

REPORT OF THE COMMISSIONER.

A.—GENERAL CONSIDERATIONS.

1.—INTRODUCTORY REMARKS.

The present report is intended to give an account of the work of the United States Fish Commission during the year 1880; closing, as it does, the first decade of its existence. Originally organized by Congress simply for the purpose of making investigations into the condition of the fisheries of the sea-coast and lakes, the subject of the actual increase of the food-fishes of the country by means of artificial propagation was added in the second year of its existence, thus establishing a twofold function.

In each department the labor has increased year by year in proportion to the increasing favor shown by Congress, until, at the end of the decade in question, its work has become of pre-eminent magnitude among similar organizations throughout the world, the results, it is hoped, being in equal proportion. What the future may have in store for the Commission of course cannot be anticipated at present. Should its scope and importance increase within the next ten years as it has in the past, it will constitute a very important element of the operations of the Government looking towards the amelioration of the condition of the country at large.

The most noteworthy features of the year may be indicated as follows:

1. The production of the German carp in large numbers, and their distribution to the various parts of the country.
2. The production of shad on an increasing scale, and their dissemination in numerous localities where they were previously unknown.
3. The construction of a special steamer (the Fish Hawk) to serve as a floating hatching-house for the production of shad, herring, striped bass, etc., and which is capable of being moved to any place where the breeding fish can be found in sufficient quantity.
4. The introduction to the notice of the American fishermen, and the use on a large scale, of the gill-net with glass-ball floats, for the purpose of capturing codfish on their winter spawning-ground.
5. The co-operation with the United States Census Bureau in obtaining the history and statistics of the North American fisheries.
6. The preparation of the American exhibit for participation in the International Fisheries Exhibition at Berlin.

7. The use of the Fish Hawk in exploring the Gulf Stream and its fauna, especially in connection with the distribution of the tile-fish.

8. The extended exploration of the fisheries of the Atlantic coast of the United States, of the great lakes, of the Gulf of California, and of the entire coast of Western America, from San Diego to Point Barrow in the Arctic Ocean.

9. The collecting of complete series of the fishes of the sea-coast and the lakes for the National Museum, including large numbers of duplicates, especially on the shores of the Pacific, for distribution to public museums and educational establishments in the United States and elsewhere.

All of these subjects will be considered more at length hereafter under their proper headings.

The death of Mr. James W. Milner, which occurred on January 6, 1880, deprived the Commission of one of its most efficient assistants. Mr. Milner had been associated with the work of the Commission on the Great Lakes, on the Potomac river, and at Gloucester almost from its inception. After suffering from ill-health for several months, during which he sought for relief in various climates, he finally succumbed, and terminated his short but very useful career.

2.—PRINCIPAL STATIONS OF THE UNITED STATES FISH COMMISSION.

A brief statement of the principal localities at which the work of the United States Fish Commission was prosecuted during the year may serve as a suitable introduction to the more extended statement of the history of operations in general.

The division of research and investigation is naturally conducted most extensively at the summer station which the Commission selects for its field work; and Newport, as the point in question, constituted a center at which a large amount of labor was carried on.

Reference has already been made to the work done along the entire coast of the United States on both oceans, of the great lakes, and of the Gulf of Mexico, in connection with the fishery census of 1880. On these lines, as well as at Newport, the investigation into the natural history and statistics of the fisheries, the methods of their prosecution, and the general natural history of such animals and plants as are related directly or indirectly to the wants or luxuries of man, were carried on to a greater or less degree.

The stations connected with the propagation of the food-fishes were, as usual, quite numerous, and witnessed a great deal of labor on the part of the employés of the Commission. Of these the most important are as follows:

1. The hatchery on McCloud River, in California, of the California salmon.

2. The ponds for breeding the California trout, situated about five miles above the McCloud River salmon station.

3. The station at Northville, Mich., for hatching the white-fish taken in Lake Huron, Detroit River, and Lake Erie.
4. The Bucksport station, on the Penobscot River, for procuring and hatching the eggs of the Penobscot or Atlantic salmon.
5. The station at Grand Lake Stream for the land-locked salmon.
6. The station at Druid Hill Park for hatching eggs of the *Salmonidæ* and for the propagation of carp.
7. The station on Monument Lot, in Washington, for carp.
8. The station at the Arsenal, in Washington, also for carp.

In addition to these, which may be called permanent stations, there was also a station at the navy-yard, in Washington, for hatching out eggs of the shad obtained from the Potomac River.

There was also a similar station for taking and hatching shad-eggs at Havre de Grace, on the Susquehanna River.

Fuller details in regard to all these subjects will be found in subsequent pages of the present report.

3.—ASSISTANCE RENDERED TO THE COMMISSION.

The act of Congress establishing the Commission directs the Executive Departments of the government to render all necessary and practicable aid in carrying out its mission; and, as in previous years, it is my very agreeable duty to report the cordial manner in which this has been done.

Navy Department.—To the Navy Department, as before, the obligations are very great. It was not necessary this season to call upon the Department for a steamer such as was furnished during previous seasons in the Blue Light and the Speedwell, the Fish Hawk being sufficient for all necessary purposes. The Department did, however, in accordance with the law of Congress, supply the officers and crew of the Fish Hawk, as also two navy launches, for use specially at Havre de Grace and on the Potomac River. A number of flags were also issued to the Commission, to be used for the fitting up of the Fishery Exhibition at Berlin.

War Department.—To the Signal Office of the War Department the Commission is indebted for the supply of a large number of water thermometers to the light-houses and light-ships along the coast for the purpose of making observations upon the temperature of the water and its relationship to the movements of the fish. Copies of observations made by the regular observers of the Signal Service were also furnished as heretofore.

By order of General McDowell, a detail of soldiers was also supplied at the McCloud station for its protection against Indians and lawless whites.

Treasury Department.—The supervising surgeon of the Treasury Department, at the request of the Commission, instructed Dr. Guiteras to visit Key West and carry on some investigations into the cause of the

great mortality among the fishes of the Gulf of Mexico. No report, however, has as yet been received upon this subject. Very effective aid in many ways was rendered by the Light-House Board.

Railroads.—The railroads of the country have continued to render a very important help in facilities extended to the messengers of the Commission in carrying fish throughout the country. As heretofore, all, called upon for the service, have issued orders to conductors and other employes to allow the messengers of the Commission to carry their fish-cans in baggage cars, with free access to them; also instructing them to allow the messengers to check empty cans as baggage to destination. To the Baltimore and Ohio, the Pennsylvania, and the Philadelphia, Wilmington and Baltimore special acknowledgments are due for carrying, free of expense, a large number of packages containing the exhibit for the Berlin Exposition.

The railroads, also, between Boston and Bangor carried a car-load of shad and its accompanying messengers free of expense.

Steamship lines.—To the foreign steamship companies the Commission is indebted for important service, especially to the North German Lloyds, which transported the entire fishery exhibit for Berlin from New York and from Baltimore to Bremen and back without any charge; the bulk amounting to nearly 12,000 cubic feet. It also, on several occasions, transported packages of eggs of fish intended for Germany and had them placed under the special care of the captain and steward.

A similar courtesy in the matter of transportation of fish-eggs was rendered by the French Transatlantic Steamship Company, by direction of its agent, Mr. Louis de Bebian.

District Commission.—Valuable help was received on various occasions from the engineer department of the District Commission, especially in connection with the laying out and construction of the carp ponds, of which Lieutenant Hoxie kindly accepted the direction.

4.—COURTESIES RENDERED BY THE COMMISSION TO FOREIGN COUNTRIES.

The applications from foreign countries for fish have continued to increase, and have always been met as far as possible. The exchange of courtesies between nations, looking towards their mutual benefit, is greatly to be encouraged; and although, so far as fish are concerned, the United States has perhaps more to give than to receive, it is none the less incumbent upon her to do what may be possible towards improving the food resources of other portions of the world.

Germany.—It is with Germany that the relationships in question have been most extended and are practically most mutual, she giving as well as receiving. In response to Herr Schuster, burgomaster at Freiberg, a number of eggs of the California salmon were forwarded from New York in apparatus of transportation specially furnished by him. A large number of eggs of the same species were also sent to Herr von Behr, president of the *Deutsche Fischerei-Verein*, and reached their des-

tinuation in excellent condition. Of this lot about half were presented by him, in the name of the Fish Commission, to the Hungarian Government.

Two hundred and fifty thousand eggs of white-fish were also sent to Herr von Behr, per steamer Donau, on the 25th of December.

France.—In France the *Société d'Acclimatation* received a number of eggs of both land-locked salmon and California salmon. About 2,000 of the former hatched out, and were to be placed in Lake Chauvette, a very deep, clear, and cold lake in Auvergne. The California salmon, after being hatched out, were divided among six different rivers of France.

England.—England has, so far, shown very little interest in the American food-fishes, and, indeed, may be said to be much behind the greater part of continental Europe in relation to fish culture generally. A London company, however, made application for and received a number of eggs of the California salmon, which were sent to Mr. Capel, of the Cray Fishery, in Kent, to be hatched out.

Netherlands.—In response to an application from the Netherlands a number of eggs of the California salmon were forwarded and successfully hatched out.

Guatemala.—Correspondence was carried on with Dr. Fenner in reference to the introduction of useful food-fishes into Guatemala. None, however, were actually transmitted.

Ecuador and Guadeloupe.—A similar correspondence was entertained, in regard to Ecuador, with Mr. Frederick Wesson, of New York, and with Guadeloupe through Mr. Charles Bartlett, United States consul. An application from this island for eggs of the brook-trout was turned over to Mr. Livingston Stone to be filled.

Canada—To Canada, as in previous years, many eggs of the California salmon were forwarded, as also a number of carp.

The minuter details of distribution of the special kinds of fish sent to foreign countries will be found in the proper portion of the present report. The transmissions to Europe have been greatly facilitated by the very liberal conduct of the French and German steamship companies in carrying the eggs free of charge and with the utmost possible care.

B.—BERLIN FISHERY EXHIBITION.

5.—ITS ORIGIN AND SCOPE.

In the year 1878 the *Deutsche Fischerei-Verein*, of Berlin, an organization having somewhat the same relationship to Germany that the United States Fish Commission has to the United States, determined, by permission of its Government, to invite the world to an international fisheries exhibition.

This was designed to include specimens of the animals and plants of the waters useful or injurious to man; illustrations of the apparatus by

which they were pursued and captured or obtained; the machinery of utilization; the raw material and the manufactured products derived from such objects; and the methods and appliances of the production and multiplication of the species, whether by artificial means or otherwise. To these were added various subsidiary subjects, such as the clothing and the social condition of the fishermen, etc.

6.—PARTICIPATION BY THE UNITED STATES.

While many countries promptly responded to this invitation and sent their cordial acceptances, no action was at first taken by the United States, and it was not until the winter of 1879-'80 that the subject came actually before Congress for its consideration. At that period, in consequence of what was understood to be the urgent desire of the German Government for the participation of the United States, a bill was passed, becoming a law in February, making an appropriation of \$20,000 to enable the United States Fish Commission to prepare an exhibit for the United States. I was notified to appear in connection with the subject, first, before the Secretary of State, and then before the Senate Committee on Foreign Relations.

Although the exhibition was to open on April 20, 1880, the bill introduced into Congress only became a law in February.

As may readily be imagined, but a very short time was left for the preparation of the exhibit and the cases to contain it, packing, shipment to Berlin, installation in the buildings in that city, and a general participation in the exhibition.

The law provided that the United States Fish Commissioner should represent the United States at Berlin, either in person, or by deputy to be appointed by the President, and, not being able to take part, I nominated Mr. G. Brown Goode as said deputy. This was promptly acceded to; Mr. Goode received his commission from the President, and immediately commenced the work of preparation.

Invitations were sent to the principal dealers in fishing-tackle and fishery supplies, to the manufacturers of articles of fish food and other economical substances derived directly or indirectly from fish, and generally to all those who were supposed to have anything to contribute on the occasion in question.

The large collections of a similar character prepared by the United States Fish Commission for exhibition at Philadelphia in 1876 were all available for the purpose, and were, for the most part, still packed in the boxes in which they had been returned from Philadelphia.

The next step was to prepare a detailed schedule of the articles necessary to constitute a fishery exhibition, and fortunately most of the articles found in the collection were available for the purpose. Additional articles were secured, especially of fish products, a field in which much progress had been made since the Centennial of 1876, and the collections were all properly packed and shipped. The cases which

had been used in the Philadelphia exhibition were also available, having originally been made portable. These were also sent off. In great part, however, before shipment, the specimens were arranged in their intended cases and photographed, so as to show their relative position, and the more readily to admit of arrangement on reaching Berlin. Mr. Goode and his assistants, among whom may be mentioned Mr. F. W. True and Capt. H. C. Chester, worked day and night, sending off the first load on the 28th February, and the last one on the 24th March, or only twelve and thirty-seven days respectively after the passage of the act. The shipments from Washington were made by way of Baltimore, and those from the north were concentrated at New York, under the charge of Mr. E. G. Blackford, the well-known fish-dealer of New York, of 80 Fulton Market, at his establishment, and forwarded from that point.

With unexampled liberality the great railroads between Washington, New York, Philadelphia, and Baltimore, namely, the Pennsylvania Railroad, the Philadelphia, Wilmington and Baltimore Railroad, and the Baltimore and Ohio Railroad, agreed to transport these packages to the point of shipment and return them to Washington free of expense. The North German Lloyd Company was equally generous, carrying them from New York and Baltimore to Bremen and back free of cost, so that the entire mass of nearly 12,000 cubic feet cost nothing whatever for transportation between Washington and Bremen. The charges from Bremen to Berlin were paid for out of the appropriation.

Mr. Goode and his party left Washington on the 16th March, he being accompanied by Mr. G. H. Hobbs and J. E. Rockwell, as general assistants; Mr. F. W. True, in charge of a portion of the exhibition; Mr. Fred. Mather, as an expert in fish culture; Capt. J. W. Collins, in charge of the ocean fishery apparatus, and Mr. Joseph Palmer, in charge of the models and stuffed specimens. Reduced rates of transportation were given to the party by the North German Lloyd, on the vessels of which company they were taken to Bremen. Owing to the great care in packing and precaution in shipping at the various points of the journey, the collections, including a large series of plaster casts of fishes, reached Berlin in safety, and the entire exhibit was in place by the 20th April, the opening day of the exhibition.

The American display received universal attention, and was generally considered as by far the most interesting feature of the exhibition. Its various divisions were constantly thronged by admiring visitors, and furnished the text of many eulogistic and critical notices.

It was originally intended to continue the exhibition for one month only, or until the 20th May. The interest, however, of the public was such that it was determined to maintain it in active existence until the 1st July, or nearly six weeks longer than was originally calculated upon.

This of course necessitated an unexpected delay in the return of the party and the collections; and it was not until the middle of July that

Mr. Goode reached New York on his return. Most of his party came with him; Mr. Rockwell, alone, having been taken ill and left behind in London in charge of his brother.

The great superiority of the American exhibit, and the interest felt in it, were manifested by the assignment to the United States of the great prize of the Emperor William, consisting of a silver epergne of great artistic merit and costly character. Numerous medals of gold, silver, and bronze, and diplomas of honorable mention, were also issued to American exhibitors.

The number of such medals would doubtless have been much greater but for the fact that most of the articles exhibited had been purchased at the expense of the Government appropriation, and being the property of the United States could not enter into the special competition. Such firms and individuals as presented what they had to show to the United States for the purpose in question secured a large number of prizes; and many more would have been obtained had the numbers of such liberally disposed parties been greater.

As mentioned in a previous paragraph, the collections were shipped by way of Bremen to the United States, and, as already explained, came free of ocean or railway charges from Bremen to Washington. The remission of freight charges represented a contribution of many thousands of dollars; and without this the appropriation made by Congress for the purpose in question would have been entirely inadequate. The transfer from Germany of perishable articles, such as the plaster casts, to the United States was, unfortunately, not so satisfactory; many being broken and requiring a considerable amount of time for their restoration.

Much pleasant intercourse was had by the American representatives at Berlin with associates from other countries; and some valuable exchanges of specimens were made, which tend materially to enrich the collections of the National Museum.

Mr. Goode, since his return, has been actively engaged in making up his report, which it is hoped will be ready for presentation to Congress through the State Department at an early day.

C.—INQUIRY INTO THE HISTORY AND STATISTICS OF FOOD FISHES.

7.—FIELD OPERATIONS AT NEWPORT, R. I.

The central station, selected by the Commission for field work during the summer of 1880, was Newport, R. I., a point intermediate between Wood's Holl and Noank, the places which had been occupied in previous years. Quarters for the party were found in different parts of the city, while a wharf and factory building belonging to Mr. John A. Griswold furnished the necessary facilities for boats and for laboratory pur-

poses. The building, erected for the manufacture of bullets, balls, and shot, furnished ample accommodations.

I left Washington with my party on the 8th of July; and in the course of a few days after arrival succeeded, with the assistance of friends in the city, in establishing satisfactory quarters for the season. Professor Verrill arrived on the 22d of July; Mr. Goode joining the party on the 17th, on his return from the fishery exposition at Berlin. As in previous years, the superintendence of the work connected with the marine invertebrates was in charge of Prof. A. E. Verrill, assisted by Mr. J. H. Emerton as artist, and Messrs. Sanderson Smith, B. F. Coons, and E. A. Andrews. Mr. Richard Rathbun, a member of the National Museum, was also a helper in the general work; while the fishes were specially cared for by Messrs. H. L. Osborn and Frederick Gardiner.

The Census branch of the Fish Commission also had its headquarters for the summer at Newport; the work being carried on; under the general direction of Mr. Goode, by Mr. Charles W. Smiley and a corps of assistants. Mr. T. B. Ferguson, Assistant Fish Commissioner, also had his headquarters at Newport. The various offices and laboratories, although widely separated in the city, were practically together in one establishment by means of connecting telephones.

The sea service of the Commission was performed by the Fish Hawk, which reached Newport on the 2d of August, and was fairly at work about the 7th. Mr. Griswold's wharf not being suitable, a permanent berth was obtained at the city wharf. Numerous trips were made during the season on the Fish Hawk, in the course of which all the region within 20 or 30 miles, including that about Block Island, was carefully examined.

Towards the close of the season several trips were made in the Fish Hawk to the edge of the Gulf Stream, and an extraordinary amount of animal life of a very varied fauna, differing from what was previously known on the American coast, was brought to light. The first of these trips was made in the end of September, and the second in the beginning of October; the vessel starting out in an afternoon, running all night, and reaching the ground in the morning; then spending the day, and returning to Newport the next night.

Vast numbers of species new to science were secured. Of mollusca alone, out of one hundred and seventy-five species collected, forty proved to be new to science. Twenty new species of deep-sea fishes were obtained.

The most important observations of the season in this off-shore region were those made upon the tile-fish, to which reference has been made in a previous report. The range of this valuable fish was greatly extended, and its existence in immense numbers satisfactorily determined.

For the purpose of investigating the tile-fish and its grounds from a fisherman's point of view, a Noank fishing-schooner was chartered and sent out with instructions to ascertain how readily the fish could be

secured by means of the trawl line. Owing, however, to a threatening storm the vessel did not remain long enough to do much work, its principal capture being a huge sword-fish, weighing some 700 pounds, taken on a small hook at a depth of 100 fathoms.

On the 7th October the Fish Hawk took on board the apparatus and collections, and returned to Washington; stopping at New Haven long enough to leave the specimens for Professor Verrill, and at Wilmington, Del., for some repairs and apparatus. Before entering Chesapeake Bay a trip was made to the edge of the Gulf Stream, and additional collections of much interest were secured.

My own departure from Newport, *en route* for Washington, took place on the 8th October.

8.—THE STEAMER FISH HAWK.

Reference was made in the report of 1879 to the appropriation by Congress for the construction of a fish-hatching vessel according to the plans prepared by Mr. C. W. Copeland, the naval architect of the Light-House Board. This vessel, a full and detailed description of which will be given in the report for 1881, was completed in the early part of 1880, but too late to be employed at once for her special object—the hatching of shad. She was built, as stated, by Messrs. Pusey and Jones, of Wilmington, and when completed was registered at 484 tons of displacement. Her outfit included all the apparatus necessary, not only for the hatching of fish, but also for scientific research generally, including a hoisting engine of great capacity and a full equipment of dredges, trawls, deep-sea thermometers, etc.

After a successful trial trip, and a subsequent completing of her equipment, she reached Newport on the 7th August, and was shortly after constantly occupied in the explorations referred to on another page.

Three trips were made to the edge of the Gulf Stream south of Newport, as was also a fourth made off Delaware Bay. The vessel arrived at Washington on the 20th November, and on the 4th December went to St. Jerome's Creek, at the mouth of the Potomac River, to procure some oysters for the ponds of the Oyster Park. In returning to Washington she encountered ice in the Potomac River at Quantico, and was obliged to retrace her path and proceed to Norfolk for repairs, where she remained all winter.

The experience of the season proved the vessel to be very effective and well adapted to her work. It was, however, thought better to lengthen her a few feet, so as to obtain a larger fish-hatching surface, and an application was accordingly made to Congress for an appropriation to carry this into effect.

During the trip of the Fish Hawk to the Gulf Stream the great utility of a specially constructed vessel and of her apparatus for dredging was fully tested. Her usefulness for investigation, when not engaged in fish-hatching, will doubtless equal expectations.

9.—FISHERY CENSUS OF 1880.

In the report for 1879 an account was given of the arrangements entered into with General Francis A. Walker, Superintendent of the Tenth Census, for procuring an exhaustive review of the fish and fisheries of the United States. The plan of investigation which was there given in full has been steadily pursued, and a large amount of material accumulated.

Although Mr. Goode, who is in charge of this investigation, was very largely preoccupied, from February until July, by the preparation for the Berlin Exhibition and by his absence in Germany, the field-work was nevertheless continuously prosecuted by the various special agents, so that by October 1st the Great Lake region, the Gulf of Mexico, and the Pacific coast had been substantially completed. The work on the Atlantic coast had proved so much greater than anticipated that Messrs. R. E. Earll and Capt. J. W. Collins were obliged to prolong their field labors and to hurry over the latter part of their work more than they would have preferred to do.

Upon the return of Mr. Goode to Washington from Berlin he directed this investigation from Newport, as has already been intimated. Early in October his headquarters were moved to Washington, and the work of writing up the final report was energetically entered upon, several of the assistants reporting at Washington for this work as fast as their field duties were completed, and others compiling their data at such places as were most convenient to them.

Mr. Ludwig Kümlein being obliged by his business engagements to withdraw from the work, his notes were placed in the hands of F. W. True for compilation.

In addition to and co-ordinate with the field work, an extended line of inquiry had been pursued by means of circulars and lists of questions. A very large number of replies to these having been accumulated, those of one single inquiry numbering over 30,000, the work of arranging and compiling them was assigned to Mr. Charles W. Smiley, who, with several assistants, had had the entire charge of their issue. A force of from twenty to thirty clerks was detailed to his assistance from the Census Office by General Walker.

By the close of the year the reports on several subjects had been completed ready for the press, and many others were in a satisfactory state of advancement.

D.—THE PROPAGATION OF FOOD-FISHES.

10.—WORK ACCOMPLISHED IN 1880.

White-fish (*Coregonus albus*).

Northville Station.—For several years past the United States Fish Commission has ordered from Mr. Frank N. Clark, of Northville, sup-

plies of eggs of the white-fish of the lakes, to meet requests from the State fish commissioners of California, Nevada, and other States, as also from Europe, Australia, and New Zealand.

The growing scarcity of white-fish in the Great Lakes, and the requests by prominent Congressmen that the United States should assist the fish commissioners of the Lake States in their work, induced me to secure all the facilities of the Northville Station, and to place Mr. Frank N. Clark in charge of it. This took place in August, 1880. A number of improvements were made in the works, in order to render the station commensurate with the proposed scale of operations. The stock of brook trout and of California mountain trout belonging to Mr. Clark was also secured, and arrangements made for their propagation.

One important feature of the Northville Station consists in a large supply of excellent spring water, quite sufficient to meet any expected demand. The temperature of the principal spring at its source is 47° Fahr., which represents far too great a degree of cold for many species of fish, but permits the proper temperature to be attained by a certain amount of exposure to the air.

Active operations were commenced in September by a visit to certain islands in Lake Erie for the purpose of arranging with the fishermen for the privilege of taking white-fish eggs from their pounds. This was also done at Alpena, Mich.

Endeavors to obtain eggs of the lake trout were considerably thwarted by the prejudice of the fishermen against this fish, claiming, as they do, that it is very destructive to the white-fish. This, however, in the opinion of Mr. Clark, is not well founded.

The actual catching of spawning white-fish commenced in the early part of November and continued for about three weeks on Lake Erie, and nearly the same length of time at Alpena.

The total number of eggs deposited in hatching boxes at Northville amounted to nearly 14,000,000, and the best of the lots taken yielded 95 per cent. of young fish.

Many interesting experiments were made by Mr. Clark in the course of his work, having special reference to the accelerating and retarding of the hatching of the eggs, whether by heat or by cold. These, with other details of the work, will be found in Mr. Clark's report in the appendix.

Of the total number of eggs taken, a little over 3,000,000 embryonized eggs were shipped to distant points; the remainder were held in the hatchery until their development, and were distributed by Mr. Clark, acting in behalf of the Commission, to the various lake waters within easy reach.

Special acknowledgments are due to the Flint and Père Marquette Railroad Company, the Michigan Central Railroad Company, the Lake Shore and Michigan Southern, and the Chicago and Northwestern, for gratuitous aid in moving the fish and their messengers.

Mr. Clark's report, in addition to the points already referred to, contains some important observations by Professor Forbes, of Normal, Ill., in regard to the food of the white-fish.

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

The McCloud River Station.—The work of the Commission at this station continues, under the direction of Mr. Livingston Stone, to be entirely satisfactory. With an almost unlimited capacity for production, no more eggs are taken than are called for by the requisitions from State commissioners of fisheries; including, of course, the two million or more annually hatched out at the station to be returned into the river to maintain the supply in the Sacramento.

It is well understood that the remarkable continuance of the abundance of the Sacramento salmon is due entirely to the work of the Fish Commission in stocking the waters artificially, and thus making good the enormous drain caused by the canneries.

Mr. Stone, in accordance with his custom, came east in the autumn of 1879; and as the season for active work approached returned to California, reaching the McCloud River on the 22d June. The water of the river was unusually cold for the season, showing a temperature of only 53°.

Mr. Stone pays a tribute of acknowledgment to the industry and fidelity of the Indians living on the reservation; no class of men, perhaps, being better able to render the service required.

A considerable amount of work was necessary to make perfectly safe roadways between the different parts of the station, the narrow mule-paths winding along the edge of steep precipices rendering locomotion extremely dangerous.

All these difficulties were finally surmounted, and on the 20th August the first ripe female salmon was taken. It was not, however, until the 31st August that the eggs were taken in any quantity; but from that date until the night of the 14th September, by which time 6,000,000 had been secured, the work was carried on uninterruptedly. After an interval of a few days the spawning was again resumed and 1,000,000 more eggs secured.

The work of taking the eggs of the salmon was interrupted by the arrival of parties to put up the telephone, which proved to be of very great service in facilitating work. The Indians were specially interested, and took great delight in talking to each other by means of it. Their poetical name for the apparatus was "Talking Spirit."

On the 1st October the work of packing and crating the eggs was begun, and in the course of three or four days 3,800,000 were packed, occupying 76 boxes and 38 crates. These were taken in wagons to Redding, Cal., and thence in a refrigerator car bound for the East. The car itself left on the 4th October, and arrived in the usual time at Chicago, where it was turned over to Mr. Ellis, who had been sent out to

that point to take charge of the eggs and distribute them to their destination.

As usual, applications for the eggs had been received from many of the State fish commissioners and from private individuals in the United States. These were supplied as far as possible, and \$10,000 were hatched at the stations of the United States Fish Commission. The principal foreign distributions consisted of 50,000 to Canada, 100,000 to France, 380,000 to Germany, and 200,000 to Holland.

Full details of the work done at the McCloud River station, with tables of the temperature of the water, the number of fish of different sexes taken from time to time, etc., will be found in the appended report of Mr. Stone.

The Rainbow, or California Mountain Trout (*Salmo irideus*).

The Crooks Creek Station.—As stated in previous reports, Mr. Stone's proposition to add the culture of California trout, *Salmo irideus*, to that of California salmon, on the McCloud River, was accepted, for which work suitable establishments and appliances were constructed about 5 miles above the salmon station.

No eggs were taken in 1879 at this new station, but between January 12 and May 26 of 1880 about 388,000 eggs were secured and properly treated for transportation. Of this number 261,000 were sent, for the most part, to the Eastern States and about 70,000 were hatched out and planted in the McCloud River for the purpose of keeping up the supply.

As soon as these operations were completed, sundry improvements to the establishment were made in the way of constructing stables, sheds, etc. The most important addition to the station was the connection made by telephone between it and the trout ponds, thus affording a ready means of communication between the two.

Later in the summer many trout were caught and put in the ponds. The latest advices for the year from Mr. Stone announce that the accommodations at the station are very commodious, the hatching house having a capacity of several millions of eggs, and that the breeding ponds are large and convenient and now contain more than 2,000 breeding trout. These, it is hoped, will furnish a large supply of eggs in the future. The maintenance of these fish in the ponds throughout the year requires a considerable outlay of money for food, superintendence, etc.

In summer the food of these trout consists of boiled refuse salmon, and in the winter of venison, and occasionally a steer. The trout now in the ponds will eat a whole deer at two feeds.

Mr. Stone reports that the males have milt in them at two years of age, and that the females spawn during their third year. These periods are about one year in advance of the same operations in the case of the *Salmo fontinalis*.

Herewith appended is Mr. Stone's report, which will be found to contain some interesting details.

The Atlantic or Penobscot Salmon (*Salmo salar*).

The Penobscot River Station.—The intermission of collecting eggs of the Penobscot salmon at Bucksport, Me., and producing young fish for distribution to the various rivers of the United States, has already been adverted to, and also the fact that the final success of the first experiment induced its renewal during the season of 1880.

The established method of buying living fish from the fishermen, and of transferring them to an inland pond for preservation until the spawning season, was continued, 522 fish having been purchased—the first on June 10, the last on July 2. The aggregate weight was 6,787 pounds, or an average of about 13 pounds to each fish.

The spawning commenced on the 25th October and ended on the 10th November.

The total number of eggs taken amounted to 2,000,000.

As before, the expenses of the work were met by the United States in conjunction with the States of Maine, New Hampshire, and Massachusetts, the larger part of the funds being supplied by the United States, which, of course, received the largest proportion of eggs, its allotment amounting to about 1,250,000.

These were divided as stated in the appendix to Mr. Atkins's report, and will, it is hoped, produce a marked effect upon the salmon supply in our various rivers.

As heretofore, the work of the station was under the direction of Mr. Charles G. Atkins, with Mr. H. H. Buck as foreman.

Schoodic, or Land-locked Salmon (*Salmo salar*, subs. *sebago*).

Grand Lake Stream Station.—The work of collecting this fish and treating and distributing the eggs, as with the Atlantic salmon, continues in charge of Mr. Charles G. Atkins, with Mr. H. H. Buck as assistant.

The results of the season's work proved to be more successful than those of any previous year. A total of over 2,000 fish was taken, yielding nearly two and a half millions of eggs, or an average of 1,630 each. The capture of spawning fish commenced in the early part of November. Fuller details will be found in Mr. Atkins's report.

The demand for the eggs of the land-locked salmon continues to be very great, and a much larger number than we are likely to obtain for years to come could easily be disposed of.

Shad (*Alosa sapidissima*).

During the season of 1880 the stations operated were two in number, and located, respectively, at Havre de Grace, Md., and at the Washington navy-yard. The number of fish hatched at these stations and successfully planted was 29,296,000. Of these 11,578,000 were transplanted to other waters, 9,855,000 were returned to the Potomac River, and 7,863,000 were returned to the Susquehanna River. The details of this distribution will be found in the table appended to this report, and

more fully in Appendix G, Article XXV, p. 553. This production of nearly 30,000,000 shad is a very gratifying increase of some 14,000,000 over 1879.

The Albemarle Sound Station, operated last year, was not continued. The field, however, was well occupied by the North Carolina State commission. The work on the Potomac River, instead of being scattered at various stations, was concentrated at the navy-yard—an arrangement which became possible through the courtesy of the Commandant of the Yard and of the Chief of the Bureau of Yards and Docks.

Havre de Grace Station.—This station, at Spesutie Narrows, on the Susquehanna River, was operated conjointly with the Maryland commission, and under the direction of T. B. Ferguson, Maryland commissioner, who placed in charge of the entire work Mr. John S. Saunders, who had been employed the previous year at the Albemarle Sound Station.

On the 29th of April two barges, containing the machinery and quarters for the men, were taken from Baltimore to the Narrows. The taking of eggs commenced on the third of May and continued until the tenth of June, at which time the fishing ceased, in accordance with the Maryland laws. During that period 13,355,000 eggs were secured. These were obtained by means of the co-operation of the fishermen, who allowed their fish to be stripped before being taken to market.

The use of the floating apparatus made it possible, and very advantageous, about the 30th of May, to move the station to a point about five miles above where the barges were first moored. This was made necessary by the apparent change in the movements of the fish, due perhaps to an influx of salt or brackish water, which a continued prevalence of southerly winds forced up the river.

The price paid the fishermen for the privilege of removing the eggs from the shad was slightly reduced from that paid in previous years; and yet, as the production was more than twenty per cent greater than in 1879, there was a material gain to the fishermen.

On the 12th of June an accident occurred, the barges being driven from their moorings by a severe storm of wind and rain. This caused a premature deposit of some 800,000 or 900,000 fish and eggs in the river, and delayed a proposed car-shipment of a million of shad to the Penobscot and Kennebec Rivers, in Maine.

A few days later, however, the number was made up by assistance from the Washington station, and the car was moved, by the courtesy of the Philadelphia, Wilmington and Baltimore Railroad Company and the connecting lines, to Bangor, where Mr. Stilwell, a commissioner of that State, took charge of the depositing of the fish. Another car-load of eggs was successfully transferred to the Nanticoke River, and 1,000,000 young fish were deposited near Seaford, Del. A half a million of eggs were delivered to J. P. Creveling, a commissioner of Pennsylvania, which were deposited by him in the upper waters of the Susquehanna River.

At the close of the season a part of the equipment was moved to Baltimore and a part was taken to Tangier Sound to be used in experiments with reference to oyster propagation, while two barges were left at the station to be used the following year.

Washington Navy-Yard Station.—A station was organized this year for the first time at this point, by permission of the commandant of the yard, with a view to bringing the eggs from the various points at which they were taken upon the river to a common rendezvous, for hatching. Accordingly the steamer Lookout was placed in service for communicating between the fishing grounds and the station. Mr. Frank N. Clark, of Northville, Mich., was placed in charge of the station, not only for the purpose of conducting the hatching operations, but also for making certain experiments in connection with this service. Messrs. W. P. Sauerhoff and William Hamlen took charge of the collection of the eggs.

The season opened on May 4, at which date 650,000 eggs were secured from 400 shad, at Captain Skidmore's fishery, Moxley's Point. Four days later, these, having been successfully hatched, were deposited in the Potomac. On the 9th of May additional shad-eggs were obtained, and also 1,220,000 herring-eggs from the same fishing-shore. More than one million of these herring were hatched and returned to the river. Later, 180,000 herring were hatched and deposited at Cumberland, Md. Shad-eggs continued to be taken nearly daily until the close of the season, June 27. The total number of shad handled was 11,790, from which 20,749,000 eggs were obtained, and 18,550,000 fish hatched. Of these, 14,350,000 were returned to the Potomac, and 4,200,000 were taken to other waters.

On the 23d of May, Superintendent Wilkins provided a baggage-car, which was loaded with two million shad, which were deposited in rivers of South Carolina and Georgia. On June 16, a car was again sent to Kentucky with 700,000 young fish, which Dr. Griffith, a commissioner of that State, deposited in suitable waters.

Transportation of shad.—The policy of distribution was changed. During previous years deposits of a few hundred thousand each were made in as many different streams as possible. This year fewer streams were stocked, but with much larger installments of fish. The success in shipping by car-loads was very gratifying, and leads the Commission to anticipate the almost exclusive use of this method hereafter. This has been rendered possible by the increased production of young fish, whereby a million of fish can be accumulated in time to forward them in one shipment before the yelk-sacs have been absorbed.

Several things, however, are very essential for a car suitable to transport the fish. Among these may be named, first, arrangements for keeping a constant temperature; second, capacity for storing special carrying vessels; third, arrangements for changing the water and aeration; fourth, comfortable accommodations for the messengers, so that they may

be constantly at their post of duty. A car can be specially constructed to supply these facilities, and thus greatly enhance the power of the Commission for moving young fish to remote waters.

Experiments.—In order to determine the feasibility of hatching shad in hydrant water a series of cones, forty-six in number, were set up at the navy-yard, and were in constant use during the season. The water was supplied from a hydrant, and the eggs as they arrived by the Lookout were placed therein. The experiment proved entirely successful, the loss being scarcely appreciable. Experiments were also conducted for determining the smallest amount of water in which young shad could be kept, as it is often found necessary to economize water during their transportation. Mr. Clark found that less than one-fourth of the usual amount of water would answer, if suitable facilities for aeration were provided.

The Carp (*Cyprinus carpio*).

Ponds in Washington.—The report of the Commissioner for 1879 gives an account of the gradual increase in efficiency in the carp ponds in Washington, the production of a considerable number of fish, and their distribution to different parts of the United States.

Various improvements in grading and leveling have had their effect. For the purpose of draining the ponds more readily, or transferring the water from one point to another, a very efficient rotary steam pump, worked by a coil boiler, was constructed by the Herreshoff Manufacturing Company, at Bristol, R. I. It is mounted on four wheels, weighs but little over a ton, and can be readily drawn by hand to any desired point. It is capable of elevating and discharging a stream of water amounting to 1,400 gallons per minute. It was put to use in the early part of May, and has been efficiently employed at various times during the year.

The connection of the ponds with the city telephone system has placed the office of the Commission in close communication with the superintendent, and greatly aided in carrying on operations at that station.

An appropriation of \$5,000 was made by Congress in December, 1877, for the improvement of these ponds, and another of \$2,200 in the spring of 1878. The District Commissioners kindly agreeing to take charge of the work, Lieutenant Hoxie prepared the plans.

A contract was made, and the first work done was the construction of a dam across the outlet of the large space between the present ponds and the river, thus converting this into a close reservoir. Advantage was taken of a very low tide to close the narrow outlet, kept open until the last moment, and after the water had all run out.

The pond, however, soon filled up to a considerable degree with rain-water, of much better quality than that which formerly backed into the pond from the mouth of the sewer.

Several drains were laid in various parts of the grounds under the

direction of the water registrar. It is hoped that the work may be entirely completed during the coming year.

For the purpose of assorting the fish and removing such as were not of an eligible quality, the different ponds were drained successively, the easternmost one being emptied on the 24th April. In addition to about 100 carp, some weighing from eight to ten pounds, and a few tench and golden ides, a large number of mud-shad (*Dorosoma*), cat-fish, and sun-fish were obtained; these, in all probability, having been introduced through the water-pipes.

The subsidiary pond at the Arsenal was drained on the 23d October, and a large number of carp obtained for distribution.

The south pond was drained on the 8th November.

The details of distribution of the carp will be found in another part of the report. In many cases the fish commissioners of the different States came to Washington to receive their supply; among others, Mr. B. F. Shaw, of Iowa, on the 27th May. An entire car-load was shipped to the fish commissioner of Missouri, at Saint Louis, on June 1st, and another, on the 25th October, to the commissioners of Wisconsin.

Säibling (*Salmo salvelinus*).

As a return for the service rendered by the United States to the *Deutsche Fischerei-Verein* in the transmission of eggs of the California salmon and the California trout, Herr von Behr, president of the *Verein*, forwarded from Bremen 100,000 eggs of the säibling (*salmo salvelinus*) by the steamship Neckar of the North German Lloyd line, reaching New York on the 1st February, 1880. Only about 6,000 of them survived.

At the suggestion of Mr. Livingston Stone they were sent to Mr. W. L. Gilbert, of Plymouth, Mass., to be hatched out. A brief note upon them, will be found in Volume I of the Fish Commission Bulletin.

The Gourami (*Osphromenus olfax*).

In previous reports of the United States Fish Commission mention has been made of the gourami (*Osphromenus olfax*) (see Part II, page lxxvii) as a most desirable species of fish for introduction into the warmer portions of the United States.

This fish belongs to the family of Labyrinthoids, and, like other allied species, is able to endure deprivation of water for a considerable time, the peculiar arrangement of the gills holding the water like a sponge and remaining moist a long time.

Its characteristics, as already explained, are extreme excellence of flesh, large size, and herbivorous character, although well provided with teeth by which it is enabled to cut and feed upon vegetables.

It is also one of the nest-bearing species, the male preparing a depository, weaving together water plants and grasses, for a receptacle in which the female lays her eggs. These eggs, as well as the young when hatched, are sedulously protected by the male until the latter are able

to shift for themselves, in this respect resembling the black bass. On this account the increase of this fish is assured even under unfavorable circumstances.

The gourami thrives best in warm waters; indeed, its introduction into ponds or rivers the surface of which is likely to be frozen over is not considered desirable. A moderate degree of cold, however, can be resisted if the bottom of the receptacle be muddy so that the fish can bury themselves in the same manner as the carp.

The gourami is a native of Cochin China, and has been transferred, among other localities, to portions of the East Indian regions, to the Mauritius, and to Guiana. They can be kept in very limited inclosures, and indeed are very often reared in tubs, where they are fed with vegetable food of any description.

The *Société d'Acclimatation* of Paris has succeeded in bringing in a few of these fish into France; but, for some reason or other, they do not appear to thrive, and it is not certain that the experiment will succeed in any part of the United States. The value of the fish, however, is so great as to warrant a special effort on the part of the Commission. On this account application was made to the *Société d'Acclimatation* for any suggestions as to the best mode of obtaining a supply and transmitting them to the United States; and the secretary, M. Raveret-Wattel, very kindly undertook to write to the agent of the society at Saigon, the capital of Cochin China, and have a small number sent by way of Hong-Kong to San Francisco.

On the application of Mr. B. B. Redding, the able Fish Commissioner of California, Mr. Stubbs, the agent of the O. and O. S. S. Company, plying between San Francisco and China, agreed to instruct Mr. Charles H. Hazwell, jr., the agent of the company at Hong-Kong, to receive and forward any fish that might be sent to him for the purpose. It is hoped, therefore, that at the proper time some of these fish may be safely landed in San Francisco, where they will be taken in charge by Mr. Redding and probably introduced into a lake of warm water, near San Gabriel, Los Angeles County, abounding in vegetation and possessing all the other characteristics necessary for a successful experiment.

E.—ABSTRACT OF CONTENTS OF THE APPENDIX.

11.—ANALYSIS.

The appendix to the present volume will be found to include a number of formal reports of the Commission in reference to different branches of operations too detailed in their character to be presented in the present general statement of work attempted and accomplished. It also contains translations, for the most part, of treatises published abroad in regard to the general fisheries and to fish and oyster culture, having direct relationship to the work in the United States, and furnishing important hints for action on our part.

A brief notice of some of these articles may not be inexpedient. They are arranged under certain heads, as follows :

A.—GENERAL CONSIDERATIONS.

This includes a statement of the proposed plan of the joint inquiry of the United States Fish Commission and the Census of 1880 into the fisheries of the United States: also an account, by Mr. Goode, of the work accomplished during the first ten years of the United States Fish Commission.

B.—DEEP-SEA RESEARCH.

In this Professor Verrill gives an account of the apparatus used by the United States Fish Commission in dredging off the coast of New England.

C.—THE SEA FISHERIES.

In this appendix are given articles upon the Icelandic, Swedish, and Norwegian fisheries in general, and upon the methods and results of certain special fisheries, such as the spring herring, sardine, and the capelin.

It also has a paper by Mr. N. P. Scudder on the halibut fishery in Davis's Strait. This gentleman was sent by the Commission in 1878, on a Gloucester halibut schooner, for the purpose of gaining information on the subject.

D.—ECONOMIC RESEARCH.

A very important communication by Prof. W. O. Atwater is here presented of an investigation into the chemical composition and economic values of the fish and invertebrates used for food. This work was initiated at the expense of the United States Fish Commission, and will be continued in the future.

E.—NATURAL HISTORY.

Mr. Goode presents an account of what is known of the various species of sword-fish in general, especially of the three belonging to the coast of the United States. Mr. R. E. Earll, of the United States Fish Commission, gives an account of his observations in regard to the hatching of Spanish mackerel in Chesapeake Bay.

An elaborate contribution to the biology of the Rhine salmon, by Mr. Rüsçh, is included in this appendix.

F.—PROPAGATION OF FOOD-FISHES.

A report by Mr. Raveret-Wattel, secretary of the *Société d'Acolimata-tion*, of Paris, upon the condition of fish-culture in foreign countries, especially as represented at the Berlin Fishery Exhibition, will be found to contain many interesting statements on the subject. A paper by Mr. J. P. J. Koltz,* translated from the French, reproduces one of the earliest

* The second edition of 1859.

systematic treatises on fish-culture published in Europe. Among other special points it contains an account of the methods of hatching fish by means of floating boxes similar in general principle to the shad-hatching box of Mr. Seth Green.

G.—SPECIAL FISH-CULTURE.

This contains a series of reports of the specialists of the United States Fish Commission on their work during the season. Mr. Frank N. Clark, upon the white-fish; Mr. Livingston Stone, upon the salmon and rainbow trout; Mr. Atkins, on the Penobscot and Schoodic salmon; on the propagation and distribution of shad. Also an article by Max von dem Borne, upon the carp.

H.—THE OYSTER.

This represents perhaps the most important portion of the appendix, containing, as it does, a reproduction of all the principal French and German treatises on the theory and practice of the artificial culture of the oyster. This is a subject to which the attention of the Fish Commission has lately been attracted, and which it hopes to develop as it has many other divisions of its work. By showing the present state of our knowledge on the subject in foreign countries, we shall be better able to take it up afresh in our own country. The principal papers in this appendix are by Professor Möbius, of Germany, and by Messrs. Coste, de Bon, Bouchou-Brandely, Renaud, and Hausser, of France, together with a report of the work done in the Netherlands in regard to the oyster and its cultivation.

J.—MISCELLANEOUS.

The appendix closes with a list of patents issued in the United States during 1879 and 1880, by Dr. Robert G. Dyrenforth, examiner-in-chief of the United States Patent Office.

12.—TABLES OF THE DISTRIBUTION OF FISH AND EGGS.

In the following tables, numbered I to VIII, and which have been prepared by Mr. Charles W. Smiley, will be found the condensed record of the distribution of white-fish, California salmon, California trout, Penobscot salmon, Schoodic salmon, shad, and carp. Fuller details will be found in various papers of the appendix: In XX, Mr. Clark's account of white-fish operations; in XXI, Mr. Stone's account of California salmon operations; in XXII, Mr. Stone's account of California trout operations; in XXIII, Mr. Atkins' account of Penobscot salmon operations; in XXIV, Mr. Atkins' account of Schoodic salmon operations; in XXV, the account of shad operations.

TABLE I.—Distribution of white-fish eggs by the United States Fish Commission during season of 1880.

| States. | Destination. | Number of eggs. |
|--------------------|------------------------------------------|-----------------|
| California | B. B. Redding, San Francisco | 500,000 |
| Iowa | B. F. Shaw, Anamosa | 500,000 |
| Kentucky | William Griffith, Louisville | 500,000 |
| Maine | E. M. Stillwell, Bangor | 1,000,000 |
| Minnesota | R. O. Sweeny, Saint Louis | 250,000 |
| Nevada | Mrs. H. C. Fenstermaker, Eureka | 25,000 |
| New Jersey | Fred. Mather, Newark | 250,000 |
| Pennsylvania | S. Weeks (for H. B. Wright), Corry | 100,000 |
| | | 3,125,000 |

TABLE II.—Distribution of California salmon eggs by the United States Fish Commission during season of 1880.

| States. | Destination. | Number of eggs. |
|----------------------|-----------------------------------------------------------------------------------------------------------------|-----------------|
| Illinois | Geneva Lake | 100,000 |
| Kansas | D. B. Long, Ellsworth | 100,000 |
| Maryland | Oakland, Garrett County | 200,000 |
| Do | Druid Hill Park, Baltimore | 200,000 |
| Missouri | Silas Woodson, Saint Joseph | 200,000 |
| Do | J. E. Humes, Versailles, Morgan County | 10,000 |
| Minnesota | R. O. Sweeny, Saint Paul | 200,000 |
| Nebraska | Nebraska Fish Commission, South Bend, Cass County | 400,000 |
| New Jersey | James Annin, jr., Caledonia, N. Y. | 300,000 |
| North Carolina | S. G. Worth, Morgantown, N. C. | 200,000 |
| South Carolina | do | 200,000 |
| West Virginia | C. S. White, Romney, care agent Green Spring Run | 150,000 |
| | FOREIGN. | |
| Canada | S. Wilnot, Newcastle, Ontario | 50,000 |
| France | Fred. Mather, for Raveret-Wattel, <i>Société d'Acclimatation</i> , Paris | 100,000 |
| Germany | Fred. Mather, for Von Behr, <i>Deutsche Fischer-Verein</i> , Berlin | 300,000 |
| Do | Fred. Mather, for F. Busse, hatching ponds, Bremen | 50,000 |
| Do | Fred. Mather, for Carl Schuster, hatching ponds, Freiburg | 30,000 |
| Holland | Fred. Mather, for Von Pestel, Government of the Netherlands, in charge of Zoological Society of Amsterdam | 100,000 |
| Do | Fred. Mather, for C. J. Botteman, hatching ponds, Bergen-op-Zoom | 100,000 |
| United States | William P. Sauerhoff, for Upper Potomac River | 810,000 |
| | | 3,800,000 |

TABLE III.—Distribution of California trout eggs by the United States Fish Commission during season of 1880.

| States. | Destination. | Number of eggs. |
|---------------------|------------------------------------------------------------------|-----------------|
| California | R. Klotz, Shasta County | 10,000 |
| Illinois | N. K. Fairbanks, Chicago | 2,500 |
| Iowa | B. F. Shaw, Anamosa | 3,500 |
| Maryland | T. B. Ferguson, Baltimore | 175,000 |
| Michigan | M. Motcalf, Battle Creek | 1,500 |
| Do | J. G. Portman, Pokagon | 2,500 |
| Do | F. N. Clark, Michigan | 2,500 |
| Minnesota | R. O. Sweeny, Saint Paul | 2,500 |
| Missouri | J. G. M. Steedman, Saint Louis | 30,000 |
| New Hampshire | S. Webber | 2,500 |
| Ohio | Hon. E. D. Potter, Toledo | 4,000 |
| Pennsylvania | Soth Weeks, Corry | 4,000 |
| West Virginia | C. S. White, Green Spring River, Baltimore & Ohio Railroad | 10,000 |
| Wisconsin | W. Welsher | 2,500 |
| | | 262,000 |

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TABLE IV.—Distribution of Penobscot salmon eggs by the United States Fish Commission during the season of 1880.

| States. | Number of lots. | Streams stocked. | Number of fish. |
|----------------------|-----------------|------------------------------------------------------------------------------------|-----------------|
| Connecticut | 6 | Connecticut River | 245,631 |
| Maine | 25 | Penobscot, Saco, Kennebec, Androscoggin, Machias, Donny's, and Presumpscot Rivers. | 529,356 |
| Maryland | 7 | Octorara and Elk Rivers, Great Northeast Creek and Potomac. | 123,432 |
| Massachusetts | 1 | Merrimac River | 48,000 |
| Minnesota | 6 | Saint-Croix, Cannon, and Mississippi Rivers, and Prior Lake | 60,000 |
| New Hampshire | 2 | Merrimac River | 395,000 |
| New Jersey | 5 | Delaware River | 128,043 |
| North Carolina | 3 | Catawba River | 11,000 |
| Pennsylvania | 4 | Susquehanna River | 99,335 |
| Wisconsin | 1 | Illinois River | 1,000 |
| | 60 | | 1,641,397 |

TABLE V.—Distribution of Schoodic salmon eggs by the United States Fish Commission during the season of 1880.

| States. | Number of lots. | Destination. | Number of fish. |
|----------------------|-----------------|--------------------------------------------------------------------|-----------------|
| California | 1 | B. B. Redding, San Francisco, Cal | 25,000 |
| Colorado | 2 | W. E. Sisty, Denver, Colo., and Thos. Morrison, Morrison, Colo. | 15,000 |
| Connecticut | 5 | H. J. Fenton, Windsor, Conn., and Geo. Jelffe, Westport, Conn. | 496,500 |
| Iowa | 1 | B. F. Shaw, Anamosa, Iowa | 25,000 |
| Kansas | 1 | D. B. Long, Ellsworth, Kans | 25,000 |
| Kentucky | 1 | Wm. Griffith, Louisville, Ky | 25,000 |
| Maine | 2 | F. C. Hewey, Phillips, Me., and E. M. Stillwell, Bangor, Me. : | 64,000 |
| Maryland | 2 | T. Hughlett, Druid Hill Hatchery, Baltimore, Md | 55,000 |
| Massachusetts | 3 | E. A. Brackett, Winchester, Mass | 310,000 |
| Michigan | 2 | J. G. Portman, Pokagon, Mich., and M. Metcalf, Battle Creek, Mich. | 85,000 |
| Minnesota | 1 | R. O. Sweeny, Saint Paul, Minn | 25,000 |
| Mississippi | 1 | C. A. Johnston, Columbia, Miss | 2,000 |
| Missouri | 1 | Silas Woodson, Saint Joseph, Mo | 10,000 |
| Nevada | 1 | H. G. Parker, Carson City, Nev | 10,000 |
| New Hampshire | 2 | A. H. Powers, Plymouth, N. H | 124,000 |
| New Jersey | 2 | E. J. Anderson, Trenton, N. J., and P. H. Christie, Verbank, N. Y. | 30,000 |
| New York | 1 | E. G. Blackford, Fulton Market, New York | 25,000 |
| North Carolina | 3 | H. H. Cary, Atlanta, Ga., and S. G. Worth, Morganton, N. C. | 35,000 |
| Ohio | 1 | L. Leppelman, Fremont, Ohio | 5,000 |
| Pennsylvania | 2 | Seth Weeks, Corry, Pa., and James Duffy, Marietta, Pa. : | 30,000 |
| Rhode Island | 1 | H. W. Mowry, Oak Lawn, R. I. | 5,000 |
| Vermont | 1 | J. M. Haven, Rutland, Vt. | 5,000 |
| Virginia | 1 | Col. M. McDonald, Lexington, Va | 25,000 |
| West Virginia | 1 | H. B. Miller, Wheeling, W. Va | 25,000 |
| Wisconsin | 1 | N. E. Fairbank, Chicago, Ill | 20,000 |
| Canada | 1 | W. H. Barber, Andover, New Brunswick | 50,000 |
| France | 1 | Fred. Mather, 25 Hill street, Newark, N. J | 40,000 |
| | 42 | | 1,641,500 |

TABLE VI.—Distribution of shad from May 7, 1880, to June 27, 1880, by the United States Fish Commission.

| States. | Number of lots. | Streams stocked. | Number of fish. |
|----------------|-----------------|-----------------------------------------------------------------------------------------------------|-----------------|
| California | 1 | Sacramento | 215,000 |
| Delaware | 3 | Christiana Creek, Jones Creek, Nanticoke | 1,350,000 |
| Georgia | 5 | Oconee, Yellow, Chattahoochee, Flint | 1,188,000 |
| Indiana | 1 | Wabash | 200,000 |
| Kentucky | 1 | Salt | 700,000 |
| Maine | 2 | Kennebec, Mattawamkeag | 675,000 |
| Maryland | 30 | Susquehanna | 7,863,000 |
| Do | 34 | Potomac | 9,855,000 |
| Do | 7 | Patuxent | 3,775,000 |
| Do | 3 | Bush, Little Youghiogheny | 485,000 |
| Do | 0 | Experimental purposes | 670,000 |
| Missouri | 8 | Osage, Salt, Chariton, Gasconade, Grand, Platte, 202, Neidaway. | 200,000 |
| Ohio | 1 | Sandusky | 200,000 |
| Pennsylvania | 2 | Susquehanna | 450,000 |
| South Carolina | 9 | Broad, Seneca, Catawba, Wateree, Lynch's Creek, Big Peece, L. Peece. Turned over to Butler & Huske. | 1,310,000 |
| Virginia | 1 | Appomattox | 160,000 |
| | 114 | | 20,296,000 |

TABLE VII.—Distribution of German carp to individuals, from October 28, 1879, to December 31, 1880, by the United States Fish Commission.

[NOTE.—So few of these fish were reared in 1879 that no statement was incorporated in the annual report for that year in reference to their distribution, and is consequently herein included.]

| States. | Number of applicants supplied. | | | Number of different localities into which carp were introduced. | | | Total number of fish sent to the applicants. | | |
|----------------------|--------------------------------|-------|--------|-----------------------------------------------------------------|-------|--------|----------------------------------------------|--------|--------|
| | 1870. | 1880. | Total. | 1870. | 1880. | Total. | 1870. | 1880. | Total. |
| Alabama | 8 | 13 | 21 | 8 | 7 | 15 | 180 | 259 | 439 |
| Arkansas | | 1 | 1 | | 1 | 1 | | 15 | 15 |
| California | 2 | | 2 | | | 2 | 72 | | 72 |
| Colorado | 14 | 11 | 25 | 6 | 7 | 13 | 300 | 134 | 440 |
| Connecticut | | 42 | 42 | | 20 | 29 | | 830 | 830 |
| Dakota | | 1 | 1 | | 1 | 1 | | 50 | 50 |
| Delaware | 4 | 7 | 11 | 4 | 4 | 8 | 100 | 220 | 320 |
| District of Columbia | 2 | 3 | 5 | 1 | 2 | 3 | 70 | 65 | 135 |
| Florida | 1 | | 1 | 1 | | 1 | 77 | | 77 |
| Georgia | 34 | 62 | 96 | 20 | 16 | 36 | 582 | 1,364 | 1,940 |
| Illinois | 2 | 7 | 9 | 1 | 6 | 7 | 40 | 130 | 170 |
| Indiana | 5 | 14 | 19 | 5 | 12 | 17 | 114 | 254 | 368 |
| Iowa | | 2 | 2 | | 2 | 2 | | 20 | 20 |
| Kansas | 1 | 11 | 12 | 1 | 7 | 8 | 16 | 104 | 120 |
| Kentucky | 8 | 105 | 113 | 5 | 51 | 56 | 124 | 2,018 | 2,142 |
| Maine | | 4 | 4 | | 4 | 4 | | 75 | 75 |
| Maryland | 73 | 280 | 353 | 47 | 110 | 168 | 1,734 | 10,228 | 11,992 |
| Massachusetts | | 37 | 37 | | 38 | 38 | | 765 | 765 |
| Michigan | | 3 | 3 | | 8 | 8 | | 128 | 128 |
| Minnesota | | 6 | 6 | | 6 | 6 | | 90 | 90 |
| Mississippi | 7 | 57 | 64 | 5 | 21 | 26 | 170 | 1,308 | 1,479 |
| Missouri | 11 | 23 | 34 | 6 | 14 | 20 | 214 | 330 | 544 |
| Nebraska | | 2 | 2 | | 2 | 2 | | 40 | 40 |
| New Hampshire | | 3 | 3 | | 8 | 8 | | 00 | 00 |
| New Jersey | 2 | 65 | 67 | 2 | 28 | 30 | 80 | 1,235 | 1,315 |
| New York | 18 | 97 | 115 | 13 | 64 | 77 | 390 | 1,707 | 2,097 |
| North Carolina | | 22 | 22 | | 12 | 12 | | 482 | 482 |
| Ohio | 4 | 62 | 66 | 2 | 43 | 45 | 88 | 1,462 | 1,550 |
| Pennsylvania | 6 | 63 | 69 | 5 | 48 | 53 | 144 | 1,081 | 1,175 |
| Rhode Island | 1 | 14 | 15 | 1 | 4 | 5 | 20 | 283 | 303 |
| South Carolina | 10 | | 10 | 11 | | 11 | 386 | | 386 |
| Tennessee | 8 | 72 | 80 | 4 | 33 | 37 | 205 | 1,184 | 1,389 |
| Texas | 80 | 93 | 123 | 19 | 80 | 49 | 776 | 1,868 | 2,644 |
| Vermont | | 7 | 7 | | 6 | 6 | | 120 | 120 |
| Virginia | 11 | 148 | 159 | 10 | 72 | 82 | 185 | 2,692 | 2,877 |
| West Virginia | 2 | 21 | 23 | 2 | 14 | 16 | 70 | 688 | 758 |
| Wisconsin | | 11 | 11 | | 11 | 11 | | 208 | 208 |
| Total | 273 | 1,374 | 1,647 | 181 | 717 | 898 | 6,203 | 31,443 | 37,646 |

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TABLE VIII.—Distribution of German carp to State commissioners and agents for propagation or distribution, and which are not included in the foregoing table.

| State. | 1879. | 1880. | Total. |
|---------------------|-------|--------|--------|
| Alabama..... | | 400 | 400 |
| California..... | 228 | | 228 |
| Colorado..... | | 476 | 476 |
| Delaware..... | 225 | 695 | 920 |
| Illinois..... | | 800 | 800 |
| Kansas..... | | 100 | 100 |
| Kentucky..... | | 1,000 | 1,000 |
| Maryland..... | | 3,000 | 3,000 |
| Michigan..... | 40 | 800 | 840 |
| Minnesota..... | | 500 | 500 |
| Mississippi..... | 750 | 300 | 1,050 |
| Missouri..... | 1,500 | 1,000 | 2,500 |
| Nebraska..... | | 200 | 200 |
| New York..... | | 1,300 | 1,300 |
| North Carolina..... | | 200 | 200 |
| Ohio..... | | 2,500 | 2,500 |
| South Carolina..... | 1,000 | 750 | 1,750 |
| Texas..... | | 5,000 | 5,000 |
| Virginia..... | 1,000 | | 1,000 |
| Total..... | 4,743 | 19,021 | 23,764 |

13.—LIST OF RAILROADS GRANTING FACILITIES IN 1880.

During the present year a still larger number of railroads have accorded the facilities for carrying fish in baggage cars and for stopping trains at bridges so as to deposit young fish. The list of railroads is given herewith, and the most hearty acknowledgment of their interest and co-operation is hereby made.

- Alabama Great Southern Railroad Company. Charles P. Ball, general superintendent, Chattanooga, Tenn.
- Alabama Central Railroad Company. W. L. Lanier, president, Selma, Ala.
- Atchison, Topeka, and Santa Fé Railroad. George O. Manchester assistant general manager, Topeka, Kans.
- Atchison and Nebraska Railroad. George H. Nettleton, general manager, Kansas City, Mo.
- Atlantic, Mississippi and Ohio Railroad Company. N. M. Osborne, secretary, Petersburg, Va.
- Atlanta and Charlotte Air-Line Railway. C. J. Foreacre, general manager, Atlanta, Ga.
- Atlanta and West Point Railroad. A. J. Orme, general passenger agent, Atlanta, Ga.
- Baltimore and Ohio Railroad Company. E. K. Hyndman, superintendent Pittsburgh division; C. H. Hudson, superintendent Trans-Ohio division; W. M. Clements, master of transportation.
- Boston and New York Air-Line Railroad Company. J. H. Franklin, superintendent, New Haven, Conn.
- Boston and Albany Railroad. C. O. Russell, superintendent, Springfield, Mass.
- Boston and Providence Railroad Company. A. A. Folsom, superintendent, Boston, Mass.
- Carolina Central Railroad. W. Q. Johnson, general superintendent, Wilmington, N. C.
- Central Railroad of New Jersey. James Moore, general superintendent and engineer, Elizabeth, N. J.; F. S. Lathrop, receiver.
- Central Railroad and Banking Company of Georgia. William Rogers, general superintendent, Savannah, Ga.
- Central Pacific Railroad Company. F. H. Goodman, general passenger and ticket agent, San Francisco, Cal.; A. N. Towne, general superintendent.

- Central Vermont Railroad Company. J. W. Hobart, general superintendent, Saint Albans, Vt.
- Charlotte, Columbia and Augusta Railroad Company. I. R. Macmurdo, general passenger agent, Richmond, Va.
- Chesapeake and Ohio Railway Company. William S. Dunn, engineer and superintendent, Richmond, Va.
- Chicago, Rock Island and Pacific Railroad Company. A. Kimball, general superintendent, Davenport, Iowa.
- Chicago and Alton Railroad. J. C. McMullin, general manager, Chicago, Ill.
- Chicago, Saint Louis and New Orleans Railroad Company. W. H. Osborn, president; J. C. Clarke, vice-president and general manager, New York.
- Chicago and Northwestern Railway. M. Hughitt, general manager, Chicago, Ill.
- Chicago, Burlington and Quincy Railroad Company. T. J. Potter, assistant general manager, Chicago, Ill.
- Chicago, Milwaukee and Saint Paul Railway Company. W. C. Van Horne, general superintendent, Milwaukee, Wis.
- Chicago, Saint Paul and Minneapolis Railroad, North Wisconsin Railroad. E. W. Winter, general superintendent, Saint Paul, Minn.
- Cincinnati, Hamilton and Dayton; Dayton and Michigan; Cincinnati, Hamilton and Indianapolis; and Cincinnati, Richmond and Chicago Railroads. L. Williams, general superintendent, Cincinnati, Ohio.
- Cincinnati Southern Railway. S. Woodward, superintendent, Cincinnati, Ohio.
- Cincinnati, Sandusky and Cleveland Railroad. Charles Howard, superintendent, Springfield, Ohio.
- Cleveland, Columbus, Cincinnati and Indianapolis Railway Company. E. B. Thomas, general manager, Cleveland, Ohio.
- Cleveland, Mount Vernon and Columbus Railroad Company. G. A. Jones, superintendent, Mount Vernon, Ohio.
- Connecticut Valley Railroad Company. Samuel Babcock, agent for trustee and superintendent, Hartford, Conn.
- Connecticut River Railroad. J. Mulligan, superintendent, Springfield, Mass.
- Connecticut Central Railroad. D. D. Warren, president, Springfield, Mass.
- Delaware and Chesapeake Railway. O. S. Sanford, superintendent, Easton, Maryland.
- Delaware, Lackawanna and Western Railroad. Samuel Sloan, president, New York.
- East Tennessee, Virginia and Georgia Railroad. John F. O'Brien, chief engineer and superintendent, Knoxville, Tenn.
- European and North American Railroad. F. W. Cram, superintendent, Bangor, Me.
- Fitchburg Railroad Company. John Adams, general superintendent, Boston, Mass.
- Flint and Pere Marquette Railway. Sanford Keeler, superintendent, East Saginaw, Mich.; H. C. Potter, receiver.
- Fort Wayne and Jackson Railroad Company. M. D. Woodford, general superintendent, Jackson, Mich.
- Galveston, Harrisburg and San Antonio Railroad Company. T. W. Peirce, president, Boston, Mass. James Converse, general superintendent.
- Galveston, Houston and Henderson Railroad. H. M. Hoxie, vice-president and manager, Galveston, Tex.
- Georgia Railroad Company. E. R. Dorsey, general freight and passenger agent, Augusta, Ga.
- Gulf, Western Texas and Pacific Railroad. M. D. Monserrate, general superintendent, Cuero, Tex.
- Hannibal and Saint Joseph Railroad Company. W. R. Woodward, superintendent, Hannibal, Mo.
- Houston and Texas Central Railroad. G. Jordan, vice-president, Houston, Tex.
- Indianapolis and Saint Louis Railroad Company. E. B. McClure, general superintendent, Indianapolis, Ind.

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- Illinois Central Railroad Company. Joseph F. Tucker, traffic manager, Chicago, Ill.
- International and Great Northern Railroad. H. M. Hoxie, general superintendent, Palestine, Tex.
- Jacksonville, Pensacola and Mobile Railroad. Edgar Vliet, master of transportation, Tallahassee, Fla.
- Kansas Pacific Railway. S. T. Smith, receiver and general superintendent, Kansas City, Mo.
- Kansas City, Lawrence and Southern Railroad Company. T. F. Oakes, general superintendent, Kansas City, Mo.
- Kansas City, Saint Joseph and Council Bluffs Railroad. I. F. Barnard, general superintendent, Saint Joseph, Mo.
- Keokuk and Saint Louis Line. H. B. Blood, general freight and passenger agent, Keokuk, Iowa.
- Little Rock and Fort Smith Railway. Theodore Hartman, general superintendent, Little Rock, Ark.
- Long Island Railroad. Thomas R. Sharp, receiver, Long Island City, N. Y.
- Louisville, Cincinnati and Lexington Railway Company. William Mahl, general superintendent, Louisville, Ky.
- Louisville and Nashville Railroad. D. W. C. Rowland, general superintendent, Louisville, Ky.
- Lake Shore and Michigan Southern Railroad. Charles Paine, general superintendent, Cleveland, Ohio.
- Montgomery and Eufaula Railroad. Lyman Wells, treasurer, Montgomery, Ala.
- Macon and Brunswick Railroad. George W. Adams, general superintendent, Macon, Ga.
- Marietta and Cincinnati Railroad. J. H. Stewart, superintendent, Cincinnati, Ohio.
- Memphis and Little Rock Railroad. Rudolph Fink, general manager, Little Rock, Ark.
- Memphis and Charleston Railroad Company. John A. Grant, general superintendent, Memphis, Tenn.
- Missouri Pacific Railway. A. A. Talmage, general superintendent, Saint Louis, Mo.
- Missouri, Kansas and Texas Railway. C. M. Sheafe, superintendent of transportation, Sedalia, Mo.
- Mississippi and Tennessee Railroad. M. Burk, general superintendent, Memphis, Tenn.
- Mobile and Montgomery Railway Company. Edmund L. Tyler, vice-president and superintendent, Montgomery, Ala.
- Mobile and Ohio Railroad. A. L. Rives, general manager, Mobile, Ala.
- Morgan's Louisiana and Texas Railroad. Charles A. Whitney, manager, New Orleans, La.
- Nashville, Chattanooga and Saint Louis Railway. J. W. Thomas, general superintendent, Nashville, Tenn.
- New York, Lake Erie and Western Railroad. E. S. Bowen, general superintendent, New York.
- New York and New England Railroad Company. J. H. Wilson, vice-president, Boston, Mass.
- New York, New Haven and Hartford Railroad Company. E. M. Reed, vice-president, New York.
- New York, Pennsylvania, and Ohio Railroad. P. D. Cooper, general superintendent, Cleveland, Ohio.
- Northern Central Railway Company, Baltimore and Potomac Railroad, and Alexandria and Fredericksburgh Railway. L. P. Farmer, general passenger agent, Philadelphia, Pa.
- Northeastern Railroad Company. A. F. Ravenel, president, Charleston, S. C.
- Ohio and Mississippi Railway Company. W. W. Peabody, general superintendent, Cincinnati, Ohio.

- Old Colony Railroad Company. J. R. Kendrick, superintendent, Boston, Mass.
- Pennsylvania Company. J. D. Layng, general manager, Pittsburgh, Pa.
- Pennsylvania Railroad Company. L. P. Farmer, general passenger agent, Philadelphia, Pa.
- Petersburgh Railroad Company. R. G. Pegram, receiver, Petersburg, Va.
- Pittsburgh, Cincinnati and Saint Louis Railway Company. D. W. Caldwell, general manager, Columbus, Ohio.
- Philadelphia, Wilmington and Baltimore Railroad. H. F. Kenny, superintendent, Philadelphia, Pa.
- Richmond and Danville Railroad Company. I. R. Macmurdo, general passenger agent, Richmond, Va.
- Richmond and Petersburg Railroad Company. Theo. D. Kline, general superintendent, Richmond, Va.
- Richmond, Fredericksburg and Potomac Railroad Company. E. T. D. Myers, general superintendent, Richmond, Va.
- Savannah, Griffin and North Alabama Railroad. Wm. M. Wadley, President, Savannah, Ga.
- Savannah and Memphis Railroad Company. W. S. Greene, general superintendent, Opelika, Ala.
- Savannah and Charleston Railroad Company. C. S. Gadsden, engineer and superintendent, Charleston, S. C.
- Savannah, Florida and Western Railway Company. H. S. Haines, general superintendent, Savannah, Ga.
- Seaboard and Roanoke Railroad Company; Raleigh and Gaston Railroad Company; Raleigh and Augusta Air Line Railroad Company; Baltimore Steam Packet Company; Albemarle Steam Navigation Company. John M. Robinson, president, Baltimore, Md.
- Selma, Rome and Dalton Railroad. Norman Webb, general superintendent, Selma, Ala.
- Southwestern Railroad of Georgia. W. G. Raoul, superintendent, Macon, Ga.
- South Carolina Railroad. John B. Peck, general superintendent, Charleston, S. C.
- Saint Louis and San Francisco Railway. C. W. Rogers, general manager, Saint Louis, Mo.
- Saint Louis, Iron Mountain and Southern Railway. A. W. Soper, general superintendent, Saint Louis, Mo.
- Saint Joseph and Denver City Railroad. L. D. Tuthill, general manager, Saint Joseph, Mo.; William Bond, receiver.
- Saint Paul, Minneapolis and Manitoba Railway. Jas. J. Hill, general manager, Saint Paul, Minn.
- Texas and Pacific Railway Company. Jno. Noble, general superintendent, Marshall, Tex.
- Texas and New Orleans Railroad. J. F. Crosby, vice-president and general manager, Houston, Tex.
- Union Pacific Railway. S. H. H. Clark, general manager, Omaha, Nebr. F. L. Kimball, general passenger agent.
- Vandalia Line; Terre Haute and Indianapolis Railroad Company. John E. Simpson, general manager, Saint Louis, Mo.
- Vicksburg and Meridian Railroad Company. E. F. Raworth, general superintendent, Vicksburg, Miss.
- Wabash, Saint Louis and Pacific Railway. Jno. C. Gault, general manager, Saint Louis, Mo.
- Washington City, Virginia Midland and Great Southern Railroad. Peyton Randolph, general superintendent, Alexandria, Va.; John S. Barbour, receiver.
- Western and Atlantic Railroad Company. William MacRae, general manager, Atlanta, Ga.

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Western North Carolina Railroad. Jas. W. Wilson, president, Morganton, N. C.

Western Railroad of Alabama. Cecil Gabbett, general manager, Montgomery, Ala.

West Jersey Railroad Company, passenger department. L. P. Farmer, general passenger agent, Philadelphia, Pa.

Western Maryland Railroad Company. J. M. Hood, general manager, Baltimore, Md.

Wilmington and Weldon, and Wilmington, Columbia and Augusta Railroads. A.

Pope, general passenger agent, Wilmington, N. C.

Wisconsin Central Railroad Company. F. N. Finney, general manager, Milwaukee, Wis.