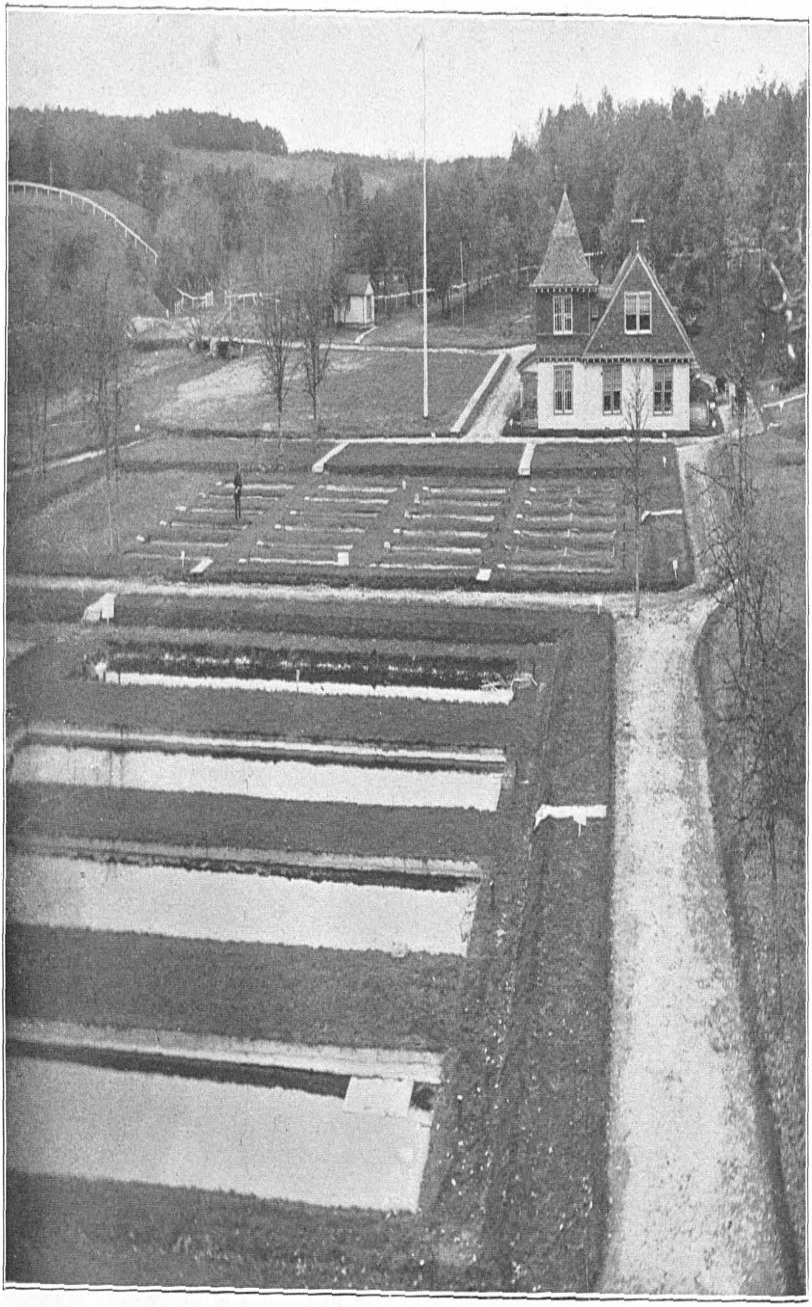


MANCHESTER STATION, IOWA, REARING PONDS AND HATCHERY.

REPORT

OF THE

UNITED STATES COMMISSIONER OF FISH AND FISHERIES

FOR THE

FISCAL YEAR ENDING JUNE 30, 1898.

I have the honor to submit a report of the work of the United States Commission of Fish and Fisheries for the year ending June 30, 1898, together with the reports of the assistants in charge of its divisions, which, with the papers describing special investigations, published as appendices to this report or in the Bulletin of the Commission, form a complete record of its operations for this period. The Commission was under the direction of Commissioner John J. Brice until February 16, 1898, when the present Commissioner, George M. Bowers, appointed February 1, took charge.

In view of the marked increase of the work of the Commission and the addition of the new stations authorized each year by Congress, and the consequent enlarged demands on its resources, it is impossible to carry on its operations in such manner as to obtain the best results with the present appropriation, which is small considering the important interests at stake, representing millions of dollars invested in the fisheries and allied interests throughout the country. It is, therefore, earnestly recommended that the estimates submitted, embodying certain increases, be favorably acted on by Congress, particularly those items providing for the propagation of food-fishes and for the contingent expenses required for scientific and statistical investigations, the demands for which are steadily increasing.

Special technical information is frequently desired for important objects, such as protective legislation by the States or the extension or establishment of fishery enterprises, and this often involves extensive studies or investigations of aquatic life, which can be carried on only under Government auspices. Appropriations are needed for the improvement of the grounds and buildings at some of the stations, and the efficiency of several could be materially enhanced by additions to their water supply and enlargement of their pond systems. The stations are always places of public interest in their respective neighborhoods, and while they are not designed for parks or pleasure-grounds it appears eminently proper that they should be made attractive and beautified to a certain degree.

While the division reports describe the work in detail, attention may be called to the progress made in fish propagation, and to some of the more important investigations and canvasses carried on by the Divisions of Inquiry respecting Food-fishes and of Statistics.

DIVISION OF FISH-CULTURE.

The operations of this division were in many respects more important than in any past year, owing in part to the natural growth of the work and in part to greater efficiency in dealing with the various questions and problems that come up for consideration.

The propagation and distribution of food-fishes during the present fiscal year exceeded by about 40 per cent the work accomplished in any other similar period. The number of adult and yearling fishes, fry, and eggs distributed in public and private waters or transferred to the State authorities was about 857,000,000, of which the largest number represented important commercial species, like the shad, cod, whitefish, salmon, lake trout, herring, pike perch, and lobster. There were 33 hatching stations and substations in use, the one located at Erwin, Tenn., having been completed and placed in operation in addition to those mentioned last year. The steamer *Fish Hawk* was also utilized for shad-hatching in Albemarle Sound and the Delaware River.

A comparison of the output for this year with that of last shows a marked expansion in the hatching of shad, Pacific salmon, and cod. The extension of the salmon-hatching work on the Pacific coast was especially gratifying, as the enormous annual drain on the salmon streams of that region makes it very important that the supply should be kept up by artificial means. At the substation situated on Battle Creek, a tributary of the Sacramento River, the largest collection of salmon eggs (48,000,000) in the history of fish-culture was made in the fall of 1897.

Although there are several desirable species of salmon in the Pacific rivers, the Commission gives its principal attention to the chinook or quinnat salmon, which is the species most desired for canning and fresh consumption. Some light has been thrown on the results of fish-cultural work on the west coast by the recent capture of a considerable number of large salmon with the soft dorsal fin missing. These are fish that were liberated from the Government hatcheries about three years ago, when they were less than a year old, after having been marked by the removal of the adipose fin. The work of the Commission is very popular in the West, and its value is generally recognized by the salmon fishermen and canners.

The wall-eyed pike or pike perch, *Stizostedion vitreum*, is one of the most valuable of the fishes of the Great Lakes. In Lake Erie, where by far the largest part of the catch is taken, it ranks first in money value. The fishing interests being desirous that the Government should keep up the supply, the propagation of this species, which had been discontinued for several years, was resumed in the spring of 1898 at

Put-in-Bay Station, on Lake Erie, 221,062,500 eggs being collected. It was also designed to take up this work on Lake Ontario, where formerly there was a comparatively large catch, but after careful investigation it was found that but few spawning fish were found on fishing-grounds that a few years ago yielded tons of fish. This disappearance from their usual spawning-grounds was attributed by some to the discharge of refuse from mills and factories into the tributaries of Lake Ontario. 30,000,000 of the eggs collected at Put-in Bay were transferred to the Lake Ontario station, and the fry resulting from them were planted in the St. Lawrence.

The passage of laws by the State of Michigan prohibiting the capture of whitefish and lake trout in Lakes Huron and Michigan from November 1 to December 15, unfortunately caused the abandonment of whitefish work on these lakes. Efforts were made to collect eggs at Duluth, but very few were secured.

At Put-in Bay, Lake Erie, notwithstanding the unfavorable weather that prevailed during the fall, 112,842,000 whitefish and 27,786,000 cisco or lake-herring eggs were collected from fish taken by the commercial fishermen; 10,000,000 of these were sent to Alpena, Mich., to be hatched and liberated in Lake Huron.

Further experiments were conducted on Lake Erie to determine the practicability of holding in pens the adult whitefish taken prior to the spawning season; 1,200 fish were secured from the fishermen in the vicinity of Put-in Bay and impounded in floating live-boxes, and over 10,000,000 eggs were thus secured. The results of the experiment, though not as large as anticipated, are encouraging, and will probably lead to a considerable extension of whitefish propagation in Lake Erie, as in this way a definite supply of spawners can be depended on. Stormy weather has in the past often prevented the taking of sufficient numbers of fish during the spawning season. In conducting this experimental work great assistance was rendered by the fishermen, who allowed the Commission to take fish from their pound nets without charge and hold them in live-boxes until after the spawning season, when they were returned to the fishermen.

The lake-trout work at Northville and Alpena stations in Michigan was larger than heretofore, notwithstanding that the passage of the act previously referred to cut short the collecting season materially and few eggs could be obtained from grounds that had in the past yielded large numbers. There is little doubt that under ordinary conditions the collections for Northville, which reached 12,000,000, would have doubled that amount.

The propagation of marine species, such as cod, flatfish, pollock, and lobsters, was the object of attention on the Atlantic Coast, at the Woods Hole and Gloucester stations. Profiting by the preliminary investigation made during the previous year, large numbers of cod eggs were obtained at Plymouth, which, with those taken from the brood-fish held at Woods Hole, made an aggregate of 153,436,000 eggs, which yielded

105,863,000 fry. Over 160,000,000 eggs were also collected at Kittery Point, Maine, which were transferred to the Gloucester Station, from which 96,700,000 cod fry were hatched and liberated.

During the months of November and December between 7,000,000 and 8,000,000 pollock eggs were collected from boats fishing out of Gloucester, and the fry resulting from them were planted in neighboring waters. It was intended to take up the propagation of this species on a large scale, but most of the pollock in that vicinity are now captured with hand lines instead of gill nets, making it impossible to obtain spawning fish in quantities.

The constant decline in the lobster fishery accentuates the necessity for increased work in this line. The schooner *Grampus* was employed during the months of April, May, and June in collecting egg lobsters along the entire coast of Maine. The fisheries on the coasts of Massachusetts, Rhode Island, and Connecticut were looked after by fishing smacks and steam launches, and as a result of these efforts 95,000,000 fry were liberated.

During the spring of 1898 over 300,000,000 shad eggs were collected on the Delaware, Susquehanna, and Potomac rivers, and in the Albemarle Sound, North Carolina; 228,000,000 of these eggs were hatched and the fry planted—a very satisfactory increase over the previous year. The usual shad operations on the Delaware with the *Fish Hawk* were interrupted by the war, which caused the detail of that vessel for naval service. To prevent the abandonment of the work, arrangements were made with the Pennsylvania authorities to operate the State hatchery at Bristol.

An important new feature of the fish-cultural work was the hatching of 3,000,000 fry of the grayling at Bozeman Station. This fine food and game fish has a very limited distribution, and its artificial propagation has heretofore been chiefly experimental.

The efforts to acclimatize food-fishes in waters to which they are not indigenous have been continued by transferring quantities of eggs of the quinnat salmon and steelhead trout to eastern stations to be hatched, so that the fry could be planted in Atlantic coastal streams. Adult tautog, lobsters, and blue crabs have been sent to California and planted in the Pacific. Many of the lobsters were females with eggs, and the plant should result in from 3,000,000 to 4,000,000 fry besides the adult lobsters.

The steady increase in the catch of shad in the United States is conclusive evidence of the value of artificial propagation. In the year 1880, prior to which time but little work of this character had been done, the catch of shad in the United States was 18,074,534 pounds; and in the years immediately succeeding 1880 until 1885, when the first results of artificial propagation became observable, the supply of these fish had decreased to such an extent that it was feared they would be exhausted for commercial purposes. In 1888 the catch had increased to 35,736,585 pounds, and in 1896, the last year for which

there are accurate data, the catch was 50,866,368 pounds, or, in round numbers, 13,000,000 fish as against a little over 5,000,000 in 1880, an increase of over 150 per cent. The value of the shad fishery to the fishermen in 1880 was $995,790; in 1896 it amounted to $1,656,711. The Commission expended during the fiscal year 1896–97, $15,726.36, and in the following year $16,356.99 in the propagation and distribution of this species. At an average annual expenditure of $15,000 per annum since 1880, the total expended in the propagation of this species during sixteen years would amount to $240,000. As a consequence of the greater abundance of the fish the cost has been materially lessened, but even at the price actually received the increased 33,000,000 pounds was worth $1,049,000, or $809,000 more than has been expended by the Commission on the propagation of this species, exclusive of the cost of the stations, in sixteen years.

Table showing the number of fish and eggs furnished for distribution by the various stations.

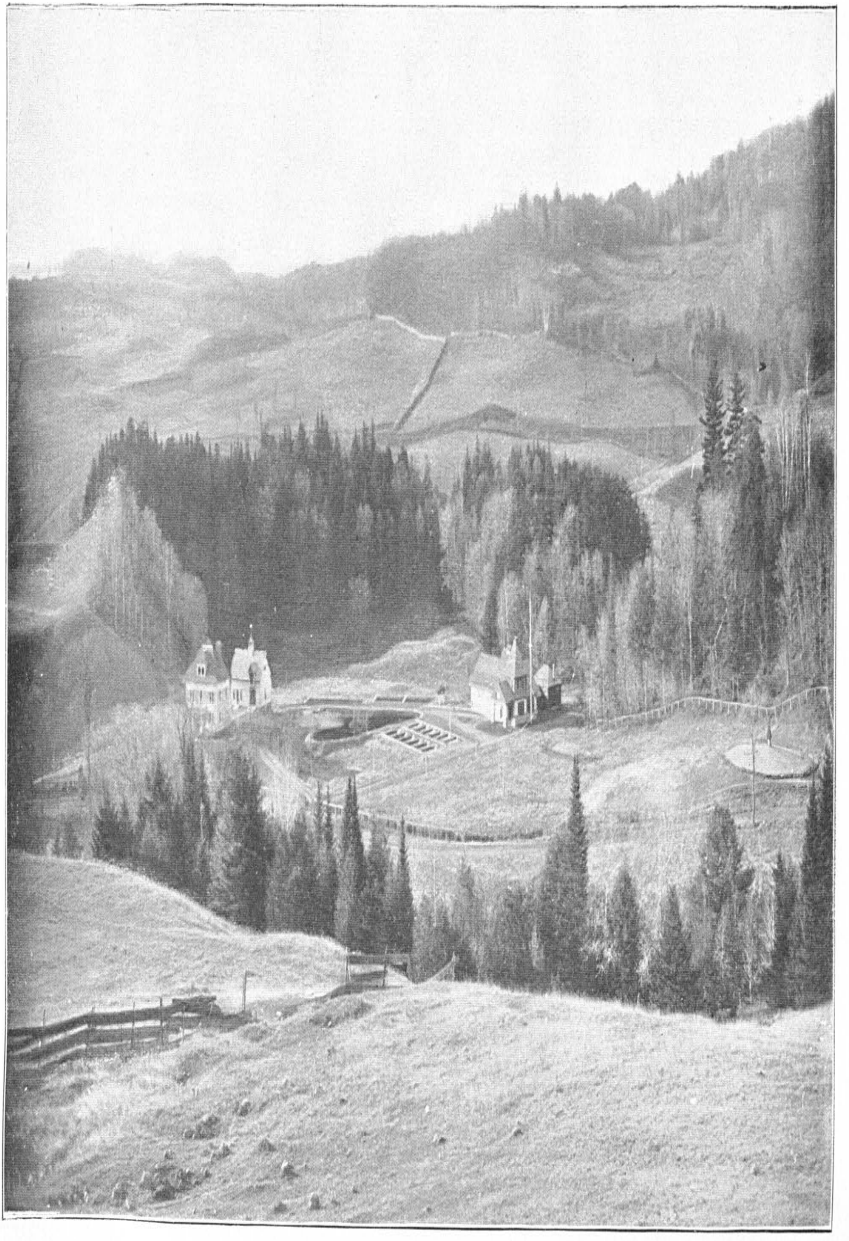
Source of supply.	Species.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Green Lake, Me	Golden trout	10,000	79,144	
	Brook trout	25,600	321,721	
	Lake trout	75,000	70,998	
	Steelhead trout		22,966	
	Quinnat salmon		901,066	
	Landlocked salmon	111,243		121,830
	Atlantic salmon			16,208
Craig Brook, Me	Atlantic salmon	400,000	1,975,070	203,697
	Atlantic salmon domesticated			829
	Landlocked salmon	60,000		1,960
	Quinnat salmon			235,935
	Steelhead trout		85,941	6,552
	Scotch sea trout			1,589
	Rainbow trout			355
St. Johnsbury, Vt	Brook trout	120,300	501,000	
	Lake trout		14,000	
	Steelhead trout		106,026	
	Landlocked salmon		3,928	
Gloucester, Mass	Cod		96,707,000	
	Pollock		4,455,000	
	Lobster		65,097,000	
Woods Hole, Mass	Cod		105,863,000	
	Flatfish		39,337,000	
	Lobster		30,102,000	
Cape Vincent, N. Y	Lake trout		982,331	
	Steelhead trout		90,060	
	Brook trout		56,000	
	Quinnat salmon		4,691,801	
	Atlantic salmon		97,071	
	Pike perch		10,043,750	
Steamer Fish Hawk	Shad	1,811,000	5,647,000	
Bristol, Pa	do		15,460,000	
Battery Station, Md	do	68,881,000	75,490,000	
Fish Ponds, D. C	do			8,036,000
	Black bass, large-mouth			14,222
	Black bass, small-mouth			1,837
	Crappie			779
Central Station, D. C	Shad	5,179,000	5,717,000	
	Loch Leven trout		7,282	
	Rainbow trout		7,948	
	Brook trout		8,068	
	Lake trout		19,640	
	Landlocked salmon		3,085	
Bryan Point, Md	Shad		47,366,000	
Wytheville, Va	Rainbow trout	130,000	25,000	169,295
	Rock bass			7,898
Put-in Bay, Ohio	Lake trout		908,800	
	Whitefish	200,000	80,290,000	
	Lake herring		18,970,000	
	Pike perch		71,110,000	
	Black bass, large-mouth			2
	Black bass, small-mouth			89
	Rock bass			268
	Sunfish			69

Number of fish and eggs furnished for distribution by the various stations—Continued.

Source of supply.	Species.	Eggs.	Fry and fingerlings.	Adults and yearlings.
Northville, Mich	Lake trout	1,010,000	3,543,000	.....
	Brook trout	2,000	228,000	1,000
	Loch Leven trout	5,000	8,000	.....
	Steelhead trout	.....	85,000	3,500
	Rainbow trout	.....	.....	8,000
Alpena, Mich	Lake trout	.....	1,445,000	.....
	Whitefish	.....	8,100,000	.....
Duluth, Minn	Lake trout	.....	5,143,000	.....
	Brook trout	.....	92,550	.....
	Steelhead trout	.....	130,000	.....
	Whitefish	.....	98,000	.....
Quincy, Ill	Black bass	.....	.....	24,808
	Crappie	.....	.....	3,103
Manchester, Iowa	Rainbow trout	.....	4,000	.....
	Brook trout	.....	19,000	.....
	Lake trout	.....	437,000	.....
Neosho, Mo	Rainbow trout	.....	14,000	73,219
	Black bass	.....	.....	10,101
	Rock bass	.....	.....	13,018
	Strawberry bass	.....	.....	5,912
San Marcos, Tex	Black bass	.....	.....	30,755
	Rock bass	.....	.....	3,700
	Crappie	.....	.....	50
Leadville, Colo	Brook trout	172,000	581,000	172,100
	Black-spotted trout	.....	270,000	.....
	Rainbow trout	.....	21,000	.....
	Yellow-fin trout	.....	7,500	.....
	Loch Leven trout	15,000	.....	8,000
Bozeman, Mont	Brook trout	.....	.....	6,000
	Steelhead trout	.....	.....	45,000
	Grayling	.....	1,500,000	.....
Baird Station, Cal	Quinnat salmon	6,555,000	6,511,800	.....
Fort Gaston, Cal	do	.....	1,276,000	.....
	Rainbow trout	.....	35,950	4,085
	Steelhead trout	60,000	650,000	.....
Olema, Cal	Quinnat salmon	.....	1,970,000	.....
Battle Creek, Cal	do	24,050,000	5,885,500	.....
Clackamas, Oreg	do	.....	10,029,796	.....
	Loch Leven trout	.....	5,175	.....
Upper Clackamas, Oreg	Quinnat salmon	.....	4,390,000	.....
Salmon River	do	.....	145,396	.....
Rogue River	do	.....	1,910,045	.....
Little White Salmon	do	.....	7,391,880	.....
Mapleton, Oreg	do	.....	440,275	.....

Summary of distribution.

Species.	Eggs.	Fry and fingerlings.	Adults and yearlings.	Total.
Shad	75,871,000	149,155,000	3,036,000	228,062,000
Quinnat salmon	30,605,000	45,643,558	230,200	78,378,758
Atlantic salmon	400,000	2,072,139	220,635	2,692,774
Landlocked salmon	171,243	7,005	121,088	299,336
Steelhead trout	60,000	1,113,354	53,572	1,226,926
Loch Leven trout	20,000	20,457	8,000	48,457
Rainbow trout	130,000	96,022	249,532	475,554
Black-spotted trout	.....	258,400	.....	258,400
Brook trout	319,300	1,863,798	161,391	2,344,489
Lake trout	1,085,000	12,521,219	.....	13,606,219
Scotch sea trout	.....	.....	1,589	1,589
Yellow-fin trout	.....	7,500	.....	7,500
Golden trout	10,000	79,144	.....	89,144
Grayling	.....	1,500,000	.....	1,500,000
Whitefish	200,000	88,488,000	.....	88,488,000
Pike perch	.....	81,153,750	.....	81,153,750
Lake herring	.....	18,970,000	.....	18,970,000
Black bass, large-mouth	.....	.....	76,064	76,064
Black bass, small-mouth	.....	.....	1,884	1,884
Crappie	.....	.....	3,369	3,369
Sunfish	.....	.....	69	69
Rock bass	.....	.....	23,352	23,352
Strawberry bass	.....	.....	5,912	5,912
Cod	.....	202,570,000	.....	202,570,000
Pollock	.....	4,455,000	.....	4,455,000
Flatfish	.....	39,337,000	.....	39,337,000
Lobster	.....	95,234,000	.....	95,234,000
Total	108,871,543	744,445,346	4,192,657	857,309,546



BIRD'S-EYE VIEW OF ST. JOHNSBURY STATION, VERMONT.

The cars of the Commission traveled 98,964 miles and detached messengers 121,160 miles while distributing fishes during the year. The Commission was again the recipient of material assistance from many railroads, as shown by the following list of roads giving free transportation, without which the work would have been much curtailed:

Name of railroad.	Cars.	Messengers.
	Miles.	*Miles.*
Atchison, Topeka and Santa Fe Rwy	7,723	.....
Atlantic Coast Line	792	.....
Austin and Northwestern R. R	.....	198
Bangor and Aroostook R. R	66	.....
Bennington and Rutland Rwy	.....	84
Boston and Albany R. R	26	.....
Boston and Maine R. R	460	1,938
Burlington, Cedar Rapids and Northern Rwy	2,330	228
Burlington and Missouri River R. R. in Nebraska	1,025	.....
Carolina and Northwestern Rwy	189	28
Central Vermont R. R	.....	292
Chesapeake and Ohio Rwy	2,355	.....
Chicago, Burlington and Quincy R. R	1,306	1,463
Chicago, Milwaukee and St. Paul Rwy	1,510	.....
Chicago and West Michigan Rwy	1,086	296
Cleveland, Cincinnati, Chicago and St. Louis Rwy	1,833	.....
Colorado Midland Rwy	556	70
Delaware and Hudson R. R	374	.....
Denver, Leadville and Gunnison Rwy	.....	3,332
Denver and Rio Grande R. R	1,944	5,206
Detroit, Grand Rapids and Western R. R	921	256
Detroit and Mackinac Rwy	1,268	122
Detroit, Toledo and Milwaukee R. R	312	.....
Duluth and Iron Range R. R	.....	264
Duluth, South Shore and Atlantic Rwy	1,222	.....
East Tennessee and Western North Carolina R. R	.....	34
Erie R. R	.....	181
Flint and Pere Marquette R. R	3,060	1,415
Fort Worth and Denver City Rwy	258	1,544
Grand Rapids and Indiana Rwy	226	.....
Grand Trunk Rwy. System	.....	8
Great Northern Rwy	1,019	.....
Gulf, Colorado and Santa Fe Rwy	342	751
Houston and Texas Central R. R	.....	1,748
Houston, East and West Texas Rwy	.....	236
Hunter's Run and Slate Belt R. R	.....	16
Illinois Central R. R	444	1,545
International and Great Northern R. R	.....	1,040
Kansas City, Fort Scott and Memphis R. R	576	.....
Kansas City, Pittsburg and Gulf R. R	586	348
Louisville and Nashville R. R	1,572	.....
Maine Central R. R	1,572	.....
Michigan Central R. R	5,409	.....
Manistique Rwy	62	.....
Minneapolis, St. Paul and Sault Ste. Marie Rwy	214	.....
Missouri, Kansas and Texas Rwy	.....	2,325
Mobile and Ohio R. R	152	.....
Montana Union Rwy	14	.....
Montpelier and Wells River R. R	.....	134
Nashville, Chattanooga and St. Louis Rwy	302	.....
New York, New Haven and Hartford R. R	484	.....
Northern Pacific Rwy	4,540	.....
Oregon R. R. and Navigation Co	869	.....
Oregon Short Line R. R	1,862	.....
Pennsylvania R. R	444	1,018
Plant System	1,086	.....
Richmond, Fredericksburg and Potomac R. R	164	.....
Rio Grande Western Rwy	1,240	.....
Rutland R. R	.....	167
Rumford Falls and Rangeley Lakes Rwy	.....	112
San Antonio and Aransas Pass Rwy	.....	886
Sioux City and Northern R. R	97	.....
Southern Pacific Co. (Atlantic System)	.....	794
Southern Rwy	1,120	.....
St. Johnsbury and Lake Champlain R. R	.....	802
St. Louis Southwestern Rwy	526	831
Texas and Pacific Rwy	492	336
Union Pacific, Denver and Gulf Rwy	154	744
Union Pacific System	4,582	.....
Wabash R. R	.....	1,976
Wisconsin Central R. R	901	.....
Woodstock Rwy	.....	28
Total of free transportation	63,167	33,346

DIVISION OF INQUIRY RESPECTING FOOD-FISHES.

The most valuable of the fishery resources of the country, the oyster, has been the subject of a number of special investigations. Pursuant to a request from the legislature, governor, and citizens of Louisiana, Lieut. Franklin Swift, U. S. N., was directed to proceed with the steamer *Fish Hawk* to make a survey of the oyster-grounds of that State, in order to furnish accurate information on which to base a revision of the oyster laws, with a view to putting the oyster industry on a more substantial footing. The vessel reached Mississippi Sound on January 31, and confined her work to the oyster-beds of St. Bernard Parish. While there was not sufficient time to complete the survey of all the oyster-grounds of the State, Dr. H. F. Moore, who took part in the investigation as zoologist, made an examination of them. It was found that the fishing methods pursued have been very injurious, in some instances resulting in the practical destruction of the oysters, and that with the adoption of improved methods and proper restrictions the oyster-planting industry might be greatly extended. The report of Dr. Moore has been transmitted to the governor of Louisiana.

The prevalence of green oysters in the Chesapeake region and elsewhere having proved very serious, financially, to the oyster-growers, has received the prompt attention of the Commission. It is the general opinion among oyster-consumers that green oysters derive their color from copper, with which they have been contaminated, and are therefore unwholesome. This belief results in large losses to oystermen, who are prevented from marketing the crop when the greenness is marked. It has been demonstrated repeatedly and announced by the Commission that the green oysters owe their color to vegetable matter which serves as food, and that no impairment in the food value of the oyster results from this condition. The announcement in the press of the discovery of copper in considerable quantities in English oysters led the Commission to make a reexamination of the subject with the result that previous tests were confirmed.

Experiments in fattening oysters for the market have been conducted at Lynnhaven, Va., where the Commission has constructed special ponds for the purpose.

The desire of the Commission to give the people of the Pacific coast a plentiful supply of eastern oysters has resulted in the shipment of a number of carloads to suitable points in California and Oregon, the plants being guarded by the local authorities during the time required for their acclimatization and propagation. In order to determine the condition of the introduced oysters, the Commission detailed Professor Washburn, of Oregon University, to visit and report on the beds. The observations, extending over the years 1897 and 1898, show that all the planted oysters have survived and grown, although there are as yet no evidences of an increase in numbers.

A canvass of the sponge fisheries of Florida was made in 1896, and to determine the relative conditions of this industry a second inquiry

was made by Dr. Hugh M. Smith in January, 1898. The second investigation emphasized the necessity of action on the part of the State to prevent serious injury to the fisheries. During the past few years the aggregate quantity of sponges taken has steadily increased, but the increase has resulted from more extended fishing as well as from the taking of sponges of less than the legal size. The present catch is also made up of comparatively large quantities of inferior varieties, as is shown by the fact that in 1895 the output of sheepswool sponges, the best variety and that of most commercial value, comprised 76 per cent of the total catch, while in 1897 it had fallen to 47 per cent. Though the sponge-grounds have been seriously affected by excessive and illegal fishing, they may yet be renewed and become capable of yielding large returns by the adoption of remedial measures, as suggested in Dr. Smith's report, published in the Bulletin for 1898.

From time to time during recent years reports have been received of the capture of shad in the tributaries of the Mississippi. Beginning with the spring of 1896, these fish had been taken each year in some numbers at various points in the Mississippi, Ohio, and Kanawha rivers. An opportunity was afforded of examining specimens taken in May, 1898, and a visit was made by Dr. B. W. Evermann to the localities where the capture of the fish was reported, and interesting observations were made. The fish were found to be a species of true shad, apparently resembling, though not identical with, the shad of the Atlantic coast rivers and the species of shad found in Alabama. They are apparently indigenous to the rivers of the Mississippi Valley, and not the results of plants of shad formerly made in those waters.

During the summer of 1897 the biological surveys in the Northwest, which have been in progress for several years, were carried on by field parties, chiefly under the direction of Dr. B. W. Evermann. In continuation of the studies of the spawning habits of the redfish in the lakes of the Northwest, a comprehensive investigation was made of Wallowa Lake in Oregon. An examination was also begun of a series of isolated lakes lying along the southern border of Oregon, about whose fauna nothing has been known. A party visited these lakes in July and August to study their physical and biological features and to make collections of fishes and other animals inhabiting them. With the completion of these investigations and a study of the collections much light will be thrown on the characteristics of the isolated fish fauna and the origin of the fauna of these and similar lakes of Oregon, California, and Nevada.

Explorations were made of the principal coastal streams of California, Washington, and Oregon, and biological examinations carried on to determine their physical characteristics, the nature of their fish fauna, and the abundance and habits of the different species of fishes frequenting them.

The studies of the movements, habits, growth, etc., of young shad in the Potomac, and of young salmon in the Sacramento, have been

continued and are affording interesting information which will be of value in the propagation of these fishes; and investigations in Lake Superior, which were begun in April, 1897, having for their object the determining of the food supply of the fishes of that lake, will, when finished, yield information of value in the planting of fish fry. Large collections of minute animal life have been made from Lake Superior, the study of which has not as yet been completed.

On account of the survey of the fur-seal rookeries made by the United States Coast and Geodetic Survey in the summer of 1897, and the second visit to the seal islands of the special commissioners who were appointed the previous year to report on the conditions of seal life, it was not deemed necessary by the Secretary of the Treasury for this Commission to send an agent to the islands to make the usual investigations. Arrangements were made through the courtesy of the special commissioners to obtain for this office photographs of the rookeries and the requisite data to continue its series of maps showing the changes in condition of the fur-seal rookeries from year to year.

The subject of the pollution of rivers and streams by mill and factory refuse, and the discharge of sewage from the towns and cities on their banks, is receiving much attention from those interested both in maintaining proper sanitary conditions and in the preservation of fish life. A memorial prepared by the Game and Fish Protective Association of the District of Columbia, urging the importance of action in this matter, was presented to Congress March 17, 1898, and published as Senate Document 194, Fifty-fifth Congress, second session. At the request of the chairman of its committee, a letter containing extracts from publications of this Commission, showing the evil effects produced upon fish life by the contamination of streams, was submitted by this office to the association for incorporation in the memorial. As stated in this letter, "the data are sufficient to clearly establish the point that river pollution is both directly and indirectly most injurious to fish and the fisheries by destroying fish and fish eggs, by driving fish away, by interfering with the fishing apparatus, and by killing or impairing the supply of minute animals and plants which are the basis of fish life." Remedial legislation is greatly to be desired in many localities.

During the summer of 1897 the Woods Hole laboratory was occupied by a small number of investigators, the attendance having been restricted to representatives of those institutions which had furnished financial aid in the establishment of the laboratory. The continued scarcity of mackerel rendered it important to continue the study of these fishes with a view to the satisfactory solution of the problem of their artificial propagation on a large scale, and among the inquiries carried on at Woods Hole was an investigation by Dr. J. Percy Moore relative to the embryology, natural history, and artificial propagation of the mackerel. The report of Dr. Moore is published as an appendix to this report (pages 1–22).

In the spring of 1898 steps were taken to increase the opportunities for scientific study at Woods Hole and to keep the laboratory open

during the entire year. Dr. H. C. Bumpus, of Brown University, was appointed director. The laboratory was opened on March 14, and by June 1 accommodations for the summer had been assigned to investigators to the full capacity of the station, and the season's work was in satisfactory progress.

DIVISION OF STATISTICS AND METHODS OF THE FISHERIES.

The principal work of this division has consisted of canvasses of the more important fisheries of certain of the New England and Middle Atlantic States and the Great Lakes, begun in August, 1897, and the South Atlantic and Gulf States, carried on in the spring of 1898. The results of the earlier field work were at once published in the form of bulletins, which were distributed to commercial organizations, boards of trade, and newspapers, and sent to custom-houses and post-offices, where they could be posted for the benefit of those interested in the regions to which reference was made.

At Gloucester and Boston there has been a falling off in the aggregate receipts of fish at the two ports since 1896. During the calendar year 1897 there were landed from American vessels at both places 126,685,598 pounds, worth to the fishermen $2,878,635. Each port participated in the decrease, though owing to certain changes in the conditions affecting the business more fares were landed at Gloucester than during the preceding year.

The fisheries of Lake Ontario have shown a steady decrease for many years, and the yield of the past year does not really represent the commercial importance of the fisheries. The yield in 1897 was only 920,996 pounds of fish, valued at $34,295, though the canvass shows more decrease in the quantity and value of the herring taken than with those species of more importance. A slight increase in whitefish is shown. The numerous resorts on this lake, frequented by anglers and pleasure-seekers, afford better employment to the fishermen during the season than fishing for the market. The falling-off in the supply of important fishes is due to a variety of causes, the conditions of which have already been discussed in the publications of this Commission.

The canvass of the South Atlantic States shows an increase as a whole since 1890 in the product, the amount of capital invested, and the number of persons employed. The increase was shared in by the States of North and South Carolina and Georgia, while the fisheries of the east coast of Florida have somewhat decreased. The total in 1897 was 80,390,465 pounds, with a value of $1,833,155. The increase was 12,674,400 pounds, valued at $252,191. The most important feature has been the marked improvement in the yield of shad and oysters in North Carolina and Georgia and of oysters in South Carolina.

On the Gulf coast some 2,200 more persons were employed than in 1890, but there has been a falling-off in the weight of fish taken, in the value of the product, and the amount of capital invested. This is undoubtedly due to unusual conditions. There have also been marked

changes in the relative values of the yield in different States. The total products amounted to 65,360,623 pounds, valued at $2,271,726 to the fishermen. The oyster fishery, valued at $748,760, was the most important, followed by the sponge fishery, valued at $355,589.

A market is developing in the Southern States west of the Mississippi River for the fishery products from southern California. Considerable shipments, consisting chiefly of barracuda, bonito, mackerel, sea bass, and spiny lobsters, have been made and have brought remunerative prices. Though the industry is yet in its infancy, it would appear that a new and increasing market will be found for California fresh fish and spiny lobsters.

Attention is called in the report of the division (page CLXV) to the fishery resources of the Yukon River, in Alaska, which thus far have only been utilized by the Indians for their own needs. The present information is fragmentary and inconclusive, but there is reason to believe that the abundance of salmon, whitefish, and other valuable species in this river will afford a food supply to the miners and traders located along its banks, and possibly become a factor in the fisheries of the country at large.

Appended to the report of the division are statistical tables relating to the fisheries of the Gulf States, the South Atlantic States, Boston and Gloucester, Mass., San Diego, Cal., and Lake Ontario, and tables showing the yield and value of certain fisheries of New England, the Middle Atlantic States, and the Great Lakes.

INVESTIGATIONS OF THE ALBATROSS.

At the beginning of the fiscal year the steamer *Albatross*, under command of Lieut. Commander Jeff. F. Moser, U. S. N., was engaged in an investigation of the fishery resources of Alaska, and this inquiry was continued until the stormy weather of fall compelled the return of the vessel to more southern latitudes.

Especial attention was given to the salmon fishery, and the report of Captain Moser, to be published in the Bulletin of this Commission for 1898, gives a full account of the expedition, and is an important contribution to this subject, supplying much-needed and detailed information.

Many of the waters visited had not been completely surveyed, and in consequence existing charts were found to be defective. In addition to the inquiries pertaining to the investigation much hydrographic work was done by Captain Moser, his notes of which, with accompanying chart corrections, have been forwarded to the Coast and Geodetic Survey.

The investigation embraced the physical characteristics of streams and their productive capacity, the species of salmon frequenting them, together with observations on the habits, sizes, and abundance of these fishes, and a comparison of their past and present abundance; the extent and methods of fishing operations and their effect on the supply

of fish; detailed statistics of the canneries and salteries, besides a general study of the subject.

All of the canneries in operation in Alaska outside of Bering Sea were visited, and as many streams explored as time would permit. Owing to the great extent of the Alaskan coast line and the character and number of its streams, it was impossible to visit them all in a single season, and no attempt was made to explore any except where redfish are found, as this species is of the most commercial importance. It had been intended to continue the investigation during the following year and carry it on until complete data are available regarding all the waters of the Territory, whether they are now fished or not, but further inquiries have been unavoidably postponed till another season, as, owing to the outbreak of the war with Spain, the *Albatross* was, on April 13, 1898, detailed by the President to the Navy Department for use as an auxiliary cruiser.

The examinations of streams were made with care, not only to determine what species of fish frequented them and to obtain complete records of them as salmon-producers, but also to discover what injury had been caused by the erection of traps and barricades, overfishing, etc. The explorations were often carried on with difficulty, owing to natural obstacles, and reliable information was difficult to obtain. At the Indian villages the reports were vague and confusing, and the whites were found to know but little of the streams, save where they themselves fish, and even these they but rarely trace to their sources to examine the spawning-grounds; moreover, large areas of the Territory are uninhabited except during the fishing season.

The most important species of salmon packed in Alaska is the redfish (*Oncorhynchus nerka*), known in other localities as the blueback, sockeye, and by various other names. The other species form but a small percentage of the output, and of these the more important are the humpback (*O. gorbuscha*) and coho (*O. kisutch*). The king salmon (*O. tschawytscha*), the well-known and valuable quinnat or chinook salmon of the Pacific States, is only found in small numbers, and in 1897 formed but little over 2 per cent of the total pack. In 1897, 688,581 cases of redfish and 157,711 cases of humpbacks were packed, 75.74 and 17.35 per cent, respectively, while the remainder of the production was made up of king salmon, cohoes, and dog salmon. The redfish is noted for its deep red color, and is preferred for canning for that reason, although other species, as the humpback and coho, might prove practically as good. The coho is more delicately flavored, has richer meat, and but for the popular prejudice in favor of the red flesh, should rank next to the king salmon in value.

The dates when the salmon arrive in sufficient quantities to be taken for commercial purposes vary largely in streams in the same neighborhood, the larger rivers and the streams nearer the sea usually receiving the first fish. As a rule the "run" from the sea to the rivers and streams for the purpose of spawning occupies practically the entire

season of open water, the different species following each other in somewhat regular sequence, so that the canneries are able to operate advantageously throughout the summer months and into the early fall. King salmon are taken as soon as the ice disappears in the spring, as early as May 6 at the Copper River, but the canneries usually begin to operate in June, as the run of redfish begins during that month. Except at Karluk, where the runs frequently extend to the first of October, cannerymen count on the supply of redfish lasting about six weeks, and the pack of this species is completed early in August. There is also considerable variation in the runs of cohoes, which follow the redfish, but which are taken in quantities from the first week in August until the canneries close, about September 20, though in one or two instances canneries commence packing cohoes as early as July. Humpbacks are said to be in condition for packing only about one month; the bulk of this species is packed in southeast Alaska, from the middle of July to the middle of August.

The fishing is carried on in the main by fishermen in the employ of the canneries, except in southeast Alaska, where, though the canneries have their own fishermen, a large part of the supply of fish is purchased from native or white fishermen. This supply is obtained under various arrangements, and frequently certain fishing rights are recognized by the canneries. These so-called rights have their foundation in prior discovery or—especially with the Indians—in continuous residence on or near the stream in question. The fisheries frequently give rise to disputes between the rival claimants to the different streams.

The streams of Alaska show the results of the enormous drains made on them by continuous fishing, and though it can not be asserted that the supply of salmon will fail entirely within a few years, there is no doubt that the streams are slowly becoming depleted. Canneries have increased in numbers, many of them have been enlarged, and the production of canned salmon is steadily increasing, but fewer salmon are caught now than formerly in the streams which have long been fished, notwithstanding the use of improved gear and appliances. Taking, for instance, a section of southeast Alaska, where, in 1889, four canneries produced 13,000 cases, and in 1897 produced double that pack—in 1889 the fish were nearly all redfish and taken from streams near the canneries, while in 1897 few redfish were taken, the pack being mainly composed of humpbacks; and yet, to obtain the supply, all the streams within 70 or 80 miles of the canneries had been fished with all the gear that could be used. Again, at another locality, where, from 1890 to 1896, an average of 61,400 cases annually were packed with fish taken from one stream by one establishment, in 1896 three canneries, putting forth great efforts to secure a large output, only packed 65,000 cases, and in 1897, with redoubled energy, 74,159 cases. Many such instances could be pointed out, but these will serve as illustrations of how the streams are being gradually depleted by the barricading of streams and overfishing—in other words, illegal fishing.

As the investigation progressed it was surprising to discover the number of streams which were, or had been barricaded, notwithstanding the strict laws prohibiting such obstructions. These conditions were more observable in southeast Alaska and Prince William Sound, as the streams there are small, easily closed, and numerous. The extensive and indiscriminate use of barricades is fatal to the natural maintenance of the salmon by preventing their ascent to the spawning-grounds. At the approach of the spawning period the salmon come to the rivers and streams, gathering in schools which grow larger and larger as the season advances, and after they have accustomed themselves to the brackish water at the mouths of the streams they are ready to ascend to the spawning-beds. If their progress is obstructed they remain in the bay or inlet about the approaches to the stream, endeavoring to pass the barricade, and thus are practically corralled and easily taken in great numbers at small expense.

It is maintained by the cannerymen that salmon held in brackish waters ripen less rapidly, and consequently by the operation of barricades they can be obtained in suitable condition for canning much later in the season.

The laws and regulations pertaining to the Alaska salmon fisheries are not very generally observed and do not prevent the illegal capture of fish. While in a minor degree the law may be defective, and owing to the varying conditions found in the vast extent of territory involved may need amending, still it is good as it stands and for the present only needs enforcement, and there is no doubt the proprietors of the canneries would be glad to see it enforced if it is done impartially.

Without considering the large amount of money invested in the canneries with their elaborate and expensive equipment, the output is worth in round numbers $3,000,000 a year, and unless effective steps are taken to prevent the indiscriminate and wasteful taking of salmon, it will be only a question of time before the cannery interests will suffer severely, and through causes for which they are in part responsible.

The canning industry in Alaska began in 1878, when two small establishments were operated at Klawak and Old Sitka, but its development really commenced in 1888, when there were 17 canneries in operation. The unusually large pack of that year attracted general attention to the business, and in consequence many new plants were erected. This resulted in an output in excess of the demand, which caused the abandonment of some of the enterprises, and also led to a consolidation of many of them into an association known as the Alaska Packers' Association. Of the 29 canneries of Alaska in operation in 1897, 17 belonged to this association, with an output of 669,494 cases, or nearly 74 per cent of the total pack.

Of the pack in 1897, southeast Alaska contributed 29.9 per cent; the Prince William Sound and Copper River region 6.6 per cent; the Cook Inlet region 6.5 per cent; the Kadiak and Chignik region 43.8 per cent, and the Bering Sea region 19.9 per cent.

The following statement of the salmon pack of Alaska for 1897, shows the daily capacity of the different canneries, the number of cases packed, and the average number of fish contained in each case:

Name of company and location of cannery.	Daily capacity (cases).	Redfish.		Cohoes.		Humpbacks.		King and dog.	
		Number of cases packed.	Average number per case.	Number of cases packed.	Average number per case.	Number of cases packed.	Average number per case.	Number of cases packed.	Average number per case.
Quadra Packing Co., Boca de Quadra	500	7,500	.....	3,000	.....	14,000	.....	.....	.....
Metlakahtla Industrial Co., Metlakahtla, Annette Island	600	7,090	.....	840	.....	7,260	.....	[1] 300	.....
Pacific Steam Whaling Co., Hunter Bay, Prince of Wales Island	800	13,162	13	5,300	7	15,926	19	.....	.....
Alaska Salmon Packing and Fur Co., Loring, Naha Bay	1,800	10,470	11.5	2,306	8.5	49,264	23	.....	.....
Boston Fishing and Trading Co., Yes or McDonald Bay	800	6,754	9	1,644	6	12,806	15	[2] 1,096	6
Glacier Packing Co., Point Highfield, Wrangell Island	1,500	7,428	9.5	8,620	8.8	28,624	23.1	[3] 1,246	3.9
North Pacific Trading and Packing Co., Klawak, Prince of Wales Island	500	9,520	13	1,995	8 to 9	4,190	22	.....	.....
Baranoff Packing Co., Redfish Bay, Baranoff Island	500	4,058	11	1,576	5	8,436	23	.....	.....
Pyramid Harbor Packing Co., Pyramid Harbor, Chilkat Inlet	1,000	31,241	10.3	1,488	7.5	.....	.....	[3] 4,727	3.1
Peninsula Trading and Fishing Co., Coquenhena, Copper River Delta	800	.....	.....	.....	.....	.....	.....	.....	.....
Pacific Packing Co., Odiak, Prince William Sound	1,500	13,315	12.7	.....	.....	9,784	24.5	[3] 202	4.8
Pacific Steam Whaling Co., Orca, Prince William Sound	1,500	21,927	9.5	3,414	7.5	3,415	18.7	.....	.....
Arctic Fishing Co., Kussilof River, Cook Inlet	1,500	24,701	14.1	2,313	12.1	.....	.....	[3] 5,518	2.5
Hume-Aleutian Packing Co., Karluk, Kadiak Island	2,000	49,633	11.9	.....	.....	.....	.....	.....	.....
Karluk Packing Co., Karluk, Kadiak Island	2,000	54,777	11.9	.....	.....	.....	.....	.....	.....
Alaska Improvement Co., Karluk, Kadiak Island	1,500	49,852	11.9	.....	.....	.....	.....	.....	.....
Arctic Packing Co., Alitak Bay, Kadiak Island	1,500	37,401	13.7	.....	.....	.....	.....	.....	.....
Pacific Steam Whaling Co., Uyak Anchorage, Kadiak Island	800	17,000	12	.....	.....	.....	.....	.....	.....
Hume Brothers & Hume, Uyak Anchorage, Kadiak Island	800	13,375	12.7	.....	.....	.....	.....	.....	.....
Uganuk Fishing Station, Uganuk Bay, Kadiak Island	1,400	2,113	10	.....	.....	.....	.....	.....	.....
Chignik Bay Co., Chignik Lagoon, Chignik Bay	2,000	36,834	12.4	942	11	[4] 383	15	.....	.....
Hume Brothers & Hume, Anchorage Bay, Chignik Bay	800	12,000	12	.....	.....	.....	.....	.....	.....
Pacific Steam Whaling Co., Anchorage Bay, Chignik Bay	800	23,500	12	.....	.....	500	20	.....	.....
Arctic Packing Co., Nushagak River, Bering Sea	2,000								
Alaska Packing Co., Nushagak River, Bering Sea	2,000	88,791	14	10,119	.....	3,123	.....	5,823	3
Bristol Bay Canning Co., Nushagak River, Bering Sea	2,000								
Point Roberts Packing Co., Kvichak River, Bering Sea	2,000	55,382	12.4	.....	.....	.....	.....	126	2.7
Arctic Packing Co., Naknek River, Bering Sea	1,800	34,496	12.4	.....	.....	.....	.....	180	.....
Naknek Packing Co., Naknek River, Bering Sea	1,500	18,000	12	.....	.....	.....	.....	.....	.....
Bering Sea Packing Co., Ugashik River, Bering Sea	1,200	.....	.....	.....	.....	.....	.....	.....	.....
Ugashik Fishing Station, Ugashik River, Bering Sea	1,800	38,261	12	.....	.....	.....	....	11	.....
Totals	.....	688,581	.....	43,557	.....	157,711	.....	[5] 19,229	.....

[1] Mixed. [2] Dog salmon. [3] King. [4] Humpbacks and dog salmon. [5] Includes dog salmon.

Considerable quantities of salmon are taken which for various reasons can not be utilized in canning, and are therefore salted. The output

of the salteries of Alaska for 1897 may be given as 10,658 barrels of redfish, 660 barrels of cohoes, 292 barrels of king salmon, 5,691 half barrels of humpback bellies, and 575 half barrels of miscellaneous.

The general importance of the salmon resources of Alaska may be seen from the following summary of the pack of canned salmon, classified by districts, from 1878—the year in which the business began—to 1897. From the very small initial pack of 8,159 cases the output has grown in less than twenty years to nearly 1,000,000 cases, the pack in 1896 being 966,000 cases and that in 1897 909,000 cases. In the regions of Cook Inlet, Prince William Sound, and Copper River salmon fishing is as yet comparatively light, but in southeastern Alaska, in Bering Sea, and at Kadiak and Chignik it is very extensive and tends to increase each year. The quantity of fresh salmon represented by the pack of 1897 was about 60,000,000 pounds, and the weight of the fish as canned was nearly 44,000,000 pounds.

The total pack of canned salmon in the twenty years indicated is seen to have been 7,508,358 cases of 48 one-pound cans. This quantity, with the 145,000 barrels of salmon which have been salted in the same period, represents over 600,000,000 pounds of fresh salmon taken from the waters of Alaska. The market value of the canned and salted product was a little over $32,000,000.

Summary, by districts, of the cases of salmon canned in Alaska from 1878 to 1897.

Year.	Southeast Alaska.	Prince William Sound and Copper River.	Cook Inlet.	Kadiak and Chignik.	Bering Sea.	Total.
1878	8,159	.....	.....	.....	.....	8,159
1879	12,530	.....	.....	.....	.....	12,530
1880	6,539	.....	.....	.....	.....	6,539
1881	8,977	.....	.....	.....	.....	8,977
1882	11,501	.....	6,044	4,200	.....	21,745
1883	18,040	.....	14,818	13,479	.....	46,337
1884	19,189	.....	21,141	20,156	400	60,886
1885	10,828	.....	19,217	33,470	14,000	77,515
1886	18,100	.....	28,433	46,150	48,822	141,505
1887	31,462	.....	30,765	71,750	72,700	206,677
1888	81,128	.....	42,451	198,650	89,886	412,115
1889	136,760	24,204	50,494	386,753	115,985	714,196
1890	142,901	42,194	28,655	350,451	118,390	682,591
1891	156,615	68,091	58,997	384,279	133,418	801,400
1892	115,722	.....	20,741	274,755	63,499	474,717
1893	136,053	76,998	31,665	291,152	107,786	643,654
1894	142,544	78,663	34,033	322,356	108,844	686,440
1895	148,476	59,494	36,188	232,237	150,135	626,530
1896	262,381	92,866	34,767	358,357	218,336	966,707
1897	271,867	62,057	32,532	298,310	254,312	909,078
Total	1,739,832	494,567	490,041	3,286,505	1,496,513	7,508,358

During the cruise of the *Albatross* fishery trials were carried on whenever opportunity offered, the efforts being especially directed toward the location of halibut banks. Halibut trawls were set in all localities, and every opportunity was taken to make inquiries. These fish were obtained everywhere, but not in large numbers excepting off Killisnoo. No great success was met with at Clarence Strait, which is a favorite halibut-ground, and the small vessels which sometimes visit this point for halibut have no certainty of finding a load. The Indians take without difficulty a sufficient supply for their own use, and, while

a fishing vessel might fill up, no great banks are known which can be relied on to supply a considerable market. South of Dixon Entrance, in the waters of British Columbia, halibut are found in large numbers throughout the winter, and in the spring are found in limited numbers in the waters of southeast Alaska.

THE STEAMER FISH HAWK.

The constant service of this vessel since she was last thoroughly overhauled in 1890 had necessitated extensive repairs, besides new boilers to supply the place of those which had been in use since 1887. Accordingly, on the completion of the mackerel work in July, 1897, the vessel was dismantled and sent to East Boston to receive a new main and auxiliary boiler. A new propeller, propeller shaft, and evaporator were added, and such other general repairs made to the machinery and joiner work as were essential to render the vessel perfectly seaworthy and serviceable. The hatching outfit also was renewed and the deck rearranged to permit an increase of the hatching capacity of about 50 per cent. Not only has the efficiency of the ship been greatly improved by these alterations and repairs, but she can now maintain an increased average speed at a considerable saving of coal and of wear on the machinery.

During the winter of 1897–98 the *Fish Hawk* was in attendance on the Fisheries Congress at Tampa, Fla., and afterwards engaged in a survey of the oyster-grounds in Louisiana, already referred to. At the conclusion of this duty, at the request of the United States Coast and Geodetic Survey, a hydrographic survey of Grand Bay, Alabama, was made in the latter part of February, 1898; and in March an investigation was conducted with reference to establishing a shad-hatchery on the Edisto River, South Carolina, but the conditions were found to be unfavorable.

When the shad season opened the usual fish-cultural work was taken up in North Carolina waters and in the Delaware River and carried on till May 4, 1898, when the vessel was, by order of the President, turned over to the Navy Department for service with the mosquito fleet during the war with Spain, her commander, Lieut. Franklin Swift, U. S. N., remaining with her. Lieutenant Swift had been in command of the *Fish Hawk* since June 27, 1895, and his services have been of great value to this Commission.

EXPOSITIONS.

The Tennessee Centennial Exposition, at Nashville, which was in progress at the close of the last fiscal year, came to an end October 31, 1897. The exhibit of the Commission, showing the workings of its various branches as described in the last annual report, attracted great attention from visitors, the specially interesting feature, as in other exhibits of the Commission, being the live fish displayed in the aquarium and the practical illustration of fish-culture, which was shown by the hatching of the eggs and the care of the fry of various species. There were hatched at different times during the season 3,500,000 shad

eggs; 10,000 trout eggs, and 20,000 eggs of the quinnat salmon. The resultant fry, after being placed on exhibition, were planted in suitable waters in Tennessee.

An act of Congress approved June 10, 1896, provided for the participation of the Executive Departments of the Government, the Smithsonian Institution, the United States Fish Commission, and the National Museum in the Trans-Mississippi and International Exposition to be held in Omaha, Nebr., from June 1 to November 1, 1898. Mr. W. de C. Ravenel, already in charge of the exhibit at Nashville, was appointed, on July 27, 1897, the representative of the Fish Commission on the Government board for the Omaha Exposition, and at the close of the exposition at Nashville arrangements were made to ship much of the material there collected to Omaha, and the other work of preparation for the latter exposition was promptly begun. The Omaha exposition is now in progress, and the exhibit of the Fish Commission, as on former occasions of this nature, is designed to show the character of the work of its branches, the methods pursued, and the results obtained.

By a joint resolution approved February 17, 1898, an invitation of the Government of Norway to take part in an international fisheries exposition, to be held at the city of Bergen, Norway, from May 16 to September 30, 1898, was accepted by this Government. The Commissioner of Fish and Fisheries was directed, in person, or by a deputy to be appointed by the President, to cause a suitable and proper exhibition and display to be made at this exposition of the food-fishes of the United States, and the methods of catching, salting, curing, and preserving them, and of the appliances used in carrying on the fishery industries of the United States. He was further authorized to use, with the consent of the Secretary of the Smithsonian Institution, any portion of the fisheries collection in the National Museum. In accordance with this resolution Capt. J. W. Collins, of Massachusetts, was designated to represent the United States at the exposition, and was duly appointed by the President on March 1, 1898. The work of collecting the necessary material for the exhibit was promptly begun, and on April 20 Captain Collins sailed for Norway. The scope of the exposition is designed to be very extensive in its illustration of the fishery industries, and, in accordance with law, at its close a full report will be submitted of the participation of the United States and of all information and results acquired by means of the exposition touching the fishery industries throughout the world.

FISHERIES CONGRESS.

On the invitation of the governor of Florida this Commission participated in the National Fisheries Congress, which convened in Tampa, Fla., to consider the propagation and protection of fish in the waters of the United States, and devise means and methods of protection for valuable food-fishes. The governors of the various States were requested to send delegates, and the convention, which was in session from January 19 to 24, was attended by many persons interested in the fisheries,

in fish-cultural work, and in scientific research. A number of papers on timely subjects were read and discussed, and it is believed that the personal meeting and interchange of views of those present will be of value to the fishery interests. This Commission was represented by Dr. Hugh M. Smith, Mr. W. de C. Ravenel, Mr. C. H. Townsend, Mr. H. F. Moore, and Lieut. Franklin Swift, of the steamer *Fish Hawk*.

As the *Fish Hawk* was on duty in neighboring waters she was directed to remain in Tampa Bay during the sessions of the congress and was visited by many of the delegates; the vessel was equipped with hatching apparatus and aquaria, in which some of the native fish and crustaceans of the region were shown, and an exhibition of the methods of deep-sea dredging was given in Tampa Bay. The Commission further participated by exhibiting collections of oysters, ornamental corals, and other products of American waters, and one of its fish transportation cars was also present. The proceedings of the congress and the papers there presented, covering a wide range of subjects, were published in the Bulletin for 1897 and also issued as a special document.

During March, 1898, an exhibition, given under the auspices of the New England Sportsmen's Association, was held in Boston, Mass., and at the request of citizens interested in the fisheries and in game, such assistance as was practicable in making the exhibit interesting and instructive was rendered by the Commission.

NEW STATIONS.

A final examination of the site selected for a fish-cultural station at Spearfish, S. Dak., was made during the summer of 1897, and as it was found that an ample supply of water would be available at all seasons the site described in the last annual report was decided on. The purchase of the land was consummated June 30, 1898, and the construction of the station will be prosecuted during the coming year.

During the summer and fall there was an investigation of the various localities in New Hampshire suggested as suitable for a fish-hatchery, and a selection was made of land near the Nashua River, about 1½ miles west of the city of Nashua. This site possesses in a greater degree than any others examined in the State the requisites for a fish-hatchery. An ample supply of water is obtainable from springs and artesian wells, and the topography of the land is such that it can be carried by gravity to the points where it will be used. The property is well suited for a favorable arrangement of buildings and ponds, and its proximity to a city of considerable size, with railroad facilities and a market for supplies, is of great advantage. The property was purchased March 28, 1898, and on May 12, 1898, the work of construction was begun.

At the new station at Erwin in Tennessee, the work has been continued, and a hatchery building, cottage for the superintendent, and other buildings have been completed. Ponds have been excavated, the water-supply lines and drains built, and necessary roads laid out. In November, although the work of construction was not complete, two

large ponds and six rearing-ponds were ready and the fish-cultural operations had begun.

On December 20, 1897, an act passed by the Virginia legislature was approved authorizing the transfer of the station at Wytheville from the State of Virginia to the United States. In accordance with an act of Congress approved June 8, 1896, the purchase was made March 5, 1898, and the preparation of plans for permanent improvements was begun. New buildings will be erected, the pond system enlarged, the water supply increased, and the efficiency of the station generally improved.

An item in the deficiency bill approved July 19, 1897, called for an investigation in the State of Georgia to select a suitable location for a fish-cultural station. A preliminary examination was made in the summer and fall of 1896 in the vicinity of Macon, as well as in other parts of the State. A number of localities were visited by agents of the Commission and a report was made to Congress January 5, 1898, showing that of all the sites examined, Cold Springs, near Bullochville, Meriwether County, is best adapted for the purpose required, having an abundant supply of clear, cold water, good railroad facilities, and land easily available for necessary constructions. Furthermore, the owner of the property is willing to donate the land to the Government for a fish-cultural station, as required by the act authorizing the survey.

On account of the importance of the blueback or sockeye salmon (*Oncorhynchus nerka*) in the Puget Sound region, the Commission has had under advisement the establishment of a hatchery for the propagation of that species at some point on the northwest coast. As extensive spawning-grounds of the blueback were known to exist at Baker Lake, Oregon, and as a hatchery had been successfully operated there by the State of Washington, a preliminary examination of the lake was made. It was found that an ample supply of eggs of the sockeye could be obtained and that the natural conditions of the locality were favorable.

At the request of citizens interested, an examination was made of the streams in the vicinity of Arkadelphia and Hot Springs, Ark., to determine on the advisability of establishing a hatchery, but no suitable location was found.

MISCELLANEOUS.

The new constructions and surveys mentioned above have been under the direction of the architect and engineer, Mr. H. von Bayer, who has continued the supervision of the repairs and alterations at the stations necessary to maintain their efficiency. Besides the routine work of this office, various charts, maps, and plans, to illustrate the reports of the Commission have been prepared there.

As there have been laws passed in many States requiring the erection of fishways wherever a dam is constructed, this office has been frequently called upon for advice, and plans and descriptions of fishways have been asked for. In order to be prepared to readily answer those

questions in future, Mr. von Bayer was directed to prepare a set of plans which combine the most important principles of fishways, and which can be easily adapted to the various constructions of dams. These plans, with directions for practical use, are completed and are ready for distribution to any State officer or other responsible person. A copy of this plan on a small scale is shown on plate III.

In addition to the regular duties of the naval engineer, he has prepared plans for new boilers for the steamer *Albatross*, and for the electrical and refrigerating apparatus at the Omaha Exhibition. Past Assistant Engineer C. W. Dyson, U. S. N., who has efficiently filled this position since October 21, 1895, was detached for regular naval duty April 26, 1898.

The distributing cars Nos. 1 and 3, having been in almost constant use fifteen years, showed the effects of continued service, and $10,000 having been appropriated, they were rebuilt and placed in thorough repair during the fall of 1898. They were supplied with modern equipment, and modifications suggested by experience were made in their arrangement and appliances, increasing their capacity and enhancing their strength and usefulness.

On account of the growth of the business of the Commission on the Pacific Coast and the consequent continued presence there of field agents and other employees, it became advisable to provide suitable office accommodations, as well as storage room for the material, which, in the form of collections, equipment, etc., had accumulated in considerable quantities. As no quarters were available in the Government Building in San Francisco, a room in the Academy of Sciences Building in that city was engaged at nominal cost, and has been of value in the convenient and prompt transaction of business in the West, especially in the preparation and distribution of reports relating particularly to the Pacific States.

During the year the bound reports, with appendices, for the fiscal years 1896 and 1897 and the following pamphlets were issued:

Report of the Commissioner for the fiscal year ending June 30, 1897, by John J. Brice. (Report for 1897, pp. I-CLXXI.)

A manual of fish-culture, based on the methods of the United States Commission of Fish and Fisheries, with chapters on the cultivation of oysters and frogs, prepared under the direction of John J. Brice, Commissioner. (Report for 1897, pp. 1-340.)

Artificial propagation of the Atlantic salmon, rainbow trout, and brook trout. (Report for 1897, pp. 27-101.)

Artificial propagation of the black bass, crappies, and rock bass. (Report for 1897, pp. 159-177.)

Notes on the edible frogs of the United States and their artificial propagation, by F. M. Chamberlain. (Report for 1897, pp. 249-261.)

Oysters and methods of oyster-culture, with notes on clam-culture, by H. F. Moore. (Report for 1897, pp. 263-340.)

The fishes of the Klamath River Basin, by C. H. Gilbert. (Bulletin 1897, pp. 1-13.)

A report upon salmon investigations in the Columbia River Basin and elsewhere on the Pacific coast in 1896, by Barton W. Evermann and Seth Eugene Meek. (Bulletin 1897, pp. 15-84.)

The fishes found in the vicinity of Woods Hole, by Hugh M. Smith. (Bulletin 1897, pp. 85-111.)

Publications of the United States Commission of Fish and Fisheries available for distribution on June 30, 1897. (Report for 1896, pp. 343-356.)

Report of observations made on board the United States Fish Commission steamer *Albatross* during the year ending June 30, 1896. (Report for 1896, pp. 357-386.)
Observations upon the herring and herring fisheries of the Northeast coast, with special reference to the vicinity of Passamaquoddy Bay, by H. F. Moore, Ph. D. (Report for 1896, pp. 387-442.)
The salmon fishery of Penobscot Bay and River in 1895 and 1896, by Hugh M. Smith. (Bulletin 1897, pp. 113-124.)
Descriptions of new or little-known genera and species of fishes from the United States, by Barton W. Evermann and William C. Kendall. (Bulletin 1897, pp. 125-133.)
Notes on the halibut fishery of the Northwest coast in 1896, by A. B. Alexander. (Bulletin 1897, pp. 141-144.)
The herring industry of the Passamaquoddy region, Maine, by Ansley Hall. (Report for 1896, pp. 443-487.)
Statistics of the fisheries of the interior waters of the United States, by Hugh M. Smith. (Report for 1896, pp. 489-574.)
Notes on the fisheries of the Pacific coast in 1895, by William A. Wilcox. (Report for 1896, pp. 575-659.)

There have been distributed 4,460 bound and 12,420 pamphlet copies of the publications of this Commission.

The Museum of Comparative Zoology has continued the publication of the series of papers based on the material collected during the investigations of the United States Fish Commission steamer *Albatross*, in 1891, and during the year has issued the following:

Memoirs, vol. XXIII, No. 1—XXI, Die Medusen; by Otto Maas.
Bulletin, vol. XXXI, No. 5—XXII, The Isopoda; by H. J. Hansen.
Bulletin, vol. XXXII, No. 5—XXIII, Preliminary report on the Echini, by Alexander Agassiz.

Appropriations were made by Congress for the operations of the Commission for the fiscal year ending June 30, 1898, as follows:

Salaries	$195,620.00
Miscellaneous expenses:	
Administration	9,000.00
Propagation of food-fishes	132,500.00
Maintenance of vessels	30,500.00
Inquiry respecting food-fishes	10,800.00
Statistical inquiry	5,000.00
For new boilers and general repairs to the steamer *Fish Hawk*	29,640.00
For rebuilding steam launch in use on Potomac River	2,000.00
For purchase of steamer *Senator* for station at Green Lake, Me	1,500.00
For purchase of steam launch for steamer *Albatross*	4,000.00
For rebuilding fish-transportation cars	10,000.00
For establishment of fish-cultural station in New Hampshire	15,000.00
For establishment of fish-cultural station at Battle Creek, Cal	3,500.00
For construction of dwelling-house at the station at St. Johnsbury, Vt.	3,500.00
For additional water supply at the station at St. Johnsbury, Vt	3,000.00
For completion of stations now under construction at—	
San Marcos, Tex	1,800.00
Manchester, Iowa	4,216.50
For investigation and selection of site for a fish-cultural station in Georgia	500.00

A report showing in detail the expenditure of these appropriations will be made to Congress in accordance with law.

GEO. M. BOWERS,
U. S. Commissioner of Fish and Fisheries.