REPORT

OF THE

UNITED STATES COMMISSIONER OF FISH AND FISHERIES

FOR THE

FISCAL YEAR ENDING JUNE 30, 1893.

The report herewith presented covers the operations of the Commission during the fiscal year beginning July 1, 1892, and ending June 30, 1893. The appropriations made by Congress were as follows:

For current expenses:	
Compensation of the Commissioner	$5,000
Propagation of food-fishes	152,500
Distribution of food-fishes	45,000
Maintenance of vessels	68,900
Inquiry respecting food-fishes	15,000
Statistical inquiry	15,000
Total	301,400
For completion of fish-cultural stations:	
Green Lake and Craig Brook, Me	8,000
St. Johnsbury, Vt	10,000
Leadville, Colo	15,000
Northville, Mich	3,000
For establishment of fish-cultural stations:	
Montana	10,000
Texas	10,000
For conducting examinations relative to the advisability of establishing fish-cultural stations:	
Washington	1,000
Tennessee	1,000
South Dakota, Iowa, and Nebraska	1,000
Wyoming	400

In accordance with law, a report showing details of expenditures from the foregoing appropriations was submitted to Congress December 4, 1893 (Senate Mis. Doc. No. 4, Fifty-third Congress, second session).

DIVISION OF ADMINISTRATION.

The work of this division has been under the general supervision of the chief clerk of the Commission, Mr. Herbert A. Gill. To it are assigned all matters connected with the general personnel of the Commission, appropriations, accounts, publications, library, office of architect and engineer, and other incidents of administration not specifically chargeable to any of the other divisions.

PUBLICATIONS.

In order that the information secured by the Commission may be placed in the hands of those interested at as early a date as possible, it has been the custom for some years to distribute, in advance of the completed reports and bulletins of the Commission, pamphlet copies of

the different papers comprising these volumes. Under this system the following papers were issued during the year:

Report of distribution of fish and eggs from July 1, 1888, to June 30, 1889. (Report for 1888, pp. 379-394.)
Notes on Entozoa of marine fishes, with description of new species, Part III. (Report for 1888, pp. 523-542.)
The anatomy of *Thysanocephalum crispum* Linton, a parasite of the tiger shark. (Report for 1888, pp. 543-556.)
Report upon the participation of the United States Fish Commission in the Centennial Exposition held at Cincinnati, Ohio, in 1888, by J. W. Collins. (Report for 1888, pp. 869-885.)
Report of the Commissioner for 1888, by Marshall McDonald. (Report for 1888, pp. I-CXXVIII.)
Report on the fisheries of the New England States, by J. W. Collins and Hugh M. Smith. (Bulletin for 1890, pp. 73-176.)
Report on an investigation of the fisheries of Lake Ontario, by Hugh M. Smith. (Bulletin for 1890, pp. 177-215.)
A report upon the fishes of Iowa, based upon observations and collections made during 1889, 1890, and 1891, by S. E. Meek. (Bulletin for 1890, pp. 217-248.)
Report of an examination of the rivers of Kentucky, with lists of the fishes obtained, by Albert J. Woolman. (Bulletin for 1890, pp. 249-288.)
Notes on the streams and fishes of Clinton County, Ky., with a description of a new darter, by Philip H. Kirsch. (Bulletin for 1890, pp. 289-292.)
A report upon the rivers of central Florida tributary to the Gulf of Mexico, with lists of the fishes inhabiting them, by Albert J. Woolman. (Bulletin for 1890, pp. 293-302.)
An investigation of the coast waters of South Carolina with reference to oyster-culture, by John D. Battle. (Bulletin for 1890, pp. 303-330.)
Report on the salmon fisheries of Alaska, by Marshall McDonald. (Bulletin for 1892, pp. 1-50.)
Observations on the hatching of the yellow perch, by S. G. Worth. (Bulletin for 1890, pp. 331-334.)
The physical and biological characteristics of the natural oyster-grounds of South Carolina, by Bashford Dean. (Bulletin for 1890, pp. 335-361.)
The present methods of oyster-culture in France, by Bashford Dean. (Bulletin for 1890, pp. 363-388.)
A contribution to our knowledge of the morphology of lamellibranchiate mollusks, by James L. Kellogg. (Bulletin for 1890, pp. 389-436.)
Report on the establishment of fish-cultural stations in the Rocky Mountain region and Gulf States, consisting of (1) a reconnaissance of the streams and lakes of western Montana and northwestern Wyoming, and (2) a report upon investigations made in Texas in 1891, by B. W. Evermann. (Bulletin for 1891, pp. 1-90.)
A statistical report on the fisheries of the Gulf States, by J. W. Collins and Hugh M. Smith. (Bulletin for 1891, pp. 91-184.)
Description of a new sucker, *Pantosteus jordani*, from the Upper Missouri Basin, by Barton W. Evermann. (Bulletin for 1892, pp. 51-56.)
Report on a collection of fishes from the Albemarle region of North Carolina, by Hugh M. Smith. (Bulletin for 1891, pp. 185-200.)
Observations on the spawning habits of the shad, by S. G. Worth. (Bulletin for 1891, pp. 201-206.)
A preliminary report on the aquatic invertebrate fauna of the Yellowstone National Park, Wyoming, and of the Flathead region of Montana, by S. A. Forbes. (Bulletin for 1891, pp. 207-258.)
Notes on a collection of fishes from the southern tributaries of the Cumberland River in Kentucky and Tennessee, by P. H. Kirsch. (Bulletin for 1891, pp. 259-268.)
Report on the fisheries of the South Atlantic States, by Hugh M. Smith. (Bulletin for 1891, pp. 269-367.)

There was also issued the complete report of the Commissioner, covering the fiscal years 1889-90 and 1890-91. (Report for 1889-91, pages 1 to 204, and I to XI.)

The distribution of the publications of the Commission consisted of 2,700 bound volumes of the Reports and Bulletins, and about 11,000 copies of the various articles appearing therein. These were sent more especially to libraries, scientific institutions, and persons specially interested in the subjects respectively presented.

The following papers, published at the expense of the Museum of Comparative Zoology at Cambridge, Mass., and covering reports of the results of the investigations carried on during 1891 by the U. S. Fish Commission steamer *Albatross*, Lieut. Commander Z. L. Tanner, U. S. N., and under the charge of Prof. Alexander Agassiz, off the west coast of Central America and Mexico, were published during the year.

Vorläufiger Bericht über die erbeuteten Holothurien, by Hubert Ludwig. (Bulletin of the Museum of Comparative Zoology at Harvard College, vol. XXIV, No. 4.)

On a peculiar type of Arenaceous Foraminifer from the American tropical Pacific, *Neusina agassizi*, by A. Goës. (Bulletin of Museum of Comparative Zoology at Harvard College, vol. XXIII, No. 5.)

SPECIAL REPORTS.

On July 2, 1892, in response to a resolution of the United States Senate for information concerning the salmon fisheries of Alaska, a report was transmitted to the Senate (Mis. Doc. 192, Fifty-second Congress, first session) discussing the origin and development of the fisheries, statistics of the fisheries, present condition of the fisheries, methods and apparatus employed, the protective regulations of the fisheries, and recommendations as to further legislation in reference thereto. This report will also be found in the Bulletin of the United States Fish Commission for 1892.

LIBRARY.

The accessions to the library, which were mainly by donation and in exchange for the publications of the Commission, embraced 1,064 books, of which about one-fourth related directly to fish and fisheries, and the balance to zoology, natural history, and kindred subjects.

OFFICE OF ARCHITECT AND ENGINEER.

While under orders to make investigations of certain localities in Montana offering advantages for the location of a fish-cultural station, Mr. Charles E. Gorham, the architect and engineer of the Commission, died at Bozeman, Mont., November 13, 1892. For the purpose of securing a competent engineer to fill the position thus made vacant, the United States Civil Service Commission held a special examination for applicants, and upon their certification Mr. Hector von Bayer was appointed thereto on March 1, 1893.

The following is Mr. Von Bayer's report, showing the work of construction at the different stations of the Commission during the year:

Green Lake Station, Maine.—The two settling reservoirs were finished; a number of new rearing ponds were excavated; a branch box flume was laid, which taps the main supply flume, for feeding the new ponds, and a system of outdoor rearing-troughs and tubs; new drains from the ponds and troughs were laid; a number of buoys were placed in Green Lake for safer navigation; a new screen-gate was put at the foot of Green Lake to prevent the escape of fish; a portion of the road leading through the grounds was graded; a brick cistern was built in the superintendent's quarters and one in the foreman's quarters; minor repairs were made to the superintendent's cottage, such as strengthening the first floor by additional posts, strengthening the roof construction by additional collar-beams, and walling up the foundation of the earth closet; the siding and roof of the ice-house were repaired; the dam at Mountainey Pond was strengthened and leaks in the main supply flume were stopped.

Craig Brook Station, Maine.—Completion of stable and annex to superintendent's cottage; building of a small settling reservoir; deepening of ponds; repairing hatchery annex by laying a floor in the former woodshed and plastering the same for an office and food room; building a small smithy and annex to the farm house; repairing water conduits and flume; and some grading of the grounds.

Woods Hole Station, Massachusetts.—Repairs to doors, windows, and blinds of main building; grading along water front of same; repairing flooring of coal wharf; bottoms of boat-landing floats, woodwork around boat landings and small fish basin renewed; and the movable coal hoist repaired.

Fish Ponds, Washington, D. C.—Repairs to ponds and embankments, to supply and drain pipes, hydrants, grounds, etc. The north half of the first floor of the superintendent's cottage was strengthened for storing books thereon.

Bryan Point Station, Maryland.—Improvements on the grounds; the rebuilding of a landing; and minor repairs to buildings.

Wytheville Station, Virginia.—Repairs to ponds; laying additional supply pipes from spring to ponds, hatchery, and railroad; new spawning beds prepared; pond walls and embankments repaired; blind ditches opened; and a flagstaff erected.

Northville Station, Michigan.—The erection of a dam with fishway across the north branch of the Rouge River, 2,400 feet southwest of the hatchery grounds; the construction of a brick reservoir on the grounds, and the laying of an 18-inch water conduit of terra cotta from said dam to the reservoir on the grounds, capable of supplying 2,000 gallons of water per minute; repairs to the telephone line between the hatchery and the railroad depot; building of new ponds and repairs to old ones; laying new supply pipes from reservoirs to hatchery and ponds; and minor repairs to buildings and outfit.

Duluth Station, Minnesota.—Repairs to tanks, flume, crib well, hatchery flooring, and grounds.

Neosho Station, Missouri.—Building new ponds, new earth closet, and woodshed; minor repairs to buildings, ponds, walks in grounds, etc.

Leadville Station, Colorado.—Repairing the old hatchery, ponds, and a break in the embankment of Lower Evergreen Lake; building a number of new ponds and grading a portion of the grounds.

Baird Station, California.—Rebuilding a bridge with rack across the McCloud River; erecting a flagstaff; repairing stable, hatching and spawning houses, and current wheel, and other minor items of damage done by the past floods.

Fort Gaston Station, California.—A dam and trap were built at Mill Creek, a tributary of the Trinity River, about 4 miles distant from the station. The auxiliary hatching house on Redwood Creek, 11 miles southwest from Fort Gaston Station, was enlarged. Repairs were made to ponds, supply flume, and buildings.

Clackamas Station, Oregon.—A rack was built across the Clackamas River, as well as across the Sandy River, a tributary of the Columbia River, 17 miles northeast of the station, with a dam and flume at the latter; a flagstaff was erected, fish inclosures made, new conduits to hatchery laid, and grounds improved.

FISHWAY, POTOMAC RIVER.

Congress, by act approved August 5, 1892, made an additional appropriation of $15,000 to complete the erection of a fishway at Great Falls, in the Potomac River, sections 4, 5, and 6 having been completed during the previous year. Plans and specifications for sections 1, 2, and 3 were prepared, and proposals for the construction were invited by advertisement. But two bids were received, of which the lower—that of Isaac H. Hathaway, of Philadelphia—was accepted, and a contract entered into with him by the Chief of Engineers, U. S. A., on November 23, 1892. Sections 2 and 3 and a part of the permanent deflecting dam were completed during the year.

OFFICE OF MECHANICAL ENGINEER.

The following is the report of Passed Assistant Engineer I. S. K. Reeves, U. S. N., detailed by the Secretary of the Navy as the mechanical engineer of the Commission:

The steam, water, circulating, heating, electric, and gas plants, together with their attachments, pipe connections, etc., which are located at the different stations, have been, as opportunity offered, examined, overhauled, and repaired.

In the machine shop at Central Station a galvanized iron pipe coil refrigerator was built and introduced for the aquaria at Central Station for regulating the temperature of the salt-water supply. A water motor of the Tuerk patent was purchased, a hard-rubber pump fitted to the same, and introduced at Central Station, not only to save the expense of $25 per month for gas, but also to allow the necessary repairs to be made to the Rider hot-air pumping engine, which had been in use continually, night and day, for the past three years and needed extensive repairs. After the erection of the above-mentioned motor the pumping engine was put in thorough repair. A Bishop & Babcock air pump was purchased and connected to the different aquaria at Central Station in order to aërate the water. There was also purchased hard-rubber piping for new supply pipe for salt-water circulation for the aquaria.

Twenty-five defective tubes in the boiler for the pulsometers at the fish ponds were cut out and new ones put in.

The steam, water, and air circulating plants, transporting tanks, and their attachments on cars Nos. 2 and 3 were thoroughly overhauled and new piping substituted where required. A duplex pump of the New York Air Brake Company was placed in car No. 3, in order to supply air circulation to transporting tanks. The iron pipe coil-refrigerator in car No. 3 was removed, the system remodeled, and a new galvanized-iron coil put in. In the spring a baggage car was purchased and equipped with boiler, circulating pump, feed pump, air pump, tanks, and necessary attachments for circulating water and air during the transportation of fish to the World's Columbian Exposition. All boilers, pumps, steam-heating apparatus, etc., on the cars of the Commission were thoroughly overhauled and tested.

The engines, pumps, boilers, etc., of steamers *Plover*, *Canvasback*, *Blue Wing*, *Curlew*, *Cygnet*, *Shearwater*, and *Petrel* were overhauled, repaired, and tested; and small repairs were also made to the hulls of these steamers where required. The steamer *Petrel* was hauled out on the railway and hull coppered below water line. The steamer *Blue Wing* was also hauled out on the railway and a new sternpost put in. The lead sleeve in the deadwood was found so much worn that a new brass sleeve was put in. A new smokestack was also fitted to the boiler, and new holding-down bolts for engines were introduced. A new awning frame of galvanized-iron pipe was made for the steamer *Curlew*, and a new awning fitted. The steamer *Shearwater* was docked in Cleveland, Ohio, and hull and decks calked and painted; the jet condenser was removed, and a copper keel condenser connected. There were also a number of minor repairs made to the hull and machinery of this steamer. A pump in stock was transferred to this steamer, to circulate the water for transporting cans.

The gravity water supply at the Duluth Station having failed on several occasions from drought and freezing up, it could not be depended upon, and it became necessary to increase the pumping plant at that station; this was done by the transfer of a pump in stock at Battery Station. This was connected to the wells on the lake shore, which increased the water supply at the Duluth Station about 150 gallons per minute, giving a total supply from the two pumps of 400 gallons per minute.

The mechanical and machine work incident to the above-mentioned repairs, alterations, etc., was almost entirely performed by the machinists and firemen of the Commission, the machine work having been done in the different shops of the Commission, which are located at the different stations.

EXPOSITIONS.

The World's Columbian Exposition, Chicago.—Capt. J. W. Collins, assistant in charge of the Division of Fisheries, continued as representative of the Commission on the Board of Management and Control till the latter part of 1892, when he resigned from the Commission. On December 29 Dr. Tarleton H. Bean, assistant in charge of the Division of Fish-Culture, was appointed as his successor on the Board.

Columbian Historical Exposition, Madrid, 1892.—The participation of the Commission in this Exposition consisted in the transmission of a complete set of the publications of the Commission. In recognition of this exhibit, the Board of Directors of the Exposition conferred a a bronze commemorative medal, which has been deposited in the United States National Museum.

ADDITIONAL FISH-CULTURAL STATIONS.

Fish-hatchery at St. Johnsbury, Vt.—In the previous report reference was made to the selection of a site near St. Johnsbury for the fish-cultural station directed by law to be established in the State of Vermont. On July 21, 1892, the necessary plat of the site selected and the deeds conveying the different properties to the United States were forwarded to the United States Attorney-General. The following December that officer certified to the sufficiency of the deeds to vest in the United States valid titles; and in January, 1893, the purchase money was paid to the respective owners. These payments were, to E. and T. Fairbanks, $1,070; Asa S. Livingston, $300; John Morgan, $500; Calvin H. Cushman, $600; total, $2,470.

By the act approved July 5, 1892, a further appropriation of $10,000 was made by Congress for the completion of the station, to include the erection of buildings, the introduction of water supply, the construction of ponds, and other features in the development of the station. Owing, however, to the death of the engineer of the Commission and the delay incident to the selection and appointment of a successor, no actual construction work was undertaken during the year.

Fish-hatchery in New York.—Under the authority given by the act approved March 3, 1891, for the establishment of a fish-cultural station on or near the St. Lawrence River, New York, a preliminary investigation was made of certain localities in that State with a view to selecting a station furnishing the requirements as set forth in the report of the Commissioner for 1889–91, page 57. A site was examined at Theresa, but no conclusion in regard to the matter was reached at the time. Derogatory reports of the water supply of that place having been received, a further examination was made the following August, and the result demonstrated the unfitness of the site. In view of the ill success that attended investigations looking toward the selection of a suitable site (examinations having been made at Waddington, Redwood, Clayton, St. Lawrence, Richland, Pulaski, and Sand Bank, none of which nearly reached the standard required), and owing to the lateness

of the season, it became necessary to postpone further investigations until another season.

Fish-hatchery at San Marcos, Tex.—In a previous report reference was made to an investigation with a view to establishing a fish-cultural station in the Gulf States, and to the fact that San Marcos, Tex., furnished a desirable site for a station for the propagation of fresh-water species of fishes. By act approved August 5, 1892, an appropriation of $10,000 was made for the establishment of such a station in Texas. Before final decision upon the selection of this site a further investigation of certain other localities was made.

In November, 1893, an offer was made by a committee of citizens of San Marcos to convey to the United States a tract of land in that town, near the head waters of the river and just below the dam of the San Marcos Water Company; to rebuild and raise the existing dam across the river, so as to provide a higher level and thus permit of the supply of water to the ponds by gravity; to obtain the right to enter upon the property of the San Marcos Water Company for the purpose of laying the necessary pipes and to take fishes from the lake for the purposes of propagation; and to secure the passage of certain city ordinances which would allow of the satisfactory conduct of the station. The consideration to be paid for the tract was $4,500, and for the water rights, dam, etc., $2,500. In view of all these circumstances, it was decided to select the San Marcos site, and the deed of Judge W. D. Wood covering the tract of ground was delivered on the 2d of May, 1893, and that of Mr. Ed. J. L. Green and the San Marcos Water Company for water rights, etc., on the 24th of April, 1893.

In accordance with the request of this office of the 14th of April, 1893, the United States attorney for the western district of Texas was directed to receive the papers and examine the titles to the property and rights thereby conveyed. Under date of May 25 the Attorney-General certified that the deed to the Wood tract was sufficient to vest in the United States a valid title to the same. In regard to the property of the San Marcos Water Company and Mr. Green, it was found that the title was affected by certain deeds of trust given by the company to secure certain issues of bonds, and it became necessary to arrange for releases, so far as the rights conveyed by the deed to the United States were concerned. Steps were therefore taken to secure from the trustees, with the consent of the holders of the bonds, the releases called for by the Attorney-General. This, however, it was impossible to have done before the close of the year, and the respective deeds were held in escrow until the final completion of all the requirements necessary to pass the property in fee simple to the United States.

Fish-hatchery at Bozeman, Mont.—In the last report of the Commissioner attention was called to the investigations which took place with a view of selecting suitable sites for the establishment of fish-cultural stations in the State of Montana and in one of the Gulf States. Of the sites examined in Montana, the most desirable for the proposed station

was that embracing Davies Springs, near Bozeman. After a careful engineering survey an option for the sale of the property at $3,500 was obtained. The site embraces some 78 acres of land, on which are the Davies Springs, flowing between 1,200 and 1,500 gallons of water per minute. Certain rights connected with the water supply of Bridger Creek are also secured. The deed of William J. Davies and his wife transferring this property was dated May 20, 1893, and this document was duly transmitted to the United States Attorney-General for examination and certification as to the sufficiency of the same to vest a valid title in the United States. On June 26, 1893, the Attorney-General, in a communication to the Commissioner, stated that this deed was sufficient to pass a valid title to the United States.

Afognak forest and fish-culture reserve.—The act approved March 3, 1891, entitled "An act to repeal timber-culture laws, and for other purposes," affecting the acquisition of public lands, provides for the reservation in Alaska of such public lands as "shall be selected by the United States Commissioner of Fish and Fisheries on the islands of Kadiak and Afognak for the purpose of establishing fish-culture stations." Under this provision of the act the President, by proclamation of December 24, 1892, set aside "Afognak Bay, River, and Lake, with their tributary streams and the sources thereof, and the lands including the same on said Afognak Island, and within one mile from the shores thereof, as a reserve for the purpose of establishing fish-culture stations, and for the use of the United States Commission of Fish and Fisheries, the boundary lines of which include the head springs of the tributaries above mentioned, and the lands the drainage of which is into the same."

COURTESIES RECEIVED AND EXTENDED.

At the request of the Secretary of State, information on the fishery laws of various countries was furnished for use in the arbitration of the Bering Sea seal controversy between this country and Great Britain.

By direction of the President, the steamer *Albatross* was transferred to the Treasury Department, for duty in the investigation of the life-history of the fur seal and of the fur-seal fishery of Bering Sea.

The Treasury Department granted facilities to Mr. Charles H. Townsend, an assistant of the Commission, to study seal life upon the rookeries of the Pribilof Islands.

Information relative to the hydrographic soundings of the steamer *Albatross* was furnished the Coast and Geodetic Survey for the Coast Pilot of Alaska.

The steamer *Albatross* was transferred to the Navy Department, by direction of the President, for duty as a patrol in Bering Sea.

Capt. W. E. Dougherty, U. S. A., was, by request, detailed by the Secretary of War to superintend the fish-cultural work at Fort Gaston, Cal.

The Commission is again indebted to Gen. Albert Ordway, commanding the District of Columbia militia, for the loan of tents and equipment for use in the shad-hatching operations on the Potomac River.

The steam launches *Petrel* and *Canvasback* were loaned to the State of Virginia for use in investigating the oyster-grounds of that State.

The Standard Oil Company loaned seven tank cars for transporting 42,000 gallons of salt water for the United States Fish Commission aquaria at the World's Columbian Exposition, and the Chesapeake and Ohio Railroad Company and Cleveland, Cincinnati, Chicago, and St. Louis Railway Company transported the above free of charge from Beaufort, N. C., to Chicago.

STATE FISH COMMISSIONS.

During the year the policy of aiding, so far as possible, the work of the fish commissioners of the various States has been continued. The extent of this coöperation is shown by the following table:

Statement showing the kinds and number of fish and fish eggs furnished to State and Territorial fish commissions during the fiscal year 1892–93.

State or Territory.	Species.	Eggs.	Fish.
Arizona	Catfish		722
	Black bass		138
	Crappie		249
	Warmouth bass		628
California*	Quinnat salmon	3,530,000	
Connecticut	Atlantic salmon	108,000	
	Von Behr trout	20,000	
	Lake trout	105,000	
Delaware	Carp		1,400
	Tench		300
	Black bass		1,000
Georgia	Carp		2,000
	Rock bass		1,000
Illinois	Catfish		1475
	Yellow perch		1445
	White bass		130
	Black bass		13,216
	Crappie		1689
	Warmouth bass		11,138
	Sunfish		130
Iowa	Lake trout	100,000	
Maryland	Carp		1,030
	Rainbow trout	46,500	
	Von Behr trout	35,000	
Minnesota	Carp		1,500
	Loch Leven trout	20,000	
	Rainbow trout	20,000	
	Von Behr trout	20,000	
	Black-spotted trout		1,000
	Brook trout	20,000	
	Lake trout	100,000	
Missouri	Tench		5,000
	Rainbow trout	20,000	18
Nebraska	Rainbow trout	37,500	
	Von Behr trout	20,000	
	Lake trout	100,000	
New Hampshire	Loch Leven trout	15,000	
	Von Behr trout	25,000	
	Lake trout	100,000	
	Atlantic salmon	50,000	
New York	Atlantic salmon	75,000	
	Lake trout	100,000	
	Whitefish	5,000,000	
Ohio	Loch Leven trout		3,350
Oregon	Brook trout	20,000	
Vermont	Von Behr trout	20,000	2,500
	Rainbow trout	81,000	
	Brook trout	20,000	
	Lake trout	300,000	
West Virginia	Carp		1,000
Wisconsin	Carp		10,000
	Black-spotted trout		3,600
Wyoming	Black-spotted trout	25,000	
Total		10,133,000	42,458

* By request of the California Fish Commission, 91,000 muskellunge fry were received from the New York Fish Commission and transferred and deposited in California waters.

† Deposited by the United States Fish Commission in waters designated by the State commissioners.

RELATIONS WITH FOREIGN COUNTRIES.

Canada.—Carp were furnished the Game and Fish Commission of Ontario, and eggs of the Loch Leven trout and Von Behr trout were sent to Mr. W. P. Greenough, Portneuf, Quebec.

France.—Eggs of the rainbow trout were sent to C. Raveret-Wattel, Paris.

Switzerland.—At the request of the Government of Switzerland 30,000 eggs of the rainbow trout were sent to Mr. Emil Warner for that Government.

Japan.—To Prof. C. Sasaki, Tokyo, were sent eggs of the Loch Leven trout, Von Behr trout, and rainbow trout.

DIVISION OF INQUIRY RESPECTING FOOD-FISHES.

The work of this division during the year is set forth in the appended report of Mr. Richard Rathbun, assistant in charge. In addition to the regular inquiries of the Commission, the assistant in charge gave much time and labor, at the request of the Department of State, in preparing, for use before the Paris Tribunal of Arbitration, information concerning the condition and character of the more important fisheries of foreign countries and the legislation for their protection and improvement.

Owing to the detail of the *Albatross* for duty in Bering Sea, under the direction of the Secretary of the Treasury, and the necessity of repairs to the ship after the completion of her duties on this detail, the investigations on behalf of the Commission in the beginning of the year could only be incidentally performed. The opportunity was embraced, however, of making a careful study of the seal rookeries of the Pribilof Islands by the naturalists of the ship, who were temporarily detached from her. Upon the surrender of the *Albatross* to the Commission, on August 31, 1892, it was necessary to give her extensive repairs, which were not completed till the following April, when the President directed that she be placed under the orders of the Secretary of the Navy for duty in connection with the sealing patrol fleet in the North Pacific Ocean and Bering Sea. Owing to these details of the ship, the systematic prosecution of the inquiries of the Commission was not possible. It is hoped, however, that another season matters may be so arranged as to permit its performance.

On the Atlantic and Gulf coasts much attention was given to the study of the oyster beds and conditions affecting them. Among the grounds examined were those of Chesapeake Bay, embracing Tangier Sound, Mobjack Bay, and the rivers tributary thereto, and Galveston Bay, Gulf of Mexico. At Sea Isle City, N. J., experiments were conducted by Prof. John A. Ryder, of the University of Pennsylvania, formerly the embryologist of the Fish Commission, with the view of determining, if possible, a practical method for the collection of oyster spat, and the creation thereby of an industry distinct from, but as practical as, that of oyster-planting. Professor Ryder's observations on the subject will be found in the report of Mr. Rathbun.

Reference was made in my previous report to the visit of Dr. Bashford Dean to Europe for the purpose of studying the methods there followed in oyster-culture. The results of Dr. Dean's investigations were issued in December, 1892, and July, 1893, being published in the Bulletins of the Commission for the years 1890 and 1891, and will undoubtedly prove of great aid to those oystermen of this country who are seeking to improve the industry.

The subject of acclimatizing the eastern oyster on the Pacific coast has received attention, and investigations of the physical conditions of certain areas have been made. Favorable conditions appear to exist in Willapa Bay, Washington, and it is proposed to make plantings there from a number of localities on the Atlantic coast as soon as a favorable opportunity may arise.

Reference is made to the report of Mr. Rathbun for a résumé by Professor Libbey of the physical inquiries conducted by him during several preceding seasons off the southern New England and Middle States coast. These inquiries were discontinued during the season of 1892, and the schooner *Grampus* was used to make a search for the tilefish in those localities where it had previously been found. A few specimens only were received. The inquiry, however, establishes the fact of the continuity of the belt of warm waters on the Gulf Stream slope, so as to permit the northward summer migration of the species. We have therefore reason to expect that the tilefish will reoccupy its old grounds in undiminished numbers and that a valuable market fishery will be established should the fish be found acceptable to consumers.

At the laboratory of the Commission at Woods Hole studies of marine life were prosecuted as in previous years. The spawning and early habits of the common scallop or pecten were investigated by Dr. James L. Kellogg; Prof. Francis H. Herrick continued his observations on the development and life-history of the lobster; Prof. H. V. Wilson on the development of certain sponges; Dr. William Patten on the sense-organs in the horseshoe crab. The other inquiries conducted will be found noted in Mr. Rathbun's report.

Extensive investigations were made of the shores and inlets of Buzzards Bay and Vineyard Sound for the purpose of studying the habits and life-history, in the younger stages, of the common food-fishes of the locality, and much important information concerning the breeding and other habits of the menhaden was secured.

The interior waters examined during the year embraced the Columbia River and some of its tributaries, in Washington, Idaho, and Montana; the rivers and lakes of Minnesota, North and South Dakota, Iowa, Nebraska, Wyoming, Wisconsin, Arkansas, and California. These investigations were for the purpose of studying the physical characteristics of these waters and also to ascertain the various forms of animal and plant life inhabiting the same. Such inquiries are especially valuable as a guide in the work of the Commission of stocking our waters with suitable food-fishes.

The destructive methods followed in the capture of fish and shellfish in the territorial and contiguous waters of the United States and the British Possessions in North America, as also in the open seas outside of the territorial limits of either country, but which are resorted to for the purpose of fishing by their respective inhabitants, as well as the polluting and obstructing of such contiguous waters, to the detriment of their fisheries, have long been matters which have invited the attention of the respective Governments; and the necessity of uniform mutual laws regulating the prosecution of the fisheries, as also the adoption of methods for the replenishing of depleted waters, have equally been felt to be necessary if the fisheries were to be maintained. An agreement was reached by the two Governments on December 6, 1892, which provided for the appointment of a joint commission of two experts, one on behalf of each government, to consider and report upon the whole question. As representative on the part of Great Britain, Dr. William Wakeham, of the department of marine and fisheries of Canada, was appointed, and on the part of the United States Mr. Richard Rathbun, of the United States Commission of Fish and Fisheries. The two commissioners had their first meeting at Washington, on March 2, 1893. For the general scope of the inquiry to be prosecuted, reference is made to Mr. Rathbun's report.

During the spring and summer of 1893 investigations were conducted to learn what, if any, benefits had resulted from the series of close seasons in the spring mackerel fishery, provided by the act of Congress passed in 1886, the information also being needed by the Joint Fishery Commission. The schooner *Grampus* attended the fishing fleet on the southern fishing-grounds and thence to those off Nova Scotia. Many valuable observations were made, and much important information secured bearing upon the fishery. As the data of several seasons are necessary before any reasonable conclusions on the subject can be reached the consideration thereof is deferred. Other incidental investigations conducted by the division are shown in the report of Mr. Rathbun.

DIVISION OF STATISTICS AND METHODS OF THE FISHERIES.

During the year the administration of the affairs of this division devolved upon Dr. Hugh M. Smith, and reference is made to his appended report for a résumé of the work accomplished. Capt. J. W. Collins, the assistant in charge, retained the general direction of the work of the division up to September 26, 1892, and on December 27 of the same year he resigned from the Commission.

The work of the Division of Statistics and Methods of the Fisheries has continued of the same general character referred to in my previous reports. The scope of the operations is, however, becoming more extended and valuable year by year, and the practical usefulness of the division is annually becoming more evident.

The work of the division has consisted chiefly of field investigations of the commercial fisheries, and the preparation of general and special reports based on the data collected by the division. A large amount of correspondence embodying technical information has been sent out by the division; a number of special discussions on fishery topics have been prepared for the use of the Commissioner and others; and considerable statistical and other data have been supplied to State officials.

The field investigations carried on by this division were addressed to regions having very important fisheries. The previous practice of taking up for investigation each year definite sections or fisheries, depending largely on work already done covering the same subject, has been continued. In this way it is possible, with the present force, to canvass the fisheries of the coast and Great Lakes States about once in three or four years. The inquiries of the division in 1893 were mainly directed to the methods and statistics of the fisheries of the Middle Atlantic States, the New England States, the Pacific States, and of the mackerel fishery. Several minor subjects were also considered, and the regular agencies at Gloucester and Boston, Mass., were continued.

The inquiries in the Middle Atlantic States were in continuation of those of the previous year, referred to in the last report; the Chesapeake basin and the adjoining ocean shores of Maryland and Virginia were then canvassed, leaving for consideration during the fiscal year 1893 the fisheries of New York and New Jersey and those parts of Pennsylvania and Delaware not tributary to the Chesapeake. The field investigations in this region covered the calendar years 1889, 1890, 1891, and 1892, except in New York, in which the time of the inquiries prevented the agents from obtaining complete statistics for the last-named year. In the appended report of the assistant full references to the scope and results of the canvass of the Middle States are given, including statistics and comparative data.

The recent serious decline in the mackerel fishery, and the great attention which the scarcity of mackerel had received, made it desirable to have full statistical and other information upon these subjects. Accordingly, in connection with the other field inquiries, elsewhere alluded to, a canvass of the mackerel fishery was undertaken in the spring of 1893, and arrangements were made for securing more detailed data than had previously been obtained. This work was in progress at the close of the fiscal year. Reference to the accompanying report of the assistant in charge will show the scope and character of the investigation.

A study of the important fisheries of the New England States was made in conjunction with the investigation of the mackerel fishery of that region. No general fieldwork had been carried on in this section since 1889, and in the meantime some noticeable changes had occurred in the condition of the industry which made another canvass in 1893

timely. Special attention was directed to the lobster fishery, whose successful continuance has been seriously imperiled by overfishing. At the close of the year this investigation was well under way.

Early in the fiscal year an investigation of the fishing industry of the Pacific States was begun by Mr. W. A. Wilcox, who had made a similar canvass in 1889. Personal visits were made to all fishing centers on the coast and the coast streams, and very valuable data were secured for each of the years intervening since the last canvass. Especially useful statistics regarding the salmon industry were obtained. Although Alaska was not visited, complete statistical information covering the fisheries of that territory were obtained from the firms engaged, all of whom have headquarters in San Francisco or other cities of that coast. In San Francisco and vicinity Mr. Wilcox was assisted by Mr. A. B. Alexander, fishery expert on the *Albatross*, who was temporarily detached from the vessel for that purpose. The inquiry closed in May, 1893. An account of this work and its results is given in the report of the assistant, and Mr. Wilcox's full report will be found among the appendices to this report.

In connection with the work of the International Fisheries Commission, Dr. Smith, at the request of the United States commissioner, Mr. Rathbun, during June, 1893, accompanied the commission to Boston, Woods Hole, Provincetown, and other New England fishing centers.

The report for this division contains a brief synopsis of the papers, based on the division's field inquiries, issued during the year. These included statistical and descriptive articles on the fisheries of the New England States, the South Atlantic States, the Gulf States, and of Lake Ontario. The report concludes with notes on some of the more important fisheries, and on certain branches possessing special interest.

DIVISION OF FISH-CULTURE.

The continued growth of the Commission rendered it necessary that the Commissioner should relieve himself of the direct supervision of the details of this division, the charge of which he had assumed upon his appointment as Commissioner. On July 6, 1892, he therefore appointed as the assistant in charge Dr. Tarleton H. Bean, the ichthyologist of the Commission. Dr. Bean assumed charge of the division and retained its immediate direction till the beginning of the following January, when his appointment as representative of the Commission on the Government Board of Management and Control of the World's Columbian Exposition, Chicago, necessitated his being relieved of other duty. Mr. S. G. Worth, the superintendent of Central Station, was then detailed as acting assistant in charge of the division, the duties of which position he performed with fidelity and skill for the remainder of the year covered by this report.

The following tables exhibit the results of work at the different stations, and the summary, by species, of the fish distributed:

Summary of eggs and fish furnished for distribution by stations in the fiscal year 1892–93.

Source of supply.	Species.	Eggs.	Fry.	Adults and yearlings.
Schoodic, Me	Landlocked salmon			48,000
Craig Brook, Me	Atlantic salmon	233,000		1,448
	Landlocked salmon			17,031
	Brook trout			34,234
Green Lake, Me	Landlocked salmon			500
Gloucester, Mass	Cod	1,195,000	20,142,000	
Woods Hole, Mass	Sea bass		1,189,000	
	Cod		850,500	
	Flatfish		288,000	
	Mackerel		434,500	
	Lobster		8,818,000	
Battery Island, Md	Shad	3,248,000	31,145,000	
Bryan Point, Md	Shad	7,874,000		
Central Station, Washington, D. C.	Shad		5,614,000	
	Rainbow trout		39,000	
Fish Ponds, Washington, D. C.	Catfish			1,270
	Carp			74,518
	Tench			336
	Golden ide			398
	Goldfish			9,424
	Shad			600,000
	Black bass			34,379
	Golden tench			20
Wytheville, Va	Carp			5,108
	Goldfish			5,990
	Rainbow trout	125,000		79,547
	Black bass			1,433
	Rock bass			13,650
Put-in Bay, Ohio	Rainbow trout		65,000	
	Lake trout		81,500	
	Whitefish	5,000,000	22,570,000	
	Lake herring		6,505,000	
	Pike perch		20,200,000	
Northville, Mich	Loch Leven trout	100,000		3,400
	Von Behr trout	175,000		150
	Brook trout	90,000		19,000
	Lake trout	905,000	250,000	23,000
Alpena, Mich	Whitefish		16,640,000	
Duluth, Minn	Loch Leven trout			1,550
	Rainbow trout		83,000	
	Lake trout		2,355,000	
	Whitefish		10,482,000	
	Pike perch	500,000	5,500,000	
Quincy, Ill	Yellow (or ring) perch			4,454
	Catfish			7,811
	Pike perch			845
	White bass			1,877
	Black bass			33,987
	Crappie			10,754
	Warmouth bass			5,670
	Sunfish			1,756
	Pickerel			133
Neosho, Mo	Carp			634
	Tench			14,855
	Goldfish			937
	Shad			200,000
	Rainbow trout	140,000		38,684
	Brook trout			1,000
	Black bass			1,968
	Rock bass			9,000
	Golden ide			10
Leadville, Colo	Loch Leven trout			2,600
	Rainbow trout			1,550
	Von Behr trout			30,050
	Brook trout			98,200
	Black-spotted trout	60,000		46,500
Baird, Cal	Quinnat salmon	3,530,000	533,100	
Fort Gaston, Cal	Rainbow trout	10,000		
	Rainbow trout		35,000	
	Von Behr trout			10,950
	Brook trout			6,193
Clackamas, Oregon	Quinnat salmon		657,000	
Steamer Fish Hawk	Quinnat salmon		4,100,000	
	Shad		6,922,000	

Summary of distribution, 1892–93.

Species.	Eggs.	Fry.	Adults and yearlings.	Total.
Catfish			8,486	8,486
Carp			72,481	72,481
Tench			15,155	15,155
Golden ide			120	120
Goldfish			12,588	12,588
Shad		44,530,000	800,000	45,330,000
Quinnat salmon	3,530,000	5,290,300		8,820,300
Atlantic salmon	233,000		1,448	234,448
Landlocked salmon			65,531	65,531
Loch Leven trout	100,000		7,500	107,500
Rainbow trout	275,000	222,000	111,357	608,357
Von Behr trout	175,000		50,821	225,821
Black-spotted trout	60,000		46,025	106,025
Brook trout	90,000		158,290	248,290
Lake trout	905,000	2,674,500	23,001	3,602,501
Whitefish	5,000,000	49,692,000		54,692,000
Lake herring		6,505,000		6,505,000
Yellow perch			4,328	4,328
Pike perch	500,000	24,600,000	845	25,100,845
Sea bass		1,189,000		1,189,000
White bass			1,710	1,710
Black bass			68,269	68,269
Crappie			9,940	9,940
Warmouth bass			4,999	4,999
Rock bass			21,560	21,560
Sunfish			1,562	1,562
Pickerel			101	101
Cod	1,195,000	20,992,500		22,187,500
Mackerel		434,500		434,500
Flatfish		288,000		288,000
Lobster		8,818,000		8,818,000
Total	12,063,000	165,235,800	1,486,117	178,784,917

In addition to the foregoing there were furnished for distribution, but lost in transit, during the year, 3,857,000 *shad fry*, 12,000 *lake-trout fry*, 1,100,000 *pike-perch fry*, and the following *adults and yearling* fish: 280 catfish, 5,662 carp, 1,915 goldfish, 50 Loch Leven trout, 8,390 rainbow trout, 329 Von Behr trout, 475 black-spotted trout, 1,237 brook trout, 599 lake trout, 126 yellow perch, 167 white bass, 4,417 black bass, 814 crappie, 671 warmouth bass, 1,090 rock bass, 194 sunfish, 32 pickerel.

For information as to the details of work at the stations, and of the distribution of their product, reference is made to the appended report of Mr. Worth.

MARSHALL MCDONALD,
Commissioner.