# United States Commission on Fish & Fisheries

## REPORT OF THE COMMISSIONER 1879.

### A.--GENERAL CONSIDERATIONS.

#### 1.—Introductory Remarks

The present report is intended to furnish an account, in compliance with law, of the operations of the United States Fish Commission during the year 1879, and for some branches of the work during the early portion of 1880. This continuation applies especially to the propagation of the eastern salmon, the land-locked salmon, the whitefish, and the cod.

The continued increase in the extent of the field of labor, referred to in previous reports, manifested itself also in 1879, as new subjects of inquiry presented themselves and increased the demands for service in the propagation and distribution of food fishes. The appreciation of the work by Congress is shown by the increase in the amount of appropriations, all of which, it is hoped, have been expended with due economy and consideration.

The machinery of the Commission, and especially its personnel, continues to be very limited, so that as much of the appropriation as practicable is used for the direct objects of the Commission.

The most noted features in the history of the Commission for the year are: First, the commencement of the distribution of young carp to various points in the United States; and, secondly, the authorization by Congress of the construction of a special steam vessel to serve as a floating station for the hatching of shad[1] and other useful food fishes. More particular allusion to this will be made under the appropriate heading.

A pleasant experience of the year was the visit of the President and Cabinet to the Havre de Grace shad hatching station on the 7th of June.

It is with very great regret that I chronicle the death, on the 6th of January, 1880, of Mr. James W. Milner, who has been connected with the Fish Commission as its principal assistant almost since its first inception in 1871. In that year, he was detailed to make an investigation of the fisheries of the lake region, the results of which were published in the annual reports of the Commission. From that time he had particular charge of the field work connected with the propagation of the shad, and their transfer, and that of other species, to various parts of



1 Shad, or River Herring

the United States. An earnest, patient, and able investigation, he very soon made himself familiar with the history of fish culture in general and the application of the various forms of fish hatching apparatus to the needs of the Commission. Some very important modifications of machinery were due to his ingenuity, and, had he lived, it is safe to assume that he would've made a very distinguished record in his favorite science.

Mr. Milner's illness, in his own opinion, was first caused by exposure while superintending the work of hatching shad at Avoca, N.C., in the spring of 1878, and afterward on the Susquehanna. He returned to Washington, where he remained several months during the summer, and then went back for a time to his residence in Waukegan, IL. After it had been determined to commence the work of hatching codfish at Gloucester in the winter of 1878-1879, Mr. Milner came to that station just prior to the breaking up of the summer party, and superintended the beginning of the work. Continuing to grow worse, he was ordered by his physician to Washington; and after remaining there for a few months, he went to Florida where he stayed during the winter and the early spring. Here he was able to spend a good deal of time in the open air, and to make a number of collections for the National Museum. Returning to Waukegan somewhat too soon, he took fresh cold, and after a time, was directed to spend the summer in the high mountain region of Colorado. Not much benefit resulted from this experiment, and in the autumn of 1879 he again returned to Waukegan, and lingered there for several months until his death on the date mentioned.

As explained in previous reports, the work of the Commission falls naturally under two distinct heads: First, the investigation into the condition of the fisheries of the United States; their statistics: manner of prosecution: and how the service can be improved further, in the methods of capture, preparation, and preservation, or the increase in abundance. Secondly, the actual increase of the supply by artificial propagation and transfer to new localities or their multiplication in those which an original abundance had become greatly reduced.

The first division of the work, as heretofore, has been, for the most part, conducted by Mr. G. Brown Goode, assisted by Dr. T. H. Bean.

The collection and determination of the marine invertebrates has been in charge of Prof. A. E. Verrill, with assistants to be mentioned hereafter.

In the illness and necessary absence of Mr. Milner I was very fortunate in being able to secure the cooperation of Mr. T. B. Ferguson, the Maryland commissioner of fisheries, of whose services, both to the cause of fish culture in general and the United States Fish Commission in particular, I have repeatedly made mention.

Of the several permanent stations of the Commission, the carp ponds have been as before under the charge of Mr. R. Hessel; the California salmon hatchery, under that of Mr. Livingston Stone; and those of the

Penobscot Salmon, and the land-locked salmon, under that of Mr. Charles G. Atkins. Fuller details will be furnished hereafter in regard to the various branches of operation.

### 2.—SPECIAL OBJECTS OF THE UNITED STATES FISH COMMISSION

In the report for 1878 I have given considerable detail, not necessary to be repeated here, a sketch of the objects of the Commission. Of course as the old problems are solved new points of inquiry arise to take their places, and in thew ide range of subjects covered by the field of the Commission, a vast deal remains to be done before its objects can be considered as properly accomplished.

Before proceeding to give special details connected with the different operations of the Commission, it gives me pleasure to acknowledge the services that have been rendered both by the Government and by private parties. The law in the statute book requiring the executive departments of the government to render the Commission all necessary and practical aid has, as heretofore, been faithfully carried out by them, as follows:

### 3.—ASSISTANCE RENDERED TO THE COMMISSION

As in previous years, the work of the United States Fish Commission has been very greatly facilitated by the cooperation of various bodies, public and private.

*The Navy Department*—The most important aid was rendered by the Secretary of the Navy, in the detail of the United States steamer Speedwell, under Lieutenant Tanner, with a full crew for a three months' service, as referred to under the head of deep sea research. Also, by the loan of a steam launch for service on the Susquehanna River.

*Treasury Department*—The Bureau of Revenue Marine, of the Treasury Department, instructed Captain Fengar, of the cutter Ewing, stationed at Baltimore, to transport three scows of the Commission from Havre de Grace to Crisfield, MD., and from Crisfield to Baltimore.

The Lighthouse Board has continued its cooperation in requiring the keepers of lighthouses and lightships to make and render monthly a record of the temperature of the water.

The United States Coast Survey, under Captain Patterson, supplied a large number of charts for the use of the Commission; and also lent a number of Casella-Miller thermometers, while awaiting a supply from London.

*The War Department*—The Secretary of War authorized the expenditure by the Engineer Bureau of an available portion of the river and harbor appropriation for dredging a channel thorugh the bar at Spesutie Island, below Havre de Grace, to allow the passage of launches at low water to the fish hatching barges near the island.

General Warren, of the Engineer Bureau, allowed the use of the schooner belonging to his office, during a period of several months in the summer, when not required by him, the Commission, of course, paying the running expenses.

The Signal Office lent the wire and cable together with the instruments necessary to effect telegraphic communication between Havre de Grace and the barges of the Commission at the Head of Chesapeake Bay. General Meyer also directed his observers to take special note of water temperatures at all the stations along the Atlantic and Pacific coasts, supplying thermometers to the observers already referred to, on the lightships and at the lighthouses. The Blank was furnished by the Commission.

A detail of a military guard at the salmon hatching station on the McCloud River by general McDowell was of great importance in protecting the property of the government against a crowd of lawless Indians and whites. An illustration of the value of this service is shown in the accompanying letter from Mr. Stone, in charge of the station.*

*The Railroads*—All the railroads of the country to which application was made for the favor furnished circulars to agents and baggage masters, instructing them to facilitate in every possible way the operations of the Commission, especially by accepting government orders for transportation and authorizing the carrying in baggage cars, without any charge, the cans containing young fish.
A list of the routes referred to will be found in the appendix.

The Pennsylvania Railroad Company in addition furnished a car, free of charge, for the transportation of all the eggs of California salmon from Chicago to Washington. The Philadelphia, Wilmington, and Baltimore Railroad also rendered a similar favor in connection with the movement of young shad to various parts of the country.

*Ocean Steamers*—The offer of free transportation of messengers and fish was made by the North German Lloyds, between Bremen and New York, and by the Royal Mail Steamship Company, between New York and Boston and Liverpool.

*Telegraph Companies*—The Western Union Telegraph Company granted permission to stretch a telephone wire on its poles between Havre de Grace and Aberdeen, beyond which to the hatching station barges it was sustained by the flying poles of the Signal Office.

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* [Extract from a letter written by Mr. Livingston Stone, September 23, 1879, United States Fishery, Baird, Shasta County, California]

The value of our military guard was well illustrated this week, as follows: Some ill-favored fellows had been hanging around here for some time, and one day they appeared with a horse and wagon. I felt sure that they meant to steal our salmon, and indeed, the next morning, just at day break, the soldiers caught them in the very act of taking the spawning salmon out of the corral. The undoubtedly meant to take a wagon-load. They met with pretty rough treatment from the soldiers, as they deserved, and the circumstance is worth a great deal to the fishery, from the effect that it will have in the community around us, upon both Indians and white men.

### 4.—SERVICES RENDERED BY THE UNITED STATES FISH COMMISSION

The extent and character of the distribution of eggs and young fish by the Fish Commission during the year will be found detailed in special reports on that subject and in the accompanying tables.

It may be well to call attention to what has been done in supplying eggs and fish to other countries. This has been done partly as an experiment, partly as a return foor favors the transportation received, and partly for the purpose of keeping up an international comity, such as should prevail between various governments. A handsome acknowledgment was made on the part of the French authorities, in the form of a gold medal issued to the Fish Commission for its services in introducing the California salmon into France. In reply to an application to that effect a full series of reports of the Commission was presented and a large amount of special information furnished.

At the close of the International Exhibition of 1876 an organization, entitled “The Permanent Exhibition Company,” took charge of the main building and secured a large portion of the contents for the purpose of maintaining, with new additions, an interesting exhibition of the resources and industries of the world in general. Their plan included illustrations of processes of various kinds, and among them those relating to fish culture. Application was made to the Fish Commission for its assistance in this connection. As, however, the immediate work of the Commission required all its material and machinery, it was thought inexpedient to incur any extra expense in having additional apparatus prepared for this purpose. The invitation, therefore, was respectfully declined.

## B.—INQUIRY INTO THE HISTORY AND STATISTICS OF FOOD FISHES

### 5.—FIELD OPERATIONS DURING THE SUMMER OF 1879

Reference has been made in previous reports as well as in the commencement of the present one to the services rendered by the Navy Department to the Fish Commission in the prosecution of its inquiries into the condition of the fisheries of the Eastern coast of the United States, the detailing, first, of the small launch in 1871; then of the “Blue Light” in 1873, 1874, and 1875, and of the “Speedwell” in 1877 and 1878, having been duly acknowledged. The work of the year 1879 has shown a similar dependence upon the cooperation of that department in the renewal of the detail of the Speedwell. Commander L. A. Beardslee having been assigned to other duty, Liuet. Z. L. Tanner, a experienced officer of the navy, was placed by the secretary in command, with Mate James A. Smith, as executive officer, William B. Boggs, as engineer, John Corwine, as paymaster, and Dr. J. H. Kidder as surgeon. Dr. Kidder acted in a similar capacity to the Commission in 1875.

Provincetown having been selected as being the center of a region

hitherto unexplored by the Commission, and as furnishing much opportunity for investigation the beginning of July was fixed upon for the commencement of the work of the summer.

With my usual corps of assistants, I left Washington on the 10th day of July, and arrived at Provincetown on the 16th, establishing headquarters at the hotel of Mr. James Gifford. The berth of the steamer and the laboratory were at the end of the wharf of Messrs. Bowley & Bros., where all necessary conveniences were readily secured. The Speedwell made her first trip to Gloucester to bring over portions of the Fish Commission equipments, which were stored at that place.

As in the previous years of the Fish Commission work, Prof. A. E. Verrill was in charge of the department of marine invertebrates, assisted by Mr. Richard Rathbun and Mr. S. Smith. Mr. G. B. Goode, assisted by Mr. F. W. True and Mr. F. Gardener, jr., supervised the collecting of the fishes, and Capt. H. C. Chester was in charge of the actual work of the dredge and the trawl.

The improvised laboratory at the end of Bowley's wharf furnished a somewhat cramped opportunity for investigation. Much information was gained by the careful study of the various forms of animal life which were brought in by the steamer.

Prof. Henry E. Webster, of Union College, Schenectady, N.Y., who spent the summer in provincetown with his assistant, Mr. N. W. Benedict, rendered very great service in accompanying and superintending the dredging parties during the temporary absence of Professor Verrill, his own special research being directed toward the Annelida, or worms.

The Speedwell was ready for sea and placed in commission at the navy yard, Washington, about noon of July 1st. When she had taken on board all necessary stores and supplies she left Washington July 9th, arriving at Provincetown July 12th, and making the trip in a little over three days. On the 16th of July she proceeded to Gloucester for the purpose of obtaining articles of apparatus which ahs been left in store at that place, returning to Provincetown on July 20th.

The first exploring trip was made on July 21st, after which date work continued whenever the weather and the operations of the Commission would permit. The regular routine embraced a sounding and temperature observation both at the surface and at the bottom before lowering either the dredge or the trawl. The vessel experienced no casualties during her term of service beyond the unexpected parting of a new three and a quarter hemp rope. This accident was followed on September 20th, by the breaking of a second spare line, bringing the work of the season to a close.

All the most important points within 20 miles of Provincetown were thoroughly explored with the exception of the coastline between Chatham and the Cape, which had been left for the last trip, and for reasons already given, was necessarily omitted. This region will, however, be the subject of subsequent examination. After one or two

trips had been made for the special purpose of determining certain points relative to ocean temperatures, the Speedwell left for Gloucester on October 1st,there stowing the apparatus and returning to Provincetown. On October 6th the vessel took on board the stores and supplies to be carried back to Washington as also the collections of natural history, a portion of which were to be left at New Haven, under Professor Verrill's care, the rest being destined for the National Museum. October 12th the Speedwell reached the navy yard, Washington, and closed finally its relationships with the Fish Commission.

The full details of the work of the Speedwell will be found in an accompanying report by Lieutenant Tanner. From this report it will be seen that the vessel was in commission 116 days; was detained in port, on account of bad weather, for 28 days, and was actually engaged in dredging and trawling 24 days. The total number of hauls made with dredge and trawl was 148, averaging 6 per day. One hundred and eighty soundings were also made. The total distance traveled during the summer trip by the steamer was 3,122 miles.

As usual the commission had a large number of visitors during the summer interested in the general operations, or in some special branch of its work. Among these may be mentioned Prof. Asa Gray, of Cambridge, Dr. Thomas Brewer, of Boston, Mr. Isaac Hinckley, of Philadelphia, Mr. John Foord, editor of the New York Times, Mr. Charles Aldrich, of Iowa, Mr. May, Fish Commissioner for Nebraska, and others.

A great many specimens were gathered in the course of the summer's work, embracing numerous duplicates desired for distribution among the various educational establishments and museums of the country.

Reference is made in another part of this report to the work connected with the investigation of the American Fisheries, undertaken in behalf of the census of 1880.

Mr. G. B. Goode, who was in special charge of this department, also had his headquarters at Provincetown with a sufficient corps to carry on his work, and was there enabled to obtain much of the statistical and other information required for the completion of his plan. The general results of the sea coast work of the summer of 1879, in connection with the statistics of the fisheries, will be embodied in the fishery reports of the census of 1880, and therefore, need not be repeated here.

After his return to Washington, Lieutenant Tanner was transferred by the Secretary of the Navy to the supervision of the construction of the Fish Commission steamer Fish Hawk, of which mention is made elsewhere.

In the report for 1878 mention was made of the fact that at the suggestion of the Commission a display station of the Signal Office establishment was put into operation at Gloucester. Finding no such station at Provincetown, and being well satisfied of its importance, I made application to General Myer for a similar service, which was granted.

The station was established there during the summer, and has been continued in operation ever since.

In previous reports, mention has been made of the discovery in great abundance off the eastern coast of New England of the pole flounder, *Glyptocephalus cynoglossus*[2], a member of the flatfish family of large, size. This fish, entirely unknown on the American coast until its discovery by the Commission in 1877, has proved to be one of the most abundant of its kind, and promises to be a very important addition to the food resources of the country whenever the beam trawl shall become generally used by the fishermen. This fish was taken in great quantities during the summer of 1879, and a large extension of its supposed range was established.

A second species of fish, also promising to be of great value as a food fish, was brought to light during the summer of 1879; specimens were first obtained about eighty miles south of Noman's Land by Captain Kirby, of Gloucester, to be known as the tile fish or *Lopholatilus chamaelonticeps*[3], constituting a genus and species entirely new to science. It is believed that the taking of this fish indicates the existence in the region of capture an important resort of food fishes in general. This point is is proposed to investigate at some future time.

### 6.—THE STEAMER FISH-HAWK

The experience of the Commission has for several years past shown the efficiency and economy of floating stations for the hatching of shad, by means which, after the work at one locality is exhausted, another can be taken up with the least possible delay. Heretofore the work has been done on floating barges, which have been towed from their winter stations in Washington, Baltimore, or Havre de Grace, to Ablemarle Sound, and thence back again, stopping at one or more stations in the course of the season to prosecute their work. Towing has, however, proved to be a matter of great expense, and, in most cases, of peril also, flat bottom boats being unfitted for the dangerous navigation of the Chesapeake Bay, where, by a curious fatality, violent storms have generally prevailed whenever such a transfer was to be made. The towing has been done by vessels of the revenue marine, through the courtesy of the Secretary of the Treasury and the superintendent of the bureau; but on more than one occasion the barges have been in imminent danger of foundering with their crews and contents.

The advantage, therefore, of having a floating hatchery on a well-constructed steamer, as being more suitable for transfer from point to point, has been urged strongly before the Commission; and, after various plans were considered, the designs of Mr. Copeland, of the Lighthouse Board, were fixed upon, and the appropriation of Congress of $45,000 for a steamer was made use of. As the law directed, the steamer was to be built under supervision of the Secretary of the Treasury, and that officer placed it in charge of the Lighthouse Board.

2 Witch Flounder or Torbay sole, right-eyed flatfish

3 Great northern tilefish or golden tile

From among many bids for the building of the same, that of Messrs. Pusey & Jones, of Wilmington, for $44,000, was accepted and the vessel, to be known as the Fish-Hawk, put under contract.

After the close of the cruise of the Speedwell in the autumn of the year, Captain Tanner was detached and placed in charge of the Fish-Hawk, visiting it at short intervals to inspect the progress of the work. In the course of the year considerable advance in its construction was made, and it is hoped that the vessel will be available for use in the spring of 1880. A detailed account of this vessel will probably appear in the next report of the Commissioner.

### 7.—ABSTRACT OF RESEARCHES PROSECUTED UNDER DIRECTION OF THE COMMISSION

Among the collateral subjects of attention by the Fish Commission has been an investigation into the chemical composition of fish under the varying circumstances of age, sex, and the condition of the reproductive apparatus. This has a very important bearing both upon the availability of fish for food and also as furnishing material for the making of oils and fertilizers. A large number of analyses have been made by Professor Atwater which already supply the means of important deductions, especially as to the comparative nutritive power of the same quantity of flesh in different species.

A fuller statement of the general results of this inquiry will be found in the next report of the United States Fish Commission.

Among the more important researches made at Provincetown during the summer was that Dr. Kidder, U.S.N., surgeon of the party, in regard to the temperature of fishes. For a long time it had been supposed that the temperature of the fishes was always the same as that of the water in which they happened to be placed, but the experiments of Dr. John Davy indicated that, in some cases at least, especially where mackerel and tunny[4] were the species in question, the actual temperature of the fish was a few degrees higher than that of the water. Dr. Kidder utilized such opportunities as were presented to him in determining this question and obtained some exceedingly interesting results, which have been published by the Fish Commission.

Among the special problems connected with the interests of the fisheries are economical methods for the production of cold, to be used in the preservation of fish for a certain length of time, either directly by reducing the temperature of the storage space, or indirectly by making ice to be employed for a similar purpose. In ordinary seasons after an abundant ice crop, the ruling prices of $1 to $3 a ton is by no means exorbitant; when, however, as is not infrequently the case, the cost is from $10 upwards, the tax becomes very serious.

Among those who have devoted themselves to the solution of this question is Professor Gamgee and to his pen I am indebted for an able articled published in the last United States Fish Commission report.

4 Atlantic bluefin tuna

Professor Gamgee has kindly offered to continue his investigations on this subject, with a special view of determining the feasibility of constructing a compact machine, which may be of service in bringing fresh to land, the specimens taken on board the Fish-Hawk. His article on the subject I hope to publish in a future report.

One object to which the Fish Commission has devoted much attention has been the bringing together of as complete a series as possible of all the various marine animals of North America. Including in this group the seals and cetaceans. Among the least known forms are the larger varieties of porpoise, grampus[5], and whales, the opportunities for examining the latter being exceedingly scanty. Little can be seen of a whale in the water, whether dead or alive, and when stranded the flacidity of the body distorts its shape to such an extent as to cause the fish to lose its natural appearance; nearly all the sketches of whales have been made from several different presentations of the animal; and, therefore, although fairly accurate, are not absolutely precise. Some of these sketches have been used for a basis of reconstruction or models of small size for the National Museum. Information having been received by telegram on the 12th of April, from Provincetown Bay, I dispatched Mr. Joseph Palmer, the modeler of the National Museum, to see whether he could not obtain a mold in plaster of the animal from which a cast might be made. He accordingly proceeded to Cape Cod, obtaining in Boston a sufficient amount of plaster in barrels for his purpose. On arriving at Provincetown, by the help of Mr. Small and other citizens, he was enabled to take a mold of the animal (a humpback, about 30 feet long) in sections, which he brought back with him to Washington, and which has been stored in the armory building, to be used in the construction of a papier mache reproduction at the proper time.

The preparation of a series of casts in plaster and papier mache of the larger fishes, begun several years ago, has been continued by Mr. Palmer and his assistant; the painting, as before, having been executed by Mr. A. Zeno Schindler and Mr. John H. Richard.

### 8.—STATISTICS OF THE FISHERIES, EXCLUSIVE OF THOSE TAKEN IN CONNECTION WITH THE CENSUS

In the summer of 1878, when the Fish Commission had its headquarters at Gloucester, an arrangement was made with Mr. George J. Marsh, in behalf of Mrs. Rogers, for the rental of a wharf and the necessary buildings at Fort Point for the service of the Fish Commission. These served as its headquarters during the season of 1878, and as the station for the codfish hatching during the winter of 1878-'79. A satisfactory arrangement was made with Mr. Marsh for continuing the lease of the premises for 1879, the necessity for such a station being quite urgent both as the central point from which the statistics of the Gloucester

5 Risso's dolphin, *Grampus griseus*

trade could be collected, and as a place of storage for a large amount of Fish Commission property. The station was in charge of Dr. T. H. Bean during the summer of 1879, and of a Mr. A. Howard Clark since September, 1879, and to those gentlemen the Commission is indebted for a large amount of valuable information. They have also utilized the opportunity of constant association with the fishing vessels by inducing their captains to preserve and present any curious specimens of marine animals taken on the fishing banks. It is well known that not only are strange fishes frequently taken on the trawls, but starfishes, corals, &c., attach themselves to, or become entangled in, the lines and are hauled on board. Inquiries on board of vessels, as they came in from a trip, have resulted in the obtaining of most important additions to the North American fauna, hundreds of species having thus been procured that would otherwise have been entirely unobtainable.

A special catalogue [catalog] of the donations derived from this source will be found in the present report.

The actual supervision of the wharf and building has been exercised by Capt. S. J. Martin, of Gloucester, who has remained on duty day and night, and who has also rendered essential service in collecting specimens and information for the Commission.

For the better appreciation of the relationships of the different fishing grounds off the eastern coast of North America, Professor Hilgard kindly consented to superintend the preparation by Mr. Lindenkohl of a relief map of the region between Sandy Hook, N.Y., and the eastern edge of the Grand Bank of Newfoundland, and from the coast of Maine and of the Gulf of Saint Lawrence to the south of Nantucket Shoals. Contour lines were traced for the different depths, and the outlines cut out in cards of different colors, superimposed the one upon the other. By using cards of different thicknesses the proportional gradations in depth, at each point were indicated in twenty-five-fathom stages up to a hundred and fifty, and by those of fifty fathoms for greater depths. This map has proved to be an object of extreme interest as illustrating much more clearly than has heretofore been possible the localities where the different kinds of fish were obtained, and showing why certain places were especially favorable fishing grounds in certain seasons.

Reference has been made in previous reports to an arrangement with Mr. Linnell, of Boston, for obtaining the statistics of the shore fisheries of Massachusetts, having their center of operations in Boston. The dock of which he is the wharfinger is a place of resort for nearly all the cod, haddock, herring, and other fishermen who sell their cargoes in that city; and as the charge for wharfage is in proportion to the character and number of fish, it becomes an easy manner to estimate with great precision. The fish not included under this arrangement are but a small percentage, and their numbers can be easily averaged.

The arrangement with Mr. Linnell was continued during the year, and his figures have been used in compounding the statistics for the census report of 1880.

## 9.—LEGISLATION IN REGARD TO FISHERIES

As might naturally be expected, the real or supposed encroachments of the different classes of fishermen upon each other or the community at large has invoked the effort to secure legislation, both on part of the United States Government and of individual States, to put a stop to the same. A yet undecided question is as to the actual jurisdiction over the waters, so far as the fisheries are concerned. It would naturally be supposed that the United States would have control at least as far as the three mile limit of the ocean, beyond which the fisheries are common to the world at large. If this point be conceded, then comes the inquiry, How far can jurisdiction be exercised over the fisheries in the bay and navigable rivers? This question has never been settled.

It is well known that for many years past, the menhaden[6] fishery has been conducted during the summer and autumn with the greatest vigor along the coast of Maine, a large number of steamers as well as sailing vessels being employed in the capture of the fish, which are then taken to factories for conversion into oil and material for fertilizers. The extent to which this has been done has, in the opinion of many, greatly tended to drive the fish from the estuaries of the bays and rivers, and thus prevent their utilization by the hand-line fishermen and the resident population generally. Most of the fish are now taken several miles out to sea by the vessels just referred to. In order, therefore, to remedy this evil, a law was passed by the State of Maine prohibiting the use of purse seines within three miles of her shore. This action very naturally excited the antagonism of the menhaden fishermen, and an appeal was made for me to counsel and advice the matter. While not able at present to say whether the complaints of the people of Maine against the menhaden fishermen are well founded or not, I could only suggest that the opportunity was a favorable one for having the question decided by transferring it to the Supreme Court of the United States. It was accordingly arranged that this should be done by making up a special case and letting it take its legal course. By a most curious coincidence, however, very few menhaden visited the coast of Maine in 1879, the falling off being extremely abrupt and very marked. What occasioned this change of habit on the part of the fish it is impossible to say. It could not have been caused by the excessive pursuit of the fish, as the number on the coast in the fall of 1878 was very great, and should have furnished an ample supply for the season of 1879. It is possible that some variation of ocean temperature or currents affected the food of the fish, if not the menhaden themselves, thus causing them to seek new feeding grounds. It will be a matter of much interest to determine to what extent this abandonment of once favorite grounds will continue in the future.

The above case has its parrallel in the departure from the coast of the United States of the bluefish, about 1763, their absence continuing well into the beginning of the next or present century.

6 Also known as mossbunker, bunker, or pogy

## C.—COOPERATION WITH THE SUPERINTENDENT OF THE CENSUS

### 10.—PRELIMINARY ARRANGEMENTS

In July, 1879, an arrangement was made with General Francis A. Walker, Superintendent of the Tenth Census, by which an investigation of the fisheries of the United States was undertaken as the joint enterprise of the United States Fish Commission and of the Census Bureau. It was decided that this investigation should be as exhaustive as possible, and that both the United States Fish Commission and the census should participate in it. The preparation of a statistical and historical report upon the fisheries, to form one of the series to be presented by the Superintendent of the Census as the result of his investigations, in 1880, has been the main object of the work, but, in connection with this, the extensive investigation into the methods of the fisheries, into the distribution of the fishing grounds, and the natural history of useful marine animals have been and are being carried on.

The direction of this investigation was placed in the hands of Mr. G. Brown Goode, who was appointed a special agent of the Census Office, and who has been carrying on this work in addition to the performance of his duties in connection with the National Museum and the Fish Commission. The work was begun on July 1, 1879, has been vigorously prosecuted since that time, and the final report will probably be presented as early as July, 1881.

### 11.—PLAN OF INVESTIGATION

The plan of the investigation was drawn up before the beginning of the work, and has been published in an octavo pamphlet of fifty-four pages, entitled “Plan of Inquiry into the History and Present Condition of the Fisheries of the United States.” Washington: Government Printing Office. 1879

The Scheme of investigation divided the work into the following departments:

I.—*Natural history of marine products.*

Under this head was to be carried on the study o the useful aquatic animals and plants of thec ountry, as well as of seals, whales, turtles, fishes, lobsters, crabs, oysters, clams, &c., sponges and marine plants, and inorganic products of the sea, with reference to (A) Geographical distribution; (B) Size; (C) Abundance; (D) Migration and movements; (E) Food and rate of growth; (F) Mode of reproduction, and (G) economic value and uses.

II.—*The fishing grounds.*

Under this head are studied the geographical distribution of all animals sought by fishermen and the location of the fishing grounds, while

with reference to the latter are considered: (A) Location; (B) Topography; (C) Depth of water; (D) Character of bottom; (E) Temperature of water; (F) Currents, and (G) Character of invertebrate life, &c,

III.—*The fishermen and fishing towns.*

Here are considered the coast districts engaged in the fisheries with reference to their relation to the fisheries, historically and statistically, and the social, vital, and other statistics relating to the fishermen.

IV.—*Apparatus and methods of capture.*

Here are considered all the forms of apparatus used by fishermen, boats, nets, traps, harpoons, &c., and the methods employed in the various branches of the fishery. Here each special kind of fishery, of which there are more than fifty in the United States, is considered separately with regard to its methods, its history, and its statistics.

V.—*Products of fisheries.*

Under this head are studied the statistics of the yield of American fisheries, past and present.

VI.—*Preparation, care of, and manufacture of fishery products.*

Here are considered the methods and the various devices for utilizing fish after they are caught, with statistics of capital and men employed, &c, : (A) Preservation of live fish; (B) Refrigeration; (C) Sun-drying; (D) Smoke-drying; (E) Pickling; (F) Hermetically canning; (G) Fur dressing; (H) Whalebone preparation; (I) Isinglass manufacture; (K) Ambergris manufacture; (L) Fish guano manufacture, and (M) Oil rendering, &c.

VII.—*Economy of the fisheries*.

Here are studied (A) Financial organization methods; (B) Insurance; (C) Labor and capital; (D) Markets and market prices; (E) Lines of traffic; (F) Exports, imports, and duties.

VIII.—*Protection and culture.*

This includes all kinds of supervision by the government, such as: (A) Legislation; (B) Bounties and licenses; (C) Fishery treaties, and (D) Public fish Culture.
The various inquiries provided for in this scheme of investigation have been made in three ways:

(I) By correspondence with persons in different parts of the country.

(II) By a systematic overhauling and compilation of past records, not the least among which are the local newspapers.

(III) By sending special agents to make personal inquiries in every part of the United States where the fisheries are of considerable importance.

The last named method has, of course, been by far the most important and the most successful, and it is unfortunate that the length of time and the amount of money available have not permitted the employment of a larger number of assistants in this branch of the work, and have not allowed them to devote as much attention to working out specific questions as has in many cases seemed imperatively necessary.

### 12.—DETAILS OF PROGRESS DURING THE YEAR

The fishery industry is of such great importance and is undergoing such constant changes that a visit of a few days to any locality, even by the most competent expert, has invariably proved unsatisfactory. They have been able to collect only the most important facts, leaving many subjects of interest untouched.

The field work has been assigned to the following special agents:

**I** Coast of Maine, east of Cape Elizabeth. *R. E. Earll and Capt. J. W. Collins*
**II** Cape Elizabeth to Plymouth (except Cape Ann) and eastern side of Buzzard's Bay. *W. A. Wilcox*
**III** Cape Ann. *A. Howard Clark*
**IV** Cape Cod. *F. W. True*
**V** Provincetown. *Capt. N. E. Atwood*
**VI** Rhode Island and Connecticut west to the Connecticut River. *Ludwig Kumlien*
**VII** Long Island and north shore of Long Island Sound and west to Sandy Hook. *Fred Mather*
**VIII** New York City. *Barnett Fillips*
**IX** Coast of New Jersey *R. E. Earll*
**X** Philadelphia. *C. W. Smiley and W. V. Cox*
**XI** Coast of Delaware. *Capt. J. W. Collins*
**XII** Baltimore and the oyster industry of Maryland and Virginia. *R. H. Edmonds*
**XIII** Atlantic Coast of the Southern States. *R. E. Earll*
**XIV** Gulf Coast. *Silas Stearns*
**XV** Coast of California, Oregon, and Washington. *Prof. D. S. Jordan and Mr. C. H. Gilbert*
**XVI** Puget Sound. *James G. Swan*
**XXVII** Alaska seal fisheries. *H. W. Elliott*
**XXVIII** Great Lakes fisheries. *Ludwig Kumlein*
**XIX** River fisheries of Maine. *C. G. Atkins*
**XX** The shad and alewife fisheries. *Marshall Mc. Donald*
**XXI** Oyster fisheries. *Ernest Ingersoll*
**XXII** Lobster and crab fisheries. *Richard Rathbun*
**XXIII** Turtle and terrapin fisheries. *F. W. True*
**XXIV** The seal, sea-elephant[7], and whale fisheries. *A. Howard Clark*

The different districts and departments of research in the preceding tables are numbered serially.

7 Elephant seals

The following table shows the intervals of time during which work has been carried on in each. (The numbers in the following table correspond with those in the preceding table.)

I. August 1 to October 30, 1879
II. September 2, 1879, to January 1, 1880
III. September, 1879, to January, 1880
IV. July to October, 1879
V. August, 1879, to January 1, 1880
VI. August 16 to January 1, 1880
VII. August 1, 1879, to January 1, 1880
VIII. January, 1879, to January 1, 1880
XIV. August, 1879, to January 1, 1880
XVIII. August, 1879, to January 1, 1880
XX. October, 1879, to January 1, 1880
XXI. September, 1879, to January 1, 1880

In addition to the field assistants already mentioned a staff from the beginning have been at work in the office of the division, carrying on correspondence, searching past records, and preparing the report for publication. Mr. C. W. Smiley, Mr. F. W. True, Mr. James Temple Brown, and Mr. George S. Hobbs have been connected with the work from its start, and from a later date Mr. J. E. Rockwell, Mr. C. W. Scudder, Mr. G. P. Merrill, and others have been thus employed. A number of clerks have also been detailed by the Superintendent of the Census, at one time as many as eight. A large part of the clerical force under the direction of Mr. Smiley, who has in special charge the correspondence and the work of compiling statistics from responses to circulars.

Some of the explorations carried on by the special agents of the Census Office, and engaged in this work, are deserving of more extended notice. The labors of Mr. Earll and Captain Collins on the coast of Maine were necessarily confined largely to the gathering of statistics, there being but little opportunity for zoological work, such as was carried on by several others of the party. The natural history of the fishes of New England, however, is well known, and the number of species of fish accessible from the shore is very limited.

A large amount of material for a very elaborate statistical, descriptive, and historical report was obtained, and also a very interesting series of sketches of fishery implements made by Captain Collins.

The same method was pursued on the coast of Massachusetts by Messrs. Clark, True, Atwood, and Wilcox. In this region considerable additions were made to the collection of fishery implements, and deposited by the Fish Commission in the National Museum.

The exploration of the Gulf of Mexico by Mr. Stearns brought about important results statistically, and also grealy increased our knowledge of the habits of the food fishes and the methods of conducting the fisheries. A number of new species were added to the fauna of the United States by Mr. Stearns and his party. The circuit of the Gulf of Mexico

from Key West to Galveston was made in a small loop, chartered for the purpose.

The work of the other specialists, engaged in the census of the fisheries, has uniformly been productive of results important to the work of the Fish Commission.

In addition to the explorations already referred to, three special expeditions were organized for the purpose of studying the methods of the vessel fishermen upon the fishing grounds.

In the summer of 1879, Mr. Newton P. Scudder was sent to study the American halibut fisheries in Davis' straits. He went as a passenger on the schooner Bunker Hill, of Gloucester, leaving that port on June 10, 1879, and returning on September 17th of the same year. His experiences are detailed in an important essay which will be printed in a subsequent number of the Fish Commission reports.

Mr. H. L. Osborn made a similar study of the Grand Bank cod fishery. He sailed from Gloucester on the schooner Victor, July 10, and returned late in October. He made extensive natural history collections and prepared an important report which will also be printed.

Mr. John P. Gordy spent three weeks upon a Gloucester mackerel schooner for the special purpose of studying the mental and moral characteristics of the fishermen and the methods of the fishery, upon which he has submitted a report containing much interesting information.

## C.—THE PROPAGATION OF FOOD FISHES
## Work accomplished in 1879.

**The Quinnat or California Salmon** (*Salmo quinnat*)

The McCloud River Station.—The experiences of previous seasons had indicated to Mr. Livingston Stone, who continued in charge of the McCloud River Station, the importance of detaining the salmon near the station by means of an impassable barrier across the river. By the construction of a rack across the river he prevented the further ascent of the fish, holding them at the fishery, where they could be readily captured by his seine when the spawning season commenced. The yield of spawning fish, and consequently of eggs, was much increased.

The obstruction on the river had also another good effect, for the rack, which prevented their ascent (their instincts preventing their going down), they were kept in the pools and were not so emaciated by the extended journey which causes them to reach the upper rivers in a state of exhaustion. Although the salmon of the McCloud River, which had hitherto been penned, suffered from much confinement, the fish which were detained by means of the rack did not seem at all affected.

As the custom prevails of turning the fish back into the river after the eggs had been taken, this device of obstructing the river has no doubt been beneficial in preserving many of the adult fish which would

otherwise have died from the exhaustion consequent upon any further ascent of the river.

Mr. Stone was much disheartened in the early part of the season by getting only young male fish (Grilse) until after the middle of August. The great number of these young males doubtless resulted from the artificially propagated fish which had been turned loose in previous years. Larger salmon, however, made their appearance in considerable numbers after the first of August, the fishing for the canneries having been stopped at that date by the limitation of the fishing season. The total production of eggs during the season of 1879 was about 9,500,000.

Mr. Stone reports that the Indians seemed much better disposed than in previous years. This change of attitude was possibly caused by the suppression of the revolts by the Army on the frontier. The presence of a detail of soldiers furnished by the commander of the department was most beneficial, not only on account of the moral effect which their presence had on the Indians, but as a restraint on the white marauders.

In Mr. Stone's report will be found the schedule of the distribution made of the 4,150,000 eggs which were taken to the East, the usual number of eggs and young fish having been reserved to keep up the stock in the McCloud River.

Besides the eggs distributed as shown in this table, 150,000 were sent to Société d'Acclimatation, Paris, France; 100,000 to the Fischerei-Verein, Germany; 150,000 to the Zoological Society of Amsterdam, Holland; and 100,000 to the Dominion of Canada.

The eggs for distribution in the Eastern States and for shipment to Europe were sent from Redding in a refrigerator car, obtained from the Central Pacific Railroad. Mr. Fred Mather, one of the assistants of the Commission, having been instructed to meet the car on its arrival in Chicago, for the purpose of overhauling the eggs and re-icing and reshipping in accordance with the schedule of distribution given to him, did so at 6.30 p.m. On the 11th of October.

The refrigerator was there opened and the eggs for Washington taken out, the chambers refilled with ice and placed in one end of an ordinary baggage car, and in the other end those for Europe, New York, Pennsylvania, and New Jersey. The eggs for Minnesota, Wisconsin, Iowa, Ohio, and Canada were left in the refrigerator car, and, after having been re-iced, were delivered to the United States and American Express Companies at three o'clock the following day.

The baggage car left Chicago at 5.15 on October 12th, bound East. On the following day it arrived in Pittsburgh, where the eggs for Pennsylvania were delivered to the Adams Express Company, consigned to Mr. S. Weeks, at Corry, Pa. The weather was unusually warm, causing the ice to melt very freely and necessitating re-icing at this point.

On the arrival of the train at Harrisburg, the three crates for Europe and the half crate for New York; the five creates for New Jersey and the

two for Marrietta, Pa., were transferred to an express car of the train for New York, where they arrived at 5.37 the next morning.

The crates were found on being unpacked to be in excellent condition, having sustained a loss of not more than 4 or 5 percent.

The half crate, which was sent to Mr. Blackford, the commissioner for New York, not having been provided with an ice chamber, was found to be a total loss.

The United States Fish Commission for several years past has been sending eggs of the California Salmon (*S. quinnat*) to Germany, Holland, and France. From some cause or other these attempts to plant our salmon in European waters have met with more or less failure, owing principally to the agents sent in charge being unable to secure the necessary accommodations for the eggs on shipboard; the parts of the vessel assigned to their use having been generally either too warm, the supply of ice limited, &c.

Accordingly when this year (1879) it was decided to make another essay at their transfer, it was proposed that the crates of eggs be placed in the hands of some officer of the ship taking them, and a bonus given him on showing a receipt from the consignees of the delivery of the eggs in good condition.

In pursuance of this plan, Mr. Fred Mather, the agent of the Commission in New York, was instructed to turn over to the purser of the North German Lloyd steamer Mosel, sailing on the 18th October, the quota of eggs intended for Germany. The purser accepted the trust, and delivered the eggs at Bremerhaven to the agent of the Deutsche Fischerei-Verein, Mr. R. Eckhardt, who gave a receipt therefor as having been received by him in healthy condition. On presentation of this receipt to Mr. Mather, the purser received the stipulated honorarium.

On the 22nd October, the consignments intended for Holland and France were placed on board the steamers Schiedam and Labrador, respectively, and received by their pursers. Those intended for Holland were taken at Rotterdam by the superintendent of fisheries of Holland, Mr. C. J. Bottemanne, and those for France were handed at Havre to the agent of the Société d'Acclimatation, Mr. Grisard, both of whom gave receipts for the delivery of the eggs to them in perfect condition.

By this mode of shipment, the eggs received the attention they required—the emulation of the officers of the respective ships having been excited—and were transported at trifling cost; the expense of a special messenger, which had previously been found necessary, being thus avoided.

These three consignments were, however, all carefully packed by Mr. Mather in the apparatus devised by him for the purpose in 1878, and which received the unqualified endorsement and approval of the French and German experts who had occasion to examine it.

A report by Mr. C. J. Bottemanne contains an interesting account of the introduction of these fish into the Netherlands. The shipment of eggs of this fish in 1877 was entirely unsuccessful, as only three fish were produced out of 100,000 eggs sent.

The transfer of the eggs the following year was more successful, as a loss of only some 26 percent was experienced, and we had become so much more expert in packing the eggs, that of the shipment made in 1879 the loss had been reduced to 21 percent. When we take into consideration the fact that the eggs were transported by wagon over a rough country for about thirty miles before they could be placed in the cars; then by rail across the continent to be reshipped for a two weeks journey across the atlantic, and after that compelled to take another journey from Rotterdam to Amsterdam, the success was somewhat remarkable.

Monsieur Bottemanne reports that most of the fish were placed in the tributaries of the Meuse, a few only having been retained in the zoological gardens at Amsterdam.

The importance of maintaining a full supply of breeding fish in the Sacramento and McCloud Rivers, for the purpose of obtaining from year to year a stock of eggs sufficiently large to meet all demands, induced an arrangement with the California commissioners by which it was agreed that about one-fifth of the whole yield, hatched out at the fishery, should be returned to the water.

As the hatching out of these eggs necessarily takes place after the close of the regular work of the commission in securing them from the breeders, it was deemed expedient to accept the offer of the California State fish commissioners to defray the actual expense of hatching, which has accordingly been paid by them in 1879, as heretofore.

The result of their work is seen in an extraordinary increase in the number of mature fish returning from the ocean, and in the greater extension of the industry of salmon canning.

**The Rainbow, or California Mountain Trout** (*Salmo iridea*)

The Crooks Creek Station.—Mr. Stone having been instructed to enlarge the operation of the work on the McCloud River by the propagation of the California brook trout, he selected a point some miles above on a small tributary of the McCloud River called George Cooks Creek.

This creek flows into the McCloud River only four miles above the salmon breeding establishment and was selected as being well supplied with clear cold water. Many difficulties were encountered in establishing this station, as only a rough Indian trail led to the site. This necessitated the “packing” of all the lumber and equiment necessary for this station.

During the season a dwelling and hatching house were built and the necessary furniture, &.c, transported to the station.

The trout hatching house was constructed on the same general plan

as the salmon hatching house, with a capacity of 6,000,000 eggs. Having prepared the ponds, which were supplied by a constant and ample flow of water, the breeding fish were captured by angling and kept in traps constructed of heavy timber poles. The traps were well secured against casualty in case of high water.

This fish is much esteemed and will no doubt be a valuable acquisition to the food fishes of the Atlantic States, especially to such watesr as may be found too warm for the less hardy brook trout native to the Atlantic.

An interesting experiment in connection with the culture of the *Salmo iridea* was made in Japan by Mr. Sekizawa Akekio, a most accomplished Japanese gentleman, who manifested very great interest in all exhibits pertaining to fish culture at the Philadelphia exhibition of 1876. Shortly after his return to Japan he established several hatching stations at various points. On June 9, 1877, he received a supply of eggs from the United States fish ponds on the McCloud River. A large number of fish were hatched out, and, as may be seen from a communication received from him on April 12, 1880, lived (for at any rate) nearly three years, at which period of their life they averaged nineteen inches in length. A drawing of one of these 3-year old fish accompanying his communication furnished a magnificent illustration of the species. At that age both males and females were ready to spawn and promised to furnish a large number of eggs.

These results show clearly the ability of this species to sustain itself in remote localities, and also illustrate the fact that in less than three years they are ready to spawn and may at that age have attained the weight of at least five pounds.

**Atlantic Salmon** (*Salmo salar*)

*The Penobscot River Station*.—The indications of the successful introduction of this fish into rivers even as far south as the Delaware and Susquehanna, and the great increase which has already been observed in its abundance in the Penobscot Bay, led tot he determination that the work which has been intermitted at Bucksport should be again pushed forward.

Mr. Atkins was therefore instructed to arrange for a supply of breeding fish and to extend the operations at Bucksport as far as practicable. It having been clearly shown that the salmon could be readily confined in fresh water ponds from June until November without interfering with the development of the ovaries, Mr. Atkins selected Dead Brook as a good site for the inclosure, and a convenient location for a hatching house.

He secured in good condition 264 salmon at an average cost of $2.16 each. A heavy rain fall on the 17th and 18th of August caused a freshet in Dead Brook which resulted in a considerable loss of fish, reducing the number to 59. He commenced to take the spawn on the 24th

of October and secured 211,692 eggs by the middle of November. These eggs were distributed to the State commissioners of New Hampshire, Massachusetts, Connecticut, New Jersey, and Maryland.

The reports from these States show that 180,000 were actually planted, principally in the tributaries of the Merrimac, Connecticut, Delaware, Susquehanna, Potomac, and Ohio rivers.

The work at this station will be continued on a larger scale hereafter, as the increase of salmon in many of the eastern rivers has been very marked and the indications point to the successful establishment of fish in the tributaries of the great lakes.

There is no more interesting fact in connection with the propagation of fishes than that of their return to the original spawning ground at the expiration of a given time. The young fish also hatched out at any point, will in their turn, seek the same place for purposes of reproduction. Numerous instances of this fact are on record: thus, Mr. Wilmot, who, for several years past ahs been engaged in hatching out salmon at Newcastle, on the north shore of Lake Ontario, has presented to the United States Fish Commission the stuffed specimen of a female fish, from which he had taken eggs for three successive years, as indicated by his marks, which were apparent on the skin. At the United States salmon hatching station on the Penobscot, Mr. Charles G. Atkins has been in the habit of tagging and numbering the fish which he captures for his purposes and which are released into Penobscot Bay when he has finished operations with them. Of these quite an appreciable number of been taken in subsequent years, identified by their labels. A still further instance of this is shown in regard to the California salmon. In previous reports I have referred to Mr. R. D. Hume, of Edinburg, Oregon, in connection with the artificial hatching of salmon by him in 1877 and 1878. In the former year he marked a hundred fish, letting them go, and the next year he is said to have retaken ten of the number.

**Schoodic Salmon**[8] (*Salmo salar*, subs. *Sebago*)

*Grand Lake Stream Station.*—Pains have been taken in previous reports to call attention to the value of this variety of the salmon family.

The facilities for procuring and caring for the eggs of this fish at Grand Lake Stream until ready for distribution, were much enlarged during this year, and although the number of spawning fish captured was not greater than in previous years, 1,113,000 eggs were procured, of which only 11 3/10 percent were lost.

During their development 249,000 eggs were reserved to keep up the supply of fish in Grand Lake Stream and 744,000 were distributed. The average length of the fish captured this year exceeds that of any of the four preceding years, the longest male fish being twenty-four inches and the longest female twenty-two inches.

Many interesting comparisons of the results obtained during the several years will be found in Mr. Atkins' very interesting report, which is appended.

8 Landlocked salmon, *Salmo salar* m. *sebago*

The first spawn was taken on November 7th, and the spawning was finished by the 22nd of the same month. The eggs had sufficiently developed to be shipped by the 6th of January, and were distributed to the waters of many States, as shown in Mr. Atkins' report.

Instructions have been given for the enlargement of the facilities, and as the fish increase, in consequence of the large deposits of young fish, the spawn procured from them can be cared for and properly developed.

Should the operation of the Commission increase in the future as they have in the past, arrangement must necessarily be made for the establishment of several supplementary stations for hatching the eggs of the Salmonidae. At present, the works on the McCloud River for the California salmon, those on the Penobscot River for the Eastern salmon, and those at Grand Lake Stream for the landlocked salmon are the only ones provided by the Commission. From these points the eggs are forwarded to the hatcheries of the various States, and the distribution and deposit of the fry is effected largely under the auspices of the State commissioners. As, however, there are large central districts available for the fish, where there are either no State commissioners, or such as are without the means for further treatment of the eggs, it has been thought advisable to look into the question of the localities, especially in the Southern and Southwestern States. The difficulty, however, is to find an ample supply of water sufficiently cold for the various species. The spring water in the south, although palatable to the taste, is usually too warm for hatching and preserving the fry of the Eastern salmon and trout. As one advantage of the California species of salmon and trout over their allies in the East consists is their greater adaptability to warm water, it is possible that this project may after a time be carried out successfully. Among other points which have been especially urged as suitable for such establishments is that of Huntsville, Ala., where a large spring in the town has been offered for this purpose.

**Shad** (*Alosa sapidissima*)

The propagation and distribution of shad were continued in the same localities that had been occupied during the previous year, and although the season was somewhat unpropitious, the aggregate yield of young shad was increased from 15,000,000 the previous year to 16,062,000, and, the arrangements for the distribution having been much improved, a large proportion of these were transferred to outside waters.

*Albemarle Sound Station*.—Although anxious to continue the work, so successfully inaugurated in previous years in Ablemarle Sound, it was not deemed advisable to transfer the full equipment of hatching apparatus to this station, as they proved to be somewhat too unwieldly to be moved with safety and certainty to such distant points. It was also anticipated that the large deposits of shad made in previous years in

the Potomac and Susquehanna Rivers would furnish during the season of 1879 a larger supply of spawning fish. It was therefore deemed advisable to retain the hatching apparatus, which had been remodeled for operations in Maryland, where it had hitherto been successful. It was determined to rely entirely upon the steamer Lookout, the services of which had been secured for the purpose, and accordingly she was sent to the mouth of the Chowan River, in charge of mr. Jno. L. Saunders, where she arrived April 11th. The season not being very far advanced at this time, the crew were employed in arranging the apparatus until the eleventh day of April, when active operations were commenced.

The equipment of the Lookout, as in previous years, consisted of six cones, placed on the deck forward of the pilot-house, which supported a distributing tank to supply them with water. These cones had been perfected under the direction of Mr. Fergusun, and proved thoroughly efficient.

The rest of the apparatus used were the plunging buckets, also an invention of Mr. Ferguson, the machinery for operating which had been much improved.

On account of the want of space on this small steamer, a hastily constructed pier was run out from the wharf at Avoca, and the use of a small steam engine was secured from Dr. Wm. R. Capehart, proprietor of the fishery, which was furnished with steam from the boilers of the Lookout, and provided the motive power to operate the plunging buckets.

From the 11th of April to the 14th of May the Lookout was moored to this wharf, her small pump supplying the cones which were used simultaneously with the plunging cylinders, a neat arrangement of pulleys having been substituted for the levers which were first used to operate the buckets.

During the period referred to 5,295,000 young shad were produced in the apparatus described, operated by the limited force which could be accommodated on this small steamer. As this apparatus was somewhat hastily improvised and much altered in details from that hitherto used, the reports from the station were looked forward to with some anxiety.

After some time spent experimenting, Mr. Saunders reported that the machinery did exceedingly well, and that the motion was better than ever before. The eggs were kept moving nicely, and the young fish came out strong and healthy. He estimated the number of eggs hatched to be at least 90 or 95 percent of the eggs placed in the cones.

Of the 5,295,000 produced, 2,115,000 were turned over to Mr. S. G. Worth, the superintendent of fisheries of North Carolina, who has always cooperated cordially with the United States Commission, to be placed in the waters of the State. A distributing depot was established at Franklin, a station on the Seaboard and Roanoke Railroad, at the head of navigation of the Chowan River, and instructions were given

to ship 200,000 fish nightly by the two alternating steamers, Chowan and Lota.

These shipments kept the messengers of the United States Commission constantly on the road transferring fish to the waters of the South and the Southwest, besides furnishing a large number to the North Carolina commission to be deposited in local waters.

The results of the operations at this station were most satisfactory when we consider the limited force employed, and hearty acknowledgments are due to Mr. Saunders and the faithful men under him.

At the close of the fishing season, on the 14th of May, the Lookout was transferred to the head of the Chesapeake Bay, where she was utilized in transferring fish to different points in Maryland.

*Havre de Grace Station*.—The two machinery barges having been remodeled, and the lever attachment to the Ferguson hatching apparatus having been replaced, under the inventor's direction, by a much neater and more compact arrangement of pulleys, the space made available by this change was utilized for the accommodation of a large number of cones. The barges were transferred early in April to Spesutie Narrows, a station which had been occupied during the previous years, and a portion of the hatching force placed on them with instructions to examine daily the fish taken by the large haul seines and gill nets operated in that locality.
The first ripe female shad was secured on the 3rd of May.
The immediate charge of this station was assigned to Mr. F. N. Clark, of Northville, Mich., but it was not until the 19th of the month that the spawning fish were at all plentiful. From that time until the close of the season the operations were attended with great success, the number of fish produced at this station, under the chage of Mr. Clark, amounting to 9,500,000.

Mr. Saunders and a portion of the force with him in North Carolina were placed on the Machinery Barge No. 2, which was moored about three miles to the north of Spesutie Narrows, not far from the town of Havre de Grace; but operations were not fairly commenced until the 30th of May, from which time to the close of the season, 1,252,000 shad were produced, making an aggregate of 16,062,000 at the three stations.

The disposition made of these fish will be found in the accompanying tables, which have been arranged, for easy reference, both geographically and chronologically.

The Potomac River Stations—The force of the commission being fully occupied in North Carolina and on the Susquehanna, operations on the Potomac were deferred until next year, when, it is hoped, a satisfactory report of results will be made.

**Carp** (*Cyprinis carpio*)
In the report of the Commission for 1878 will be found detailed the account of its labors connected with the culture of carp up to the end

of that year, and especially of the transfer of a portion of the fish (brought over from Germany by Mr. Hessel and deposited first in the Druid Hill Park ponds) to the Monument lot, in the city of Washington.

The fish spawned in Druid Hill Park in 1878, but unfortunately they hybridized with some of the goldfish that had accidentally got into the ponds, so instead of having any carp of pure breed, there were about 2,000 crosses; these were destroyed, as being of no special value.

The work of 1879 was more satisfactory. Six thousand young of different preeds were secured, whereof 2,750 were planted in Maryland, the remainder being distributed in other States. The number of fish given to each applicant was from twelve to sixteen. The demand for the carp has always been very great, and the calls have increased so rapidly as to render it doubtful whether, even with a much larger productoin, all the requirements can be met.

*The Monument Station*.—The station on the grounds of the Washington Monument for the cultivation of the carp has been maintained with great efficiency during the year, under the continued superintendence of Mr. Rudolph Hessel. Much labor has been expended in improving the walks, banks, and ponds, and in planting ornamental trees and shrubs, including the introduction of quite a variety of water plants, as pond-lilies, &c.

In April, a telephonic connection was established with the ponds, which proved of very great importance, giving to the superintendent and watchmen the means of instantaneous communication with the offices of the Commission and with the police headquarters, this latter advantage greatly adding to the safety of the property.

The larger pond, to the west of Executive avenue, which had originally been one, was divided into two by constructing causeways from the island to the east and west shores. This was done for the purpose of enabling the contractors for the white house lot sewer to prosecute their work along the northern half of the pond without being interfered with by the water; the southern half was accordingly kept filled while the northern half was empty. This has been to some extent a source of inconvenience to the Commission, but has greatly facilitated the work connected with the sewer.

During the severe winter the surface of the ponds was frozen, and the use of the north pond for skating purposes was permitted; the east pond, being filled with fish, was carefully kept undisturbed by means of placards forbidding the entrance of skaters upon it; no difficulty was experienced in maintaining this regulation. From time to time applications were made to have the north pond flooded for the improvement of the sport. Unfortunately, the inlet pipes, being near the bottom of the pond, made it impossible to allow a discharge over the surface. It may be a question whether, when the supply of water for city purposes is greater, it may not be expedient to have at hand the means

of surfacing the ice, when much cut up, with a fresh coat, for the benefit of the skating community.

*The Arsenal Station.*—The pond at the arsenal was, as before, in charge of Mr. Elliot Jones, chief clerk. The scale carp were planted in the pond, and the few young fish obtained were duly distributed.

It is proposed, with the consent of the military authorities, to extend these ponds another year, so as to render them more available for their purposes.

*The Druid Hill Park Station*.—The United States Commission continues to be under many obligations to the commissioners of Druid Hill Park for the important facilities afforded in the way of propagating carp from the parent fish, placed there on their arrival from Germany in 1877. New ponds were built for the accommodation of the fish, in part at the expense of the United States Fish Commission. They, however, were not ready until the latter part of the season. Had they been prepared earlier, the production would probably have been largely increased. Distribution of about 3,000 carp was made to the citizens of Maryland, that number constituting nearly all of the fish found upon drawing off the single pond, which alone it was considered expedient to lay bare.

*Transfer of German Carp by Dr. Finsch.*—The importance of securing a fresh supply of the best varieties of German carp for distribution throughout the country, induced me to attempt a renewal of the stock which had been brought over by Mr. Hessel. I therefore gladly embraced an offer made by Dr. Otto Finsch, an eminent German naturalist, to bring with him, on an intended visit to the United States, an additional lot. He accordingly ordered from Mr. Eckhardt, of Lübbinchen, 100 Mirror carp, a year and a half old, and from six to eight inches long. These were received in four coal-oil barrels, each containing twenty-five fish. They came over on the “Lessing,” of the Hamburg-American packet line, leaving Hamburg on April 23rd, and arriving at New York on May 6th. The total loss of fish on the passage was 77, leaving only 23 to be sent to Washington, where they were delivered to Mr. Hessel, superintendent of the ponds.

A detailed account of the circumstances attendant upon this transfer of carp will be found in an article by Dr. Finsch in the appendix.

**Codfish** (*Gadus morrhua*)

In the report for 1878 a reference was made to the successful hatching of codfish at the Gloucester station. For the purpose of determining the possibility of transporting cod over long distances, a small number of the young fish were forwarded by express from Gloucester to Washington, arriving January 26th in excellent condition. These were placed on exhibition in the rooms of the Committee on Appropriations in both House and Senate, and were also exhibited to the President and Cabinet. On the 2nd of August I went with Mr. Ferguson from Provincetown

town to Wood's Holl for the purpose of examining into the possibilities of hatching cod at that point. The indications were strongly in favor of the success of such an undertaking.

**Striped Bass or Rock-fish**[9] (*Roccus lineatus*)

It has been a great desideratum with the Commission to find a locality where the striped bass, or rock-fish can be obtained for purposes of propagation by artificial means. I regret to say that, so far, the success of the Commission in this respect has not been very great. During 1879, however, the opportunity was offered to make some experiments of this kind, which proved to be highly satisfactory. The fishery of Dw. W. R. Capehart, at Scottish Hall, Albemarle Sound, the seat of the shad hatching work, furnished on May 6th three large females with ripe spawn,t he eggs of wich, when stripped, filled about twelve one-gallon cans. The eggs, when first spawned, were pale green, slightly larger than those of a herring, becoming after impregnation somewhat larger than the eggs of the shad. They were transparent and almost invisible, excepting for an oily globule whereby the presence of the egg could be detected. These eggs were placed in vessels used for hatching shad, some in cones and others in floating boxes, the period of introduction being midnight of May 6th. On the morning of May 9th, almost all the eggs were hatched, showing a much more rapid development than that of the shad eggs under similar circumstances. While the eggs were thought to be somewhat larger than those of the shad, the embryo was considerably smaller; although with a disproportionally large sized umbilical sac, they escaped readily through the wire-cloth used in the propagation of the shad.

A number of the fish were sent to Washington, and some to Baltimore, where the fish were deposited in the hatching house of Druid Hill Park. They proved to be much more hardy than the shad, as shown by the fact that some of the young were kept in a tin pail for ten days without change of water and evinced no signs of suffering.

**Transfer of fish**.

*Marine and fresh-water species to California*—Upon application by the fish commissioner of California, Mr. Livingston Stone was authorized to undertake the transfer, in a car specially arranged for the purpose, of a series of fishes and invertebrates, especially of striped bass, eels, black bass, and lobsters. The principal difficulty was in regard to the saltwater species, for whose benefit it became necessary to carry a large quantity of salt water, with which the supply in the reservoirs was from time to time renewed. For some weeks before starting Mr. Stone had kept about a thousand gallons of water, by the end of which time it had become perfectly clear, the dead matter having settled to the bottom. It was a matter of some difficulty to procure striped bass of sufficient size for the transfer. They were, however, by permission of the New Jersey State commissioners, obtained in the Navesink River. The lobsters

9 Also Rockfish

were secured from Messrs. Johnson and Young, of Boston; the eels were furnished from Albany by Mr. Seth Green, while the black bass were sent from Charleston, N.H.

Mr. Stone started for the west on June 12th, and after various experiences arrived with comparatively little loss of fish at Sacramento, where some of the fresh water fish were planted. The striped bass were placed in the Sacramento River near Martinez, and the lobsters were introduced in the water at Oakland wharf.

The details of this trip will be found in the appendix.

*Transfer of carp from Europe*.—The result of this experiment, made under direction of Dr. Finsch, will be found under the heading of carp.

Tables of the distribution of fish.
In the following tables will be found the record of the distribution of shad, arranged first, by the successive dates of shipment, and, secondly, geographically by States. In the report of Mr. Stone is detailed the distribution of California salmon, while in that of Mr. Atkins are given the particulars referring to the distribution of the Penobscot and Schoodic salmon. The shipments of carp have been so small, comparatively, as scarcely to be entitled to a distinct tabulation. In the next annual report I hope to present a minute statement of the entire history of the introduction of young fishes into the water of the United States, so far as the agency of the United States Commission is concerned, and that from the earliest dates. To these I refer for any deficiencies in the present account.

I.—*Chronological record of distribution of young shad made from April 18, 1879, to June 14, 1879, from Avoca, N. C., and Havre de Grace, Md., under direction of the United States Commissioner of Fish and Fisheries.*

| Date. | Place whence taken. | Number of fish— | | State. | Introduction of fish. | | | Transfer in charge of— | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| | | Originally taken. | Actually planted. | | Town or place. | Stream. | Tributary of— | | |
| Apr. 18 | Scotch Hall Fishery, Avoca. | 100,000 | 100,000 | North Carolina.. | Weldon | Roanoke River | Albemarle Sound | C. J. Huske | Earliest fish out of egg. |
| 18 to 24 | Scotch Hall | 50,000 | 50,000 | do | Avoca | Albemarle Sound | Atlantic Ocean | S. G. Worth | |
| 21 | do | 30,000 | 30,000 | do | Near Warsaw | Six Runs | Cape Fear River | Tom Taylor | |
| 21 | Avoca | 70,000 | 70,000 | do | do | do | do | do | |
| 21 | Scotch Hall Fishery. | 30,000 | 30,000 | do | Rocky Mount | Tar River | Pamlico Sound | J. A. Woodward | |
| 21 | Avoca | 70,000 | 70,000 | do | do | do | do | do | |
| 24 | Scotch Hall Fishery. | 100,000 | 100,000 | do | Near Warsaw | Six Runs | Cape Fear River | C. J. Huske | |
| 24 | do | 50,000 | 50,000 | do | Scotch Hall Fishery. | Albemarle Sound | Atlantic Ocean | Tom Taylor | |
| 24 | do | 25,000 | | do | Pollocksville | Trent River | Neuse River | do | The 25,000 were 4 days old when taken up and were 40 hours en route. |
| 24 | Avoca | 100,000 | 95,000 | do | do | do | do | do | |
| 24 | do | 100,000 | 115,000 | do | Near Milburnie | Neuse River | Pamlico Sound | W. M. Russ | |
| 24 | Scotch Hall Fishery. | 25,000 | | do | do | do | do | do | The 25,000 were 4 days old when taken up and were 28 hours en route. |
| 24 | do | 60,000 | 60,000 | do | Scotch Hall Fishery. | Albemarle Sound | Atlantic Ocean | J. P. Heywood | |
| 24 | do | 100,000 | 100,000 | do | Near Kirby's Bridge (Warsaw) | Six Runs | Cape Fear River | C. J. Huske | |
| 25 | Avoca | 100,000 | 100,000 | do | Mount Olive | Goshen Creek | do | J. A. Woodward | |
| 25 | do | 100,000 | 100,000 | do | Rocky Mount | Tar River | Pamlico Sound | W. M. Russ | |
| 26 | do | 150,000 | 150,000 | Mississippi | Jackson | Pearl River | Gulf of Mexico | J. F. Ellis | |
| 28 | do | 75,000 | 75,000 | Georgia | Columbus | Chattahoochee River. | Appalachicola River. | L. Kumlein | |
| 29 | do | 75,000 | 75,000 | North Carolina.. | Avoca | Salmon Creek | Chowan River | J. A. Woodward | |
| 29 | do | 150,000 | 150,000 | do | Weldon | Roanoke River | Albemarle Sound | do | |
| 30 | do | 325,000 | | South Carolina.. | | | | | Turned over to South Carolina; nearly a total loss. |
| May 2 | do | 200,000 | 40,000 | Alabama | Railroad crossing | Allapahaw River | Suwanee River | C. W. Schuermann | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2 | ..... | ..... | 40,000 | ....do ..... | ....do ..... | Little River..... | ....do ..... | ....do ..... | |
| 2 | ..... | ..... | 60,000 | Florida ..... | ....do ..... | Ocilla River ..... | Gulf of Mexico... | ....do ..... | |
| 2 | ..... | ..... | 60,000 | ....do ..... | ....do ..... | Ockolockonee River. | ....do ..... | ....do ..... | |
| 2 | Avoca ..... | 120,000 | 120,000 | Virginia ..... | Near Franklin .... | Blackwater River. | Chowan River .... | Tom Taylor..... | |
| 2 | ....do ..... | 100,000 | 100,000 | North Carolina.. | Weldon..... | Roanoke River.... | Albemarle Sound . | J. A. Woodward .. | |
| 2 | ....do ..... | 100,000 | 90,000 | ....do ..... | Millburnie..... | Neuse River..... | Pamlico Sound ... | C. J. Huske ..... | |
| 3 | ....do ..... | 100,000 | 100,000 | Georgia..... | Macon ..... | Ockmulgee River. | Altamaha River .. | J. F. Ellis ..... | |
| 3 | ....do ..... | 25,000 | 25,000 | Virginia ..... | Franklin' ..... | Blackwater River. | Chowan River .... | S. G. Worth..... | |
| 3 | ....do ..... | 75,000 | 75,000 | South Carolina.. | Biggin Church.... | Cooper River ..... | Charleston Harbor | J. A. Woodward .. | |
| 3 | ....do ..... | 150,000 | 150,000 | North Carolina.. | Avoca ..... | Salmon Creek..... | Chowan River .... | ....do ..... | |
| 5 | ....do ..... | 160,000 | ..... | ..... | ..... | ..... | ..... ..... | L. Kumlein ..... | 3 cans of fish dead before leaving Franklin, 2 more dead before reaching Weldon, balance died after leaving Wilmington, N. C. |
| 6 | ....do ..... | 100,000 | 100,000 | Virginia ..... | Nottoway Station. | Nottoway River .. | Chowan River .... | J. A. Woodward & G. H. Williams. | |
| 6 | ....do ..... | 240,000 | 100,000 | North Carolina.. | Near Salisbury ... | Yadkin River..... | Pedee River ..... | C. J. Huske & Tom Taylor. | |
| 7 | ....do ..... | 120,000 | 60,000 | Georgia ..... | Covington ..... | Ulcofanhanchee River. | Ocmulgee River .. | C. W. Schuermann | |
| 7 | ..... | ..... | 60,000 | ... do ..... | Conyers ..... | Yellow River..... | ....do ..... | ....do ..... | |
| 7 | Avoca ..... | 150,000 | 150,000 | Virginia ..... | Franklin..... | Meherrin River... | Chowan River .... | J. A. Woodward .. | |
| 7 | ....do ..... | 75,000 | 75,000 | ... do ..... | ....do ..... | Blackwater River. | ... do ..... | W. M. Russ ..... | |
| 7 | ....do ..... | 75,000 | 75,000 | ....do ..... | Nottaway Station | Nottoway River .. | ....do ..... | G. H. Williams.... | |
| 7 | ....do ..... | 95,000 | 95,000 | ....do ..... | Franklin..... | Blackwater River. | ....do ..... | W. M. Russ ..... | |
| 8 | ....do ..... | 225,000 | ..... | ..... | ..... | ..... | ..... | ..... | Shipped by steamer from Norfolk for Crisfied. Heavy storm caused a delay and fish all died. |
| 8 | ....do ..... | 15,000 | 15,000 | North Carolina.. | Avoca ..... | Salmon Creek..... | Chowan River .... | ..... | |
| 8 | Salmon Creek .... | 200,000 | 30,000 | Louisiana..... | Railroad crossing. | Roundaway Creek | Mississippi River. | H. E. Quinn ..... | |
| 8 | ..... | ..... | 35,000 | ... do ..... | ....do ..... | Tensas River ..... | ....do ..... | ....do ..... | |
| 8 | ..... | ..... | 30,000 | ... do ..... | ....do ..... | Bayou Macon ..... | Tensas River .... | ....do ..... | |
| 8 | ..... | ..... | 35,000 | ....do ..... | ... do ..... | Bœuf River .. .... | Washita River.... | ... do ..... | |
| 8 | ..... | ..... | 35,000 | ....do ..... | ... do ..... | Crew Lake ..... | ..... ..... | ....do ..... | |
| 8 | ..... ..... | ..... ... | 35,000 | ....do ..... | Monroe ..... | Washita River.... | Black River ..... | ....do ..... | |
| 9 | Salmon Creek..... | 215,000 | 215,000 | North Carolina.. | Avoca ..... | Salmon Creek..... | Chowan River .... | ..... | |
| 9 | ....do ..... | 210,000 | 210,000 | ....do ..... | ....do ..... | ....do ..... | ....do ..... | Wm. M. Russ ..... | |
| 12 | ....do ..... | 250,000 | 250,000 | ....do ..... | ....do ..... | ....do ..... | ....do ..... | ..... | |
| 13 | ....do ..... | 175,000 | 90,000 | Alabama..... | Near Union Springs | Pea River ..... | Choctawhatchee River. | L. Kumlein ..... | |
| 13 | ..... | ..... | 85,000 | ....do ..... | ....do ..... | Conecuh River... | Escambia River.. | ....do ..... | |
| 13 | Avoca ..... | 140,000 | 25,000 | Mississippi ..... | Meridian ..... | Chunky River ... | Chickasawhee River. | C. W. Schuermann | |
| 13 | ..... | ..... | 75,000 | Alabama..... | Columbus..... | Tombigbee River. | Mobile Bay ..... | ... do ..... | |

*1.—Chronological record of distribution of young shad made from April 18, 1879, to June 14, 1879, &c.*—Continued.

| Date. | Place whence taken. | Number of fish— | | State. | Introduction of fish. | | | Transfer in charge of— | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| | | Originally taken. | Actually planted. | | Town or place. | Stream. | Tributary of— | | |
| Apr. 13 | Avoca | 100,000 | 100,000 | Virginia | Nottaway | Nottoway River | Chowan River | Taylor & Woodward. | |
| 13 | do | 500,000 | 500,000 | North Carolina | Deep Bend | North River | Albemarle Sound | | |
| 14 | Norfolk, Va. | 250,000 | 80,000 | Virginia | Franklin | Blackwater River | Chowan River | J. F. Ellis | Fish in bad condition, all but 80,000 died before leaving Norfolk, Va. |
| 16 | Spesutie Narrows | 300,000 | 300,000 | Maryland | Spesutie Narrws. | Susquehanna River | Chesapeake Bay | United States and Maryland. | |
| 17 | do | 140,000 | 60,000 | do | Cordova Station | Miles Creek | do | Thos. Hughlett, jr. | |
| 17 | | | 80,000 | do | do | Wye Mills Creek | Miles Creek | do | |
| 18 | Spesutie Narrows | 150,000 | 150,000 | do | Salisbury | Wicomico River | Chesapeake Bay | Levin Campbell | |
| 19 | do | 225,000 | 115,000 | do | Savage | Patuxent River | do | J. F. Ellis | |
| 19 | | | 110,000 | do | Laurel | do | do | do | |
| 19 | Spesutie Narrows | 100,000 | 100,000 | do | Spesutie Narrows | Susquehanna River | do | United States and Maryland. | |
| 19 | do | 200,000 | 100,000 | Texas | Minneola | Sabine River | Gulf of Mexico | H. E. Quinn | |
| 19 | | | 100,000 | do | Dallas | Trinity River | do | do | |
| 20 | Spesutie Narrows | 200,000 | 50,000 | Mississippi | Ripley | Tippah River | | J. F. Ellis | |
| 20 | | | 50,000 | do | Railroad crossing | Tallahatchie River | Yazoo River | do | |
| 20 | | | 50,000 | do | do | Yocana River | do | do | |
| 20 | | | 50,000 | do | do | Yallabusha River | do | do | |
| 21 | Spesutie Narrows | 25,000 | 25,000 | Maryland | Havre de Grace | Susquehanna River | Chesapeake Bay | United States and Maryland. | |
| 21 | do | 175,000 | 90,000 | Texas | Hearne | Brazos River | Gulf of Mexico | L. Kumlein | |
| 21 | | | 85,000 | do | Austin | Colorado River | do | do | |
| 21 | Spesutie Narrws. | 100,000 | 100,000 | Maryland | Spesutie Narrows | Susquehanna River | Chesapeake Bay | United States and Maryland. | |
| 22 | do | 200,000 | 50,000 | Texas | Near Columbus | Colorado River | Gulf of Mexico | C. W. Schuermann | |
| 22 | | | 50,000 | do | Near Luling | San Marcus River | Guadalupe | do | |
| 22 | | | 50,000 | do | Near Seguin | Guadalupe River | Gulf of Mexico | do | |
| 22 | | | 50,000 | do | San Antonio | San Antonio River | do | do | |
| 24 | Spesutie Narrows | 20,000 | 20,000 | Delaware | Seaford | Nanticoke River | Chesapeake Bay | Thos. Hughlett, jr. | |
| 24 | | | 80,000 | Maryland | Federalsburg | do | do | do | |
| 24 | Spesutie Narrows | 150,000 | 150,000 | do | Spesutie Narrows | Susquehanna River | do | United States and Maryland. | |
| 26 | do | 150,000 | 100,000 | do | Whaleysville | Pocomoke River | do | Levin Campbell | |
| 26 | | | 50,000 | do | Near Berlin | St. Michael's River | do | do | |
| 26 | Spesutie Narrows | 150,000 | 150,000 | do | Spesutie Narrows | Susquehanna River | do | United States and Maryland. | |
| 27 | do | 100,000 | 100,000 | do | do | do | do | do | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 28 | ....do | 125,000 | 125,000 | ....do | ... do | ....do | ....do | ....do | |
| | 28 | ....do | 200,000 | 200,000 | Kentucky | Shepherdsville | Salt River | Ohio River | J. F. Ellis | |
| | 29 | ....do | 100,000 | 100,000 | Maryland | Henderson | Choptank River | Chesapeake Bay | Thos. Hughlett, jr. | |
| | 29 | ....do | 50,000 | 50,000 | ....do | Spesutie Narrows | Susquehanna River | ....do | United States and Maryland. | |
| | 29 | ....do | 200,000 | 50,000 | Georgia | Railroad crossing | Tugaloo River | Savannah River | H. E. Quinn | |
| | 29 | | | 37,500 | ....do | Gainesville | Chattahoochee River. | Appalachicola River. | ....do | Half of one can of fish died while taking it from Gainesville to the river. |
| | 29 | | | 100,000 | ....do | Resaca | Coosa River | Alabama River | ....do | |
| | 30 | Spesutie Narrows. | 200,000 | 140,000 | Maryland | Millington | Chester River | Chesapeake Bay | Levin Campbell | |
| | 30 | | | 60,000 | ....do | Centreville | Corsica Creek | Chester River | ....do | |
| | 30 | Spesutie Narrows | 200,000 | 200,000 | ....do | Spesutie Narrows | Susquehanna River | Chesapeake Bay | United States and Maryland. | |
| | 30 | ....do | 150,000 | 150,000 | ....do | ....do | ....do | ....do | ....do | |
| | 31 | ....do | 200,000 | 100,000 | ....do | Middletown | Sassafras River | ....do | Thos. Hughlett, jr. | |
| | 31 | | | 100,000 | ....do | ... do | Bohemia River | ....do | ....do | |
| | 31 | Spesutie Narrows. | 400,000 | 400,000 | ....do | Battery Light | Susquehanna River | ....do | United States and Maryland. | |
| | 31 | ....do | 200,000 | 50,000 | Missouri | Franklin | Meramec River | Mississippi River | L. Kumlein | |
| | 31 | | | 75,000 | ....do | Piedmont | Black River | White River | ....do | |
| | 31 | | | 75,000 | ....do | Poplar Bluffs | ....do | ....do | ....do | |
| June | 1 | Spesutie Narrows | 40,000 | 40,000 | Maryland | Havre de Grace | Susquehanna River | Chesapeake Bay | United States and Maryland. | |
| | 1 | ....do | 160,000 | 20,000 | Kansas | La Cygne | Meris de Cygnes River. | Osage River | J. F. Ellis | |
| | 1 | ....do | | 15,000 | ....do | Manhattan | Blue River | Kansas River | ....do | |
| | 1 | | | 15,000 | ....do | Railroad crossing | Republican River | ....do | ....do | |
| | 1 | | | 15,000 | ....do | ....do | Solomon River | ....do | ....do | |
| | 1 | | | 15,000 | ....do | Ellsworth | Smoky River | ....do | ....do | |
| | 1 | | | 5,000 | ....do | Redding | Meris de Cygnes River. | Osage River | ....do | |
| | 1 | | | 10,000 | ....do | Emporia | Neosho River | Arkansas River | ....do | |
| | 1 | | | 2,000 | ....do | Cottonwood Falls | Cottonwood River. | Neosho River | ....do | |
| | 1 | | | 3,000 | ....do | Florence | ....do | ....do | ....do | |
| | 1 | | | 3,000 | ....do | ....do | Doyle Creek | ....do | ....do | |
| | 1 | | | 5,000 | ... do | Halstead | Little Creek | Arkansas River | ....do | |
| | 1 | | | 5,000 | ... do | Hutchinson | Cow Creek | ....do | ....do | |
| | 1 | | | 10,000 | ... do | El Dorado | Walnut River | ....do | ....do | |
| | 1 | | | 10,000 | ....do | Great Bend | ... do | ... do | ....do | |
| | 1 | | | 27,000 | ... do | Leonard | Pawnee River | ... do | ... do | |
| | 1 | Spesutie Narrows. | 200,000 | 200,000 | Maryland | Elkton | Elk River | Chesapeake Bay | Thos. Hughlett, jr. | |
| | 1 | ....do | 300,000 | 300,000 | ... do | Spesutie Narrows | Susquehanna River | ....do | United States and Maryland. | |
| | 1 | ....do | 400,000 | 400,000 | ....do | Battery Light | ....do | ....do | ....do | |
| | 2 | ....do | 300,000 | 300,000 | ....do | Port Deposit | ....do | ....do | ... do | |
| | 2 | ....do | 250,000 | 100,000 | Tennessee | Nashville | Cumberland River | Ohio River | C. W. Scheurmann | |
| | 2 | | | 75,000 | ....do | Johnsonville | Tennessee River | ... do | ....do | |
| | 2 | | | 25,000 | ....do | Dresden | East Obion | Mississippi River | ... do | |
| | 2 | | | 50,000 | ....do | Paducah | West Obion | ... do | ....do | |

*I.—Chronological record of distribution of young shad made from April 18, 1879, to June 14, 1879, &c.*—Continued.

| Date. | Place whence taken. | Number of fish— | | State. | Introduction of fish. | | | Transfer in charge of— | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| | | Originally taken. | Actually planted. | | Town or place. | Stream. | Tributary of— | | |
| June 2 | Spesutie Narrows. | 200,000 | 200,000 | Maryland..... | Spesutie Narrows. | Susquehanna River | Chesapeake Bay .. | United States and Maryland. | |
| 2 | Old Bay Fishery .. | 120,000 | 120,000 | ....do ..... | Old Bay Fishery .. | ....do ..... | ....do ..... | ....do ..... | |
| 3 | Spesutie Narrows. | 225,000 | 200,000 | West Virginia .. | Piedmont..... | Potomac River.... | ....do ..... | H. E. Quinn ..... | Lost all the fish in one can. |
| 3 | ....do ..... | 300,000 | 150,000 | Maryland..... | Princess Anne.... | Monokin River ... | ....do ..... | Thos. Hughlett, jr. | |
| 3 | ..... | ..... | 125,000 | ....do ..... | Newtown ..... | Pocomoke River .. | ....do ..... | ....do ..... | Lost all fish in one can. |
| 3 | Spesutie Narrows. | 150,000 | 150,000 | ....do ..... | Spesutie Narrows. | Susquehanna River | ....do ..... | United States and Maryland. | |
| 4 | ....do ..... | 175,000 | 175,000 | ....do ..... | Cockeysville..... | Gunpowder River. | ....do ..... | Thos. Hughlett, jr. | |
| 4 | ....do ..... | 150,000 | 150,000 | ....do ..... | Battery Light..... | Susquehanna River | ....do ..... | United States and Maryland. | |
| 6 | ....do ..... | 100,000 | 100,000 | ....do ..... | Spesutie Narrows. | ....do ..... | ....do ..... | ....do ..... | |
| 7 | ....do ..... | 85,000 | 85,000 | ....do ..... | Old Bay Fishery .. | ....do ..... | ....do ..... | ....do ..... | Station No. 2. |
| 7 | ....do ..... | 200,000 | 100,000 | Ohio ..... | Fremont ..... | Sandusky River .. | Lake Erie ..... | H. E. Quinn ..... | |
| 7 | ..... | ..... | 100,000 | Indiana..... | Terre Haute..... | Wabash River ... | Ohio River..... | ....do ..... | |
| 8 | Spesutie Narrows | 175,000 | 175,000 | Maryland..... | Relay Station ..... | Patapsco River ... | Chesapeake Bay .. | Wm. Hamlen ..... | 50,000 from Station No. 2. |
| 8 | ....do ..... | 100,000 | 100,000 | ....do ..... | Spesutie Narrows. | Susquehanna River | ....do ..... | United States and Maryland. | |
| 9 | ....do ..... | 137,000 | 137,000 | ....do ..... | Old Bay Fishery .. | ....do ..... | ....do ..... | ....do ..... | |
| 9 | ....do ..... | 200,000 | 65,000 | West Virginia .. | Rowlesburg ..... | Cheat River ..... | Ohio River..... | L. Kumlein ..... | |
| 9 | ..... | ..... | 65,000 | ....do ..... | Grafton..... | Tygart's Valley... | ....do ..... | ....do ..... | |
| 9 | ..... | ..... | 70,000 | ....do ..... | Clarksburg ..... | West Fork River . | ....do ..... | ....do ..... | |
| 10 | Spesutie Narrows. | 200,000 | 200,000 | Maryland..... | Point of Rocks.... | Potomac River.... | Chesapeake Bay .. | J. F. Ellis ..... | |
| 10 | ....do ..... | 125,000 | 125,000 | ....do ..... | Patuxent ..... | Patuxent River... | ....do ..... | W. M. Russ ..... | 50,000 from Station No. 2. |
| 10 | ....do ..... | 200,000 | 50,000 | ....do ..... | Federalsburg ..... | Nanticoke River.. | ....do ..... | Thos. Hughlett, jr. | |
| 10 | ..... | ..... | 25,000 | ....do ..... | Airey's Station ... | Transquaking Riv'r | ....do ..... | ....do ..... | |
| 10 | ..... | ..... | 25,000 | ....do ..... | Cambridge ..... | Blackwater River. | ....do ..... | ....do ..... | |
| 10 | ..... | ..... | 50,000 | ....do ..... | Hillsborough ..... | Tuckahoe River .. | ....do ..... | ....do ..... | |
| 10 | ..... | ..... | 50,000 | ....do ..... | Henderson ..... | Choptank River .. | ....do ..... | ....do ..... | |
| 10 | Spesutie Narrows. | 150,000 | 150,000 | ....do ..... | Battery Light..... | Susquehanna River | ....do ..... | United States and Maryland. | |
| 11 | ....do ..... | 125,000 | 105,000 | ....do ..... | Railroad crossing . | Gunpowder River | ....do ..... | Newton Simmons . | Nearly all fish in one can died. |
| 11 | ....do ..... | 200,000 | 140,000 | ....do ..... | ..... | ..... | ..... | ..... | 60,000 fish lost before leaving Havre de Grace, balance in good condition |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | turned over to Mr. Creveling, of Pennsylvania. |
| 11 | ....do ..... | 160,000 | 160,000 | ....do ..... | Little Falls ..... | Potomac River.... | ....do ..... | J. F. Ellis ..... | |
| 11 | ....do ..... | 125,000 | 20,000 | Arkansas ..... | Railroad crossing . | Little Red River.. | Black River ..... | W. M. Russ ..... | |
| 11 | ..... | ..... | 25,000 | ....do ..... | ....do ..... | Saline River ..... | Ouachita River ... | ... do ..... | |
| 11 | ..... | ..... | 40,000 | ....do ..... | ....do ..... | Ouachita River ... | Black River ..... | ....do ..... | |
| 11 | ..... | ..... | 40,000 | ... do ..... | Fulton..... | Red River ..... | Mississippi River. | ....do ..... | |
| 12 | Spesutie Narrows. | 200,000 | 150,000 | Kentucky ..... | Shepherdsville.... | Salt River ..... | Ohio River..... | Newton Simmons . | |
| 12 | ..... | ..... | 50,000 | Indiana ..... | Indianapolis ..... | White River..... | Wabash River... | ....do ..... | |
| 13 | Old Bay Fishery .. | 125,000 | 20,000 | Tennessee ..... | Knoxville..... | Holston River .... | Tennessee River.. | J. F. Ellis ..... | Station No. 2. |
| 13 | ..... | ..... | 15,000 | ....do ..... | Chattanooga..... | Tennessee River.. | Ohio River..... | ... do ..... | |
| 13 | ..... | ..... | 45,000 | Alabama..... | Lebanon ..... | Big Wills Creek .. | Coosa River ..... | ....do ..... | |
| 13 | ..... | ..... | 45,000 | ....do ..... | Tuscaloosa ..... | Black Warrior River. | Tombigbee River . | ....do ..... | |
| 13 | Old Bay Fishery .. | 175,000 | 50,000 | Delaware ..... | Black Bird Station | Appoquinimink Creek. | Delaware Bay .... | Thos. Hughlett, jr. | |
| 13 | ..... | ..... | 25,000 | ... do ..... | Clayton..... | Duck Creek..... | ....do ..... | ....do ..... | |
| 13 | ..... | ..... | 100,000 | ... do ..... | Milford ..... | Mispillion Creek.. | ... do ..... | ... do ..... | |
| 13 | Spesutie Narrows. | 125,000 | 65,000 | West Virginia.. | Hinton ..... | New River ..... | Great Kanawha River. | H. E. Quinn..... | 25,000 from Station No. 2. |
| 13 | ..... | ..... | 60,000 | ....do ..... | Railroad crossing . | Greenbrier River . | New River..... | ....do ..... | |
| 14 | Old Bay Fishery & Spesutie Narrows. | 150,000 | 75,000 | Missouri..... | Gates Springs..... | James River..... | White River..... | L. Kumlein ..... | 100,000 from Station No. 2. |
| 14 | ..... | ..... | 75,000 | ....do ..... | 15 miles from Arcadia. | San François River. | Mississippi River. | ....do ..... | |
| 14 | Old Bay Fishery & Spesutie Narrows. | 75,000 | 75,000 | Maryland..... | Port Deposit..... | Susquehanna River | Chesapeake Bay .. | United States and Maryland. | |
| 14 | ....do ..... | 200,000 | 200,000 | ....do ..... | Havre de Grace... | ....do ..... | ....do ..... | ....do ..... | |
| | | 16,842,000 | 15,589,500 | | | | | | |

II.—*Geographical record of distribution of shad from April 18,*

| Date. | Place whence taken. | Number of fish— | | State. | Introduction of fish. |
|---|---|---|---|---|---|
| | | Originally taken. | Actually planted. | | Town or place. |
| May 13 | Salmon Creek | 90,000 | 90,000 | Alabama | Near Union Springs |
| 13 | do | 85,000 | 85,000 | do | do |
| 13 | Avoca | 75,000 | 75,000 | do | Columbus |
| June 13 | Old Bay Fishery | 45,000 | 45,000 | do | Lebanon |
| 13 | do | 45,000 | 45,000 | do | Tuscaloosa |
| 11 | do | 125,000 | 20,000 | Arkansas | Railroad crossing |
| 11 | do | | 25,000 | do | do |
| 11 | do | | 40,000 | do | do |
| 11 | do | | 40,000 | do | Fulton |
| May 24 | Spesutie Narrows | 20,000 | 20,000 | Delaware | Seaford |
| June 13 | Old Bay Fishery | 50,000 | 50,000 | do | Blackbird Station |
| 13 | do | 25,000 | 25,000 | do | Clayton |
| 13 | do | 100,000 | 100,000 | do | Milford |
| May 2 | Avoca | 60,000 | 60,000 | Florida | Railroad crossing |
| 2 | do | 60,000 | 60,000 | do | do |
| Apr. 28 | do | 75,000 | 75,000 | Georgia | Columbus |
| May 2 | do | 40,000 | 40,000 | do | Railroad crossing |
| 2 | do | 40,000 | 40,000 | do | do |
| 3 | do | 100,000 | 100,000 | do | Macon |
| 7 | do | 60,000 | 60,000 | do | Covington |
| 7 | do | 60,000 | 60,000 | do | Conyers |
| 29 | Spesutie Narrows | 200,000 | 50,000 | do | Railroad crossing |
| 30 | do | | 87,500 | do | Gainesville |
| 27 | do | | 100,000 | do | Resaca |
| June 7 | do | 100,000 | 100,000 | Indiana | Terre Haute |
| 12 | do | 50,000 | 50,000 | do | Indianapolis |
| 1 | do | 160,000 | 20,000 | Kansas | La Cygne |
| 1 | do | | 15,000 | do | Manhattan |
| 1 | do | | 15,000 | do | Railroad crossing |
| 1 | do | | 15,000 | do | do |
| 1 | do | | 15,000 | do | Ellsworth |
| 1 | do | | 5,000 | do | Reading |
| 1 | do | | 10,000 | do | Emporia |
| 1 | do | | 2,000 | do | Cottonwood Falls |
| 1 | do | | 3,000 | do | Florence |
| 1 | do | | 3,000 | do | do |
| 1 | do | | 5,000 | do | Halstead |
| 1 | do | | 5,000 | do | Hutchinson |
| 1 | do | | 10,000 | do | El Dorado |
| 1 | do | | 10,000 | do | Great Bend |
| 1 | do | | 27,000 | do | Larned |
| May 28 | do | 200,000 | 200,000 | Kentucky | Shepherdsville |
| June 12 | do | 150,000 | 150,000 | do | do |
| May 8 | Salmon Creek | 200,000 | 30,000 | Louisiana | Railroad crossing |
| 8 | do | | 35,000 | do | do |
| 8 | do | | 30,000 | do | do |
| 8 | do | | 35,000 | do | do |
| 8 | do | | 35,000 | do | do |
| 8 | do | | 35,000 | do | Monroe |
| 16 | Spesutie Narrows | 300,000 | 300,000 | Maryland | Spesutie Narrows |
| 17 | do | 140,000 | 60,000 | do | Cordova Station |
| 17 | do | | 80,000 | do | do |
| 18 | do | 150,000 | 150,000 | do | Salisbury |
| 19 | do | 225,000 | 115,000 | do | Savage |
| 19 | do | | 110,000 | do | Laurel |
| 19 | do | 100,000 | 100,000 | do | Spesutie Narrows |
| 21 | do | 25,000 | 25,000 | do | Havre de Grace |
| 21 | do | 100,000 | 100,000 | do | Spesutie Narrows |
| 24 | do | 80,000 | 80,000 | do | Federalsburg |
| 24 | do | 150,000 | 150,000 | do | Spesutie Narrows |
| 26 | do | 150,000 | 100,000 | do | Whaleyaville |
| 26 | do | | 50,000 | do | Near Berlin |
| 26 | do | 150,000 | 150,000 | do | Spesutie Narrows |
| 27 | do | 100,000 | 100,000 | do | do |
| 28 | do | 125,000 | 125,000 | do | do |
| 29 | do | 100,000 | 100,000 | do | Henderson |
| 29 | do | 50,000 | 50,000 | do | Spesutie Narrows |
| 30 | do | 200,000 | 140,000 | do | Millington |
| 30 | do | | 60,000 | do | Centreville |
| 30 | do | 200,000 | 200,000 | do | Spesutie Narrows |

1879, *to June* 14, 1879, *by United States Fish Commission.*

| Introduction of fish. | | Transfer in charge of— | Remarks. |
|---|---|---|---|
| Stream. | Tributary of— | | |
| Pea River | Choctawhatchee River | L. Kumlien | |
| Conecuh River | Escambia River | do | |
| Tombigbee River | Mobile Bay | C. W. Schuerman | |
| Big Wills Creek | Coosa River | J. F. Ellis | |
| Black Warrior River | Tombigbee River | do | |
| Little Red River | Black River | W. M. Russ | |
| Saline River | Ouachita River | do | |
| Ouachita River | Black River | do | |
| Red River | Mississippi River | do | |
| Nanticoke River | Chesapeake Bay | Thos. Hughlett, jr. | |
| Appoquinimink Creek | Delaware Bay | do | |
| Duck Creek | do | do | |
| Mispillion Creek | do | do | |
| Ocilla River | Gulf of Mexico | C. W. Schuermann | |
| Ockolockonee River | do | do | |
| Chattahoochee River | Appalachicola River | L. Kumlien | |
| Allapahaw River | Suwanee River | C. W. Schuermann | |
| Little River | do | do | |
| Ocmulgee River | Altamaha River | J. F. Ellis | |
| Ulcofanhanchee River | Ocmulgee River | C. W. Schuermann | |
| Yellow River | do | do | |
| Tugaloo River | Savannah River | H. E. Quinn | |
| Chattahoochee River | Appalachicola River | do | One-half of one can of fish died while taking it from Gainesville to the river. |
| Coosa River | Alabama River | do | |
| Wabash River | Ohio River | do | |
| White River | Wabash River | Newton Simmons | |
| Marais des Cygnes River | Osage River | J. F. Ellis | |
| Blue River | Kansas River | do | |
| Republican River | do | do | |
| Solomon River | do | do | |
| Smoky River | do | do | |
| Marais des Cygnes River | Osage River | do | |
| Neosho River | Arkansas River | do | |
| Cottonwood River | Neosho River | do | |
| do | do | do | |
| Doyle Creek | do | do | |
| Little River | Arkansas River | do | |
| Cow River | do | do | |
| Walnut River | do | do | |
| do | do | do | |
| Pawnee River | do | do | |
| Salt River | Ohio River | do | |
| do | do | Newton Simmons | |
| Roundaway Creek | Mississippi River | H. E. Quinn | |
| Tensas | do | do | |
| Bayou Macon | Tensas River | do | |
| Bœuf | Ouachita River | do | |
| Clear Lake | | do | |
| Ouachita River | Black River | do | |
| Susquehanna River | Chesapeake Bay | United States and Maryland. | |
| Miles Creek | do | Thos. Hughlett, jr. | |
| Wye Mills Creek | Miles Creek | do | |
| Wicomico River | Chesapeake Bay | Levin Campbell | |
| Patuxent River | do | J. F. Ellis | |
| do | do | do | |
| Susquehanna River | do | United States and Maryland. | |
| do | do | do | |
| do | do | do | |
| Nanticoke River | do | Thos. Hughlett, jr. | |
| Susquehanna River | do | United States and Maryland. | |
| Pocomoke River | do | Levin Campbell | |
| Saint Michael's River | do | do | |
| Susquehanna River | do | United States and Maryland. | |
| do | do | do | |
| do | do | do | |
| Choptank River | do | Thos. Hughlett, jr. | |
| Susquehanna River | do | United States and Maryland. | |
| Chester River | do | Levin Campbell | |
| Corsica Creek | do | do | |
| Susquehanna River | do | United States and Maryland. | |

II.—*Geographical record of distribution of shad from April* 18, 1879, *to*

| Date. | Place whence taken. | Number of fish— | | State. | Introduction of fish. |
|---|---|---|---|---|---|
| | | Originally taken. | Actually planted. | | Town or place. |
| May 30 | Spesutie Narrows. | 150, 000 | 150, 000 | Maryland | Spesutie Narrows |
| 31 | ....do | 200, 000 | 100, 000 | ....do | Middletown |
| 31 | ....do | | 100, 000 | ....do | .....do |
| 31 | ....do | 400, 000 | 400, 000 | ....do | Battery Light |
| June 1 | ....do | 40, 000 | 40, 000 | ....do | Havre de Grace |
| 1 | ....do | 200, 000 | 200, 000 | ....do | Elkton |
| 1 | ....do | 300, 000 | 300, 000 | ....do | Spesutie Narrows |
| 1 | ....do | 400, 000 | 400, 000 | ....do | Battery Light |
| 2 | ....do | 300, 000 | 300, 000 | ....do | Port Deposit |
| 2 | ....do | 200, 000 | 200, 000 | ....do | Spesutie Narrows |
| 2 | Old Bay Fishery | 120, 000 | 120, 000 | ....do | Old Bay Fishery |
| 3 | Spesutie Narrows. | 300, 000 | 150, 000 | ....do | Princess Anne |
| 3 | ....do | | 125, 000 | ....do | Newtown |
| 3 | ....do | 150, 000 | 150, 000 | ....do | Spesutie Narrows |
| 4 | ....do | 175, 000 | 175, 000 | ....do | Cockeysville |
| 4 | ....do | 150, 000 | 150, 000 | ....do | Battery Light |
| 6 | ....do | 100, 000 | 100, 000 | ....do | Spesutie Narrows |
| 7 | ....do | 85, 000 | 85, 000 | ... do | Old Bay Fishery |
| 8 | ....do | 175, 000 | 175, 000 | ....do | Relay Station |
| 8 | ....do | 100, 000 | 100, 000 | ....do | Spesutie Narrows |
| 9 | ....do | 137, 000 | 137, 000 | ....do | Old Bay Fishery |
| 10 | ....do | 200, 000 | 200, 000 | ....do | Point of Rocks |
| 10 | ....do | 125, 000 | 125, 000 | ....do | Patuxent |
| 10 | ....do | 200, 000 | 50, 000 | ....do | Federalsburg |
| 10 | ....do | | 25, 000 | ....do | Airey's Station |
| 10 | ....do | | 25, 000 | ....do | Cambridge |
| 10 | ... do | | 50, 000 | ....do | Hillsborough |
| 10 | ....do | | 50, 000 | ....do | Henderson |
| 10 | ....do | 150, 000 | 150, 000 | ....do | Battery Light |
| 11 | ....do | 125, 000 | 105, 000 | ....do | Railroad crossing |
| 11 | ....do | 200, 000 | 140, 000 | ....do | |
| 11 | ....do | 160, 000 | 160, 000 | ....do | Little Falls |
| 14 | ....do | 75, 000 | 75, 000 | ....do | Port Deposit |
| 14 | ....do | 200, 000 | 200, 000 | ....do | Havre de Grace |
| Apr. 26 | Avoca | 150, 000 | 150, 000 | Mississippi | Jackson |
| May 13 | ....do | 65, 000 | 25, 000 | ....do | Meridian |
| 20 | Spesutie Narrows. | 200, 000 | 50, 000 | ....do | Ripley |
| 20 | ... do | | 50, 000 | ....do | Railroad crossing |
| 20 | ....do | | 50, 000 | ....do | .....do |
| 20 | ... do | | 50, 000 | ....do | .....do |
| 31 | ....do | 200, 000 | 50, 000 | Missouri | Franklin |
| 31 | ....do | | 75, 000 | ....do | Piedmont |
| 31 | ....do | | 75, 000 | ....do | Poplar Bluffs |
| June 14 | ....do | 150, 000 | 75, 000 | ....do | Gates Springs |
| 14 | ....do | | 75, 000 | ....do | 15 miles from Arcadia |
| Apr. 18 | Scotch Hall Fishery, Avoca. | 100, 000 | 100, 000 | North Carolina | Weldon |
| 18 to 24 | Scotch Hall | 50, 000 | 50, 000 | ....do | Avoca |
| 21 | ....do | 30, 000 | 30, 000 | ....do | Near Warsaw |
| 21 | Avoca | 70, 000 | 70, 000 | ....do | .....do |
| 21 | Scotch Hall | 30, 000 | 30, 000 | ....do | Rocky Mount |
| 21 | Avoca | 70, 000 | 70, 000 | ....do | .....do |
| 24 | Scotch Hall | 100, 000 | 100, 000 | ....do | Near Warsaw |
| 24 | ....do | 50, 000 | 50, 000 | ....do | Scotch Hall Fishery |
| 24 | ....do | 25, 000 | | ....do | Pollocksville |
| 24 | Avoca | 100, 000 | 95, 000 | ....do | .....do |
| 24 | ....do | 100, 000 | 115, 000 | ....do | Near Milburnie |
| 24 | Scotch Hall | 25, 000 | | ....do | .....do |
| 24 | ....do | 60, 000 | 60, 000 | ....do | Scotch Hall Fishery |
| 24 | ....do | 100, 000 | 100, 000 | ....do | Near Kirby's Bridge (Warsaw). |
| 25 | Avoca | 100, 000 | 100, 000 | ....do | Mount Olive |

*June* 14, 1879, *by United States Fish Commission*—Continued.

| Introduction of fish. | | Transfer in charge of— | Remarks. |
|---|---|---|---|
| Stream. | Tributary of— | | |
| Susquehanna River | Chesapeake Bay | United States and Maryland. | |
| Sassafras River | do | Thos. Hughlett, jr. | |
| Bohemia River | do | do | |
| Susquehanna River | do | United States and Maryland. | |
| do | do | do | |
| Elk River | do | Thos. Hughlett, jr. | |
| Susquehanna River | do | United States and Maryland. | |
| do | do | do | |
| do | do | do | |
| do | do | do | |
| do | do | do | |
| Monokin River | do | Thos. Hughlett, jr. | |
| Pocomoke River | do | do | Lost all the fish in one can. |
| Susquehanna River | do | United States and Maryland. | |
| Gunpowder River | do | Thos. Hughlett, jr. | |
| Susquehanna River | do | United States and Maryland. | |
| do | do | do | |
| do | do | do | Station No. 2. |
| Patapsco River | do | William Hamlin | 50,000 from Station No. 2. |
| Susquehanna River | do | United States and Maryland. | |
| do | do | do | |
| Potomac River | do | J. F. Ellis | |
| Patuxent River | do | W. M. Russ | 50,000 from Station No. 2. |
| Nanticoke River | do | Thos. Hughlett, jr. | |
| Transquaking River | do | do | |
| Blackwater River | do | do | |
| Tuckahoe River | do | do | |
| Choptank River | do | do | |
| Susquehanna River | do | United States and Maryland. | |
| Gunpowder River | do | N. Simmons | Nearly all in one can died. |
| | | | 60,000 fish lost before leaving Havre de Grace; balance in good condition, turned over to Mr. Creveling, of Pa. |
| Potomac River | Chesapeake Bay | J. F. Ellis | |
| Susquehanna River | do | United States and Maryland. | |
| do | do | do | |
| Pearl River | Gulf of Mexico | J. F. Ellis | |
| Chunky River | Chickasawhee River | C. W. Schuermann | |
| Tippah River | | J. F. Ellis | |
| Tallahatchie River | Yazoo River | do | |
| Yocana River | do | do | |
| Yalabusha River | do | do | |
| Moramec River | Mississippi River | L. Kumlien | |
| Big Black River | White River | do | |
| do | do | do | |
| James River | | do | 100,000 from Station No. 2. |
| San Francois River | | do | |
| Roanoke River | Albemarle Sound | C. J. Huske | Earliest fish out of egg. |
| Albemarle Sound | Atlantic Ocean | S. G. Worth | |
| Six Runs | Cape Fear River | Tom Taylor | |
| do | do | do | |
| Tar River | Pamlico Sound | J. A. Woodward | |
| do | do | do | |
| Six Runs | Cape Fear River | C. J. Huske | |
| Albemarle Sound | Atlantic Ocean | Tom Taylor | The 25,000 were 4 days old when taken up, and were 40 hours en route. |
| Trent River | Neuse River | do | |
| do | do | do | |
| Neuse River | Pamlico Sound | W. M. Russ | The 25,000 were 4 days old when taken up, and were 28 hours en route. |
| do | do | do | |
| Albemarle Sound | Atlantic Ocean | J. P. Heywood | |
| Six Runs | Cape Fear River | C. J. Huske | |
| Goshen Creek | do | J. A. Woodward | |

II.—*Geographical record of distribution of shad from April* 18, 1879, *to*

| Date. | Place whence taken. | Number of fish— | | State. | Introduction of fish. |
|---|---|---|---|---|---|
| | | Originally taken. | Actually planted. | | Town or place. |
| Apr. 25 | Avoca | 100, 000 | 100, 000 | North Carolina | Rocky Mount |
| 29 | ....do | 75, 000 | 75, 000 | ....do | Avoca |
| 29 | ....do | 150, 000 | 150, 000 | ....do | Weldon |
| May 2 | ....do | 100, 000 | 100, 000 | ....do | ....do |
| 2 | ....do | 100, 000 | 90, 000 | ....do | Milburnie |
| 3 | ....do | 150, 000 | 150, 000 | ....do | Avoca |
| 6 | ....do | 240, 000 | 100, 000 | North Carolina | Near Salisbury |
| 8 | ....do | 15, 000 | 15, 000 | North Carolina | Avoca |
| 9 | Salmon Creek | 215, 000 | 215, 000 | ... do | .....do |
| 9 | ....do | 210, 000 | 210, 000 | ....do | .....do |
| 12 | ....do | 250, 000 | 250, 000 | ... do | .....do |
| 13 | ....do | 500, 000 | 500, 000 | North Carolina | Deep Bend |
| June 7 | Spesutie Narrows | 100, 000 | 100, 000 | Ohio | Fremont |
| Apr. 30 | Avoca | 825, 000 | ..... | South Carolina | ..... |
| May 3 | ....do | 75, 000 | 75, 000 | ....do | Begin Church |
| 5 | ....do | 160, 000 | ..... | ....do | ..... |
| June 2 | Spesutie Narrows | 250, 000 | 100, 000 | Tennessee | Nashville |
| 2 | ....do | ..... | 75, 000 | ....do | Johnsonville |
| 2 | ....do | ..... | 25, 000 | ....do | Dresden |
| 2 | ....do | ..... | 50, 000 | ....do | Paducah |
| 13 | Old Bay Fishery | 20, 000 | 20, 000 | ....do | Knoxville |
| 13 | ....do | 15, 000 | 15, 000 | ....do | Chattanooga |
| May 19 | Spesutie Narrows | 200, 000 | 100, 000 | Texas | Minneola |
| 19 | ....do | ..... | 100, 000 | ....do | Dallas |
| 21 | ....do | 175, 000 | 90, 000 | ....do | Hearne |
| 21 | ....do | ..... | 85, 000 | ...do | Austin |
| 22 | ....do | 200, 000 | 50, 000 | ....do | Near Columbus |
| 22 | ....do | ..... | 50, 000 | ....do | Near Luling |
| 22 | ....do | ..... | 50, 000 | ....do | Near Sequin |
| 22 | ....do | ..... | 50, 000 | ....do | San Antonio |
| 2 | Avoca | 120, 000 | 120, 000 | Virginia | Near Franklin |
| 3 | ....do | 25, 000 | 25, 000 | ....do | Franklin |
| 6 | ....do | 100, 000 | 100, 000 | ... do | Nottoway Station |
| 7 | ....do | 75, 000 | 75, 000 | ....do | .....do |
| 7 | ....do | 150, 000 | 150, 000 | ....do | .....do |
| 7 | ....do | 75, 000 | 75, 000 | ....do | .....do |
| 7 | ....do | 95, 000 | 95, 000 | ....do | .....do |
| 8 | ....do | 225, 000 | ..... | ....do | ..... |
| 13 | ....do | 100, 000 | 100, 000 | ....do | Nottoway |
| 14 | ....do | 250, 000 | 80, 000 | ....do | Franklin |
| June 3 | Spesutie Narrows | 225, 000 | 200, 000 | West Virginia | Piedmont |
| 9 | ....do | 200, 000 | 65, 000 | ....do | Rowlesburg |
| 9 | ....do | ..... | 65, 000 | ....do | Grafton |
| 9 | ....do | ..... | 70, 000 | ....do | Clarksburg |
| 13 | ....do | 125, 000 | 65, 000 | ....do | Hinton |
| 13 | ....do | ..... | 60, 000 | ....do | Railroad crossing |
| | | 16, 842, 000 | 15, 569, 500 | | |

*June* 14, 1879, *by United States Fish Commission*—Continued.

| Introduction of fish. | | Transfer in charge of— | Remarks. |
|---|---|---|---|
| Stream. | Tributary of— | | |
| Tar River | Pamlico Sound | W. M. Russ | |
| Salmon Creek | Chowan River | J. A. Woodward | |
| Roanoke River | Albemarle Sound | do | |
| do | do | do | |
| Neuse River | Pamlico Sound | C. J. Huske | |
| Salmon Creek | Chowan River | J. A. Woodward | |
| Yadkin River | Peedee River | C. J. Huske and Tom Taylor. | |
| Salmon Creek | do | | |
| do | do | | |
| do | do | W. M. Russ | |
| do | do | | |
| North River | Albemarle Sound | | |
| Sandusky River | Lake Erie | H. E. Quinn | |
| | | | Turned over to South Carolina nearly a total loss. |
| Cooper River | Charleston Harbor | J. A. Woodward | |
| | | | 3 cans of fish dead before leaving Franklin, 2 more died before reaching Weldon, balance died after leaving Wilmington, N. C. |
| Cumberland River | Ohio River | C. W. Schuermann | |
| Tennessee River | do | do | |
| East Obion River | Mississippi River | do | |
| West Obion River | do | do | |
| Holston River | Tennessee River | J. F. Ellis | Station No. 2. |
| Tennessee River | Ohio River | do | |
| Sabine River | Gulf of Mexico | H. E. Quinn | |
| Trinity River | do | do | |
| Brazos River | do | L. Kumlien | |
| Colorado River | do | do | |
| do | do | C. W. Schuermann | |
| San Marcus River | Guadalupe River | do | |
| Guadalupe River | Gulf of Mexico | do | |
| San Antonio River | do | do | |
| Blackwater River | Chowan River | Tom Taylor | |
| do | do | S. G. Worth | |
| Nottoway River | Chowan River | J. A. Woodward & G. H. Williams. | |
| do | do | G. H. Williams | |
| do | do | J. A. Woodward | |
| do | do | W. M. Russ | |
| do | do | do | |
| | | | Shipped by steamer from Norfolk for Crisfield. Heavy storm caused a delay and all fish died. |
| do | do | Taylor and Woodward. | |
| Blackwater River | Chowan River | J. F. Ellis | Fish in bad condition; all but 80,000 died before leaving Norfolk, Va. |
| Potomac River | Chesapeake Bay | H. E. Quinn | Lost all fish in 1 can. |
| Cheat River | Ohio River | L. Kumlien | |
| Tygart's Valley | do | do | |
| West Fork River | do | do | |
| Now River | | H. E. Quinn | 25,000 from Station No. 2. |
| Greenbrier River | | do | |