it doubtless occurs in all the clearer, colder streams.

**23. Exoglossum maxillingua** (LeSueur). *Cutlip Minnow; Nigger Chub.*

In 1818 Rafinesque described a specimen of this species from Lake Champlain under the name *Exoglossum nigrescens*. Whether his type came from the Vermont side of the lake we do not know. We have obtained it at Plattsburg, and it doubtless will be found in Vermont waters.

## Family ANGUILLIDÆ. The Eels.

**24. Anguilla chrysypa** Rafinesque. *Common Eel.*

Mr. Thompson gives three species of eels (*Muræna vulgaris*, *M. bostoniensis*, and *M. argentea*) as being found in the waters of Vermont. All, however, belong to the one species, which appears to be common in Lake Champlain and the Connecticut. Concerning it Mr. Thompson says:

"The common eel, found in Connecticut River and in the streams and ponds in this State on the east side of the Green Mountains, I suppose to belong to this species. Not having obtained specimens of this and the following species, I can only give Dr. Storer's description of them. In some of the ponds this eel grows to a very large size. They are frequently taken at the outlet of Barnard Pond, weighing 8 or 10 pounds."

## Family HIODONTIDÆ. The Moon-eyes.

**25. Hiodon tergisus** LeSueur. *Moon-eye; "Winter Shad."*

Thompson says this is often called the whitefish by the fishermen, and that it is considered a very good fish for the table, but that it is not taken in Lake Champlain very plentifully.

## Family CLUPEIDÆ. The Shad.

**26. Alosa sapidissima** (Wilson). *Common Shad.*

Concerning the occurrence of the shad in Vermont, Mr. Thompson remarks:

"This excellent and valuable fish, which is common both to Europe and America, was formerly taken in Connecticut River in large quantities, particularly in the neighborhood of Bellows Falls. It is still taken plentifully in Merrimac River and in many other streams which flow into the Atlantic Ocean from New England. I can not learn that it has ever been taken in Lake Champlain, but on account of some resemblance in form and appearance between this species and the *Coregonus albus*, [*C. clupeiformis*] or whitefish, the name of shad, or lake shad, is here very generally applied to the latter."

### Family SALMONIDÆ. The Trouts and Whitefishes.

**27. Coregonus quadrilateralis** Richardson. *Round Whitefish; Menominee Whitefish; Shadwaiter.*

We obtained no examples of this whitefish in Vermont and have no absolutely certain evidence of its occurrence in the waters of that State. We have seen specimens, however, from small lakes in New Hampshire and in the Adirondacks. In the Adirondacks it is a common species, and we have no doubt of its occurrence in both Lakes Champlain and Memphremagog.

**28. Coregonus clupeiformis** (Mitchill). *Common Whitefish.*

Exact information concerning the presence of this and other species of whitefishes in Lakes Champlain and Memphremagog is very much to be desired. There is in the National Museum a single specimen of the true whitefish, said to have been taken in Missisquoi Bay. Under the name *Coregonus albus* (which he called *whitefish*, or "*lake shad*") Mr. Thompson has the following:

"This fish, though the same as the celebrated *whitefish* of the Western and Northwestern lakes, is generally known in Vermont by the name of *lake shad*. Its Indian name at the Northwest is *attihawmeg*. This fish is quite common in Lake Champlain, and, in some years, is taken in the months of May and June in considerable quantities with the seine. It is also found in many of the small lakes in Lower Canada connected with the St. Lawrence on the south side, notwithstanding the assertion of Dr. Richardson* that it does not exist in the St. Lawrence below the Falls of Niagara. This is universally considered a most excellent fish, and nearly all are disposed to acquiesce in the opinion of Charlevoix that, 'whether fresh or salted, nothing of the fish kind can excel it.' But few, I think, will agree with the Baron La Hontan, who says that it should be eaten without any kind of seasoning, because 'it has the singular property that all kinds of sauce spoil it.' In warm weather this fish should be either cooked or salted soon after it is taken, as it quickly becomes soft and is spoiled. It is excellent either boiled or fried. The mode of boiling at the Northwest, according to Dr. Richardson, is as follows:

'After the fish is cleansed and the scales scraped off, it is cut into several pieces, which are put into a thin copper kettle, with water enough to cover them, and placed over a slow fire. As soon as the water is on the point of boiling the kettle is taken off, shook by a semi-circular motion of the hand backward and forward, and replaced on the fire for a short time. If the shaking be not attended to exactly at the proper moment, or be unskillfully performed, the fish, coagulating too suddenly, becomes comparatively dry to the taste, and the soup is poor.'

"The stomach of this fish is remarkably thick, and when cleansed and cooked is esteemed a great luxury. The whitefish is very thick and fleshy, and on account of the smallness of the head, fins, and intestines the waste in dressing is less than in any other fish. The greater part of those taken in Lake Champlain are from 15 to 20 inches in length, and weigh from 1 to 3 pounds, though smaller ones are often taken, and occasionally larger ones, weighing from 3 to 6 pounds. They are usually sold fresh as taken from the water, and the price varies from 6 to 10 cents a pound. The whitefish seems to subsist principally upon small molluscous animals. I have sometimes found more than 100 univalve and bivalve shells in the stomach of a single fish."

Mr. Thompson does not give either the round whitefish (*C. quadrilateralis*) or the Musquaw whitefish (*C. labradoricus*) as found in the waters of Vermont, but the second of those species is undoubtedly found there and the other almost certainly occurs in the Vermont lakes. It is evident that Thompson confounded two or three species and that much of what he says of the common whitefish really applies to the Musquaw whitefish. All the specimens of so-called "whitefish" or "shadwaiters" which we were able to secure belonged to the single species *C. labradoricus* (the Musquaw whitefish). The probabilities are that there are four species of whitefish

* Fauna Boreali Americana, vol. III, page 196

in Lake Champlain, viz, the true whitefish (*C. clupeiformis*), the Musquaw whitefish (*C. labradoricus*), the round whitefish (*C. quadrilateralis*), and the lake herring (*Argyrosomus artedi*), but further evidence is necessary to settle the exact status of each. The artificial propagation and planting of the various food-fishes greatly complicates questions of distribution of this kind. The true whitefish and perhaps others have been planted in Lake Champlain, and it will now be difficult to determine the natural relations of the species of fishes in this lake.

29. **Coregonus labradoricus** Richardson. *"Shadwaiter"; "Shad"; Musquaw Whitefish.*

We have examined the following specimens of this species from Vermont waters: Two, Nos. 67 and 68, 15 and 19½ inches long and weighing 1¼ and 2¼ pounds, respectively, from Missisquoi Bay, obtained by Mr. Richard Rathbun in 1894, and one 18 inches long, weighing a little over 2⅛ pounds, caught in Lake Memphremagog, received from Hon. L. D. Miles, of Newport, November 23, 1894. The following are descriptions of these specimens:

No. 67. Head 4⅝; depth, 3½; eye 4⅝; snout 4⅔; D. 11; A. 11, not counting rudiments; maxillary 4 in head, just reaching front of pupil, lower jaw included; the distance from snout to occiput 2½ in the distance from occiput to dorsal; scales 10–72–9; gillrakers 9+17 (counting the one in the angle with those on the long arm) short, 2½ in eye.

No. 68. Head 5+; depth 3⅘; eye 5; D. 12; A. 11; snout 5; maxillary just reaching front of eye, 3⅘ in head, lower jaw included; distance from snout to occiput 2⅔ in distance from occiput to dorsal; scales 10–71–8; gillrakers 9+16 (counting the one in the angle as one of the long arm) short, the longest 2 in eye. Color dark on back and sides, but paler than the above; white below; fins all black-tipped as in No. 67.

Description of specimen from Lake Memphremagog, a spent female, 18 inches long: Head 4⅛; depth 4; eye 5; snout 4⅕; D. 10; A. 11; maxillary 4 in head, just reaching front of eye; mandible 2⅔ in head, reaching past middle of pupil, lower jaw included; snout projecting, pig-like; height of dorsal 2 in head, last ray 4 in head; first ray of anal 2, last ray 6, in head; pectorals equal last ray of dorsal or the ventrals in length; caudals deeply forked; scales 10–87–9; gillrakers, 10+15, and 10+16, the longest 2 in eye. Color rather dark olivaceous; sides silvery with greenish reflections, white below; scales on sides of belly with few dusky spots; fins all black-tipped, as in *A. nigripinnis*, all paler at base.

There is a large specimen in the National Museum (No. 102881) from Lake Champlain, collected by Mr. P. S. Phelps.

The two examples from Missisquoi Bay were collected in October, 1894, by Mr. Niles, who called them true whitefish; the one received from Mr. L. D. Miles from Lake Memphremagog, November 23, 1884, is what he called "shadwaiter."

Mr. Eli Cameron, of Rouses Point, says the fishermen often spear bluebacks through the ice in winter. These also are probably *C. labradoricus*.

Mr. A. S. Hilliker, of Alburg Springs, says that "the principal catch by the licensed seines in Missisquoi Bay in the fall is the shad, a kind of whitefish. They bring about 8 cents a pound shipped to New York. They are ripe with spawn in November, when they come from deep water into shallow water, where they spawn."

Mr. Samuel Decker, of West Swanton, says that the "shad" are gotten mostly in the fall, when they come into shallow water for spawning.

Hon. L. D. Miles, of Newport, says the shadwaiters spawn in the fall, when they come near the shores from deep water.

We have received two fine specimens of this fish from Mr. Collins. One was a male, 16½ inches long, and weighed 2 pounds; the other a female, 23 inches long, and weighing 6 pounds. They had apparently spawned last fall. They were called "whitefish or shad" by Mr. Collins.

**30. Argyrosomus artedi** (LeSueur). *Lake Herring; Cisco.*

Recorded by Mr. Thompson from Lake Champlain:

"This fish is only occasionally met with in Lake Champlain, but they sometimes appear here in myriads. In the spring of 1847 they were, for a short time, taken at Burlington in very large numbers, as many as 200 being taken at one haul of the seine. In some years none at all are taken here. The specimen from which the preceding description is made was taken in 1818, and I learned of only two others being taken at that season. It resembles somewhat the lake shad, *C. albus* [*C. clupeiformis*], but is a rounder fish, having much less depth in proportion to its length. It is much esteemed as an article of food. It is common in Lake Ontario and Lake Erie, and is called in many places the shad salmon."

Mr. Titcomb informs us that this species is quite common in several Vermont lakes, notably Lake Bomoseen, in Rutland County. For the protection of other fish it is not lawful to net them, and they are seldom caught for market except an occasional illegally taken haul. In the fall of the year, October or November, they appear in large schools, close to the rocky shores of the lake, for the purpose of spawning. They are not seen at any other season of the year.

The National Museum contains a specimen (No. 17000) of this species, sent from Vergennes, Vt., by Mr. M. E. Hall. We know of no other definite record of its presence in the waters of that State.

**31. Salmo salar** Linnæus. *Common Atlantic Salmon.*

We have no record of any recent occurrence of the Atlantic salmon in Vermont. Concerning this fish Mr. Thompson says:

"The salmon, formerly very plentiful in nearly all the large streams in this State, is now so exceedingly rare a visitant that I have not been able to obtain a specimen taken in our waters from which to make a description for this work. They have entirely ceased to ascend our rivers, and only straggling individuals are now met with in Lake Champlain. I have heard of only one being taken here during the past summer, and that I did not see. The causes which have been principally operative in driving these fishes from our waters have already been mentioned. When the country was new, according to Dr. Williams, there was a regular and abundant migration of these fishes to and from our waters in spring and autumn.* They came up Connecticut River about the 25th of April and proceeded to the highest branches. Shortly after they appeared in Lake Champlain and the large streams which fall into it. So strong is their instinct for migration that, in ascending the streams, they forced their passage over cataracts of several feet in height and in opposition to the most rapid currents. They were sometimes seen to make six or seven attempts before they succeeded in ascending the falls. When thus going up in the spring they were plump and fat and of an excellent flavor, and from the beginning of May to the middle of June they were taken in great numbers. When they arrived in the upper parts of the streams they deposited their spawn. Toward the end of September they returned to the ocean, but so emaciated and lean as to be of little account as an article of food. In the spring salmon were often taken weighing from 30 to 40 pounds."

**32. Cristivomer namaycush** (Walbaum). *Lake Trout; Longe; Togue.*

The lake trout or longe is said to be uncommon in Lakes Champlain and Memphremagog now. Mr. H. M. Price, of Burlington, says that one is occasionally taken. Mr. Miles, of Newport, says that very large longe are occasionally taken in Lake Memphremagog. One weighing 24 pounds was recently taken near the Mountain House.

Concerning this species Mr. Thompson has the following:

"This species of trout bears considerable resemblance to the *Salmo trutta*, or salmon trout, of Europe, and, being mistaken for that fish by the first European settlers of this country, it has since usually borne the name of *salmon trout*. In the

* History of Vermont, vol. 1, page 147.

northern parts of this State and in the eastern townships in Canada it is at present extensively known by the name of *longe*. In Pennant's Arctic Zoology and by the fur-traders at the Northwest its more common appellation is *namaycush*, or *namaycush salmon*. It is called by Dr. Mitchill the *Great Lake trout*, and he describes it under the scientific name of *Salmo amethystus*.* This magnificent trout equals or surpasses the common salmon in size, and is found in most of the lakes and large ponds in the northern parts of North America. In the Great Lakes at the Northwest it is often taken weighing from 30 to 60 pounds, and, according to Dr. Mitchill, it has been taken at Michilimackinac of the enormous weight of 120 pounds. This fish was formerly common in Lake Champlain and in several ponds in the western part of the State, but, like the salmon, it is now rarely caught in those waters. It is, however, still found in considerable plenty in several ponds in the northern part of Vermont, particularly in Orleans County. Bell-water Pond, in Barton, and several ponds in Glover, Charleston, etc., are much celebrated on account of the fine longe which they afford. These usually vary from half a pound to 10 pounds, but are often much larger. Individuals are said to have been taken recently in Glover weighing 25 pounds and in Charleston exceeding 40 pounds.

"This fish passes most of the time in the deepest parts of the lakes and ponds, but, according to Dr. Richardson, resorts to the shallows to spawn in October. It is a very voracious fish, and is sometimes termed the tyrant of the lakes. It is taken with the hook and line, and is also speared by torchlight. Its flesh is of a reddish-yellow color, and is very much esteemed as an article of food. Roasting is said to be the best method of cooking it. 'The Canadian voyageurs are fond of eating it raw, in a frozen state, after scorching it for a second or two over a quick fire, until the scales can be easily detached, but not continuing the application of heat long enough to thaw the interior.'" †

According to Mr. Titcomb, "Lake Dunmore, in Addison County, is good fishing for longe. Willoughby Lake is the largest and best lake for them in northern Vermont. Maidstone Lake, in Essex County, is inhabited by a longe so distinctly individual that many consider it a distinct variety. It is highly prized as a table fish, but does not grow so large as in many other lakes. The average weight of those found in Maidstone Lake is 2 to 3 pounds."

**33. Salvelinus fontinalis** (Mitchill). *Common Eastern Brook Trout.*

One specimen, 4¼ inches long, was obtained in Sleeper River at St. Johnsbury. Numerous young trout were seen in a small stream on the east side of Lake Memphremagog. The brook trout is, of course, well distributed over this region. Mr. Thompson has the following interesting paragraphs concerning its former abundance:

"The brook trout is more generally diffused over the State than any other species of fish, there being scarcely a brook or rill of clear water descending from our hills and mountains in which it is not found. When the country was new they also abounded in the larger streams, where they often grew to the weight of 2 or 3 pounds. But they have been diminished by the causes already mentioned and have been sought after with such eagerness as the most delicious article of food of the fish kind that they are now seldom taken in our streams exceeding half a pound in weight, and much the greater number of them weigh less than a quarter of a pound. In many of the ponds they are still taken of a larger size, but their flavor is thought to be less delicious than that of those taken in running water, especially in ponds with muddy bottoms. The rapidity with which this and other species of fishes multiply under favorable circumstances was exemplified in an astonishing manner at an early day, in Tinmouth, in this State. 'A stream which was about 20 feet wide and which, like other streams, contained trout and suckers of the ordinary size and number, had a dam built across it for the purpose of supplying water for a sawmill. This dam formed a pond,

* Jour. Ac. Nat. Science, Philadelphia, vol. 1, page 410.
† Richardson's Fauna Boreali-Americana, vol. III, page 180.

which covered, by estimation, about 1,000 acres, where the trees were thick and the soil had never been cultivated. In two or three years the fish were multiplied in the pond to an incredible number. At the upper end, where the brook fell in, the fish were to be seen in the spring running over one another, so embarrassed by their own numbers as to be unable to escape from any attempt made to take them. They were taken by the hands at pleasure, and swine caught them without difficulty. With a small net the fishermen would take half a bushel at a draft and repeat their labors with the same success. Carts were loaded with them in as short a time as people could gather them up when thrown upon the banks, and it was customary to sell them in the fishing season for a shilling a bushel. While they thus increased in numbers they also became more than double their former size. This great increase of fishes is supposed to have been occasioned by the increased means of subsistence in consequence of carrying the water over a large tract of rich and uncultivated land.'*

"The trout is usually taken with the hook, and the bait universally used is the red earthworm, everywhere known by the name of *angle worm*. Fishing for trout is a favorite and common amusement, and parties frequently go 15 or 20 miles for the sake of indulging in it."

Mr. Titcomb is very properly of the belief that the majority of the fish referred to by Williams were suckers rather than trout. He says:

"While it is the trout for which Vermont is famous and it is a fact that they increase rapidly and grow to an astonishing size in a short period, when in a stream or pond which has been raised or flowed over new ground, I doubt very much the story about the pond in Tinmouth, referred to by Thompson. I think the fish he describes were suckers. The same wonderful catch of suckers can be made to-day."

### Family ARGENTINIDÆ. The Smelts.

**34. Osmerus mordax** (Mitchill). *Smelt; Ice-fish.*

The smelt is said to be an abundant fish in Lakes Champlain and Memphremagog. At the time of our visit to those lakes these fish were in deep water and would not readily take a hook, so no specimens were obtained then. In the fall they come out into shallow water, when they can be caught. During the winter they bite freely and can be taken through the ice. They can be taken with hook and line, but are also sometimes seined. They are said to make an excellent bait for longe. Through the kindness of Hon. L. D. Miles we received on November 23, 1894, twenty-one fine specimens of smelt taken in Lake Memphremagog. These present the following measurements:

Head 4; depth 6; eye 4½; maxillary reaching posterior margin of eye; D. 10; A. 15; length in inches, 6¾; 6⅞; 7; 7; 7; 7; 7⅛; 6⅞; 7¼; 7⅜; 6⅜; 6½; 6⅝; 6¾; 6¾; 6¾; 7¼; 7⅛; 6¾; 7; 7⅜. Weights in grams (1 ounce equals 28.35 grams): 28, 29, 32, 29, 32, 29, 32, 27, 33, 38, 27, 27, 27, 30, 31, 29, 35, 31, 29, 32, 34. The total weight was 641 grams, or a little less than 2¼ pounds.

According to Mr. Titcomb, "Smelt do not come to the surface in our fresh-water lakes until late in winter or early spring. They are then taken through the ice with hook and line. No one appears to know whether they enter our streams to spawn or spawn in the lakes, and I have never been able to settle this question, but presume they enter and leave the streams before the ice is out."

The United States Fish Commission has received a number of unusually large smelt through the kindness of Mr. S. F. Lane, of Port Henry, N. Y. These fish were taken by hook and line in Lake Champlain March 7, in 15 to 70 feet of water, and are locally known as ice-fish. The largest example measured 12½ inches in total length and weighed 214 grams, or nearly one-half pound.

* Williams's History of Vermont, vol. 1, page 149.

In a recent number of *Forest and Stream* Mr. A. N. Cheney has the following very interesting account of this species as an inhabitant of Lake Champlain:

"More than twenty years ago I first heard of the 'ice-fish' of Lake Champlain, and when I saw them I found them to be the common smelt; but from that time to this the identity of the fish has been questioned at recurring intervals. Last year when I saw smelts being taken at Port Henry over 1 foot long and weighing one-half pound each, and was told that even larger ones were caught through the ice at Port Henry and Westport, I was obliged to admit that I had never seen smelts of such great size; nevertheless that is what they were. Last week I was at Port Henry and the identity of the 'ice-fish' was once again discussed, with the added information that the fish were now sent quite regularly to New York City, where they were pronounced to be different from the smelt. I had some packed to bring home with me, and asked to have several of the very large ones put in the box to have the matter of species set at rest. The man who furnished the fish told me that after Mr. Cobb's visit to the lake the United States Fish Commission had sent for specimens to determine just what 'ice-fish' really were, and that specimens had been forwarded to Dr. Hugh M. Smith. I asked Dr. Smith about them and he writes me:

"The specimens of "ice-fish" recently sent to us from Lake Champlain were the salt-water smelt (*Osmerus mordax*). They were fine examples, the largest being more than 1 foot in length and weighing one-half pound. The females were filled with ripe spawn. I have never seen such fine smelts on the New England coast, although they are sometimes taken in Maine and Massachusetts fully as large as those under consideration. As you know, this species is landlocked in some of the Maine lakes, and Professor Evermann took specimens in Lake Memphremagog; the fish in the latter lake, however, are quite small. In your opinion do the Lake Champlain smelts come up the St. Lawrence River each year for the purpose of spawning, or are they permanent residents of the lake?'

"I believe that smelts are not permanent residents of Lake Champlain, as they are caught only through the ice in February and March, and a search for them by the anglers in the summer and fall months has proved fruitless. In New Hampshire, where the smelt is landlocked, I have caught them in June, July, and August, and if they remained in Lake Champlain permanently they would be found by those who have persistently sought them. Another reason for thinking that they come from the St. Lawrence only to spawn, for it will be noticed that they are caught in the lake just before the spawning season, is that they have two runs of smelt in that river, one of small fish and one of large fish, such as are mentioned by Dr. Smith, the large fish of the lake answering to those known to run up the river. The landlocked smelt that I have caught in New Hampshire are much more slender, length for length, than the Champlain fish, showing that the latter are accustomed to rich pasturage probably not found in the lake. In Lake Champlain the large and small smelts are caught together, showing that the schools must mingle after they reach the lake, and they mingle in more than one way, for large smelts have been caught with small smelts inside of them, showing that the big fellows feed on their small brethren. One big smelt has been convicted of eating seven small ones at a single meal. This I learned only a few days ago."

The views expressed by Mr. Cheney do not meet the approval of all the anglers or persons who have observed the fishes of Lake Champlain. In another issue of *Forest and Stream* Mr. Bainbridge Bishop, of New Russia, N. Y., takes issue with Mr. Cheney upon the question as to whether the smelt come up regularly from the sea. We make the following extract from Mr. Bishop's interesting letter:

"As a rule Lake Champlain smelt and herring do not migrate to salt water, but at the approach of summer retire to the deepest part of the lake, where they find 200 to 400 feet of water. Here they stay at the bottom most of the time. When the broad lake freezes over they work up in shoaler water, where the fishermen take them through the ice. They are caught later in the winter at Port Henry, it being farther away from the deeper part of the lake. I have seen smelt in the lake every month in the year, and have caught them in most of the summer and fall months. While trolling off Cedar Beach in very deep water, with a lake-trout rig, I caught a

smelt 14 inches in length. This was in July. I was running a good-sized dace 150 feet below the surface, using 1½ pounds lead. Also in August, while trolling, I caught a one-half-pound smelt in the middle of the lake opposite Westport, where I was running a minnow 200 feet below the surface. When camping in August at Apple Tree Point, a little north of Diamond Island, I used to go out before sunrise to fish for wall-eyed pike in about 100 feet of water. Very often the pike would chase and drive schools of smelt to the surface. They would leap out of the water by hundreds; they were fair-sized smelt.

"In September I was fishing on a reef far out in the lake opposite Westport. This reef has 18 feet of water on it, breaking off suddenly to 200 feet. A strong current was running from the deep water over the reef. Pike were biting finely. Once in a while the water would fairly boil close around the boat, caused by the smelt coming to the surface, driven up by large fish. Some of the pike threw smelt from their mouths after they were in the boat. Game Protector Goper Liberty was with me at the time. Once while anchored on this reef in a still time, with the current running as before, suddenly I noticed great quantities of air bubbles rising to the surface all over the reef. This was a mystery, but it was soon solved by the appearance of thousands of smelt leaping from the water, apparently disabled and in trouble. It seems that the current brought them up from deep water and the diminished pressure expanded their air bladders to such a degree that it brought them to the surface in distress, notwithstanding that they expelled part of the air before they broke water.

"I have taken fair-sized smelt from the mouths and throats of wall-eyed pike all through the summer and fall months—this was when fishing in and near very deep water—and have frequently used smelt so taken for bait with good success. My friend, Samuel P. Avery, jr., tells me that he picked up a dead smelt on the shore of his island at Button Bay. He went out on his favorite reef, and with this single smelt caught five fine wall-eyes. Smelt are the natural food of wall-eyes in Champlain and make the best of bait. I have never found smelt in black bass taken in Lake Champlain. Sometimes smelt come to the surface toward night, and in cloudy weather, when the lake is still, observing persons can see them swimming about in large schools, making a wide and curious ripple on the water. This is generally seen at the middle of the lake, where the water is the deepest. Smelt can be caught in Lake Champlain in any of the summer months by going to the right place and using the right means, but I do not think to much advantage, as they lie in deep water and are more scattered than in winter; still, by a little effort enough can be caught to use for bait.

"Here I want to raise a note of warning to those that think of introducing smelt to feed lake trout. They are ferocious little brutes and persistent destroyers of small fish living in all depths of water; they would destroy the young trout. This I think is one reason lake trout are not more plenty in Champlain."

In another issue of *Forest and Stream* Mr. Cheney gives still further information upon this subject. He says:

"In *Forest and Stream* of March 28 I wrote of the smelts, or, as they are called locally, 'ice-fish,' of Lake Champlain, and said that I believed that they were not permanent residents of the lake, 'as they are caught only through the ice in February and March, and a search for them by the anglers in the summer and fall months has proved fruitless.' My friend, Mr. Roland E. Robinson, has written me a letter upon this subject, from which I quote:

'Hon. M. F. Allen, of that place (Ferrisburg, Vt.), told me a few years ago of catching pike-perch off Split Rock, in Lake Champlain, that were gorged with smelt. I do not recall the date, but it could not have been earlier than the middle of June, and may have been in July or August. Mr. Allen is an old angler, well acquainted with the varieties of fish common in our waters, and could not have been mistaken in the identity of the smelt. I well remember seeing an occasional specimen among the great hauls of other fish taken in the old days of unrestricted seining on the then famous fishing-ground at the mouth of Lewis Creek, the Sungahneetook, or Fishing Weir River of the Waubanakees. These facts go to show that the smelt remain in the lake during at least part of the summer.'

"The author of 'Uncle 'Lisha' is the first person to my knowledge residing on or near Lake Champlain to call the smelt of the lake by its proper name, or, in fact, to admit that it is a smelt. That Mr. Robinson has himself observed the smelt among the fish caught in the lake, and that Senator Allen bears like testimony, should settle the question of their presence in the lake in summer. There is a whitefish found in Lake Champlain the young of which might be mistaken for the smelt when found inside other fish, unless the observer was familiar with both species, but this would not apply to either of the gentlemen quoted. A strange thing about the smelt is that they have not been caught by those who have searched for them in the summer months. My information on this subject comes from fishermen at Port Henry only. A year ago, when smelt fishing through the ice was at its height, I visited the fishermen on the ice and questioned them as to their knowledge of the smelt in the summer months. All agreed that, although search had been made for them, they had not been taken. Another strange thing is that no one seems to know anything about where they spawn."

Hon. L. D. Miles, of Newport, says that the smelt is not native to Lake Memphremagog, but was planted there several years from Lake Champlain, and that it has increased quite rapidly. It remains in the lake all the time, coming into shallow water from the first of October to the middle of June. He thinks they spawn on the same beds used by the shadwaiter. They are caught in spring and fall, chiefly in seines, but some are taken with hook and line.

Mr. Bishop's experience with this fish seems to furnish pretty conclusive evidence that it is permanently resident in Lake Champlain, as it doubtless is in Lake Memphremagog.

Knowing what we do of the physical environment of the landlocked smelt in the small lakes of Maine, one would be disposed to believe, in the absence of evidence to the contrary, that those in Lakes Champlain and Memphremagog are also landlocked.

The smelt from Cobessicontic Lake, Kennebec County, Me., was described as a distinct species by Professor Cope in 1870, under the name *Osmerus abbotti*. In the same year Professor Cope described specimens from Wilton Pond, in the same county, as *Osmerus spectrum*. These two supposed new species have usually been regarded as not being specifically distinct from *Osmerus mordax*. The Cobessicontic smelt is said to have the head shorter, the body more slender, and the eye smaller than in the common smelt. The Wilton smelt is said to have the body still more slender, the eye large, and the mouth and maxillary short. We have no specimens of either of these varieties and have had no opportunity to compare them with the true smelt. We have, however, compared examples from Lakes Champlain and Memphremagog with specimens from salt water, and, being unable to discover any tangible differences, are not willing to admit them even to subspecific rank.

Concerning this species Thompson says:

"The smelt is one of those migratory species of fishes which pass a part of the time in salt water and a part in fresh. Though not a constant visitant in our waters, he occasionally makes his appearance, and is sometimes taken in Lake Champlain in very considerable numbers. The form of this fish is long and slender, and its bright silvery hue renders it very beautiful. It is sometimes taken with the hook, but more commonly with the net, and is very highly esteemed as an article of food. In Massachusetts, according to Dr. Storer's report, 750,000 dozen of these fishes are taken annually in Watertown alone and sent to Boston market."

### Family UMBRIDÆ. The Mud Minnows.

**35. Umbra limi** (Kirtland). *Mud Minnow; Mudfish.*

No specimens were obtained by us, but it is doubtless a common fish in suitable places in Vermont. Concerning it Mr. Thompson has the following:

"These fishes exist in considerable numbers in the marshes and coves along the margin of Lake Champlain, and of the rivers which fall into it. They are very tenacious of life, and live longer than most fishes without water. During droughts,

as the waters subside and recede from the coves, they have the power, by a springing motion, of transporting themselves from one little puddle to another. They also have the power of partially burying themselves and living in the mud and among the moist grass roots, after the other small fishes associated with them are all dead for the want of water. In these situations vast numbers of them are devoured by birds, muskrats, and foxes. In severe droughts, like that of 1841, the quantity of small fishes which die in consequence of the drying up of the coves is exceedingly great. In one small cove, which I visited on the 24th of September, 1841, I found mudfishes and other small fishes dead in piles in the low places which had become dry. One small portion of the cove, still covered with water and leaves to the depth of 4 or 5 inches, was literally filled with fishes struggling together for existence. This portion amounted to about one square rod, and in this space there could not have been much less than a barrel of fishes. They consisted of pickerel, yellow perch, shiners, bullpouts, and mudfishes, but mostly of the two last. My feelings were really pained at the sight, and, moved by compassion for the poor fishes, I heartily wished for rain, which, on the next day, came in abundance, to the joy not only of the fishes and their sympathizers, but of the whole country."

### Family LUCIIDÆ. The Pikes.

**36. Lucius reticulatus** (LeSueur). *Pickerel.*

Our collection contains a fine example of this species, weighing 3 pounds, for which we are indebted to the skill and kindness of Mr. J. F. Lincoln, who took it while trolling in Missisquoi Bay, July 20.

Mr. Titcomb writes us that "*Lucius reticulatus* is common on both sides of the Green Mountains. When it gets into our ordinary trout lakes or ponds it means extermination to the trout. If bullheads follow the pickerel in waters where food is not abundant, the pickerel gradually grow less in numbers. One informant says he has found the *reticulatus* dead on the surface of the water with bullheads in them, and that the latter often kill the fish which swallow them."

According to Thompson, this is the common pickerel east of the Green Mountains, as the next species is the more common on the west side:

"This is the common pickerel on the east side of the Green Mountains in Vermont, as the preceding species is on the west side. It is found in Connecticut River and most of its larger tributaries, and it has multiplied exceedingly in several ponds to which it has been transported by the inhabitants in the neighborhood. This is the common pickerel of Massachusetts and the other New England States."

**37. Lucius lucius** (Linnæus). *Common Pike; Pickerel.*

This is a common fish in Vermont, especially in the western part. It is usually called pickerel, but toward the north end of the State and in Canada it is generally called pike. Two fine examples were obtained by us in Missisquoi Bay. It seems to be common in Lakes Memphremagog and Champlain, and is one of the principal species taken in gill nets when used. They are also caught by trolling and are considered good game fish by many. They spawn in the spring, when they come out into the marshes for that purpose.

Mr. Thompson says:

"This species is very common in Lake Champlain and in all its larger tributaries. It is generally known in Vermont by the name of *pickerel*. About the north end of the lake and in Canada generally it is called the *pike*, on account of its resemblance to the English pike. Indeed, the resemblance is so close that Dr. Richardson regards them as identical, and has described our pike in his Fauna Boreali-Americana, under the name of the foreign species *Esox lucius*, but they are generally regarded by naturalists as distinct species. This fish grows to a large size, frequently exceeding 30 inches in length and weighing 10 or 12 pounds. It is very voracious and devours great numbers of reptiles and small fishes. It is taken both with the hook and seine, and is considered a very good fish for the table. The fishermen say that there

is another fish of this family in Lake Champlain, which they call the *Maskalongè*. If so, it is probably the fish which Richardson (*Fauna Boreali*, p. 127) calls *E. estor, maskinongè*. I lately received one which was sent me as a *maskalongè*, but which proved to be only a plump specimen of the *common pike.*"

**38. Lucius masquinongy** (Mitchill). *Maskallonge; Muskallonge; Mascalonge.*

The maskallonge is said to be taken occasionally in Lake Champlain and the mouths of the larger tributary streams. It is said not to occur in Lake Memphremagog. Thompson records it from the Lamoille River, but we have seen no examples from those waters. It is seldom reported from any tributary to Lake Champlain except the Missisquoi River, in which it furnishes good sport to the few initiated fishermen.

Thompson has the following interesting remarks regarding the "Masquallonge:"

"This fish has, till lately, been confounded with the *Esox estor*, or common pike, or lake pickerel. When my description of the *E. estor* was published, in 1842, I doubted the existence of this species in our lake, but since that time my mind has changed on the subject. In May, 1847, I received from my friend, the Hon. A. G. Whittemore, of Milton, a fish caught near the mouth of the River Lamoille, which the fishermen called masquallonge. It was 26 inches long and weighed about 6 pounds. Upon examining it I was fully satisfied that it was of a species distinct from *E. estor*, and, as I could find no description of it under any other name, I made out a description and gave it the name of *Esox nobilior.*

"In April, 1848, I received another specimen from the same source, which weighed 19 pounds and was 41½ inches long. In May, 1849, two specimens were brought along, both caught near the mouth of the Lamoille, one of which weighed 40 pounds and the other 27 pounds. I purchased the latter, and from it the preceding description is chiefly drawn. Believing this species to attain a larger size and to be a more excellent fish for the table than any other species of the pike family found in the United States, I have given it the specific name of *nobilior*. It is a fish which is eagerly sought and commands the highest price in market, but it is rare in Lake Champlain, compared with *E. estor*, or common pike. Very good figures of both of these species are given in Frank Forester's Fish and Fishing, but both under wrong names; the *E. nobilior* being figured under the name of *E. estor*, and the *E. estor* under that of *E. lucioides.*

"The vulgar name *masquallonge* appears to have been given by the early French settlers of Canada to the pikes and pickerels generally, it being a term or phrase descriptive of the whole family—*Masque*, signifying face or visage, and *allonge*, lengthened, they all having lengthened or elongated heads. In modern times this name, *musquallonge*, has been confined, by the fishermen, to the species here described, while the other species bear the vulgar name of pike or pickerel. The methods of spelling this Canadian-French name have been almost as numerous as the authors who have used it, as may be seen by the following: *Maskallonge*, LeSueur; *masquinongy*, Dr. Mitchill; *maskinonge*, Dr. Richardson; *muskallonge*, Dr. Kirtland; *muskellunge*, Dr. DeKay.

"The oldest forms of this name, it will be seen, approach nearest, both in spelling and pronunciation, to the phrase *Masque allonge*, which we have supposed to be its origin, and, therefore, afford presumptive proof of the correctness of our supposition.

"This fish may usually be distinguished from the common pike by its dark circular markings and its more robust proportions. Its head is proportionally shorter, the face flatter and less grooved, and the width across the eyes and upper jaw greater than in the *estor*. But, perhaps, the mark by which it may be most readily distinguished is on the cheek, the lower half of the cheek in the *E. nobilior*, in front of the preoperculum, being naked, or without scales, while in the *E. estor* the whole cheek is covered with scales. The difference in the general aspect of the two species may be seen by comparing the figure of the *E. estor* below with the *E. nobilior* at the head of this article.

"The specimen here described was a female with her abdomen filled with eggs, contained in two ovaries which extended nearly the whole length of the cavity. This fish abounds much more in the streams and smaller lakes in Canada than in Lake Champlain."

### Family GASTEROSTEIDÆ. The Sticklebacks.

**39. Eucalia inconstans** (Kirtland). *Brook Stickleback.*

Through the kindness of Mr. John W. Titcomb the Commission has received a specimen of this species from a small brook in Franklin County, Vt. This brook, which is the outlet of Franklin Pond, empties into Pike River, which flows from Vermont, through Canada, into Missisquoi Bay. Mr. Titcomb says that the stickleback is reported to be common in that particular brook, but he does not think he has seen it elsewhere in the State.

Mr. Thompson appears not to have noticed it.

### Family PERCOPSIDÆ. The Trout Perch.

**40. Percopsis guttatus** Agassiz. *Trout Perch.*

Concerning the discovery and naming of this interesting fish Mr. Thompson has the following:

"The first knowledge I had of this fish was in the summer of 1841, when I found a specimen of it, 5 inches long, which was dead, and had been drifted up by the waves on the lake shore in Burlington. On examining it I found it to possess the adipose and abdominal fins of the trout, but in its teeth, gillcovers and particularly in its hard, serrated scales, to bear considerable resemblance to the perch family. After searching all the books within my reach without finding it described I concluded that it might be new, both in genus and species, and accordingly, in allusion to the above-mentioned properties, I described it in my journal under the provisional generic name of *Salmoperca*. A notice of this fish was omitted in my History of Vermont, published in 1842, because I had then only one specimen, and upon that one, with my little experience, I did not think it prudent to found a new genus and species. When Professor Agassiz was at Burlington in 1847 I submitted the above-mentioned specimen to his inspection, having at that time obtained no others. At first sight he thought it might be a young fish of the salmon family, but upon further examination he said it was not a salmon, nor any other fish with which he was acquainted.

"During the summer of 1847 I found three other specimens of this fish, dead, on the lake shore. One of these I took with me to Boston in September to the meeting of the Association of American Geologists and Naturalists, and put it into the hands of my friend, D. H. Storer, M. D., with a request that he would ascertain what it was and let me know.

"In May, 1849, I obtained from Winooski River a number of living specimens, which I kept alive for some time; and, observing the great translucency of the living fish when held up toward the light I gave it the specific name of *pellucida*, having previously called it, in my journal, *coceta*, from its wing-like pectoral fins.

"About this time I noticed, in the proceedings of the Boston Society of Natural History, that Professor Agassiz had laid before the society an account of a new genus of fishes discovered by him in Lake Superior, which he proposed to call *Percopsis*. Suspecting, from the brief description given of it, that it was identical with my *Salmoperca*, I wrote to Dr. Storer and inquired of him if the specimens from Lake Superior presented to the society by Professor Agassiz were like the one I put into his hands in 1847. He wrote me that he could not say—that the specimen went out of his hands soon after he received it and he had not seen it since.

"In Professor Agassiz's Lake Superior, page 248, I find an account of his genus *Percopsis* and his species *P. guttatus*, and I have no doubt that it is identical with my *Salmoperca pellucida*. Still, I have thought it best to let it remain, in this Appendix, under the name I had given."

### Family CENTRARCHIDÆ. The Sunfishes and Basses.

**41. Ambloplites rupestris** (Rafinesque). *Rock Bass.*

According to Thompson, "this fish is here known by no other name than *rock bass*. It is quite a common fish in Lake Champlain and its larger tributaries. It is usually taken with the hook along the precipitous rocky banks of the lake and rivers, and from this circumstance it derives its name. It is considered a very good fish for the table, and its weight is usually about half a pound." A nearly ripe female was received from Missisquoi Bay April 25.

Mr. Titcomb says that the rock bass is quite common in many lakes other than Champlain, particularly in Lake Bomoseen.

**42. Lepomis megalotis** (Rafinesque). *Big-eared Sunfish.*

This sunfish is recorded by Thompson from the Connecticut River at Barnet.

**43. Eupomotis gibbosus** (Linnæus). *"Sunfish"; "Pond Perch."*

Mr. Thompson says:

"This is a very common fish in the coves along the margin of Lake Champlain, and about the mouths of our rivers. Though extensively known by the name of *sunfish* and *pond perch*, it is perhaps more generally known by the name of *pumpkin seed*. It is also sometimes called *bream*. This fish, though said in Jardine's Naturalists' Library to be of unobtrusive colors, is one of the highest colored and most beautiful fishes found in our waters, 'oftentimes vieing in brilliancy with the tropical fishes.' The sunfish, though often taken with other fishes in the seine, is more commonly taken with the hook, at which it bites with avidity. Its flesh is white and palatable, but the fish being small, thin, and bony, is little sought as an article of food."

Two examples, the larger 9 inches long and weighing 10½ ounces, were received April 25 from Missisquoi Bay.

**44. Micropterus dolomieu** Lacépède. *Small-mouthed Black Bass.*

This important game fish is pretty generally distributed throughout the State, and it is probably more abundant now than it was in Thompson's time. He says:

"The black bass, by which name this fish is here generally known, ranks as one of the best fishes taken from our waters; but, as is apt to be the case with good fishes, it is much less abundant than several other species which are greatly its inferior in point of quality. It is usually taken with the seine, and its weight varies from 1 to 5 or 6 pounds."

One small specimen was obtained by us in Missisquoi Bay. Mr. Eli Cameron, of Rouses Point, says there are a good many bass in Lake Champlain, and that they spawn in May and the fore part of June. Samuel Decker says the black bass are abundant and that they spawn in May and June. Others state that the black bass is common in Vermont, and that they spawn in May and June or even as late as July, when they come upon the reefs for that purpose. Mr. Miles claims that the small-mouthed black bass is not indigenous to Lake Memphremagog, but that it was planted there some years ago. An unripe male, 14 inches long and weighing 1½ pounds, was received from Missisquoi Bay. Mr. Collins states that only two examples of the species were taken in his seine during the six weeks of its operation ending April 15.

Mr. Titcomb says:

"Black bass spawn in June and July. Many fishermen insist that they spawn earlier. On June 12, 1896, I took two small-mouthed black bass in Lake Champlain on one of the fishing-grounds where it was claimed they did not spawn, but came there from the spawning-grounds. Upon examination both fish were found to be females and full of spawn. The intestines of the stomach were empty and clean, as if they had been washed and wiped out. They undoubtedly took my hook to get it off from their spawning bed."

### Family PERCIDÆ. The Perches and Darters.

**45. Stizostedion vitreum** (Mitchill). *Wall-eyed Pike; Pike.*

Mr. Thompson says:

"The usual length of this fish is from 14 to 20 inches and its weight from 1 to 4 pounds. It is taken very plentifully from the waters of Lake Champlain and its tributaries. It is a firm, bony fish, but as the bones are large and easily separated from the flesh, they are much less troublesome than in the perch and some other species. Its flesh is well flavored, though not so juicy and rich as that of our whitefish and some few others. In the form of its body and the situation of its fins it closely resembles the perches, but its head and teeth are more like the pikes, and hence its name, *Lucio-Perca*, or *Pike-Perch*. This fish is called by Dr. Williams, in his History of Vermont, the *white perch*, but is generally known in Vermont simply by the name of *pike*, while the fish usually called pike in other places is here called *pickerel*. This fish, on the contrary, is called pickerel in Canada. We have another species of this genus, probably the *L. canadensis*, but I am unable to say so positively at present."

The pike is perhaps the most important food and game fish of Lake Champlain, and in the spring of the year it constitutes the principal catch. According to Mr. John W. Titcomb, they go up the east side of Missisquoi Bay when going to their spawning-grounds, but return to the lake by going down the west side. The fishermen on the Hog Island side get them full of roe, while those on the other side get only spent fish. The principal spawning-grounds about Lake Champlain seem to be in Missisquoi Bay and in the lower parts of the larger rivers, particularly the Lamoille and the Missisquoi. The spawning time in Lake Champlain is quite early in the spring, chiefly in April and May. Mr. A. L. Owen, of Burlington, thinks they spawn even before the ice goes out, as he has caught spent fish in April. Mr. A. L. Barrows, of Burlington, thinks they spawn about April 20; says he has caught many full of spawn in April as they were passing Highgate on their way to Missisquoi River; many spawn in Lamoille River. Mr. B. R. Seymour, of Burlington, says they spawn early in the spring, even before the ice goes out, and that their principal spawning-grounds are in Missisquoi Bay and Missisquoi, Lamoille, and Winooski rivers He says that, after spawning, the pike run down the east shore of the lake until stopped by the Sand Bar Bridge. This he regards as a calamity in that it prevents the fish from going on into the southern portion of the lake. This bridge connects Grand Isle with the Vermont shore and has no opening under it through which fish may pass. They might work to the westward and then on south, but Mr. Seymour thinks they are more likely to return north.

The wall-eyed pike is one of the principal game fishes of Lake Champlain. Mr. H. M. Price, of Burlington, says they range in weight from 2 to 5 pounds, the average being, perhaps, 2½ pounds. Mr. Barrows says they average about 2 pounds. According to Mr. Miles, the wall-eyed pike is not found in Lake Memphremagog.

According to Mr. Titcomb, its spawning season in the rivers seems governed by the time the ice leaves the river. They appear immediately after the breaking up of ice in the spring in Missisquoi River, near the dam at Swanton. This is as far as they can ascend the river, and they do not make their appearance until the ice goes out.

Among the fishes sent by Mr. Collins from Missisquoi Bay are two wall-eyed pike. One is an unripe male 25 inches long weighing 5¼ pounds, the other an unripe female 18¼ inches long and weighing 2¼ pounds. The condition of the reproductive organs indicates that the spawning period would not begin until near the middle of May. The stomachs contained nothing that could be identified.

**46. Stizostedion canadense** (Smith). *Sauger; "Ground Pike-Perch."*

Mr. Thompson says there is a second species of *Stizostedion* in Vermont, and thinks it is probably this species. In the Appendix (p. 30) he says:

"When the Natural, Civil, and Statistical History of Vermont was published I was well satisfied that the species here described was distinct from the *L. americana*, but was not so clear whether it was a species already described or not. The difference

between this species and the *L. americana* is so obvious that they are instantly distinguished, even when there is no difference in size; but while the latter species often exceeds 2 feet in length, and weighs 5 or 6 pounds, the *L. canadensis* seldom, if ever, exceeds 14 inches in length, or half a pound in weight. It is much less common in Lake Champlain than the *L. americana*, but is frequently taken in company with it. It usually swims very near the bottom of the water, and hence it has received the name of *ground pike* (pike perch). As an article of food this species is held in the same high esteem as the common pike perch."

Mr. Titcomb writes us that the sauger or rock pike, as it is locally called, is caught in seines while fishing for the pike perch. It does not grow as large as the latter, and is not much valued as a food-fish. It is usually sold as "cull fish" rather in the barrels of clear pike perch.

Two examples of the sauger or sand pike were received from Mr. Collins. One was a nearly ripe female 14½ inches long, weighing three-fourths of a pound, the other an unripe male 15 inches long, weighing three-fourths of a pound. These would indicate an earlier spawning time than that for the wall-eyed pike. The stomach of the male contained a 3-inch minnow, too badly digested for identification, and a number of small insects.

**47. Perca flavescens** (Mitchill). *Yellow Perch; Ringed Perch.*

Mr. Thompson says:

"The yellow perch is one of the most common fishes found in Lake Champlain and in the mouths of the rivers falling into this lake. They are taken both with the seine and hook, but chiefly with the latter. In the winter they are caught by cutting holes in the ice. They vary from 8 to 12 and even 14 inches in length, and are carried around for sale from house to house in the villages along the lake, at all seasons of the year, neatly scaled and dressed ready for cooking. In this condition they are sold at from 10 to 20 cents a dozen, according to the season and their abundance. The flesh of the perch is white, firm, and agreeable to the palate, but is rather dry and bony.

"This fish agrees throughout with Dr. Mitchill's description of his *Bodianus flavescens*, and is undoubtedly the species from which his description was drawn. Cuvier having obtained specimens of this and another species which very closely resembles it, from the waters of the United States, gave to this species the name of *P. serrato-granulata*, on account of its serrated and granulated gill-covers; to the other, distinguished from this by the want of granulations, by its smaller size and greater number of brown bands upon its sides, he gave the name of *P. flavescens*."

The yellow perch is one of the most common fishes of the State and is said to be particularly abundant in Missisquoi Bay. Specimens were obtained by us in Clyde River, near Newport, and from Missisquoi Bay.

Three specimens were received April 25 from Missisquoi Bay. They were 9½ to 10 inches in length and weighed about 7 ounces each. Two were fully ripe females, the other a nearly ripe male.

**48. Percina caprodes** (Rafinesque). *Log Perch; "Hogfish."*

This species, which is one of the largest of the darters, was found in abundance in Missisquoi Bay; the eleven examples saved are all small, measuring from 1¾ to 3¼ inches in length. We obtained it at Rouses Point and Plattsburg on the west shore of the lake, but did not find it elsewhere in Vermont, though it doubtless occurs throughout the State. Concerning this species Mr. Thompson has the following:

"This fish, though its vulgar name might be thought to imply the contrary, is certainly one of the most symmetrical and beautiful fishes found in our waters. It received the name of *hogfish* from a resemblance in the form of its snout and lower jaw to those of that quadruped. It is quite common in the mouths of the streams which fall into Lake Champlain, but being a slender fish and never exceeding 4 or 5 inches in length, no account is made of it as an article of food, and very little is known of its habits. It swims low in the water, and when at rest usually lies at the bottom."

**49. Boleosoma nigrum olmstedi** (Storer). *Tessellated Darter.*

This darter is contained in Thompson's list, and it appears to be quite common in Missisquoi Bay. Our collection contains a dozen examples, 1¼ to 1⅝ inches long, from that place. It probably occurs elsewhere in the State, but we have no exact information upon the matter. Thompson says:

"The habits of this fish are quite peculiar. It moves not from place to place by an even, labored motion, like other fishes, but proceeds by sudden leaps or darts, impelling itself forward by its tail and pectoral fins, which it moves as a bird does its wings. It remains suspended in the water no longer than it keeps its pectoral fins in rapid motion. When the motion of its fins ceases the fish sinks at once to the bottom, showing that its specific gravity is greater than water, owing, doubtless, to its want of a swimming bladder. When it reaches the bottom it alights upon its stiff ventral fins, upon which it stands on the bottom, balanced with its head elevated, as a bird stands on its feet. I kept several specimens of this fish alive in a vessel of water for some time for the purpose of watching their motions and learning their habits. They were very uneasy and seemed extremely anxious to escape from their confinement. Aided by their caudal and pectoral fins in giving them an impulse upward, and by their ventrals in climbing and adhering, they would often raise themselves up the perpendicular sides of the vessel, entirely above the surface of the water, excepting only the caudal fin. Another peculiarity of this fish is its power of bending its neck and moving its head without moving the body, in which respect it equals many of the reptiles. This fish is entitled to the name of *darter*, both from its sudden motion and from its having the general form of a dart."

In the stomach of a small ling (14 inches long), caught by Mr. Collins in Missisquoi Bay about April 23, were found at least thirty examples of this darter.

### Family SCIÆNIDÆ. The Drums.

**50. Aplodinotus grunniens** Rafinesque. *Fresh-water Drum; "Sheepshead."*

"This fish is quite common in Lake Champlain, and is here generally known by the name of *sheepshead*. It is also found in the western lakes and Ohio River, where it is more commonly called the *white perch*. This fish, taken from the Ohio River, is said to be fat, tender, and well flavored; but ours is lean, tough, and bony, and seldom eaten. It received its vulgar name from its resemblance in appearance to the *Sargus ovis*, which is also called *sheepshead*, on account of its 'arched nose and smutty face'; but the resemblance is in appearance only, for while the latter is considered one of the most delicious fishes for the table, the former is seldom carried to the table."

The fresh-water drum is still a common fish in Lake Champlain, but we know nothing of its occurrence elsewhere in the State. We obtained one large example with Mr. Decker's seine in Missisquoi Bay July 20, and on April 25, 1896, Mr. Collins sent us two examples taken in Missisquoi Bay at Swanton. One of these was an unripe male 28 inches long weighing 12½ pounds, the other a more nearly ripe male 19 inches long and weighing 3¾ pounds. Their stomachs were empty.

### Family GADIDÆ. The Codfish.

**51. Lota maculosa** (LeSueur). *Ling; "Methy;" Cusk.*

Mr. Thompson says:

"This fish, which is quite common in Lake Champlain and its tributaries, I have referred to LeSueur's species the *Gadus maculosus*, as agreeing more nearly with his description than with any other to which I have access. There are, however, several differences between them. In LeSueur's species the jaws are said to be equal; in ours the upper jaw is uniformly longest; in his the lateral line is said to be in the middle of the body; in ours, anterior to the vent, it is much nearer the back than the belly. Our fish bears considerable resemblance to the *Lota brosmiana* described by Dr. Storer in the Boston Journal of Natural History, vol. IV, page 58. But it

differs from his description and figure in having the upper jaw longest, in having the snout more pointed and less obicular, etc. Judging from the descriptions, without specimens for comparison, I should say that our fish differs as much from either of the species referred to as they differ from each other, and that they either constitute three distinct species or are all varieties of the same species.

"The ling is held in very low estimation as an article of food, the flesh being tough and the flavor unpleasant. This fish is one of the greatest gormandizers found in our waters. If he can procure food he will not desist from eating so long as there is room for another particle in his capacious abdomen. He is frequently taken with his abdomen so much distended with food as to give him the appearance of the globe or toad-fish. The smallest of the three before me, when my description was made, being 16 inches long, was so completely filled with the fishes swallowed that their tails were plainly seen in its throat by looking into its mouth. On opening it I found no less than 10 dace, *L. pulchellus* [*Semotilus corporalis*], all about the same size, and none of them less than 4 inches long. Seven of these were entire, and appeared as if just swallowed. Upon the others the digestive process had commenced."

The ling is still found in Lake Champlain, but it is said not to occur in Lake Memphremagog. According to Mr. Titcomb, the cusk, which is common in the Connecticut River, is caught with hook and line, and in the winter by fishing through the ice in the night, setting a number of lines and baiting with live bait. It will take live minnows about sundown and from that time until sunrise. This method of fishing is carried on by local fishermen at Lunenburg, Vt. It is also found in Willoughby Lake. It spawns in March or April, and is regarded as a valuable food-fish.

An unripe male ling was received from Missisquoi Bay through the kindness of Mr. A. L. Collins April 25. It was 14 inches long and weighed 1 pound. In its stomach we found thirty individuals of the common darter of that lake—*Boleosoma nigrum olmstedi*. Besides this number, which could be identified, there was a large mass of material too badly digested to permit of certain identification, but which probably represented still other darters.

### Family COTTIDÆ. The Sculpins.

**52. Cottus gracilis boleoides** (Girard). *Blob; "Chucklehead."*

One specimen obtained in Sleeper River near St. Johnsbury, July 25. Mr. Titcomb says it is common in that stream. It was not seen by us elsewhere, though it is doubtless not rare throughout that portion of the State drained by the Connecticut.

Mr. Titcomb says the "chucklehead" is found on both sides of the Green Mountains and is often used as bait for large trout by the patient fisherman.

**53. Cottus gracilis gobioides** (Girard). *Blob.*

This fish was originally described from specimens obtained in Lamoille River near Johnson, Vt. Thompson has the following:

"For the specimen here described I was indebted to the kindness of Mr. R. Colberth. He caught it while fishing for trout in a branch of the river Lamoille, in Johnson. This fish usually lies still at the bottom, or concealed under the stones in the streams, and seldom moves, except when disturbed, and then its motions are sluggish and labored. It is called in some places the 'slow fish.' It probably derived the name of 'star-gazer' from the favorable position of its eyes for looking upward, they being placed very near the top of the head. It seldom exceeds 4 inches in length."

# 9.—A REPORT UPON THE FISHES OF SOUTHWESTERN MINNESOTA.

By Ulysses O. Cox.

During the past five years the writer has been making collections of the fishes from the various streams and lakes in the southwestern part of Minnesota, especially from the Minnesota and Blue Earth rivers and their tributaries. In June, 1894, at the suggestion of the United States Commissioner of Fish and Fisheries, several additional lakes and streams were visited for the express purpose of learning as much as possible concerning the run of the buffaloes and suckers, about which so much has been said by various persons in this region.

All of that portion of the State where these investigations were made lies in the region of glacial drift, and, with the exception of limited areas around Mankato, where limestone and sandstone outcrop, and at Ortonville and a few other places along the Upper Minnesota River, where granite outcrops, the entire surface is covered with drift matter.

A large area near Mankato is wooded, and this wooded area extends in a greater or less degree on the east to the State line, while west from Mankato it is but a few miles to the eastern border of the Great Plains.

The fishes here listed were taken from Minnesota River and its tributaries or Des Moines River and its tributaries, but most of them are from the former. It is thought desirable to include in the list those fishes which were collected by Prof. A. J. Woolman and the writer from Upper Minnesota River and Big Stone Lake in July, 1892, and which have been listed by Mr. Woolman in the Report of the United States Fish Commission for 1893 pages 343 to 373.

The following is a classified list of the waters from which the fishes here listed were taken:

*Minnesota system.*

Little Minnesota River at Browns Valley.
Big Stone Lake at Browns Valley and Ortonville.
Minnesota River at Ortonville, Appleton, Montevideo, and Mankato.
Pomme de Terre River at Appleton.
Chippewa River at Montevideo.
Blue Earth River at Mankato.
Minneopa Creek near Mankato.

*Minnesota system*—Continued.

Lake Washington near Mankato.
Lake George near Mankato.

*Des Moines system.*

Des Moines River at Windom.
Wood Lake at Windom.
East and West Okabena Lake at Worthington.
Heron Lake at Heron Lake.
Round Lake near Worthington.

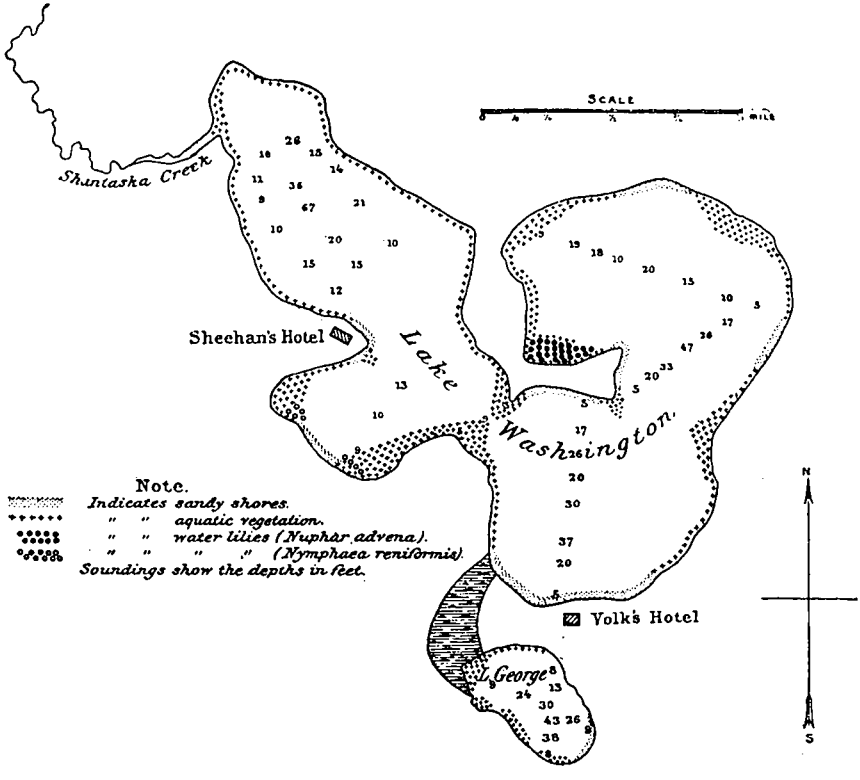
Minnesota River rises in Roberts County, S. Dak., where it is known as the Little Minnesota. It flows southeast and empties into the head of Big Stone Lake, where, at its mouth, it is nothing more than a small creek. Throughout its entire length its course is tortuous, its current sluggish, and its bottom muddy. Big Stone Lake is nothing more than the remains of an ancient glacial river bed. It varies in width from a mile to 1½ miles and is about 40 miles in length, its greatest extent being from northwest to southeast. It is shallow everywhere, the greatest depth not supposed to exceed 20 feet, and the average less than 10. Lying in the prairie region, there is no timber except a narrow belt along its shores, and even this has been nearly all removed by the settlers in the vicinity. At the southern end of Big Stone Lake the Minnesota River again emerges, not any larger than when it entered. It still has a muddy bottom and takes a very winding course. It continues to flow southeast until it reaches Mankato, in Blue Earth County, where it changes its course to due north and finally northeast, until it empties into the Mississippi near St. Paul. At Mankato it has a bed about 525 feet wide, which it fills during high water, but during the greater part of the year the stream is not more than 40 feet wide and 1½ feet deep on an average. The current is not swift, averaging during low water 1¼ feet per second and at high water seldom gains a velocity exceeding 3 feet per second. The river bottom at Mankato is sandy and gravelly, as might be judged from the banks, which are in many places made up of sand and gravel. Except when the water is disturbed by rains it is clear, comparatively free from aquatic vegetation, and quite pure above the city of Mankato. Below the city it is very much contaminated by sewage, where, during low water, very few of the higher forms of aquatic animals are found.

Minnesota River has but two northern tributaries of any importance, Pomme de Terre and Chippewa rivers. From the south it receives Lac qui Parle, Yellow Medicine, Redwood, Cottonwood, and Blue Earth rivers, the latter emptying into the Minnesota near where the Minnesota makes the bend in Blue Earth County. Blue Earth River, which rises in northern Iowa, is the largest tributary of the Minnesota. At Mankato it has a bed which is 200 feet in width, but the stream during the dry season narrows down to a mere brook not more than 10 feet in width on the ripples and having a depth of 6 inches or less. Notwithstanding, there are holes in which fish can live the entire year, and at the proper season bass and pike fishing is excellent at various places.

The bottom is generally sandy or gravelly, and in a few places it is covered with bowlders. The water is pure but warm.

Minneopa Creek is a very small brook which enters the Minnesota River from the south, 4 miles above Mankato. At certain seasons it becomes almost dry, but at one place there is a large hole and a waterfall, when the stream is running, and in this there are some fishes. Those referred to below were taken near the falls, known as Minneopa Falls.

Lake Washington lies in the southern part of Lesueur County, about 12 miles northeast from Mankato, and contains in the neighborhood of 1,100 acres. It has an outlet on the northwest which is known as Shantaska Creek, and which flows into Minnesota River near St. Peter. By reference to the map it will be seen that the shores of this lake are somewhat irregular and that in places the water is quite deep as compared with similar lakes of the region. In a bay on the west there are sedges and lily pads (*Nymphæa reniformis*), several species of




Map of Lakes Washington and George, LeSueur County, Minnesota.

*Potamogeton*, algæ, and various other aquatic plants, and these are densely populated with the lower forms of animal life commonly found in such places. In the northern part of the eastern point there is also much vegetation, but no lily pads, and at many places along the shore sedges grow. This lake has long been noted for its commercial fishing, and is at present one of the best fishing-points in this part of the State. The fishes commonly taken are the pickerel, wall-eyed pike, large-mouthed black bass, rock bass, and crappie. The pickerel and the wall-eyed pike are most abundant.

Lake George, which lies a few hundred yards to the south of Lake Washington, is not one-fourth the size of the latter, is almost circular, and does not have such deep water, the deepest sounding showing 43 feet. Along its southern, western, and northern shores there is an abundance of aquatic vegetation, water lilies being found in the southern and northwestern portions. At the northwestern shore there is a marsh, which represents the former outlet of the lake and which leads into Lake Washington. The shores of the lake are wooded. Black bass and crappies are very common in this lake.

The following is a list of the fishes which have been taken from the Minnesota River and its tributaries:

FISHES FROM THE MINNESOTA RIVER AND ITS TRIBUTARIES.

1. **Ichthyomyzon castaneus** Girard. *Lamprey.* One specimen was taken from Minnesota River at Mankato in 1892, and so far this is the only one that has been recorded.
2. **Polyodon spathula** (Walbaum). *Paddle-fish; Spoon-bill; Duck-billed Cat.* Several specimens have been taken from Minnesota River at Mankato in the springtime, generally about June 1.
3. **Scaphirhynchus platorhynchus** (Rafinesque). *Shovel-nosed Sturgeon; White Sturgeon.* Several specimens have been taken from Minnesota River at Mankato, generally in springtime.
4. **Lepisosteus osseus** (Linnæus). *Common Gar-Pike; Long-nosed Gar; Billfish.* Specimens have been taken from Lake Washington, near Mankato, where they are very numerous, but they are reported by fishermen from nearly all the lakes and streams of the region.
5. **Amia calva** Linnæus. *Mudfish; Dogfish; Bowfin; Lawyer.* Two specimens were taken from LeSueur River near Mankato; it is reported common in Lake Washington.
6. **Ictalurus punctatus** (Rafinesque). *Channel Cat; Silver Cat.* Mr. Cram reports this fish very common in Minnesota River near Mankato in the spring.
7. **Ameiurus nebulosus** (LeSueur). *Common Bullhead; Horned Pout.* Three specimens were taken in Blue Earth River at Mankato in 1891. It seems to be rare.
8. **Ameiurus melas** (Rafinesque). * Big Stone Lake, common; *Chippewa River at Montevideo; ponds near Minnesota River at Mankato; Blue Earth River at Mankato, very common; Minneopa Creek near Mankato, common; Lake Washington.
9. **Noturus flavus** Rafinesque. *Stone Cat.* Blue Earth River at Mankato, not common.
10. **Schilbeodes gyrinus** (Mitchill). * Pomme de Terre River at Appleton.
11. **Schilbeodes exilis** (Nelson). Blue Earth River at Mankato, one specimen; not common.
12. **Ictiobus cyprinella** (Cuvier & Valenciennes). The large buffalo referred to further on is supposed to be this species. If correct, it is common in Big Stone Lake and Lake Washington.
13. **Ictiobus bubalus** (Rafinesque). *Sucker-mouthed Buffalo; Small-mouthed Buffalo.* A number of small specimens were taken from the Minnesota River at Mankato.

*All data starred were taken from Prof. A. J. Woolman's paper, Report of the United States Fish Commission for 1893 (1896), pages 343–373.

14. **Carpiodes difformis** Cope. Several specimens taken from Blue Earth River at Mankato.
15. **Carpiodes velifer** (Rafinesque). *Big Stone Lake; Minnesota and Blue Earth rivers at Mankato.
16. **Catostomus commersoni** (Lacépède). *Common Sucker; Black Sucker.* *Little Minnesota River at Browns Valley; Minnesota and Blue Earth rivers at Mankato; Lake Washington. Common at all these places.
17. **Catostomus nigricans** LeSueur. *Hog Sucker; Stone-roller; Hog Mullet.* Minnesota River at Mankato, not common; very common in Blue Earth River at the same place. In 1891 the writer saw a large school of several hundred large ones near the mouth of this river.
18. **Moxostoma aureolum** (LeSueur). *Redhorse; Mullet; Large-scaled Sucker.* Minnesota and Blue Earth Rivers at Mankato, common. Frequently taken by hook and line in springtime.
19. **Campostoma anomalum** (Rafinesque). *Stone-roller; Stone-lugger;* Minnesota and Blue Earth rivers at Mankato, very common.
20. **Hybognathus nuchale** Agassiz. *Silvery Minnow.* Ponds near Minnesota River at Mankato; Minneopa Creek; Blue Earth River at Mankato.
21. **Pimephales promelas** Rafinesque. *Flat-head; Black-headed Minnow.* *Big Stone Lake; *Chippewa River at Montevideo; Minnesota and Blue Earth rivers at Mankato; Minneopa Creek at Mankato. Very common everywhere.
22. **Pimephales notatus** (Rafinesque). *Blunt-nosed Minnow.* *Big Stone Lake; *Pomme de Terre River at Appleton; *Chippewa River at Montevideo; Minnesota and Blue Earth rivers at Mankato. Common.
23. **Semotilus atromaculatus** (Mitchill). *Horned Dace; Creek Chub.* *Big Stone Lake; *Chippewa River at Montevideo; Minnesota and Blue Earth rivers at Mankato. Very common.
24. **Abramis crysoleucas** (Mitchill). *Golden Shiner; Bream.* A few small ones taken from Blue Earth River, Mankato.
25. **Notropis cayuga** Meek. *Pomme de Terre River at Appleton; Minnesota and Blue Earth rivers and ponds near Minnesota River at Mankato. Very common.
26. **Notropis heterodon** (Cope). *Pomme de Terre River at Appleton. Not common.
27. **Notropis blennius** (Girard). *Straw-colored Minnow.* *Chippewa River at Montevideo; ponds near the Minnesota River and the Blue Earth River at Mankato. Common.
28. **Notropis hudsonius** (De Witt Clinton). *Spawn-eater; Spot-tailed Minnow; Shiner.* *Little Minnesota River at Browns Valley; Lake Washington. Common. Specimens from Lake Washington are very much darker in color and appear at first to be a different species.
29. **Notropis whipplii** (Girard). *Silver-fin.* Ponds near Minnesota River and Blue Earth River at Mankato. Common.
30. **Notropis cornutus** (Mitchill). *Shiner; Red-fin; Dace.* *Little Minnesota River at Browns Valley; *Big Stone Lake; Minnesota River; ponds near the Minnesota River, Blue Earth River, and Minneopa Creek, Mankato. Very common everywhere.
31. **Notropis dilectus** (Girard). Minnesota and Blue Earth rivers at Mankato. Very common here, but it has not been taken in any other place in southern Minnesota so far as known.
32. **Rhinichthys cataractæ** (Cuvier & Valenciennes). *Long-nosed Dace.* Pomme de Terre River at Appleton, common.

33. **Hybopsis hyostomus** (Gilbert). Blue Earth River at Mankato. Several specimens have been taken, but it is not common.
34. **Hybopsis kentuckiensis** (Rafinesque). *Chub; Jerker.* * Big Stone Lake; Blue Earth River at Mankato. Not common.
35. **Anguilla chrysypa** Rafinesque. *Common Eel.* One specimen has been reported from the Minnesota River at Mankato. This was taken by hook and line.
36. **Dorosoma cepedianum** (LeSueur). *Gizzard Shad; Hickory Shad.* Just as the ice broke in the Minnesota River at Mankato in the spring of 1891 a number of large specimens were taken and the fishermen commented on the fact, saying that these fish had not been seen here for a number of years. A few small ones were taken in a seine in September, 1892. Since that time they have been scarce.
37. **Umbra limi** (Kirtland). *Mud Minnow; Dogfish.* Lake Washington, common.
38. **Lucius lucius** (Linnæus). *Common Pike; Pickerel.* Very common in all of the lakes of the region and occasionally taken in the streams.
39. **Fundulus diaphanus** (LeSueur). * Big Stone Lake; * Pomme de Terre River at Appleton; Blue Earth River at Mankato; Lake Washington. Rather common.
40. **Eucalia inconstans** (Kirtland). *Brook Stickleback.* Minnesota River, Blue Earth River, and Minneopa Creek at Mankato. Not common.
41. **Percopsis guttatus** Agassiz. * Big Stone Lake.
42. **Pomoxis sparoides** (Lacépède). *Calico Bass; Strawberry Bass; Grass Bass.* Blue Earth River at Mankato and Lake Washington. Very common.
43. **Ambloplites rupestris** (Rafinesque). Blue Earth River at Mankato, common.
44. **Apomotis cyanellus** (Rafinesque). *Blue-spotted Sunfish; Green Sunfish.* Minnesota and Blue Earth rivers and Minneopa Creek at Mankato. Common.
45. **Lepomis megalotis** (Rafinesque). *Long-eared Sunfish.* * Chippewa River at Montevideo.
46. **Micropterus dolomieu** Lacépède. *Small-mouthed Black Bass; River Bass.* Common in Blue Earth River at Mankato. Many fine specimens are taken with hook and line.
47. **Micropterus salmoides** (Lacépède). *Large-mouthed Black Bass; Oswego Bass; Green Bass; Bayou Bass.* * Big Stone Lake; Lake Washington. Very common in nearly all the lakes of the region.
48. **Stizostedion vitreum** (Mitchill). *Wall-eyed Pike.* * Big Stone Lake; * Chippewa River at Montevideo; Minnesota River at Mankato; Lake Washington. Very common and a valuable food-fish.
49. **Perca flavescens** (Mitchill). *Yellow Perch; Ringed Perch.* * Little Minnesota River at Browns Valley; * Chippewa River at Montevideo; ponds near the Minnesota River and Blue Earth River at Mankato; Lake Washington. Very common.
50. **Hadropterus aspro** (Cope & Jordan). *Black-sided Darter.* * Big Stone Lake; * Pomme de Terre River at Appleton; * Chippewa River at Montevideo; Minnesota and Blue Earth rivers at Mankato. Very common.
51. **Boleosoma nigrum** (Rafinesque). *Johnny Darter.* * Big Stone Lake; * Pomme de Terre River at Appleton; * Chippewa River at Montevideo; Minnesota and Blue Earth rivers at Mankato. Very common.
52. **Ammocrypta pellucida clara** Jordan & Meek. *Sand Darter.* Minnesota and Blue Earth rivers at Mankato. Common on sand bars.
53. **Etheostoma zonale** (Cope). A few specimens have been taken in Blue Earth River at Mankato.
54. **Etheostoma iowæ** Jordan & Meek. * Little Minnesota River at Browns Valley; * Big Stone Lake; * Pomme de Terre River. Common.
55. **Etheostoma cœruleum** Storer. *Blue Darter; Rainbow Darter.* Ponds near Minnesota River and Blue Earth River at Mankato. Not common.
56. **Boleichthys fusiformis** (Girard). A few specimens taken from Blue Earth River at Mankato. Rare.

**57. Roccus chrysops** (Rafinesque). *Striped Bass; White Bass.* Rather common in Big Stone Lake. Several specimens were taken here in 1892.

**58. Aplodinotus grunniens** Rafinesque. *Sheepshead; Thunder-pumper; Drum; White Perch.* A large specimen was taken in Little Minnesota River at Browns Valley in 1892 and several in Big Stone Lake. A number have been taken from Minnesota River at Mankato, and it is reported very common in Lake Washington, where its grunting or croaking is often heard.

Des Moines River rises in Murray County, Minn., flows southeast across Cottonwood and Jackson counties, and thence south through Iowa. At Windom, Minn., where it was examined, it was but a small stream 40 to 50 feet wide and averaging a foot in depth, although there were many holes that were deeper. The bottom was gravelly. A dam had been built across the river here and no provision had been made for a fishway. Fish were quite abundant below the dam where we seined.

Cottonwood Lake lies a mile east of Windom and covers about a quarter section. Its shores are mostly gravelly and free from trees except on the southeast portion. A small area on the west side contained some aquatic plants. A few minnows, sunfish, and catfish were taken in the seine, and pickerel fishing was reported good in season. No suckers were taken. The lake was reported as being quite shallow, and dead fish are common along the shores after a hard winter.

Heron Lake, lying in the northwest portion of Jackson County, is 12 miles long and about 3 miles wide at its widest place. Nearly all of the northern half is grown up with sedges and other aquatic plants. On the west side, about midway between the two ends of the lake, is a projection known as Pelican Point, and here the shores are sandy and there is very little aquatic vegetation. At this point the average depth is 4 feet, the greatest depth not exceeding 5 feet. The southern end of the lake is generally open, and here the commercial fishing is good, although limited to a few species, pickerel being the fish commonly taken. Bass and pike were reported, but very few were caught. A better breeding-place for fish than the north end of Heron Lake would be hard to find, but the shallowness of the water is a serious drawback to its becoming an important fish lake. Two creeks empty into Heron Lake from the west, the one farthest north being Jack Creek. Okabena Creek, farther south, is the largest, but both are small and of little importance.

Okabena lakes lie in the southeastern part of Nobles County, at Worthington. East Okabena Lake is now about dry, but the west lake still contains some fish. It is 2¼ miles long from east to west and averages a mile in width, but the greatest depth in 1894 was 6 feet, and in 1895 the depth was considerably less than this. It is a typical prairie lake, with shores built of bowlder walls and with gravelly beaches. The water was quite well filled with aquatic vegetation the latter part of June, 1894, and at the west end of the lake there was a swampy shore at the mouth of a small creek where sedges grew and which was

an excellent breeding place for fishes, although of limited area. The commercial fishes of the lake are pike, pickerel, suckers, and buffalo.

Round Lake lies 12 miles southeast of Worthington and is known as a fishing-point, although small and shallow. It is about 2 miles broad from north to south and probably three fourths of a mile longer than broad. The soundings made at the time visited did not show a depth beyond 7 feet. There was an abundance of aquatic vegetation, which ought to furnish excellent breeding-grounds for fishes. The fishes commonly taken are pike and pickerel.

The following is a list of the fishes which have been taken by us from the Des Moines River and its tributaries:

FISHES FROM THE DES MOINES RIVER AND ITS TRIBUTARIES.

1. **Lepisosteus osseus** (Linnæus). *Common Gar-pike.* Reported common in Okabena Lake.
2. **Ameiurus melas** (Rafinesque). *Bullhead.* Des Moines River and Cottonwood Lake at Windom; Jack Creek near Heron Lake. Common.
3. **Schilbeodes gyrinus** (Mitchill). Des Moines River at Windom; Jack Creek. Not common.
4. **Ictiobus cyprinella** (Cuvier & Valenciennes). *Common Buffalo-fish.* Reported very common in Round and Okabena lakes, if this is the species.
5. **Catostomus commersoni** (Lacépède). *Black Sucker; Common Sucker.* Reported Common in Okabena Lake. Several specimens taken from Des Moines River at Windom.
6. **Moxostoma anisurum** (Rafinesque). *White-nosed Sucker.* One specimen was taken from Des Moines River at Windom.
7. **Moxostoma aureolum** (LeSueur). *Redhorse.* Des Moines River at Windom. Common.
8. **Pimephales promelas** Rafinesque. *Flathead; Black-headed Minnow.* Des Moines River at Windom; Cottonwood Lake at Windom; Heron Lake; Round Lake. Common everywhere.
9. **Pimephales notatus** (Rafinesque). *Blunt-nosed Minnow.* Des Moines River at Windom. Common.
10. **Semotilus atromaculatus** (Mitchill). *Horned Dace; Creek Chub.* Des Moines River at Windom. Common.
11. **Abramis crysoleucas** (Mitchill). *Golden Shiner; Bream.* Des Moines River and Wood Lake at Windom; West Okabena Lake at Worthington; Round Lake. Very common.
12. **Notropis cayuga** Meek. Des Moines River at Windom; Heron Lake; West Okabena Lake at Worthington; Round Lake. Common.
13. **Notropis blennius** (Girard). *Straw-colored Minnow.* Common in Des Moines River at Windom.
14. **Notropis hudsonius** (De Witt Clinton). *Spawn-eater; Spot-tailed Minnow.* Very common in Round Lake.
15. **Notropis cornutus** (Mitchill). *Shiner; Red-fin; Dace.* Des Moines River at Windom. Common.
16. **Notropis rubifrons** (Cope). Des Moines River at Windom. Not common.
17. **Rhinichthys atronasus** (Mitchill). *Black-nosed Dace.* Des Moines River at Windom. Not common.
18. **Lucius lucius** (Linnæus). *Common Pickerel.* Very common in Heron, Round, and Okabena lakes.
19. **Fundulus diaphanus** (LeSueur). West Okabena Lake at Worthington; Round Lake.

20. **Eucalia inconstans** (Kirtland). *Brook Stickleback.* Des Moines River at Windom. A few specimens taken.
21. **Ambloplites rupestris** (Rafinesque). *Rock Bass* One specimen taken in Des Moines River at Windom. Rather common.
22. **Apomotis cyanellus** (Rafinesque). *Blue-spotted Sunfish; Green Sunfish.* One specimen taken in Des Moines River at Windom.
23. **Lepomis pallidus** (Mitchill). *Blue Sunfish.* Several small specimens were taken from West Okabena Lake at Worthington.
24. **Eupomotis gibbosus** (Linnæus). *Common Sunfish; Pumpkin Seed.* One specimen taken in West Okabena Lake at Worthington. Reported to be common.
25. **Stizostedion vitreum** (Mitchill). *Wall-eyed Pike.* West Okabena Lake at Worthington; Round Lake. Common.
26. **Perca flavescens** (Mitchill). *Yellow Perch; Ring Perch.* Des Moines River at Windom; Cottonwood Lake at Windom; Heron Lake; West Okabena Lake at Worthington; Round Lake. Very common.
27. **Hadropterus aspro** (Cope & Jordan). *Black-sided Darter.* Des Moines River at Windom. Not common.
28. **Boleosoma nigrum** (Rafinesque). *Johnny Darter.* Des Moines River at Windom. Very common.
29. **Etheostoma iowæ** Jordan & Meek. Des Moines River at Windom; West Okabena Lake at Worthington. Not abundant.
30. **Etheostoma flabellare lineolatum** (Agassiz). *Fan-tailed Darter.* One specimen taken in Des Moines River at Windom.

## NOTES ON THE RUN OF SUCKERS AND BUFFALO-FISH.

From the information stated below and from the many other reports given by old residents of southern Minnesota it is evident that at one time large buffalo-fish and suckers literally filled many of the lakes in this portion of the State, and were especially noticeable during the spawning season. Just what has become of these fishes is still a question, for they do not seem to be present in any of these lakes now where they were once so abundant, or, if so, only in limited numbers. Probably many of them have been killed by freezing, since the water in all the lakes is now so much more shallow than it was formerly. This is certain in some of the lakes, for the fish have been found along the shores in the spring in immense numbers dead, but it is not true of all the lakes. It is not certain just what species of buffalo is referred to in these reports, for none have been examined since the writer began to collect information concerning them. A dead one found on the shore of Big Stone Lake in 1892 was identified as *Ictiobus cyprinella*, and it is thought that possibly this is the species referred to in the other lakes of the region.

Buffaloes were reported to be very common in Big Stone Lake in 1892 and were often taken in large numbers during the spawning season, which is the latter part of May or the first of June, or, as the old settlers put it, "when the plum blossoms are out." Both the buffaloes and the suckers (*Catostomus commersonii*) are seen but a short time, generally for only a day or two, but at that time every fish seems to have come to the shore, and each scrambles to see how near he can get

out of the water and yet remain under. They are reported as often seen with their entire dorsal fins projecting above the water, and at this time men have gone into the water and thrown the fish out with their hands.

Lake Washington was at one time much higher than at present, and there was a large stream leading from it, and the buffaloes and suckers would crowd into this outlet, and at one of the mills several wagon-loads of large buffaloes were once taken. The following is a statement from Mr. Wildes, who still lives in the region, concerning Lake Washington:

When I came to Minnesota, more than 35 years ago, Lake Washington was a magnificent body of water, the largest of a number of lakes all more or less closely connected and whose outlet was Shantaska Creek, which emptied into the Minnesota River at Kasota. This section of Minnesota was then covered with an almost unbroken forest of gigantic deciduous trees, beneath whose branches, covered with dense foliage, the yearly rains sank into the soil to fill the sloughs and lakes to overflowing. The creeks and outlets of the lakes and sloughs were obstructed with fallen trees and leaves; the land surface was covered with leaves, weeds, and grass. Six flour and saw mills were located along Shantaska Creek and did a good business, and most of the time had an abundant supply of water. Now this creek is dry the greater part of the year. In 1860, and for a number of years after, the rainfall was at least three times what it is now. The water has receded greatly in all the lakes, and some have completely dried up and are now turned into cultivated fields and hay meadows. In those days the fish were very abundant and the mills along Shantaska Creek were sometimes stopped by their getting into the waterwheels.

The buffalo ran out of the large lakes into the inlets and outlets generally during the month of May, sometimes earlier or later, and only once a year, rarely staying more than two or three days. I have noticed that the run was almost always at the beginning or during a rain storm. In the spring of 1894, during a rain storm, some buffalo-fish ran out of Lake Washington into a small lake and remained there during the summer and were seen through the ice at the beginning of the following winter. The buffalo-fish attain a large size in Lake Washington, often more than 3 feet in length and 1 foot in depth. When the buffalo are running they always stir up the mud so that it is impossible to observe their doings, but I imagine that they were spawning.

Suckers are not so numerous as the other kinds of fish. Some suckers reach a weight of 6 pounds.

John Kendall, who formerly lived on Lake Washington, states that in 1850 the buffalo ran down the outlet every spring to the Minnesota River, but since the outlet became so small these fish go to the inlet, a very small creek, to spawn. He also states that but one buffalo was seen in 1894, and this was taken in the inlet. A few suckers were taken there also.

Patrick Sheehan states that there are still many buffaloes and suckers in Lake Washington, in his opinion, although he has not seen many in the last few years. Mr. Sheehan has lived on the shore of Lake Washington for a number of years.

Careful inquiry was made of the residents along Heron Lake, when it was visited in 1894, and everyone reported that the buffaloes and suckers were abundant in the lake, but were only seen for a few days

in the spring, and that in the spring of 1894 very few had been seen. None are ever taken with hook and line. Careful seining failed to capture the young of either.

A number of citizens of Worthington reported that in 1893 the buffaloes tried to pass from one Okabena Lake into the other, and that immense numbers were speared, many of them weighing 40 pounds apiece. It is reported that the farmers came there and hauled away wagonloads of these fishes and dressed and dried them for winter use. During the last few years very few have been seen. Many dead suckers were reported along the shores of West Okabena Lake in the spring of 1894, when the ice melted. Similar reports come from Round Lake, but at the time it was visited by the writer (spring of 1894) the buffalo had not been seen, and careful seining failed to secure specimens of either suckers or buffalo.

What information the writer has been able to obtain concerning these fish is very unsatisfactory. Their sudden appearance and their as sudden disappearance render it difficult to make observations on them, and the fact that they are never taken during the remainder of the year increases the difficulty of obtaining accurate information concerning them.

## DESCRIPTION OF A NEW SPECIES OF LEUCISCUS FROM THE UPPER MISSISSIPPI RIVER BASIN IN MINNESOTA.

**Leuciscus nachtriebi**, new species.

Type locality: Mille Lacs Lake, Aitkin County, Minn., where several specimens were taken by the Minnesota Natural History Survey in 1892. Associate type localities: Man Trap, Mud, and Elbow lakes in the region of Park Rapids, Hubbard County, where several specimens were taken by the Minnesota Natural History Survey in 1893. In all about 40 specimens have been taken. (Type, No. 47688, U. S. Nat. Mus. Co-type in Leland Stanford Jr. Univ. Mus.)

Description: Head 4¼ to 4½; depth 5 (4⅛ to 5¼); eye 4; snout 4⅝; dorsal 8; anal 8. Body rather heavy, not greatly compressed; back slightly elevated, its curve a little greater than that of the belly; caudal peduncle rather stout, its depth one-half the length of the head. Head rather short, not any more compressed than the body, upper surface slightly flattened; snout quite blunt in mature specimens, its length 1⅛ times width of eye; mouth not very large, but little oblique, lower jaw included; maxillary scarcely reaching to front of orbit; pharyngeal teeth 2, 4-5, 2. Dorsal fin inserted nearer base of caudal than tip of snout, also slightly back of ventrals; caudal fin forked; anal slightly smaller than dorsal; ventrals small, not reaching vent by one-third their length; pectorals inserted rather high, not reaching the ventrals by three-fourths their length; scales small, 12-72-9, lateral line complete on mature specimens, decurved, the pores extending on head in several lines, one passing back of eye, another down to nostril. General color dusky, darkest on back; sides above lateral line dull silvery, below lateral line light silvery; a faint dark dorsal band in some specimens, in others absent; no black lateral band, but some specimens have a very faint dusky shade along lateral line; no light stripe above lateral line; upper portion of opercles with a dusky shade, lower part bright silvery; upper part of head dark-colored; all the above colors typical in the young as well as adults. Length 4 inches.

*L. nachtriebi* differs from *L. neogæus* in having a well-developed lateral line, a smaller eye, fewer scales, less oblique mouth, a shorter maxillary, and in being

a larger fish and differently colored. It differs from *L. elongatus*, a species which might occur in the State, in having a smaller mouth, the lower jaw never projecting, head less pointed, a shorter maxillary, finer scales, and the absence of the black lateral band. The accompanying tabulated measurements will give some idea of the variation in the species. The species is named for Prof. Henry F. Nachtrieb, State zoologist of Minnesota.

| Tag. | Length, inches. | Head. | Depth. | Dorsal fin. | Anal fin. | Scale. | Lateral line. | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Right. | Left. |
| *4 | 3¾ | 4⅛ | 5 | 8 | 8 | 12-75- 9 | Complete | Complete. |
| 5 | 3⅜ | 4⅓ | 4⅞ | 8 | 8 | 12-72- 9 | do | Complete, except about 6 scales. |
| 6 | 3½ | 4¼ | 5 | 8 | 8 | 12-73- 8 | do | Complete. |
| †7 | 3⅜ | 4¼ | 5 | 8 | 8 | 12-72- 9 | Complete, except 3 or 4 scales. | Complete, except 3 or 4 scales. |
| 8 | 3¼ | 4⅛ | 4⅞ | 8 | 8 | 13-74- 9 | Complete | Complete. |
| 9 | 3⅜ | 4¼ | 5 | 8 | 8 | 11-74- 9 | Complete, except 3 or 4 scales. | Complete, except 3 or 4 scales. |
| 10 | 3 | 4⅛ | 5 | 8 | 8 | 12-76-10 | Complete | Complete. |
| 11 | 3⅛ | 4⅛ | 5 | 8 | 8 | 12-72- 9 | do | Do. |
| 12 | 4 | 4⅛ | 5⅛ | 8 | 8 | 12-79- 9 | do | Do. |
| 13 | 3⅛ | 4⅛ | 5 | 8 | 8 | 12-74- 9 | do | Do. |
| 14 | 2⅜ | 4 | 4⅜ | 8 | 8 | 12-72- 9 | do | Do. |
| 15 | 2¼ | 4 | 4⅜ | 8 | 8 | 12-71- 9 | do | Do. |
| 16 | 2 1/16 | 4⅛ | 4⅜ | 8 | 8 | 12-71- 9 | do | Do. |
| 17 | 2⅛ | 4 | 4⅛ | 8 | 8 | 12-72- 9 | Complete, except 3 or 4 scales. | Complete, except 3 or 4 scales. |
| 18 | 2 3/16 | 4⅛ | 5 | 8 | 8 | 12-71- 9 | Complete, except 15 scales. | Complete, except last few scales. |
| 19 | 2⅛ | 4 | 5 | 8 | 8 | 12-71- 8 | Complete, except last 3 or 4 scales. | Complete, except last 3 or 4 scales. |
| 20 | 2⅛ | 4 | 4⅞ | 8 | 8 | 12-74- 9 | Nearly complete | Nearly complete. |
| 21 | 2⅛ | 4⅛ | 5 | 8 | 8 | 12-71- 8 | Complete | Complete. |
| 22 | 2⅛ | 4⅛ | 5 | 8 | 8 | 12-72- 8 | do | Complete, except 30 scales. |

* Co-type, in Leland Stanford Jr. Univ. Mus. † Type, No. 47688, U. S. Nat. Mus.

' Eight specimens, each 1⅛ inches long, from the same locality as Nos. 14 to 22, are similar in color and other characteristics, but the lateral line is entirely absent. The pores on the head are developed in some. Nos. 4 to 11, inclusive, are from Mille Lacs Lake, Aitkin County, and Nos. 12 to 22, inclusive, are from Mud and Elbow lakes, Hubbard County.

# 10.—LIST OF PUBLICATIONS OF THE UNITED STATES COMMISSION OF FISH AND FISHERIES FROM ITS ESTABLISHMENT IN FEBRUARY, 1871, TO FEBRUARY, 1896.

By CHARLES W. SCUDDER.

During the quarter of a century in which the United States Commission of Fish and Fisheries has been in existence, it has issued 18 volumes of annual reports, 14 volumes of annual bulletins, and 7 volumes on the Fishery Industries of the United States, as follows:

ANNUAL REPORTS. (Octavo.)

| Designation. | For the year— | Published. | Pages. | Plates. |
|---|---|---|---|---|
| Part I | 1871-2 | 1873 | XLVII + 852 | 40 |
| II | 1872-3 | 1874 | CII + 808 | 37 |
| III | 1873-5 | 1876 | LI + 77 | ..... |
| IV | 1875-6 | 1878 | L + 1020 | 9 |
| V | 1877 | 1879 | XLVIII + 981 | 35 |
| VI | 1878 | 1880 | LXIV + 968 | 36 |
| VII | 1879 | 1882 | LI + 846 | 62 |
| VIII | 1880 | 1883 | XLVI + 1060 | 44 |
| IX | 1881 | 1884 | LXXI + 1146 | 27 |
| X | 1882 | 1884 | XCII + 1101 | 54 |
| XI | 1883 | 1885 | XCV + 1206 | 161 |
| XII | 1884 | 1886 | LXXI + 1204 | 46 |
| XIII | 1885 | 1887 | CXII + 1108 | 230 |
| XIV | 1886 | 1889 | LVII + 1071 | 46 |
| XV | 1887 | 1891 | LXIII + 900 | 112 |
| XVI | 1888-9 | 1892 | CXXVIII + 902 | 90 |
| XVII | 1889-91 | 1894 | ..... + 664 | 67 |
| XVIII | 1892 | 1894 | CCIV + 528 | 47 |

ANNUAL BULLETINS. (Octavo.)

| | | | | |
|---|---|---|---|---|
| Vol. I | 1881 | 1882 | VIII + 466 | 21 |
| II | 1882 | 1883 | VIII + 467 | 3 |
| III | 1883 | 1883 | IX + 497 | 1 |
| IV | 1884 | 1884 | XII + 488 | 3 |
| V | 1885 | 1885 | XI + 494 | 2 |
| VI | 1886 | 1887 | X + 495 | 7 |
| VII | 1887 | 1889 | VIII + 475 | 39 |
| VIII | 1888 | 1890 | IX + 494 | 74 |
| IX | 1889 | 1892 | XI + 504 | 166 |
| X | 1890 | 1893 | VII + 400 | 94 |
| XI | 1891 | 1894 | VI + 431 | 88 |
| XII | 1892 | 1894 | VII + 489 | 118 |
| XIII | 1893 | 1894 | VII + 462 | 41 |
| XIV | 1894 | 1895 | V + 496 | 25 |

FISHERY INDUSTRIES OF UNITED STATES. (Quarto.)

| Designation. | For the year. | Published. | Page. | Plates. |
|---|---|---|---|---|
| Sec. I (text) | 1880 | 1884 | XXXIV + 895 | ..... |
| I (plates) | 1880 | 1884 | XX | 277 |
| II (text) | 1880 | 1887 | IX + 787 | ..... |
| III, IV } 1 vol. | 1880 | 1887 | XVIII + 238 | 49 |
| | 1880 | 1887 | V + 178 | 19 |
| V (text), Vol. I | 1880 | 1887 | XXII + 808 | ..... |
| V (text), Vol. II | 1880 | 1887 | XX + 881 | ..... |
| V (plates) | 1880 | 1887 | XVI | 255 |

These publications are all Congressional documents, and a certain number are allotted to each Senator and Member of the House of Representatives; a small quota is also assigned to the Commission, from which various libraries, institutions of learning, and such persons as are specially interested in the subject-matter are supplied.

Each volume is made up of separate papers pertaining chiefly to investigations conducted by the Commission; and a small edition of each paper is issued as it is printed and completed, in advance of the entire volume, in order that it may reach the public as soon as possible. All of the Fishery Industries of the United States and the annual reports and bulletins prior to 1887 are out of print, and the quota allowed this Commission of some of the more recent publications has been distributed.

The following list gives the title of each paper that has been published by the Commission, but does not give the subtitles. It is arranged alphabetically by authors, and is followed by a subject index.

# LIST OF PAPERS PUBLISHED BY THE UNITED STATES FISH COMMISSION.

1. ABBE, W. A. Proposed limitation of menhaden fishing to July 1, and of mackerel fishing to June 15. Occurrence of herring. Bulletin, III, for 1883, p. 468. 1883. (Out of print.)
2. ABBOTT, CHARLES C. Notes on some fishes of the Delaware River. Report for 1875-76, IV, pp. 525-845. 1878. (Out of print.)
3. ABERNETHY, A. S. Salmon in the Clackamas River. Bulletin, VI, for 1886, p. 332. 1886. (Out of print.)
4. ADAMS, A. C., and W. C. KENDALL. Report upon an investigation of the fishing-grounds off the west coast of Florida. Bulletin, IX, for 1889, pp. 289-312 (including 2 figs.), plate CXI. 1891. Pamphlet No. 162.
5. ADAMS, A. LEITH. The lake trouts. Report for 1872-73, II, pp. 357-362. 1874. (Out of print.)
6. ADAMS, EMMA H. Salmon canning in Oregon. Bulletin, V, for 1885, pp. 362-365. 1885. (Out of print.)
7. AKEKIO, SEKIZAWA, Memorandum on fish-culture in Japan, with a notice of experiments in breeding the California trout. Report for 1879, VII, pp. 645-648. 1882. (Out of print.)
8. ALBRO, SAMUEL. Condition of the shore fisheries of Massachusetts and Rhode Island in 1871. Report for 1871-72, I, p. 8. 1873. (Out of print.)
9. ALLEN, JOEL A. Natural history of the seals and walruses. The fisheries and fishery industries of the United States, sec. I, pp. 33-74, plates 12-25. 1884. (Out of print.)
10. ALLEN, WILLIAM S. Statement concerning the menhaden fishery. Report for 1877, V, p. 413. 1879. (Out of print.)
11. ALLPORT, MORTON. Present state of the salmon experiment in Tasmania. Report for 1878, VI, pp. 819-823. 1880. (Out of print.)
12. AMELN, JOHAN. Society for promoting the Norwegian fisheries. Report for 1878, VI, pp. 241-243. 1880. (Out of print.)
13. AMTLICHE BERICHTE, &c. Transportation of live fish. Bulletin, II, pp. 95-102 (including 4 figs.). 1882. (Out of print.)
14. ANCHER, ERNST. The Kurren and Keitel (fishing vessels) of the Courland Haff. Bulletin, IV, for 1884, pp. 167-168. 1884. (Out of print.)
15. ANDERSON, G. A. Report on shad-hatching in New Jersey in 1874. Report for 1873-74 and 1874-75, III, pp. 327-328. 1876. (Out of print.)
16. ANDERSON, JOHN. Notes upon the biology of the salmon and grilse. Bulletin, III, for 1883, p. 429. 1883. (Out of print.)
17. ANDERSON, JOHN. Notes upon the Scotch fish and fisheries. Bulletin, V, for 1885, pp. 217-221. 1885. (Out of print.)
18. ANDERSSEN, JOAKIM. Report upon the department of fisheries in the world's exposition in Philadelphia, 1876. Report for 1878, VI, pp. 47-71. 1880. (Out of print.)
19. ANDERTON, J. L. Statement concerning the menhaden fishery. Report for 1877. V, p. 460. 1879. (Out of print.)
20. ANNANIASSEN, A. Extracts from the report on his voyage to Iceland. From "Selskabet for de Norske Fiskeriers Fremme." Report for 1884, XII, pp. 309-322. 1886. (Out of print.)
21. ANNANIASSEN, ABR. Klip-fish at the Shetland Islands. Bulletin, V, for 1885, pp. 316-319. 1885. (Out of print.)
22. ANNIN, jr., JAMES. Poachers or destructive visitors to fish ponds. Bulletin, IV, for 1884, pp. 85-86. 1884. (Out of print.)
23. ANONYMOUS. Statistics of the fisheries of the United States in 1880. Bulletin, III, for 1883, pp. 269-271. 1883. (Out of print.)

24. ANONYMOUS. Extracts from the first annual report of the Fishery Board of Scotland for the year ending December 31, 1882. Report for 1882, x, pp. 229-236. 1884. (Out of print.)
25. ANONYMOUS. The British sea-fisheries act, 1883. Report for 1883, xi, pp. 259-278. 1885. (Out of print.)
26. ANONYMOUS. Distribution of duplicate sets of marine invertebrates, 1879-1886. Report for 1886, xiv, pp. 843-867. 1889. (Out of print.)
27. ANONYMOUS. Resolution asking for the abrogation of the fishery clause of the Washington treaty, passed at a convention of New England fishermen which met at Gloucester, December 27, 1884. Bulletin, v, for 1885, p. 447. 1885. (Out of print.)
28. ANONYMOUS. Report of distribution of fish and eggs by the U. S. Fish Commission from July 1, 1887, to June 30, 1888. Report for 1887-88, xv, pp. 363-370. 1891. (Out of print.)
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