

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

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

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

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

GENERAL FIELD INVESTIGATIONS.

THE MACKEREL FISHERY.

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

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

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

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

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

States	Vessel fishermen.			Shore or boat fishermen.			Total.		
	1890.	1891.	1892.	1890.	1891.	1892.	1890.	1891.	1892.
Maine.....	374	482	418	2,420	2,603	2,387	2,803	3,085	2,805
New Hampshire.....	32	25	25	23	16	20	55	41	45
Massachusetts.....	1,440	1,722	1,876	948	969	1,006	2,388	2,691	2,882
Rhode Island.....	58	60	71	72	72	74	130	132	145
Connecticut.....		17	16					17	16
Total.....	1,904	2,306	2,406	3,472	3,660	3,487	5,376	5,906	5,893

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

REPORT OF COMMISSIONER OF FISH AND FISHERIES. 117

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

Items.	Maine.		New Hampshire.		Massachusetts.	
	No.	Value.	No.	Value.	No.	Value.
1890.						
Vessels	28	\$88,700	3	\$3,700	153	\$306,205
Outfit		38,900		1,950		97,041
Tonnage	1,608		90		6,305	
Boats	1,072	105,210	43	1,620	778	79,622
Apparatus, vessel fisheries:						
Seines	37	20,000	4	1,600	142	70,365
Gill nets	179	1,134	20	300	402	4,235
Lines					1,383	193
Apparatus, boat fisheries:						
Seines	5	300			2	900
Gill nets	3,800	27,811	75	1,125	3,174	32,099
Pound nets and weirs	108	40,705			175	183,825
Lines	4,584	570	20	2	1,051	212
Total		324,239		10,297		775,207
1891.						
Vessels	35	111,975	2	3,000	164	423,794
Outfit		48,000		1,285		125,810
Tonnage	2,079		75		7,728	
Boats	2,156	112,287	36	1,525	799	80,992
Apparatus, vessel fisheries:						
Seines	49	25,050	4	1,500	181	92,320
Gill nets	149	894			386	3,700
Lines					1,094	156
Apparatus, boat fisheries:						
Seines	5	350			3	1,050
Gill nets	4,031	30,817	75	1,125	2,822	27,980
Pound nets and weirs	159	59,165			192	190,950
Lines	5,020	752	6	1	1,888	226
Total		389,290		8,436		946,987
1892.						
Vessels	32	92,450	2	3,000	164	489,719
Outfit		41,210		1,385		137,972
Tonnage	1,758		75		8,657	
Boats	2,005	109,576	34	1,580	830	80,941
Apparatus, vessel fisheries:						
Seines	44	21,750	4	1,500	184	102,450
Gill nets	181	1,086			431	4,335
Lines					972	152
Apparatus, boat fisheries:						
Seines	6	375	1	100	3	900
Gill nets	3,882	28,354	75	1,125	2,752	27,550
Pound nets and weirs	154	52,026			207	184,710
Lines	4,224	542			2,250	273
Total		347,369		8,690		1,028,102

Items.	Rhode Island.		Connecticut.		Total.	
	No.	Value.	No.	Value.	No.	Value.
1890.						
Vessels	15	\$13,100			201	\$411,705
Outfit		1,236				139,727
Tonnage	158				8,161	
Boats	36	5,300			2,829	191,761
Apparatus, vessel fisheries:						
Seines					183	92,865
Gill nets					601	5,609
Lines	136	85			1,519	278
Apparatus, boat fisheries:						
Seines					7	1,200
Gill nets					7,049	61,935
Pound nets and weirs					283	224,530
Lines	144	29			6,399	813
Total		19,750				1,120,583
1891.						
Vessels	16	14,100	1	\$3,000	218	555,869
Outfit		1,336		1,300		177,740
Tonnage	173		71		10,126	
Boats	36	5,300			3,027	200,104

118 REPORT OF COMMISSIONER OF FISH AND FISHERIES.

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

Items.	Rhode Island.		Connecticut.		Total.	
	No.	Value.	No.	Value.	No.	Value.
1891—continued.						
Apparatus, vessel fisheries:			2	\$700	236	\$119,570
Seines					535	4,594
Gill nets					1,246	242
Lines	152	\$86				
Apparatus, boat fisheries:					8	1,400
Seines					6,928	59,922
Gill nets					351	250,115
Pound nets and weirs					7,058	1,008
Lines	144	29				
Total		20,851		5,000		1,370,504
1892.						
Vessels	18	17,700	1	3,000	207	605,869
Outfit		1,022		1,300		183,489
Tonnage	203		71		10,764	
Boats	37	5,800			2,906	196,097
Apparatus, vessel fisheries:			2	700	234	126,400
Seines					612	5,421
Gill nets					1,158	261
Lines	186	109				
Apparatus, boat fisheries:					10	1,375
Seines					6,709	57,029
Gill nets					361	236,736
Pound nets and weirs					6,631	845
Lines	148	30				
Total		25,261		5,000		1,414,422

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

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

States.	Total quantity as taken from the water (pounds).	Quantity sold fresh.		Quantity sold salted.	
		Pounds.	Value.	Pounds.	Value.
1890—Maine	3,514,217	2,106,017	\$127,706	898,800	\$70,569
New Hampshire	107,800	74,800	6,140	22,000	1,578
Massachusetts	6,084,095	2,393,495	163,606	3,060,400	221,075
Rhode Island	339,175	88,375	7,652	167,200	13,509
Connecticut					
Total	10,945,287	4,722,687	305,104	4,148,400	300,731
1891—Maine	6,087,045	3,837,345	194,724	2,090,800	139,264
New Hampshire	68,460	10,560	522	38,600	2,187
Massachusetts	11,939,074	3,898,174	242,123	5,360,600	303,351
Rhode Island	274,475	93,275	8,176	120,800	9,583
Connecticut	93,300			62,200	3,408
Total	19,362,354	7,839,354	445,545	7,682,000	457,793
1892—Maine	5,072,433	2,521,233	133,781	1,700,800	113,685
New Hampshire	59,000	15,500	1,420	29,000	2,525
Massachusetts	16,037,805	4,762,905	305,839	7,516,600	484,657
Rhode Island	226,975	111,475	9,934	77,000	5,802
Connecticut	98,700			65,800	4,817
Total	21,494,913	7,411,113	450,974	9,389,200	611,486

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

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

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

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

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

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

120 REPORT OF COMMISSIONER OF FISH AND FISHERIES.

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

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

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

Year.	Maine.				New Hampshire.			
	Fresh.		Salted.		Fresh.		Salted.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1880.....	4,352,455	\$135,249	18,228,000	\$524,055	308,000	α\$10,580	1,470,000	\$41,160
1887.....	1,011,814	54,809	3,023,000	159,784	144,377	8,849	49,600	2,728
1888.....	573,509	40,703	1,121,000	73,900	56,616	4,118	43,400	3,348
1889.....	417,441	36,074	502,100	51,904	21,860	2,010	24,000	2,359
1890.....	2,166,017	127,705	898,800	70,569	74,800	6,140	22,000	1,578
1891.....	3,837,345	194,724	2,099,800	130,264	10,560	522	36,600	2,187
1892.....	2,521,233	133,781	1,700,800	113,685	15,500	1,420	29,000	2,525

Year.	Massachusetts.				Rhode Island.			
	Fresh.		Salted.		Fresh.		Salted.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1880.....	16,896,308	\$224,720	20,684,200	\$853,420	89,000	α\$2,670		
1887.....	5,890,092	287,657	15,084,500	870,025	208,063	18,545	500,200	\$28,541
1888.....	4,755,925	268,800	8,920,050	650,520	237,100	20,007	303,800	23,624
1889.....	2,305,028	190,074	4,382,167	394,517	236,612	25,081	302,000	24,555
1890.....	2,393,495	163,666	3,060,400	221,075	88,375	7,652	167,200	13,509
1891.....	3,898,174	242,123	5,360,600	303,351	93,275	8,176	120,800	9,583
1892.....	4,762,905	305,839	7,516,600	484,657	111,475	9,934	77,000	5,802

Year.	Connecticut.				Total.			
	Fresh.		Salted.		Fresh.		Salted.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
1880.....	37,000	α\$1,110	844,600	\$24,282	21,742,763	\$374,329	50,226,800	\$1,442,917
1887.....	41,700	3,210	50,280	3,046	7,356,046	373,070	18,716,580	1,064,124
1888.....	28,160	2,276	24,500	2,100	5,651,310	335,904	10,412,750	762,492
1889.....	33,500	3,311	16,100	1,539	3,074,441	256,550	5,286,967	474,874
1890.....					4,722,687	395,164	4,118,400	306,731
1891.....			62,200	3,408	7,849,354	445,645	7,682,000	457,783
1892.....			65,800	4,817	7,411,113	450,074	9,389,200	611,486

α Approximate.

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

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

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

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

Apparatus.	Maine.		New Hampshire.		Massachusetts.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
1890.						
Salt fish:						
Seines.....barrels..	3,993	\$64,311	80	\$1,103	13,560	\$192,825
Gill nets.....do.....	104	1,583	30	475	386	6,331
Pound nets.....do.....	231	2,340			29	415
Lines.....do.....	166	2,335			1,327	21,564
Total.....	4,494	70,569	110	1,578	15,302	221,075
Fresh fish:						
Seines.....pounds..	10,350	1,068	28,800	2,790	618,480	36,901
Gill nets.....do.....	815,148	48,572	28,000	1,950	499,007	40,586
Pound nets.....do.....	874,784	46,582			1,133,438	74,588
Lines.....do.....	456,755	31,544	18,000	1,400	142,370	11,531
Total.....	2,166,017	127,766	74,800	6,140	2,393,495	163,606
1891.						
Salt fish:						
Seines.....barrels..	8,047	113,825	193	2,187	25,456	283,143
Gill nets.....do.....	312	3,924			525	7,504
Pound nets.....do.....	1,233	17,288			83	1,788
Lines.....do.....	307	4,227			739	10,916
Total.....	10,499	139,264	193	2,187	26,803	303,351
Fresh fish:						
Seines.....pounds..	13,916	825	5,760	232	679,380	41,355
Gill nets.....do.....	1,049,485	56,281	3,000	210	521,807	42,520
Pound nets.....do.....	1,882,361	77,060			2,495,675	142,329
Lines.....do.....	691,593	60,558	1,800	80	201,312	15,913
Total.....	3,837,345	194,724	10,560	522	3,898,174	242,123
1892.						
Salt fish:						
Seines.....barrels..	7,539	102,546	145	2,525	84,637	440,016
Gill nets.....do.....	225	3,125			935	14,030
Pound nets.....do.....	137	1,499			1,107	17,500
Lines.....do.....	603	6,515			904	13,051
Total.....	8,504	113,685	145	2,525	37,583	484,057
Fresh fish:						
Seines.....pounds..	83,751	4,843	13,500	1,280	1,105,435	73,644
Gill nets.....do.....	806,510	45,703	2,000	140	607,787	47,449
Pound nets.....do.....	1,174,328	59,348			2,740,709	159,832
Lines.....do.....	456,644	26,887			308,974	24,914
Total.....	2,521,233	133,781	15,500	1,420	4,702,905	305,830

122 REPORT OF COMMISSIONER OF FISH AND FISHERIES.

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

Apparatus.	Rhode Island.		Connecticut.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
1890.						
Salt fish:						
Seines.....barrels.....					17,643	\$258,239
Gill nets.....do.....					520	8,389
Pound nets.....do.....					260	2,755
Lines.....do.....	836	\$13,509			2,320	37,348
Total.....	836	13,509			20,742	306,731
Fresh fish:						
Seines.....pounds.....					660,630	40,759
Gill nets.....do.....					1,312,155	91,108
Pound nets.....do.....					2,098,202	121,170
Lines.....do.....	88,375	7,652			705,700	52,127
Total.....	88,375	7,652			4,722,687	305,164
1891.						
Salt fish:						
Seines.....barrels.....			311	\$3,408	34,607	402,563
Gill nets.....do.....					837	11,428
Pound nets.....do.....					1,316	19,076
Lines.....do.....	604	9,583			1,050	24,726
Total.....	604	9,583	311	3,408	38,410	457,793
Fresh fish:						
Seines.....pounds.....					690,056	42,412
Gill nets.....do.....					1,574,292	99,017
Pound nets.....do.....					4,378,056	219,389
Lines.....do.....	93,275	8,176			1,187,950	84,727
Total.....	93,275	8,176			7,839,354	445,545
1892.						
Salt fish:						
Seines.....barrels.....			329	4,817	42,050	549,904
Gill nets.....do.....					1,160	17,155
Pound nets.....do.....					1,244	19,059
Lines.....do.....	385	5,802			1,892	25,368
Total.....	385	5,802	329	4,817	46,946	611,486
Fresh fish:						
Seines.....pounds.....					1,202,686	79,767
Gill nets.....do.....					1,416,297	93,292
Pound nets.....do.....					3,915,037	216,180
Lines.....do.....	111,475	9,934			877,093	61,735
Total.....	111,475	9,934			7,411,113	450,974

THE NEW ENGLAND STATES.

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

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

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

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

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

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

The catch of shad in apparatus set especially for that fish was 939,110 pounds, valued at \$34,948, of which quantity 850,150 pounds, worth \$27,192, were taken in Maine, and 88,960 pounds, worth \$7,756, in Connecticut. The yield of the different kinds of apparatus in each State was as follows: Pound nets, 669,450 pounds, \$19,590 (all in Maine); seines, 17,252 pounds, \$1,704 (all in Connecticut); gill nets, 180,700 pounds, \$7,602, in Maine; 71,708 pounds, \$6,052, in Connecticut. The catch of the regular shad fishermen was greatly augmented by the take of persons using apparatus set primarily for other fish. Thus, in Maine, pound nets took 17,420 pounds, valued at \$789, and gill nets 1,400 pounds, \$70; in Massachusetts, pound nets caught 48,382 pounds, \$2,409; purse seines (operated from mackerel vessels) 79,300 pounds, \$1,986; haul seines, 6,827 pounds, \$410; in Rhode Island, pound nets secured 24,350 pounds, \$776; in Connecticut, pound nets yielded 21,602 pounds, \$1,679.

Considered in the aggregate, the New England shad fishery has declined since 1880. An analysis of the statistics shows that in Maine the catch has decidedly increased and that in Connecticut the decrease has been noticeable. In New Hampshire and Rhode Island there has also been a marked decline, while in Massachusetts the output in 1892

was about the same as in 1880. The total catch of shad in the New England States in 1880 was 2,117,392 pounds, having a value of \$88,730. Of this quantity, 580,319 pounds were taken in Maine, 6,417 pounds in New Hampshire, 164,524 pounds in Massachusetts, 48,100 pounds in Rhode Island, and 1,318,032 pounds in Connecticut. The difference between the output in 1880 and 1892 was 979,001 pounds, valued at \$45,663. In Maine the increase, amounting to 288,651 pounds, or about 50 per cent, was chiefly in the Kennebec River, and in Connecticut the decreased output, 1,207,470 pounds, or 92 per cent, was mostly in the Connecticut River.

The failure of the shad fishery of Connecticut River is one of the most noteworthy changes in the condition of the New England river fisheries in recent years. During the first half of the present century this was, next to the Potomac, doubtless the principal shad stream in the United States. The decline in the fishery dates from and may be definitely traced to the erection of a dam at Hadley Falls, Massachusetts, in 1848. A steady annual decrease in the catch was thereafter reported up to 1868, but as late as 1867 the output of the river was 628,500 shad. In 1869 and 1870 the effects of artificial propagation, first undertaken in 1867, were manifested and large numbers of people who had abandoned the fishery resumed operations; these carried on their business without regard for restrictions, and the supply again became exhausted and has since shown an almost unbroken annual decrease for twenty years, the decline being facilitated by overfishing, the interception of larger numbers of fish at or near the mouth of the river by means of nets, the pollution of the water by sewage and factory refuse, and the construction of jetties at the mouth of the river by which the migrating fish have been diverted to other streams.

The following table, compiled from the reports of the Connecticut and Massachusetts Fish Commissions, shows the number of shad taken in the Connecticut River in each of those States in a series of years. The figures for Massachusetts are fully as suggestive as those for Connecticut. The relatively large catch shown for that State in 1881 was due to a reduction from 5 inches to 2 inches in the size of the mesh permitted to be used in nets; this resulted in a greatly increased yield, consisting chiefly of small fish, and was immediately followed by an inordinately small catch.

Statement of the number of shad taken in the Connecticut River during a series of years.

Years.	Connecticut.	Massachusetts.	Total.	Years.	Connecticut.	Massachusetts.	Total.
1867.....	526,500	102,000	628,500	1884.....	150,045	1,503	151,638
1876.....		12,792	12,792	1885.....	190,300	1,718	192,018
1877.....		6,503	6,503	1886.....	117,950	577	118,527
1878.....		17,790	17,790	1887.....	80,350	850	81,200
1879.....	436,981	13,409	450,390	1888.....	68,450	824	69,274
1880.....	289,918	7,727	277,645	1889.....	42,325	796	43,121
1881.....	351,678	38,382	390,060	1890.....	34,318	58	34,376
1882.....	272,903	2,270	275,673	1891.....	26,503		26,503
1883.....	177,308	3,591	180,899	1892.....	18,376		18,376

The alewife fishery.—Among the river fishes of the New England States the alewives rank next to the smelt in importance, although in all the New England States except Maine and New Hampshire the alewife catch exceeds in value that of the smelt. The fishery is most extensive in Massachusetts, where nearly half the quantity and more than half the value of the yield are obtained. In Maine and Rhode Island the fishery is of similar extent, the former State having a somewhat larger catch and the latter a greater value.

Most of the alewife fishing is done in the rivers or the waters adjoining the river mouths. In Maine the principal alewife grounds are the Machias, Penobscot, Damariscotta, Kennebec, and Sheepscot rivers. In New Hampshire fishing is done in the Piscataqua River. The fishery in Massachusetts is most extensive in Cape Cod Bay, on Marthas Vineyard, and in the Bass, Essex, Rowley, Agawan, Taunton, Mattapoissett, and Acushnet rivers. The catch in Rhode Island is made in Narragansett Bay, and in Connecticut the Connecticut River is the only important fishing-ground.

In 1892 the number of persons in New England engaging in the capture of alewives was 571. Of these, 318 were in Massachusetts and 179 in Maine. The apparatus employed consisted of 112 seines, 203 gill nets, 60 pound nets and weirs, and 151 dip nets. These, with the 258 boats used, had a value of \$17,686. The total catch of alewives amounted to 7,847,928 pounds, with a value of \$100,364, of which 1,313,977 pounds, valued at \$19,826, were incidentally taken in apparatus set primarily for other fish—salmon weirs in Maine and pound nets employed in general shore fishing in Massachusetts, Rhode Island, and Connecticut. The output in Massachusetts was over 3,650,000 pounds, for which the fishermen received \$58,516. The principal part of the catch in Maine and New Hampshire was taken in weirs, in Massachusetts and Rhode Island seines took the largest quantities, while in Connecticut the most prominent apparatus was the gill net, which also took considerable quantities in Maine. More than one-third the aggregate yield was caught with seines, and almost as much with pound nets and weirs.

The herring fishery.—The taking of the sea herring is one of the most important fisheries of New England, because of its actual value and of the extensive industries dependent on it. The value of the herring fishery is exceeded only by that of such prominent fisheries as the whale, cod, mackerel, haddock, halibut, oyster, clam, and lobster; and, if the closely related business of canning and smoking herring is considered, the herring becomes more important than any other New England fishery product except cod.

The herring is taken chiefly in Maine and Massachusetts, although its range embraces the entire New England coast. By far the largest fishery is in Maine, where there are more herring fishermen, more capital invested in the fishery, and more fish taken than in all the other States combined. In Massachusetts, however, the fishery is important.

The bulk of the catch in Maine is consumed in the preparation of sardines and in smoking; while in Massachusetts more herring are used for bait in the line fisheries than for any other purpose.

In 1892 the number of persons engaged in fishing for herring in this region was 1,995; of these, 1,409 were in Maine. The capital invested in vessels, boats, and apparatus that were used in the capture of herring was \$364,840; of this sum, \$197,420 is to be credited to Maine, and \$164,687 to Massachusetts. The aggregate catch of herring was 53,064,929 pounds of fresh fish; this was valued at \$386,871 as it left the hands of the fishermen in a fresh, pickled, or smoked state.

Weirs, pound nets, gill nets, and seines take large quantities of herring, but brush weirs secure the major part of the catch. In Maine, these latter are to be credited with fully three-fourths of the herring yield, and in the entire region they took nearly three-fifths of the aggregate catch. Gill nets rank next to weirs and pounds in the quantity of their yield; they are especially important in Maine, where about seven-ninths of the herring thus secured are obtained. Seines take less than half the fish caught with gill nets, and are more prominent in Massachusetts than in Maine. On parts of the Massachusetts coast, the use of dip nets and torches in the capture of herring is rather a prominent feature of the fisheries, but in other States this primitive method is now of no importance.

Comparing the results of the herring fishery with previous years for which complete data are available, it appears that in 1892 the total output was nearly double that in 1880, and was considerably larger than in 1887, 1888, or 1889. In Maine the catch in 1892 was nearly twice that in 1880, and in Massachusetts the increase was comparatively almost as large. The yield in both Maine and Massachusetts in 1892 was larger than in any other year for which data are available. The following table shows, by States, the quantity and value of herring caught in each of the years named, the weights representing the fish as taken from the water:

Table showing for a series of years the catch of herring in the New England States.

States.	1880.		1887.		1888.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Maine	21,455,192	\$122,596	32,134,095	\$200,615	30,018,007	\$239,949
New Hampshire	108,750	632	225,500	1,793	358,200	3,060
Massachusetts	7,794,780	62,998	8,711,650	74,290	10,846,770	96,776
Total	29,358,722	180,526	41,071,155	276,698	50,222,977	339,785

States.	1889.		1892.	
	Pounds.	Value.	Pounds.	Value.
Maine	30,056,999	\$239,571	40,814,164	\$274,397
New Hampshire	19,800	105	146,000	1,015
Massachusetts	10,434,103	90,782	12,103,465	110,829
Total	40,510,902	330,528	53,064,229	386,841

NOTE.—In Rhode Island in 1892, 700 pounds of herring were caught, having a value of \$30.

In addition to the herring smoked at the sardine canneries in Maine, large quantities are so prepared by the fishermen of the eastern part of the State. In 1892, 10,495,143 pounds of fresh herring taken in American waters, chiefly with brush weirs, were consumed in the preparation of 5,997,225 pounds of smoked fish. These were placed on the market in 1,060,320 boxes, each holding about 5 pounds, and 27,825 boxes holding about 25 pounds each, the value of the smoked fish being \$136,297. By far the largest quantities of herring are smoked by the fishermen of Eastport and Lubec, who also obtain many herring for smoking from weirs set in Canadian waters. The business is also important in the towns of Jonesport, Trescott, Cutler, Addison, and Machiasport. Between 1889, when the Fish Commission conducted an investigation of the Maine fisheries, and 1892, the year covered by the last canvass, this branch experienced a large increase, as shown by the following figures:

Comparative statement of the quantities of herring smoked by Maine fishermen in 1889 and 1892.

Items.	1889.	1892.	Increase in 1892.	Percentage of increase.
Fresh herring utilized pounds..	5,761,000	13,301,395	7,540,395	131
Herring smoked:				
Regular size..... boxes..	626,400	1,460,320	833,920	133
Value.....	\$98,031	\$162,150	\$64,125	65
Bloaters..... boxes..	6,400	34,825	28,425	444
Value.....	\$5,008	\$23,741	\$18,733	374
Total quantity as smoked..... pounds..	3,292,000	8,172,225	4,880,225	150
Total value.....	\$103,039	\$185,897	\$82,858	80

The present extent of the smoked-herring business as compared with the conditions ten years ago is one of the most noteworthy features of the Maine fisheries. This branch has steadily increased since the abrogation of the Washington treaty in 1885. It is not possible to present satisfactory comparative figures showing separately the fish smoked by fishermen and canners and the quantity coming from American and Canadian waters, but accurate statistics may be given showing for the years 1880, 1887, 1888, 1889, and 1892 the total extent of the smoked-herring business. This branch was somewhat less extensive in 1887 than in 1880, but since 1887 the business has steadily increased, and in 1892 had more than double the importance it had twelve years before.

Comparative summary of the smoked-herring business of Maine in 1880, 1887, 1888, 1889, and 1892.

Year.	Fresh herring utilized (pounds).	Herring smoked.					
		Regular size.		Bloaters.		Equivalent number of pounds as smoked.	Total value of smoked fish.
		Boxes.	Value.	Boxes.	Value.		
1880.....	6,138,042	318,915	\$63,783	51,700	\$36,190	4,434,111	\$96,973
1887.....	5,984,098	588,207	88,506	10,120	11,982	3,419,485	100,488
1888.....	7,030,761	755,077	124,705	23,402	15,449	4,360,435	140,154
1889.....	8,008,243	910,880	143,061	19,641	15,369	5,090,425	159,830
1892.....	17,765,460	1,781,214	198,670	49,825	33,306	10,151,695	232,036

The salmon fishery.—The taking of salmon is one of the most interesting of the New England river fisheries, although its economic importance is slight as compared with many other fisheries of that region. While straggling salmon are found in a number of the rivers, it is only in the Penobscot that the yield is sufficiently large to warrant notice, less than one-tenth the total annual output coming from other streams. Special fishing for salmon is prosecuted only in the St. Croix, Denny, and Penobscot rivers, the fish obtained in other waters being only an incidental element in the catch of nets set for shad, alewives, and other fish.

In 1892, the number of persons fishing specially for salmon in the Maine rivers was 198, of whom 174 were in the Penobscot. Of these, 29 used gill nets, 159 pound nets or weirs, and 10 lines. There were 20 gill nets employed, valued at \$615; the pound nets and weirs were 211 in number, worth \$14,450. The boats and shore and other property connected with the fishery had a value of \$5,339. The aggregate catch was 98,322 pounds, for which the fishermen received \$20,332. The quantity taken in the Penobscot River was 92,282 pounds (equivalent to 6,789 fish), valued at \$19,124. The output of the St. Croix, Denny, and Kennebec rivers, respectively, was 2,560 pounds, with a value of \$512; 1,200 pounds, \$216; and 2,080 pounds, \$460. In addition to the salmon catch shown, a few fish were taken in the Merrimac River and at several points on the Massachusetts coast. These, however, were generally released, in conformity with law. The gill-net catch amounted to only 3,650 pounds, valued at \$745; that of lines was 560 pounds, with a value of \$112, while the yield in pound nets was 94,112 pounds, worth \$19,475. In Connecticut less than 200 pounds of salmon were taken in pound and gill nets set for shad, alewives, and other fish.

A small decrease (12,916 pounds, valued at \$1,685) occurred in the New England salmon catch in 1892, as compared with 1880, although a comparison with intermediate years for which statistics are available shows a more pronounced decline. Thus, in 1887, the total yield was 186,067 pounds, valued at \$36,736; in 1888, 205,679 pounds, valued at \$41,635; and in 1889, 153,159 pounds, valued at \$34,406, these figures being obtained in the official investigations of this division.

The principal decline in the New England salmon fishery considerably antedated 1880, however, and was coincident with the erection of dams or other barriers to the passage of fish. As early as the beginning of the century the rivers of Maine began to experience a decline, and one by one the numerous streams to which the salmon had been accustomed to resort ceased to support the fish, until only the Penobscot remains. Prior to 1798, salmon were very abundant in the Connecticut River; in that year a 16-foot dam was placed entirely across the river about 100 miles above its mouth, and from that time the fish began to decrease. By 1810 the salmon had almost disappeared, and during the succeeding sixty years the fish was practically unknown in this river.

There seems little reason to doubt that the preservation of the salmon run in the Penobscot River has been due entirely to artificial propagation, which began about 1871 and has continued to the present time.

The known results of the attempts to acclimatize salmon in new streams warrants the belief that but for cultivation salmon would have long since been exterminated on the east coast of the United States. The plants of salmon fry in New England waters by the national and State fish commissions aggregated about 20,000,000 to 1892.

The suggestive history of salmon propagation in the Connecticut may here be outlined. The first planting of fry in this river, consisting of 2,000, was made in 1869. A second lot of 30,000 was planted in 1870. In 1873 150,000 were planted in the tributaries of the river, and in 1874 another lot of 1,180,000 was introduced. In 1875 the plantings consisted of 500,000, and in 1876 300,000. Results were soon seen. In 1872 a 7½-pound female, a 10-pound female, and a 1-pound grilse, apparently the results of the plantings in 1869, were taken. In 1874 and 1875 smolts were observed in large numbers in this stream, and several were caught in the Farmington River, the principal tributary of the Connecticut. At least three or four salmon were caught in 1876, while in 1877 the catch amounted to about a dozen. The best results, however, were observed in 1878, four years after the largest deposits had been made. During that season the catch amounted to probably 500 marketable fish, the average weight of which was reported as about 12 pounds, some of them weighing 20 pounds. The catch in 1879 is reported as having been somewhat less than in 1878, but the average weight was greater, most of those taken exceeding 18 pounds. Because of certain difficulties, relatively few fry have been planted in the Connecticut River since 1879, and since that year the catch has been very small, only a few stragglers being reported each year. In 1882 four were reported, two of which weighed 23 and 25 pounds, respectively, the other two about 15 pounds each. In 1884 two were captured. In 1887 the catch was unusually large, about twenty being reported. In 1892 three, weighing 35 pounds, were caught in gill nets set below Chester, in the township of Saybrook, and six others, weighing 78 pounds, were taken in pound nets on either side of the mouth of the river.

The smelt fishery.—While the catching of smelt is not of great importance in comparison with other branches of the New England fisheries, this fishery has some interesting features and in parts of Maine is of considerable extent. The fish enter the fresh waters of all the coast States of the region, but only in Maine are they sufficiently abundant to constitute a prominent river fish; there they are more valuable than salmon, shad, alewives, or any other anadromous species.

Smelt fishing is carried on along the entire coast of Maine, but is most extensive in the Machias, Westongus, Penobscot, Bagaduce, Damariscotta, Sheepscot, Kennebec, and Saco rivers, in Penobscot Bay, Muscongus Sound, Casco Bay, and in small streams in York County. In Massachusetts regular smelt fishing is confined to the Merrimac River. The smelt catch in Rhode Island is obtained in the Pawcatuck River. The Thames and Mystic rivers are the principal smelt streams in Connecticut.

The smelt fishery in 1892 gave employment to over 2,000 persons, of whom more than 1,900 were in Maine. These used, as apparatus of capture, 161 seines, 305 bag nets, 62 traps and weirs, and 3,858 lines, which, with 408 boats, had a value of \$32,406, of which over \$29,000 represented the investment in Maine. The quantity of smelts taken was 1,697,768 pounds, for which the fishermen received \$123,963, the catch in Maine being 1,616,758 pounds, valued at \$115,913. The product of the fishery in 1892 was greater than in any other year for which data are available. Thus, in 1880, the New England catch was 966,641 pounds, worth \$51,313; in 1887, 1,316,350 pounds, \$96,467; in 1888, 1,397,450 pounds, \$103,584; in 1889, 1,209,385 pounds, \$84,912. More than half the aggregate catch in 1892 was obtained with seines, after which, in point of output, came lines and bag nets.

The increase in recent years over 1880 has been chiefly due to the employment of more fishermen and the use of more apparatus. Thus, in Maine the smelt fishermen in 1880 numbered only 992 against 1,913 in 1892, and the number of smelt seines (the most prominent apparatus now used) increased from 4 to 152.

The lobster fishery.—This fishery has of late attracted much attention on account of the serious decrease in the output in the principal lobster-producing States, and special attention was given to it in the field inquiries. The lobster is generally distributed in the coastal waters of the New England States, and in each its capture constitutes an important industry. It is more valuable in Maine than in all the other States combined, and is the principal fishery product of the State.

This fishery in 1892 gave employment to 3,673 persons directly engaged in fishing. Of these, 2,628 were in Maine, 26 in New Hampshire, 616 in Massachusetts, 145 in Rhode Island, and 258 in Connecticut. The vessels employed in catching lobsters numbered 55, and were valued, with their outfit, at \$63,590. They were provided with 6,457 pots, having a value of \$11,124, and carried 151 fishermen. Seven of the vessels belonged in Maine, 2 in Massachusetts, 12 in Rhode Island, and 34 in Connecticut. The number of boats used was 3,925, valued at \$323,290; 2,888 were in Maine, 29 in New Hampshire, 739 in Massachusetts, 86 in Rhode Island, and 183 in Connecticut. The pots or traps employed in the boat fishery numbered 190,617, valued at \$206,118, of which 152,121 are to be credited to Maine, 1,393 to New Hampshire, 25,872 to Massachusetts, 5,121 to Rhode Island, and 6,110 to Connecticut. The live-cars and other accessory property connected with this fishery had a value of \$55,709, of which \$30,746 belonged in Maine and \$18,573 in Massachusetts. The quantity and value of the lobster catch in 1892 were as follows: Maine, 17,642,677 pounds, \$663,043; New Hampshire, 196,350 pounds, \$11,790; Massachusetts, 3,182,270 pounds, \$205,638; Rhode Island, 774,100 pounds, \$53,762; Connecticut, 1,614,530 pounds, \$101,358; a total of 23,409,927 pounds and \$1,035,591.

A comparison of the extent of the New England lobster fishery in 1880 and 1892 shows that in the aggregate there has been an advance

in practically every item. In 1880 the number of lobster fishermen was 2,759, divided as follows among the States: Maine 1,843, New Hampshire 44, Massachusetts 595, Rhode Island 129, Connecticut 148. The increase in 1892 was therefore 914, or 33 per cent; the largest advances were in Maine and Connecticut.

The increase in the investment has been very marked in every State; it rose from \$263,963 in 1880 to \$659,831 in 1892, the gain being 150 per cent. The number of boats and vessels used advanced from 2,438, valued at \$150,537, in 1880, to 3,980, worth \$386,880, in 1892; in Maine the increase in this item was from 1,797 to 2,895, and in Massachusetts from 446 to 741. The lobster pots or traps employed in 1880 numbered 140,083, valued at \$217,242, the increase in 1892 being 43,009, or 31 per cent.

The output of the New England lobster fishery in 1880 was 19,946,733 pounds, valued at \$477,484; the catch in 1892 was 3,463,194 pounds larger and \$558,107 more valuable, an increase of 17 per cent in quantity and 117 per cent in value.

The increased valuation per pound in 1892 as compared with 1880 indicates the condition of the fishery and suggests the actual decline which is not disclosed by the bare figures for the catch. The following table, showing the percentage of increase or decrease in the quantity and value of the yield in the two years named, strikingly illustrates this point. In Maine, while the output increased 23.95 per cent, the value of the catch to the fishermen increased 146.72 per cent. In Massachusetts there was a decrease in the quantity of 26.26 per cent, but an increase in the value of 23.42 per cent. Similar noteworthy differences appear for the other States.

Comparison of the New England lobster catch in 1880 and 1892.

States.	1880.		1892.		Increase (+) or decrease (-).		Percentage of increase or decrease.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Maine	14,234,182	\$268,739	17,042,077	\$663,043	+3,408,495	+\$394,304	+ 23.95	+146.72
New Hampshire..	250,000	7,500	196,350	11,790	- 53,650	+ 4,290	- 21.46	+ 55.73
Massachusetts....	4,315,416	158,229	3,182,270	205,638	-1,133,146	+ 47,409	- 26.26	+ 23.42
Rhode Island	423,250	15,871	774,100	53,762	+ 350,850	+ 37,891	+ 82.89	+238.74
Connecticut	723,885	27,145	1,014,530	101,358	+ 890,645	+ 74,213	+123.04	+273.30
Total	19,946,733	477,484	23,408,927	1,035,591	+3,463,194	+ 558,107	+ 17.38	+116.88

An additional evidence of the decline in this fishery is the diminished average catch per man. In 1880 the Maine lobster fishermen took, on an average, during the season 7,723 pounds of lobsters; in 1892 they caught 6,713 pounds. The change in this State has been especially marked since 1889, in which year the average catch per man was 12,019 pounds. The average yield in Massachusetts was 7,253 pounds in 1880 and 5,165 pounds in 1892. In Rhode Island there has been an advance in this respect from an average of 3,281 pounds per man in 1880 to 5,338 pounds in 1892. A similar increase has occurred in Connecticut, the average being 4,884 pounds in 1880 and 6,258 pounds in 1892. It

will be seen, however, that the increase has been due to the use of larger numbers of traps per man. Considering the entire region, the average catch per man was 7,229 pounds in 1880 and 6,374 pounds in 1892.

Further indication of a diminished supply of lobsters is seen in the smaller average catch per trap. In 1880 the average quantity of lobsters taken in the New England States was 142 pounds per trap; in 1889 it was 180 pounds, and in 1892 it was 119 pounds. The figures for Maine are 136 pounds per trap in 1880 and 115 pounds in 1892. In 1889, when the lobster fishery reached its height, it was 195 pounds, against 193 in 1888 and 200 in 1887. In Massachusetts the average catch per pot declined from 149 pounds in 1880 to 121 pounds in 1892. The decrease was most marked in Rhode Island and Connecticut. In the former the average was 194 pounds in 1880 and 122 pounds in 1892, while in Connecticut the average for 1880 was 349 pounds and for 1892 only 149 pounds.

The following comparative table shows the New England lobster catch in the five years for which figures are available, and gives a clear idea of the fluctuations which have characterized the fishery in each State:

States.	1880.		1887.		1888.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Maine	14, 234, 182	\$268, 739	22, 916, 642	\$512, 014	21, 694, 731	\$515, 880
New Hampshire	250, 000	7, 500	142, 824	6, 268	136, 350	7, 256
Massachusetts	4, 315, 416	158, 229	3, 511, 075	156, 204	3, 743, 475	172, 936
Rhode Island	423, 250	15, 871	570, 039	27, 128	588, 500	28, 047
Connecticut	723, 885	27, 145	1, 487, 020	82, 594	1, 477, 226	85, 723
Total	10, 946, 733	477, 484	28, 027, 600	784, 238	27, 640, 282	808, 842

States.	1889.		1892.	
	Pounds.	Value.	Pounds.	Value.
Maine	25, 001, 351	\$574, 165	17, 642, 077	\$663, 043
New Hampshire	137, 175	6, 415	196, 350	11, 790
Massachusetts	3, 353, 787	148, 492	3, 182, 270	205, 638
Rhode Island	456, 000	21, 565	774, 100	53, 782
Connecticut	1, 501, 230	83, 090	1, 614, 530	101, 358
Total	30, 449, 603	833, 736	23, 409, 927	1, 035, 591

The whale fishery.—The whale fishery continues to be one of the most important branches of the New England fisheries, although its importance is much less than formerly, owing to the scarcity of whales, the withdrawal of vessels from the business, and the transfer of interests to the Pacific Coast, where the conditions for carrying on the fishery are better. New Bedford, which in 1880 had 123 vessels engaged in whaling, in 1892 had a fleet of only 41 vessels, 17 of which made their headquarters at San Francisco. The other 11 vessels, comprising the New England whaling fleet in the latter year, hailed from Provincetown, Boston, Edgartown, and New London. The value of the vessels and their outfits was \$700,700, and the tonnage of the fleet was 9,537.60 net. The crews numbered 1,409. The following table shows the rigs represented and the grounds resorted to by the vessels of each port.

The yield of the whale fishery consisted of 211,235 gallons of whale

oil valued at \$88,712, 440,159 gallons of sperm oil valued at \$294,931, 120,150 pounds of bone valued at \$585,347 and 20 pounds of ambergris valued at \$5,277. The aggregate value of the fishery products was \$974,267, of which \$656,072 represented the results of the fishery carried on by New Bedford vessels rendezvousing at San Francisco and fishing in the North Pacific and Arctic oceans; their catch was made up of whale oil worth \$67,778, sperm oil worth \$37,044, and whalebone worth \$551,250. The aggregate gross stocks of the vessels fishing from the different ports are shown in the summary.

Summary of the New England whaling fleet in 1892.

Hailing ports.	Number of vessels of each rig.					Number of vessels on each fishing-ground.					Gross value of catch.	
	Steuers.	Barks.	Ships.	Brigs.	Schooners.	Total.	North Pacific and Arctic oceans.	Atlantic Ocean.	Okhotsk Sea.	Hudson Bay.		Total.
New Bedford:												
At New Bedford.....		11	1		12	24		23		1	24	\$226,360
At San Francisco.....	2	14		1		17	14		2		17	656,072
Provincetown.....				1	7	8		8			8	80,140
Edgartown.....				1	1	1		1			1	6,332
Boston.....				1	1	1		1			1	4,040
New London.....				1	1	1		1			1	1,323
Total.....	2	25	1	3	21	52	14	35	2	1	52	974,267

The oyster fishery.—With the exception of the cod, the oyster was the most valuable product of the New England fisheries in 1892. Although absent from the waters of Maine and New Hampshire, and taken in only limited quantities in Massachusetts, the extent of the fishery in Rhode Island and Connecticut is sufficient to give the oyster a position in advance of such important products as haddock, halibut, herring, mackerel, lobsters, and whales.

The New England oyster industry in 1892 gave direct employment to 1,741 persons, of whom 1,152 were fishermen and 589 were shoresmen, 714 of the former and 561 of the latter being in Connecticut. The aggregate investment in the industry was \$471,931, exclusive of the oyster-grounds. Of this amount over \$400,000 is to be credited to Connecticut. \$370,000 represented vessels and their outfit, \$89,000 boats, and \$12,000 dredges and tongs. The yield of the oyster fishery consisted of 1,175,182 bushels of market oysters, valued at \$1,201,782; 1,004,245 bushels of seed oysters, valued at \$567,347; and 230,661 bushels of shells, used for planting purposes, valued at \$8,263.

The most interesting and suggestive feature of the oyster industry of this section is the complete dependence for the supply on grounds under private ownership or control. During the period between 1880 and 1892 great changes occurred in the methods of the oyster fishery. In 1880 the exhaustion of the natural oyster-grounds had resulted in a decrease in the fishery, the average size of the oysters was smaller than before, and a still further decline in the industry was unavoidable

under the conditions prevailing. The output of the fishery in that year was only 435,650 bushels, a quantity insignificant when compared with the yield which subsequent experience has shown to be possible in these waters. The most noteworthy change in the condition of the industry occurred in Connecticut, which has been the scene of the most extensive and remunerative oyster-culture in the world. The entire history of the oyster industry in that State, as well as in the other States of the section, has demonstrated the futility of depending on natural oyster-grounds for the supply and the possibility of bringing barren areas of sea bottom, hitherto regarded as useless, under profitable cultivation. The Connecticut system has attracted much attention and has been adopted by other States. For a detailed account of the methods and conditions which have contributed to the development of the oyster industry of Connecticut, recourse should be had to the State reports and to papers¹ published by this Commission.

In addition to the value of fishing property (vessels, boats, apparatus) employed in the Connecticut oyster fishery, there are very important investments represented by the private oyster-grounds, the crop on the beds, and the shore property and cash capital required by the large operators for the proper conduct of the business. In 1892 the market value of the oyster-grounds was \$1,283,650; the oysters planted on the grounds had an estimated value of \$2,118,600; the value of the wharfs, buildings, etc., connected with the industry was \$361,270, and the cash capital was \$370,000.

According to the official State records, the available area for oyster fishing and planting in Connecticut is 93,601 acres. The division of this area into private and public grounds is shown in the following table, in which the areas over which the State and towns respectively exercise jurisdiction are separately indicated:

	Grounds.	Public.	Private.
		Acres.	Acres.
State.....		5,809	67,905
Town.....		13,482	6,403
Total.....		19,291	74,310

The public beds in 1892 yielded less than a bushel of market oysters and less than 11 bushels of seed oysters to the acre. The private beds, on the other hand, produced on an average 13 bushels of market oysters and 10 bushels of seed oysters per acre, if the entire grounds be considered, but if, as is proper, only the part actually utilized in 1892 be regarded (about 18,225 acres), then the average production per acre was 53 bushels of market oysters and 41 bushels of seed oysters. The average value per acre of the oysters taken from the public or natural beds was under \$4, while the yield of the cultivated grounds had an average value of about \$75 per acre.

¹ See especially "Notes on the oyster industry of Connecticut," by J. W. Collins (Bulletin U. S. Fish Commission 1889), and "The methods of deep-water oyster culture," by Henry C. Rowe (Bulletin U. S. Fish Commission 1893).

Following is a table showing the quantity and value of the market and seed oysters taken from public and private grounds in 1892:

Grounds.	Bushels.	Value.
Private grounds:		
Market oysters.....	972, 074	\$878, 500
Seed oysters.....	752, 460	474, 340
Total.....	1, 724, 534	1, 352, 000
Public grounds:		
Market oysters.....	13, 720	10, 125
Seed oysters.....	201, 920	63, 224
Total.....	215, 640	73, 349
Grand total.....	1, 940, 174	1, 425, 249

The business of planting seed oysters and of placing various kinds of shells on the oyster-grounds for the purpose of furnishing a suitable place for the attachment of the oyster spat is very extensive. The use of crushed stone and gravel for the latter purpose is also resorted to in some parts of the State. The quantity and value of the seed, shells, and stone deposited on the grounds in 1892 are given in the following table; 106,500 bushels of the seed sown, valued at \$62,260, represented small oysters brought from the South.

Items.	Quantity.	Value.
Seed oysters..... bushels.....	288, 700	\$122, 670
Shells..... do.....	1, 666, 450	125, 416
Crushed stone and gravel..... tons.....	20, 745	21, 435
Total.....		269, 521

The most northern locality on the New England coast where any form of oyster-culture is practiced is in the mouth of Parker River, at Newburyport, Mass., where 12 acres are under cultivation. In 1892 1,500 bushels of oysters, costing \$1 per bushel, were planted. When taken up they amounted to 1,800 bushels, which were sold at retail in Newburyport for \$2,700. Mr. Hall, field agent, reports as follows on the oyster business at this place:

This is not a natural oyster region. The business is very small, and there is no prospect that it will ever increase. The oysters are planted in April and taken up during the following summer and fall. The bottom is hard mud. Sea cabbage (an alga) grows on portions of the beds. The oystermen believe it is beneficial to the oysters. The seed oysters, which come from Barnstable Bay, are large when planted. After lying on the beds one season they open 1 gallon to the bushel. No seed oysters are produced on the beds, and those brought from Barnstable Bay cost too much to render competition practicable on the part of the producers at Newburyport, as market oysters can be obtained in Boston from Virginia, Maryland, Rhode Island, and elsewhere more cheaply than they can be raised at Newburyport.

On the southern part of the Massachusetts coast, the principal places where the oyster fishery is carried on are Barnstable Bay and Wellfleet Bay, on the northern side of the Cape Cod Peninsula; Oyster Pond and Oyster Pond River, at Chatham, on the east side of the cape; Cotuit Harbor and Lewis Bay, arms of Vineyard Sound, which washes

the southern shores of the peninsula; Red Brook Harbor, Bourne Neck, Buttermilk Bay, Onset Bay, Wareham River, Sippican Harbor, and Westport River, all tributaries of Buzzards Bay; and Taunton River, which enters Narragansett Bay. The oysters in these localities are taken from natural grounds having an area of about 1,100 acres and from cultivated beds with an area of about 3,125 acres. The principal natural grounds are in Taunton River and the most extensive cultivated beds are in Onset Bay and Wareham River.

The inquiries of the office showed that about 1,500 acres in Onset Bay and its arms and 800 acres in Wareham River were utilized for oyster-culture by 47 planters. Some of the planters do only a small business, while others are quite extensively engaged. Some years the set is very good, that in 1893 being the best in many years. It is reported that fully half the yearly output represents native growth. In 1892, 7,041 bushels of market oysters, valued at \$14,082, were taken; 10,600 bushels of seed oysters from Connecticut and Rhode Island and 10,000 bushels of shells, costing \$7,160, were planted on the grounds in the same year. The seed from Rhode Island remains planted one year and is then returned to Providence River to mature. This is done chiefly to escape the ravages of starfish in Rhode Island waters while the oysters are young, starfish being uncommon in Onset Bay and Wareham River and doing no damage. The borer, however, is quite destructive, and the periwinkle is also injurious.

Mr. W. A. Wilcox, field agent, has submitted the following notes on the oyster industry of Taunton River:

Taunton River has more acres in natural oyster beds than any other ground in the State. The natural oyster beds are estimated to cover 1,000 acres of ground; they extend on either side of the river in an almost continuous bed from the mouth at Fall River up as far as Dighton. The oyster beds are owned by the towns bordering on the river, the town right extending from the shore to the middle of the stream. Each town leases its oyster privileges to one person, who has the exclusive right to take oysters from grounds within the respective towns between September 1 and June 1. The leases are sold at public or private sale, and are good for one year or a term of years. During 1892 the town licenses for that year were as follows: Fall River, \$152; Somerset, \$710; Dighton, \$275; Berkeley, \$1,500; Freestone, \$1,000 (two leases). The town of Freestone sells one privilege for Taunton River and one for Asonet River. The latter is a small stream tributary to Taunton River; natural oyster beds are found from its mouth for a distance of 2½ miles upstream.

In past years the Taunton River oysters were highly esteemed and considered equal to any in the State, but since about 1883, when extensive copper works were established at Taunton, the oysters, from some unknown cause, have taken on a greenish-yellow color and an astringent coppery flavor. As a consequence, they are not now considered wholesome and are not placed on the market or used locally, and the beds are now only valuable for the seed oysters produced. Of late years about 25,000 bushels of seed oysters have been taken annually from Taunton and Asonet rivers and transplanted in Providence River, where they lose their undesirable color and flavor, becoming equal to any oysters taken from Providence River, which is noted for its fine stock. The seed are taken up during April and May, when about 50 rowboats, with one man each, are at work on the beds. The men tong the oysters, taking on an average about 25 bushels daily, for which service they receive 10 to 20 cents a bushel.

Of late years oysters are reported to be growing scarce, which is not surprising, as there has been no good set for a number of years, and the beds are allowed no chance to recuperate.

The oyster output of Rhode Island is at present obtained almost wholly from private cultivated grounds. These have an area of about 700 acres. In 1892 there were taken from these beds 156,080 bushels of marketable oysters, valued at \$239,941. As the oysters remain on the beds for about three years, on an average, and as about one-third of the ground gives up these oysters annually, it appears that the average production of marketable oysters to the acre is 670 bushels, valued at \$1,020. The natural oyster beds of the State have become practically unproductive of marketable oysters. In 1892 only 2,000 bushels, valued at \$2,075, were taken off the natural grounds. In addition to these, 14,865 bushels of small oysters, worth \$5,783, were obtained, which were used for planting purposes.

A striking illustration of the utility of a rational system of water culture applied to mollusks is seen by comparing the oyster with other shellfish the beds of which are not subject to private ownership except on an exceedingly small scale. The susceptibility of the soft clam, the quahog, and the scallop to cultivation is perhaps as pronounced as that of the oyster, and the comparison is therefore fair. While the average quantities of soft clams, of quahogs, and of scallops taken for market in the New England States in 1892 were, respectively, 227 bushels, 154 bushels, and 176 bushels per man, the average quantity of oysters was 1,892 bushels per man. The incomes of the fishermen from the sale of these products indicate a similar disparity, being \$125 per man for soft clams, \$168 per man for quahogs, \$141 per man for scallops, and \$1,536 per man for oysters.

The clam fishery.—Clams are among the most valuable fishery resources of the New England States, and their collection constitutes one of the most extensive and important branches of the fisheries. Throughout this region the soft clam or long clam (*Mya arenaria*) is found abundantly; but it is only along the southern part of the coast that the quahog or round clam (*Mercenaria mercenaria*) occurs. The former is the more abundant and important species, considering the yield in the aggregate; it is especially prominent in Maine and Massachusetts. The quahog is most important in southern Massachusetts.

The number of persons engaged in clamming is larger than in any other fishery under consideration, with the exception of the lobster. Over 3,300 persons in 1892 took clams for a livelihood during some part of the year. In Maine there were more than 1,900 clam fishermen and in Massachusetts over 800. Owing to the inexpensive outfit required for clamming and the comparative ease with which the clams are taken, this fishery is of great assistance to the poorer classes in the fishing communities; and it is a saying along parts of the Maine coast that "the clam beds keep many people off the town." The semiprofessional nature of the fishery in Maine may be judged from the circum-

138 REPORT OF COMMISSIONER OF FISH AND FISHERIES.

stance that the average value of the clams taken in 1892 was only \$80 per man.

The New England clam catch in 1892 was 759,402 bushels, valued at \$462,889. The yield of soft clams was 667,509 bushels, valued at \$362,477, and that of quahogs 91,893 bushels, with a market value of \$100,412. The production of each species by States is given in the following table:

Production of soft clams and quahogs.	States.	Bushels.	Value.
Soft clams.....	Maine.....	416,806	\$157,431
	New Hampshire.....	1,050	975
	Massachusetts.....	191,923	133,529
	Rhode Island.....	33,950	45,232
	Connecticut.....	23,780	25,320
	Total.....	667,509	362,477
Quahogs.....	Maine.....		
	New Hampshire.....		
	Massachusetts.....	54,823	61,801
	Rhode Island.....	19,050	20,275
	Connecticut.....	17,120	18,336
	Total.....	91,893	100,412
Total.....	Maine.....	416,806	157,431
	New Hampshire.....	1,050	975
	Massachusetts.....	246,746	195,330
	Rhode Island.....	53,900	65,497
	Connecticut.....	40,900	43,656
	Total.....	759,402	462,889

In Maine a large part of the clams taken are salted, to be used as bait in the line fisheries for cod and other ground fish. The salted clams are placed in barrels holding about 12 bushels of shucked clams. In 1892, 75,269 bushels were thus utilized in the preparation of 5,938 barrels of clam bait, for which the fishermen received \$27,044. Notwithstanding the increase in the clam production in 1892 as compared with 1880, the quantity of clams salted for bait was much greater in 1880, being 178,164 bushels, from which were prepared 12,726 barrels of pickled clams, valued at \$63,630.

Between 1880 and 1892 the output of soft clams fluctuated considerably; in Maine, Massachusetts, and Rhode Island, the yield in 1889 was larger than in any other year for which complete data are available, the aggregate catch being double that in 1880. The season of 1892 was unusually poor in both Maine and Massachusetts; the catch was but little more than in 1880, and the total production of the region was hardly 100,000 bushels more than in 1880. The years 1887 and 1888 also had a larger output than 1880 and 1892.

The yield of quahogs in 1892 was perhaps the largest known up to that time. Massachusetts experienced a noteworthy advance, which counterbalanced the decline in Rhode Island and Connecticut. The abundance of this mollusk, however, seems to have been singularly uniform, as judged by the aggregate catch, the smallest production, in 1889, being only 25 per cent less than the largest in 1892.

Following is a comparative exhibition of the results of the clam fishery in each State during all the years for which figures are at hand:

Comparative statement of the yield of clams in the New England States during a series of years.

	Soft clams.		Quahogs.		Total.	
	Bushels.	Value.	Bushels.	Value.	Bushels.	Value.
Maine:						
1880.....	318,383	\$101,808			318,383	\$101,808
1887.....	608,780	228,490			608,780	228,490
1888.....	600,675	227,665			600,675	227,665
1889.....	595,105	200,761			595,105	200,761
1892.....	416,806	167,431			416,806	157,431
New Hampshire:						
1880.....	17,960	8,980			17,960	8,980
1887.....	280	140			280	140
1888.....	300	150			300	150
1889.....	300	150			300	150
1892.....	1,050	975			1,050	975
Massachusetts:						
1880.....	158,626	76,195	11,050	\$5,525	169,676	81,720
1887.....	230,659	121,202	35,540	21,363	266,199	142,565
1888.....	243,777	127,838	26,165	14,822	270,942	142,660
1889.....	240,831	137,711	16,913	12,549	257,744	150,260
1892.....	191,923	133,529	54,823	61,801	246,746	195,330
Rhode Island:						
1880.....	53,060	48,664	42,000	35,000	95,060	83,564
1887.....	25,825	25,030	19,215	15,689	45,040	40,729
1888.....	30,825	30,030	33,029	28,075	63,854	58,105
1889.....	33,375	32,475	25,600	25,600	63,025	58,075
1892.....	33,050	45,222	19,950	20,275	53,000	65,497
Connecticut:						
1880.....	75,000	38,000	40,250	29,475	115,250	67,475
1887.....	20,735	25,370	18,887	18,077	39,622	44,047
1888.....	26,575	24,270	18,907	18,729	45,482	42,999
1889.....	28,360	24,800	21,362	21,114	49,722	46,014
1892.....	23,780	25,320	17,120	18,336	40,900	43,656
Total:						
1880.....	623,029	273,547	102,300	70,000	725,329	343,547
1887.....	899,279	400,232	73,642	55,739	972,921	455,971
1888.....	902,152	409,953	78,101	61,626	980,253	471,579
1889.....	895,971	395,997	67,925	59,263	963,896	455,260
1892.....	667,569	362,477	91,893	100,412	759,462	462,889

The question of artificially raising clams has received but little consideration; the following note of Mr. Ansley Hall, field agent, on the inception of clam-culture at Essex, Mass., will therefore prove of interest:

I found quite an interesting feature in connection with the clam fisheries at Essex, Mass., in the shape of clam-culture. In 1888 an act was passed by the legislature authorizing the selectmen of the town to stake off in lots of 1 acre or less each of the flats along the Essex River and let them to persons desiring to plant clams, for a rental of \$2 per acre or lot for five years and an additional fee of 50 cents. Thus far 37½ acres have been taken up and seeded with clams. Small clams are dug on the natural beds and planted on these hitherto unproductive flats. Mr. J. Bennett Fuller states that about 500 bushels are required to plant an acre properly. During the first two years (1889 and 1890) the people were slow to avail themselves of the privilege of planting, for fear that after they had spent their time and labor they would not be able to secure protection from trespassers. But in 1891 and 1892 lots were obtained and planted. The principal difficulty encountered has been the loss of the clams by the sand washing over them, the bottom in some localities being soft and shifting. In 1892 there were 25 acres that were quite productive, about one-third of the entire catch of the section being obtained from them. The catch from these lots is not definitely known, but is estimated at about 2,500 barrels.

The cultivated clams possess some advantage over the natural growth from the fact that they are more uniform in size and are as large as the best of the natural

clams. They bring \$1.75 per barrel, while the natural clams sell for \$1.50 per barrel. This is the price received by the catchers. One acre of these clams is considered to be worth \$1,000 if well seeded and favorably located so as not to be in danger of being submerged with sand. This valuation would be too high for an average, since all the acres are not equally well seeded and located. The clammers are generally impressed that the industry can be extensively and profitably developed, and their only fear is that they will not be able to secure lots permanently. The greater part of the land available for this purpose is covered by the deeds of people owning farms along the river and the consent of the land-owners has to be obtained before lots can be taken up. It seems probable, however, that the business will continue to progress unless checked by complications that may arise relative to the occupancy of the grounds.

The scallop fishery.—The taking of scallops is recognized as a commercial fishery only in Maine, Massachusetts; and Rhode Island. In the first-named State, where the fishery is of least importance, the scallop taken differs from that obtained in the other States and is known as the giant scallop or smooth scallop (*Pecten magellanicus*). It attains a very large size, but is found only in circumscribed limits and is not especially abundant in the accessible localities. The common scallop (*Pecten irradians*) ranges from southern Massachusetts to Connecticut, and is very abundant in parts of Massachusetts and Rhode Island.

The principal grounds resorted to by the Maine scallop fishermen in 1892 were the eastern side of Mount Desert Island, the region between Deer Isle and Castine, and the Sheepscot River. In Massachusetts the scallop-grounds are in Nantucket Sound and Buzzards Bay. Scallops are generally distributed in the waters of Rhode Island, the largest catch, however, being obtained in Greenwich Bay, a tributary of Narragansett Bay, in Kent County.

In 1892 the scallop fishery was engaged in by 55 vessel fishermen, 838 boat fishermen, and 80 shoresmen, 973 persons in all. Of the fishermen, 142 were in Maine, 509 in Massachusetts, and 242 in Rhode Island. The aggregate investment in the industry was \$102,397, of which \$11,535 represented the value of 24 vessels, \$81,970 the value of 626 boats, and \$8,892 the value of the apparatus used. Of the aggregate sum \$63,592 was invested in Massachusetts. The quantity of scallops taken for market in Maine was 19,374 bushels, having a value of \$9,455; in Massachusetts, 84,154 bushels, valued at \$75,637, and in Rhode Island, 52,690 bushels, valued at \$38,998. In Connecticut, where there is no regular scallop fishery, 440 bushels of scallops, worth \$330, were taken by clam fishermen.

A } The New England scallop output in 1892 was 231 per cent larger and the value of the catch was 905 per cent greater than in 1880. The very interesting and unusual feature shown by the statistics of a greatly augmented yield, attended by an even greater increase in the selling price, is to be accounted for by the fact that the mollusks have steadily risen in popular favor as a food product. In 1880 the yield of scallops in Massachusetts was only 7,568 bushels, having a value of \$3,514, and in Rhode Island was 35,600 bushels, valued at \$8,900. No

fishery was at that time prosecuted in Maine. The output of giant scallops in this State has decreased since 1887, the first year for which statistics were obtained. Thus, in that year 35,204 bushels were taken, valued at \$13,994; in 1888, 29,578 bushels, worth \$11,278, and in 1889, when the fishery probably reached its height, 45,368 bushels, valued at \$18,647.

The menhaden industry.—In 1892 seven menhaden factories were in operation in the New England States; four of these were in Connecticut, two in Rhode Island, and one in Massachusetts. In previous years several firms were engaged in the menhaden industry in Maine. The business was much less extensive than during a number of previous years. The details of this branch are brought out in the following table, which shows an investment of over \$588,000 in factories, vessels, etc., a catch of 21,450,500 pounds of menhaden (equivalent to about 35,750,835 fish), and resulting manufactured products with a value of \$134,144. In Rhode Island the 1,120,400 pounds of other fish besides menhaden reported as being utilized in the industry consisted chiefly of sea-robin and sculpins.

Table showing by States the extent of the menhaden industry in the New England States in 1892.

Items.	Massachusetts.	Rhode Island.	Connecticut.	Total.
Number of factories in operation.....	1	2	4	7
Value of factories.....	\$8,000	\$215,500	\$66,800	\$282,300
Amount of cash capital.....	\$1,000	\$42,000	\$22,500	\$65,500
Number of shoresmen employed.....	6	70	70	146
Number of fishermen employed.....	22	161	86	269
Number of steam vessels employed.....	1	8	4	13
Not tomago.....	69.46	627.32	343.72	696.78
Value.....	\$12,000	\$126,000	\$49,000	\$187,000
Value of outfit and apparatus.....	\$2,493	\$34,791	\$16,100	\$53,384
Pounds of menhaden handled.....	60,000	10,355,600	11,034,800	21,450,500
Value to fishermen.....	\$300	\$38,904	\$34,087	\$73,291
Pounds of other fish handled.....		1,120,400		1,120,400
Value to fishermen.....		\$1,400		\$1,400
Number of gallons of oil made.....	1,100	136,540	176,000	313,640
Value as sold.....	\$394	\$37,001	\$49,826	\$87,221
Number of tons of scrap prepared.....	12	1,758	1,675	3,465
Value as sold.....	\$144	\$21,016	\$24,860	\$46,923

The canning industry.—The business of canning herring, mackerel, lobsters, and clams is very extensive in Maine, where it supports important fisheries. The canning of herring as sardines is the most prominent branch of this nature, and the extent of the herring fishery is in a large part due to the canneries. Fifty-eight separate establishments were operated in 1892; of these, 37 canned only sardines; 3, sardines and lobsters; 2, sardines, plain herring, lobsters, and clams; 2, sardines, lobsters, and clams; 1, lobsters only; 5, clams only; 2, herring and clams; 2, sardines and clams; 2, lobsters and clams, and 2, lobsters, clams, and herring. In Massachusetts, where the conditions appear favorable for fish canning, only 5 such establishments were in operation. At these mackerel and herring were canned.

The value of the property devoted to the canning industry in Maine in 1892 was \$439,210; an additional cash capital of \$549,700 was required

to conduct the business. The cannery employees numbered 5,020. Over 63,000,000 pounds of raw products, for which the fishermen received \$399,749, were consumed in canning. The value of the prepared products was \$2,486,247.

In Maine most of the canneries are located in the eastern part of the State, in Washington County, where there were 39 in 1892. The prominent centers of the canning industry in that county are Eastport and Lubec; the former has for many years been the chief sardine center of the country, and in 1892 had 15 canneries, most of them of large size, while Lubec had 13 such establishments in 1892, and in 1893 had an increase which gave it a greater number than Eastport. The other places in this county in which canneries were located are Robbinston 2, Perry 1, West Pembroke 1, Cutler 1, Machiasport 1, Jonesboro 1, Jonesport 2, Millbridge 2. In Hancock County there were 9 canning houses, situated as follows: Prospect Harbor 1, Greens Landing 2, Oceanville 1, Brooklin 1, Hancock 1, Southwest Harbor 1, Bass Harbor 1, West Tremont 1. Knox County had 1 cannery at St. George. The 4 canneries in Lincoln County were at Pemaquid, South Bristol, Boothbay Harbor, and Round Pond. In Cumberland County were 5 canneries, as follows: Portland 2, Pine Point 2, West Scarborough 1.

The 50 establishments in Maine engaged in the preparation of sardines and plain canned herring utilized over 57,000,000 pounds of fresh herring, for which the fishermen were paid \$253,848. A conspicuous part of the raw material consumed by the factories in Eastport and Lubec came from Canadian waters and is not shown in the figures for the herring fishery elsewhere given. From the foregoing there were prepared 568,853 cases (equivalent to 48,460,110 cans) of sardines, 14,883 cases (or 548,496 cans) of plain herring, 828 barrels of Russian sardines, 2,048 barrels of pickled herring, and 335,894 boxes of smoked fish, the whole having a value of \$2,081,994. The most important of the numerous grades of canned herring are the small fish packed in oil in quarter-pound cans and generally known to the trade as "quarter oils." Of these, 396,428 cases of 100 cans each were prepared, for which \$1,455,245 was received, an average price of \$3.67 per case, or 3 $\frac{3}{4}$ cents per can. Next in point of importance are the sardines in mustard in three-quarter pound cans. Of these, 149,020 cases of 50 cans each were canned, the market value of which was \$435,863, or \$2.92 per case. Other rather important grades of sardines are "half-oils," "three-quarter spices," and "quarter-mustards."

The 11 lobster canneries operated in Maine in 1892 were located in four counties, 5 being in Washington, 3 in Lincoln, 2 in Hancock, and 1 in Knox. The quantity of fresh lobsters utilized was 5,326,322 pounds, for which the canneries paid \$78,720; from these, 25,732 cases of 1-pound and 2-pound cans were prepared, for which the canneries received \$195,953.

At many of the sardine canneries in Washington County, Me., the smoking of herring constitutes an important branch. The herring so

utilized are mostly surplus fish or fish too large for canning. The business is most extensive in Eastport and Lubec, a large part of the fish coming from Canadian waters, as is the case with the sardine fish. The quantity of herring utilized for smoking at the sardine canneries was about 3,465,000 pounds. The prepared product consisted of 320,894 regular-sized boxes and 15,000 boxes of bloaters, the weight of the smoked fish being 1,979,470 pounds, and the value \$46,139.

The canning of soft clams, in the form of clam chowder, plain clams, and clam juice, is carried on at 17 establishments on the Maine coast—1 in Washington County, 6 in Hancock County, 4 in Lincoln County, 5 in Cumberland County, and 1 in Knox County.

In the following table the details of the canning industry of Maine are given:

Table showing the extent of the canning industry of Maine in 1892.

Items.	No.	Value.	Items.	No.	Value.
Establishments	58	\$388,200	<i>Manufactured products—con- tinued.</i>		
Cash capital		549,700			
Employees	5,020		Plain herring:		
Vessels and boats	106	51,010	One pound.....cases..	7,971	\$22,894
Total.....		988,910	Two pound.....do.....	6,912	17,288
<i>Raw products utilized.</i>			Pickled herring.....barrels..	2,048	9,170
Herring.....pounds..	57,061,320	253,848	Russian sardines.....do.....	828	4,153
Mackerel.....do.....	51,760	1,330	Smoked herring:		
Lobsters.....do.....	5,326,322	78,720	Regulars.....boxes..	320,894	36,514
Clams.....bushels..	185,914	65,842	Bloaters.....do.....	15,000	9,025
Total.....		399,740	Lobsters:		
<i>Manufactured products.</i>			One pound.....cases..	25,603	105,114
Sardines, in oil:			Two pound.....do.....	129	839
Quarters.....cases..	396,428	1,455,245	Clams:		
Halves.....do.....	6,614	31,870	One pound.....do.....	34,146	108,933
Sardines, in mustard:			Two pound.....do.....	23,313	49,658
Quarters.....do.....	5,031	21,582	Clam chowder:		
Three-quarters.....do.....	149,020	435,863	One pound.....do.....	675	2,294
Sardines, in spices:			Three pound.....do.....	6,341	19,631
Quarters.....do.....	543	2,145	Clam juice.....do.....	1,151	4,604
Three-quarters.....do.....	5,705	18,011	Total.....		2,466,107
Two pound.....do.....	730	1,643	<i>Secondary products.</i>		
Three pound.....do.....	1,042	3,126	Oil.....gallons..	14,140	3,160
Odd sizes.....do.....	2,000	7,500	Pomace.....tons..	1,506	14,632
"Brook trout" (herring):			Refuse.....do.....		2,348
One pound.....cases..	278	1,090	Total.....		20,140
Two pound.....do.....	1,462	4,286	Total of manufactured and secondary products.....		2,486,247
Mackerel:					
One pound.....do.....	708	3,040			

Statistical recapitulation.—In the following series of tables the extent of the foregoing fisheries is shown by States. The statements relate (1) to the number of persons engaged in each branch, (2) to the vessels, boats, and apparatus employed in each fishery, and (3) to the quantity and value of the catch in each form of apparatus. In the tables of persons engaged and of boats, vessels, and apparatus used, the full extent of each branch is shown, regardless of the duplications of persons and appliances employed in two or more fisheries.

In a statistical paper printed in the Bulletin of the Fish Commission for 1893, use was made of the advance returns for the New England

REPORT OF COMMISSIONER OF FISH AND FISHERIES. 145

Table showing by States the vessels, boats, and apparatus employed in the capture of certain products of the fisheries of the New England States in 1892—Continued.

Fisheries and apparatus.	Maine.		New Hampshire.		Massachusetts.		Rhode Island.		Connecticut.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Shad:												
Boats	297	\$6,640							55	\$2,095	352	\$8,735
Pound nets, trap nets, and weirs	156	13,280									156	13,280
Seines									12	675	12	675
Gill nets	365	3,425							46	2,312	411	5,737
Total		23,345								5,082		28,427
Smolt:												
Boats	390	9,895					6	\$175	12	195	408	10,265
Pound nets, trap nets, and weirs	50	1,680					12	1,350			62	3,030
Seines	152	7,970					1	175	8	560	161	8,705
Bag nets	255	9,810	50	\$200							305	10,010
Lines		383		5		\$8						396
Total		29,738		205		8	1,700			755		32,406
Lobster:												
Vessels	7	6,070			2	1,350	12	7,000	34	31,400	55	45,820
Tonnage	77.11				17.77		84.43		322.17		501.48	
Outfit		980				360	1,505		14,865		17,770	
Boats	2,888	242,629	20	591	739	47,162	86	15,320	183	17,585	3,836	323,290
Pots	153,043	143,709	1,393	2,786	26,102	38,479	6,341	10,000	10,105	22,178	197,074	217,242
Total		393,368		3,380		87,351		33,975		86,028		604,122
Clam:												
Vessels					1	1,000	2	1,100			3	2,100
Tonnage					7.89		16.48				24.37	
Outfit						20	265				285	
Boats	1,548	27,506	14	180	663	16,000	183	4,860	172	5,290	2,580	53,836
Hoes, rakes, etc.		1,804		11		2,605		833		463		5,806
Total		29,400		191		19,625		7,058		5,753		62,027
Oyster:												
Vessels					1	2,000	6	18,100	123	304,140	130	324,240
Tonnage					17.87		79.90		2488.44		2,580.21	
Outfit						2,100	3,322		40,540		45,962	
Boats					309	22,440	189	14,430	543	52,413	1,101	89,284
Dredges					158	912	62	2,415	240	3,198	460	6,525
Tongs					275	1,457	204	2,214	509	2,249	1,078	5,920
Total						28,900		40,482		402,540		471,931
Scallop:												
Vessels	2	400			19	8,800	3	1,400			24	10,600
Tonnage	33.60				130.27		17.58				181.45	
Outfit		170				700		65			935	
Boats	64	3,610			322	49,370	240	28,990			626	81,970
Dredges and rakes	105	504			1,236	4,722	874	3,060			2,215	8,892
Total		4,684				63,592		34,121				102,397
Whale:												
Vessels						51	364,000		1	4,000	52	368,000
Tonnage						9,410.27			127.33		9,537.60	
Outfit and apparatus						329,100			3,000		332,100	
Total						693,700			7,000		700,700	

146 REPORT OF COMMISSIONER OF FISH AND FISHERIES.

Table showing by States and apparatus with which caught the quantities and values of certain products taken in the fisheries of the New England States in 1892.

Species and apparatus.	Maine.		New Hampshire.		Massachusetts.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Alewives:						
Pound nets, trap nets, and weirs.....pounds..	1,411,350	\$13,302	45,000	\$693	720,025	\$10,850
Gill nets.....do.....	583,150	3,877				
Seines.....do.....			5,000	80	1,853,200	32,812
Dip nets.....do.....	282,000	1,875			1,077,650	14,854
Total.....	2,276,500	19,054	50,000	770	3,650,875	58,516
Herring:						
Pound nets, trap nets, and weirs.....pounds..	32,072,214	224,250			6,247,315	60,164
Gill nets.....do.....	6,905,700	42,396	140,000	1,500	1,915,900	14,639
Seines.....do.....	1,832,250	7,738	6,600	115	2,323,600	20,593
Dip nets.....do.....	4,000	13			1,616,650	15,433
Total.....	40,814,164	274,397	146,600	1,615	12,103,465	110,829
Menhaden:						
Pound nets, trap nets, and weirs.....pounds..					185,010	3,036
Gill nets.....do.....	83,140	532	4,000	40		
Seines.....do.....					65,000	722
Total.....	83,140	532	4,000	40	250,010	3,758
Salmon:						
Pound nets, trap nets, and weirs.....pounds..	94,112	19,475				
Gill nets.....do.....	3,650	745				
Lines.....do.....	560	112				
Total.....	98,322	20,332				
Shad:						
Pound nets, trap nets, and weirs.....pounds..	686,870	20,379			48,382	2,409
Gill nets.....do.....	182,100	7,672				
Seines.....do.....					80,127	2,396
Total.....	868,970	28,051			134,509	4,805
Smolt:						
Pound nets, trap nets, and weirs.....pounds..	72,870	6,215				
Seines.....do.....	839,478	54,363				
Bag nets.....do.....	301,050	25,159	10,500	1,650		
Lines.....do.....	403,360	30,176	14,500	1,450	3,000	600
Total.....	1,616,758	115,913	31,000	3,100	3,000	600
Lobsters:						
Pots.....pounds..	17,642,677	663,043	196,350	11,790	3,182,270	205,638
Clams:						
Rakes, hocs, etc...bushels..	416,806	157,431	1,050	975	246,746	195,330
Oysters, market:						
Dredges and tongs....do.....					29,807	59,638
Oysters, seed:						
Dredges and tongs....do.....					35,000	24,000
Total.....					64,807	83,638
Scallops:						
Dredges and rakes.bushels..	19,374	9,455			84,154	75,637
Whale:						
Oil, whale.....gallons..					208,085	87,389
Oil, sperm.....do.....					440,159	294,931
Bone.....pounds..					120,150	585,347
Ambergris.....do.....					20	5,277
Total.....						972,944
Total value special fisheries.....		1,288,208		18,290		1,711,695

Table showing by States and apparatus with which caught the quantities and values of certain products taken in the fisheries of the New England States in 1892—Continued.

Species and apparatus.	Rhode Island.		Connecticut.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Alowives:						
Pound nets, trap nets, and weirs pounds.	487,468	\$8,126	79,360	\$683	2,743,203	\$33,651
Gill nets do.			601,600	3,125	1,184,750	7,002
Seines do.	702,125	10,090			2,560,325	42,982
Dip nets do.					1,359,650	16,720
Total	1,189,593	18,216	680,960	3,808	7,847,928	100,364
Herring:						
Pound nets, trap nets, and weirs pounds.	700	30			38,320,229	284,444
Gill nets do.					8,961,600	58,535
Seines do.					4,162,450	28,446
Dip nets do.					1,020,650	15,446
Total	700	30			53,064,929	386,871
Menhaden:						
Pound nets, trap nets, and weirs pounds.	34,000	57	2,515,200	7,332	2,734,210	10,425
Gill nets do.					87,140	572
Seines do.	10,726,600	40,725	20,432,280	63,543	31,223,880	104,995
Total	10,760,600	40,782	22,947,480	70,880	34,045,230	115,992
Salmon:						
Pound nets, trap nets, and weirs pounds.			78	45	94,190	19,520
Gill nets do.			35	24	3,685	769
Lines do.					560	112
Total			113	69	98,435	20,401
Shad:						
Pound nets, trap nets, and weirs pounds.	24,350	776	21,602	1,679	781,204	25,243
Gill nets do.			71,708	6,052	253,808	13,724
Seines do.			17,252	1,704	103,370	4,100
Total	24,350	776	110,562	9,435	1,138,301	43,067
Smelt:						
Pound nets, trap nets, and weirs pounds.	18,740	1,720			91,610	7,935
Seines do.	19,460	1,840	8,810	790	867,748	56,993
Bag nets do.					317,550	20,809
Lines do.					420,860	32,226
Total	38,200	3,560	8,810	790	1,697,768	123,963
Lobsters:						
Pots pounds.	774,100	53,762	1,614,530	101,358	23,409,927	1,035,591
Clams:						
Rakes, hoes, etc. . . . bushels.	53,000	65,497	40,900	43,650	750,402	462,880
Oysters, market:						
Dredges and tongs . . . do.	159,581	253,459	985,794	888,685	1,175,182	1,201,782
Oysters, seed:						
Dredges and tongs . . . do.	14,865	5,783	954,380	537,564	1,004,245	567,347
Oyster shells:						
Dredges and tongs . . . do.	40,661	2,033	190,000	6,230	230,681	8,263
Total	215,107	261,275	2,130,174	1,432,479	2,410,088	1,777,392
Scallops:						
Dredges and rakes . bushels.	52,690	38,098	440	330	150,618	124,420
Whale:						
Oil, whale gallons.			3,150	1,323	211,235	88,712
Oil, sperm do.					440,159	294,631
Bone pounds.					120,130	585,347
Ambergris do.					20	5,277
Total				1,323		974,267
Total value special fisheries		482,806		1,664,128		5,165,217

THE GREAT LAKES.

In connection with the consideration of the fish and fisheries of the basin of the Great Lakes by the international commission appointed by the United States and Canada to investigate the fisheries of the contiguous waters of the two countries, a canvass of the commercial fisheries of the United States waters of these lakes was begun by this division in May, 1894, and by the close of the fiscal year had progressed satisfactorily. The inquiry related to the statistics and methods of the industry, the abundance of the economic fishes, and the changes occurring since the last investigation. The United States Fish Commission conducted a complete canvass of the Great Lakes in 1891, the results of which are published in the annual report for 1892; but recent marked and rapid changes in certain important phases of the industry made another inquiry at this time desirable in order to arrive at a proper knowledge of the extent and methods of the fisheries.

SPECIAL INQUIRIES.

PACIFIC COAST FISHERIES.

In November, 1893, Mr. A. B. Alexander, fishery expert on the *Albatross*, was detached from that vessel and assigned to temporary field duty in this division. He was ordered to make a study of those fishes which have been artificially introduced into the waters of the Pacific States and become the object of fisheries. Supplementary instructions were subsequently issued covering a canvass of the whale fishery and salmon-canning industry. Mr. Alexander had previously been engaged in similar inquiries for this division, and his familiarity with the fisheries of the region made his services valuable. The inquiry began November 7, and was continued until about February 10. Work was begun in the vicinity of San Francisco, extended as far south as Monterey Bay, and later carried on at Portland, Astoria, and other places on the northern part of the west coast.

The fishes to which attention was specially directed were shad, striped bass, black bass, catfish, eel, and carp. The inquiry was addressed to the methods, apparatus, history, and statistics of the fisheries, to the wholesale trade, and to such phases of the natural history as may have a bearing on the practical aspects of the subject. Statistical data relating to the calendar year 1893 were obtained. The data collected for the whale fishery consisted of the statistics for the year 1893 for the San Francisco fleet and for the New Bedford vessels rendezvousing at the former port. The salmon investigation covered all phases of the packing industry in California, Oregon, Washington, and Alaska. While it was not feasible to visit all streams on which salmon canneries were located, nor to personally study the salmon-packing in Alaska, complete information was obtainable for the more remotely located canneries at the headquarters of the firms located in San Francisco and Portland.

The notes submitted by Mr. Alexander on the shad and striped bass are reserved for incorporation in a special report now in course of preparation, in which the entire subject of fish acclimatization in the Pacific States is considered. His statistics of the whale fishery and salmon-canning industry have been embodied in a general report on the fisheries of the Pacific States, prepared by Mr. W. A. Wilcox. An outline of the results of his work is here given.

The shad is increasing in numbers yearly, and is now one of the cheapest fish on the coast. Comparatively few years ago only the wealthy could afford to buy shad; now it is within the reach of everyone. Only a small part of the supply is taken, and few fish are obtained in nets set especially for them. With proper apparatus, the catch could doubtless be increased to ten times more than it is at present.

During the year 1893 the fish was very numerous in the Sacramento and San Joaquin rivers and in the San Francisco Bay region, which is the center of its abundance, and was very low in price. About the middle of November it was selling at 2 cents a pound in the city markets, and about the first of the month the fish sold as low as 4 and 5 cents apiece. Mr. Alexander found the crab fishermen were using shad for bait, a circumstance forcibly illustrating the fish's abundance and cheapness.

In Monterey Bay, the southern limit of distribution of the fish, it is more abundant on the north side, near Soquel and Santa Cruz, than on the south side, in the vicinity of Monterey. Only six shad were taken at Monterey in 1893, while on the other side of the bay the catch was much larger, although small as compared with that in other waters.

In the Columbia River the shad is very rapidly increasing in numbers. Each season shows a decided increase over the preceding one. The physical conditions appear to be quite as favorable to the shad as those found in the Sacramento and San Joaquin rivers. Only an inconspicuous part of the run is taken, and the entire quantity marketed is obtained incidentally in traps and seines operated for salmon.

The striped bass, like the shad, has steadily increased in numbers, and like the shad it attains its greatest abundance in San Francisco Bay and its tributaries. In the lower courses of the Sacramento and San Joaquin rivers it is very numerous and it may there be taken at all seasons. It is, however, much less numerous than the shad and holds a higher place in popular estimation as a food-fish. At the present rate of increase, it would appear that in a few years the supply will so far exceed the demand that the price of the fish will be reduced almost to that of the shad.

Monterey Bay marks the southern limit of the range of the striped bass as it does of the shad. The bass is so uncommon in the bay that it may almost be regarded as a straggler. At Monterey only two or three have ever been taken. At Santa Cruz only one was taken in 1893; this weighed 15 pounds. At Capitola bass were first taken in 1893; 25, weighing 260 pounds, were obtained in a drag seine.

This fish has not as yet distributed itself along the more northern parts of the Pacific Coast. It is not known from the Columbia River, and there are no records of its capture at any place in either Oregon or Washington.

An interesting fact disclosed by Mr. Alexander's inquiries is that the striped bass feed largely on carp, which are very numerous in the rivers frequented by the bass, and are by many persons considered of little value. If further inquiries show that carp constitute an important part of the food supply of the bass, they will doubtless rise in popular favor. On November 22, of 9 bass opened in the San Francisco markets 6 contained carp, and Mr. Alexander is convinced that 7 bass in every 10 will be found to contain carp.

Black bass are well distributed in numerous rivers, lakes, and reservoirs in California, but are not taken in commercial fishing. The fish have readily become accustomed to their new environments and are rapidly increasing.

Carp and catfish are very abundant in the Sacramento and San Joaquin and Columbia rivers, and are also found in other waters of the west coast. They do not rank high as food-fish, but considerable quantities are taken and sold in the San Francisco, Sacramento, and Portland markets. The catfish have failed to attain the average size reached by the fish in their natural habitat, but the carp are as large as those found anywhere in the country.

Diligent inquiry was made by Mr. Alexander as to the possible existence of lobsters on the Pacific Coast as a result of the attempts to acclimatize them made by the United States Commission of Fish and Fisheries. Several reports of the capture of the eastern lobster had from time to time been circulated since the experimental plans were made, and in the summer of 1893 accounts of the taking of other reputed lobsters in the vicinity of Monterey were published. Mr. Alexander reported as follows on this subject:

Reports are frequently circulated that lobsters have been taken by the fishermen of Monterey, but each time the investigation which has followed has proved the story false. Those not familiar with the lobster easily mistake the fresh-water crayfish for that animal. During the past season a report was circulated through the press of this coast that several small Eastern lobsters had been caught at Monterey, and to add strength to the story it was stated that samples had been sent to the Fish Commission for identification, and word had been sent back that the samples received were the genuine Eastern lobster. Such reports are very misleading, and have caused considerable inquiry to be made concerning the lobsters planted on the coast in 1888.

The writer has had occasion to interview the fishermen of Monterey several times during the past four years, but has never been able to find a man who was certain he had caught a lobster. Prof. Charles H. Gilbert saw the specimens that were taken this summer, and states that they were fresh-water crayfish.

That several of the lobsters planted at Monterey have been caught, there is little doubt. Captain Nichols, of the United States Navy, says that several years ago he ate a lobster which was purchased at a market in Oakland; being an Eastern man, and having taken an interest in the fisheries all his life, it is to be presumed that he is correct in what he says. The white fishermen say they have never been guilty of saving what they supposed to be lobsters, but are of the opinion that the Chinese

have caught and sold many specimens, but of this there is no direct proof. From what can be learned it would seem that the lobsters planted here were either caught before they had time to increase, or the character of the bottom and general surroundings was not suited to them for propagating.

No traces of the lobsters planted off Trinidad, Cal., have ever been found. The fishermen of that locality have made diligent search for them with such appliances as they had, but to no purpose. Captain Nichols, in charge of the Light-House Board of California, has had lobster pots made and set on and near the spots where they were planted. This kind of apparatus has also met with negative results.

In view of the fact that nearly five years have passed since the planting was made, it is very probable that the water and general surroundings of this locality are not conducive to their growth. A few lobsters planted off the coast washed by so vast an ocean as the Pacific can not be considered a fair test; 302 lobsters, the number planted, would naturally in a few days become more or less scattered, and the sexes widely separated and perhaps never got together again.

It is frequently stated that a lobster ought to live in a water where crayfish are found. This can hardly be expected, for crayfish are never found as far north as Monterey Bay, which proves conclusively that they require warmer water than a lobster, and in all probability they would not live off the New England coast.

The geographical position, temperature of water, and general character of the bottom in many parts of Alaska are, in the opinion of the writer, much better suited to the requirements of the lobster than that part of the coast lying below or south of Cape Flattery. The whole archipelago of southeastern Alaska contains many places where the lobster would be more likely to live and multiply than any other place on the Pacific Coast.

The temperature and other environments of this region correspond more closely to the home of the lobster on the Atlantic Coast. It is quite evident that lobsters require a change in temperature of water far greater than they would find off the Pacific Coast below 50° N. latitude, from the fact that they are only found in latitudes where the water undergoes such a change.

The coast of southeastern Alaska is cut up into hundreds of islands both large and small, forming numerous bays, channels, and estuaries very similar to the coast of Maine and some parts of Nova Scotia and Newfoundland. From Massachusetts to the Gulf of St. Lawrence is where the lobster abounds in greatest numbers, and in this region the water in summer is comparatively warm and in winter extremely cold, elements perfectly congenial to this crustacean. In Alaska the water annually undergoes, to a much less degree, the change which takes place in the latitudes above mentioned. All things considered, no great mistake would be made in planting lobsters in the waters of southeastern Alaska. The harbor of Sitka would be an excellent place to try the experiment; also at Hooniah. There are many localities equally as good above Prince of Wales Island, viz: Howkan, Nichols Bay, and Shakan; or at Loring, Revillagigedo Island, and several more points farther up the Behm Canal.

The canvass of the whale fishery carried on from San Francisco by San Francisco and New Bedford vessels disclosed a fleet of 49 vessels in 1893. In comparatively recent years San Francisco has attained leading importance as a whaling center. The scarcity of whales in the Atlantic Ocean and the relative abundance of the valuable bowhead whales in the North Pacific and Arctic oceans have led to the transfer of a number of New Bedford vessels, which, with the local fleet, have made San Francisco the principal rendezvous for whaling vessels in the United States.

The fleet consisted of 35 vessels belonging in San Francisco and 14 others owned in New Bedford. The tonnage of the combined fleet was 13,910 net tons, and the value was \$1,702,360. Thirteen of the vessels

were propelled by steam. Detailed figures showing the number and tonnage of vessels of each rig, etc., are given in the following table:

Vessels.	San Francisco fleet.		New Bedford fleet.		Total.	
	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.
Steam barks.....	9	3,188.66	2	763.73	11	3,952.39
Steam brigs.....	1	164.78			1	164.78
Steam barkentine.....	1	281.42			1	281.42
Barks.....	a 15	4,573.25	10	3,358.57	25	7,931.82
Brigs.....	4	779.87	1		5	779.87
Ship.....			1	328.55	1	328.55
Schooners.....	b 5	471.57			5	471.57
Total.....	35	9,459.55	14	4,450.85	49	13,910.40
Value.....		\$656,000		\$241,000		897,000
Value of outfit.....		595,360		210,000		805,360

a Includes one vessel of 307.24 tons burned at sea while bound for the Arctic Ocean.
 b Includes one vessel of 141.25 tons engaged in trading for bone and ivory with the natives in the Arctic Ocean.

The persons employed on the whaling vessels with headquarters at San Francisco numbered 1,767; 1,214 of these were on the local fleet and 553 on the New Bedford vessels. The 13 steamers carried 520 persons, an average of 40 to a vessel, while the 36 sailing vessels had 1,247 men, an average of about 35, as shown in the following table:

Rigs.	San Francisco fleet.	New Bedford fleet.	Total.
Steam barks.....	373	86	459
Steam brigs.....	24		24
Steam barkentine.....	37		37
Barks.....	590	402	992
Brigs.....	108	27	135
Ship.....		38	38
Schooners.....	82		82
Total.....	1,214	553	1,767

In 1893 337 whales were taken by the San Francisco whaling fleet; of these, 288 were obtained by San Francisco vessels and 49 by New Bedford vessels. The catch comprised 278 bowhead whales, 45 sperm whales, 13 right whales, and 1 humpback whale; these yielded 225,951 gallons of oil and 417,266 pounds of bone, worth \$1,136,657. Figures showing the results of the fishery by San Francisco and New Bedford vessels are separately given in the following statement:

Table showing the number of whales taken and products obtained by the fleet rendezvousing at San Francisco in 1893.

Whales taken.	San Francisco vessels.	New Bedford vessels.	Total.	Products.	San Francisco vessels.	New Bedford vessels.	Total.
Sperm.....	40	5	45	Sperm oil.....galls.	31,400	5,700	37,100
Right.....	5	8	13	Whale oil.....do.	117,441	71,410	188,851
Bowhead.....	243	35	278	Whalebone.....lbs.	368,966	48,300	417,266
Humpback.....		1	1	Ivory.....do.			
Total.....	288	49	337	Value.....	\$956,249	\$180,408	\$1,136,657

NOTE.—In addition to the products given, 1,350 pounds of bone and 2,000 pounds of Ivory, valued at \$3,700, were landed by a vessel that traded with the natives.

The classification of the whaling fleet by fishing-grounds and the number of whales of each species taken on the different grounds are given in the following table. The importance of the North Pacific and Arctic oceans will be readily seen from the figures presented. More than nine-tenths (293) of the whales captured were taken on those grounds, and of these fully 280 were obtained in the Arctic Ocean.

Table showing by fishing-grounds the number of whales taken by the vessels rendezvousing at San Francisco in 1893.

Fishing-grounds.	San Francisco fleet.					New Bedford fleet.					Total.							
	No. of vessels.	Number of whales.				No. of vessels.	Number of whales.				No. of vessels.	Number of whales.						
		Sperm.	Right.	Bowhead.	Humpback.		Total.	Sperm.	Right.	Bowhead.		Humpback.	Total.	Sperm.	Right.	Bowhead.	Humpback.	Total.
North Pacific and Arctic oceans.....	33	5	243	.....	248	13	4	5	35	1	45	46	4	10	278	1	293
Okhotsk Sea.....	1	3	.....	.....	3	1	1	3	.....	.....	4	2	4	3	.....	.....	7
South Pacific and Indian oceans.....	1	37	.....	.....	37	.....	.....	.....	.....	.....	1	37	.....	.....	.....	.....	37
Total.....	35	40	5	243	288	14	5	8	35	1	49	49	45	13	278	1	337

^a Includes one vessel burned on the way to the fishing-grounds and one vessel engaged in trading for bone and ivory.

The season in the Arctic was remarkably successful. One vessel took 48 bowhead whales; these yielded 72,000 pounds of bone, valued at \$180,000. Five other vessels secured, respectively, 45, 38, 30, 26, and 20 whales and stocked over \$100,000 each (\$163,750 to \$104,298).

The practice of remaining in the Arctic during the winter in order to be early on the grounds is becoming more prevalent, and 7 steamers and 3 sailing vessels wintered near the mouth of the Mackenzie River in 1893.

In May, 1894, the writer made a brief visit to the Pacific Coast for the purpose of studying the apparatus and methods of the fisheries. He was instructed by the Commissioner to make observations on the condition of the salmon industry, the sturgeon fishery, and other prominent branches, and to give special attention to those fishes which have been artificially introduced into the waters of the Pacific States, namely, the shad, the striped bass, the catfish, and the carp.

The inquiry began in San Francisco, Cal., May 24 and was terminated at Portland, Oreg., June 25. The short time available restricted the inquiry to the fisheries of greatest extent and interest and to the localities affording the best opportunities to see the greatest variety of fishery products and methods. The results of the inquiry will be incorporated in a special report and need only be outlined at this time.

The time spent in San Francisco and vicinity was chiefly devoted to the consideration of the market fishery for salt-water products; to the salmon, shad, striped bass, sturgeon, and other fisheries in the lower

courses of the Sacramento and San Joaquin rivers and in San Francisco, San Pablo, and Suisun bays, and to the San Francisco fish trade. Some valuable data relating to the acclimatized fishes were obtained from the records of the wholesale dealers. Through the courtesy of the California Fish Commission several days were passed in the Sacramento-San Joaquin delta, where are located the principal spawning-grounds of the shad and striped bass and important fishing-grounds for them, salmon, and other species.

A short visit was made to San Pedro, in Los Angeles County, for the purpose of investigating the sardine fishing and canning at that place. While the sardine (*Clupea sagax*) is found along the whole length of the west coast, it appears that it is only in the southern part of its range that it occurs in sufficient abundance and with enough regularity to permit the prosecution of a successful business. A sardine cannery was established at San Pedro in 1893. This is the only cannery of the kind now on the Pacific Coast, although for a number of years prior thereto sardine canning had been done at San Francisco. Sardines of suitable size are quite abundant, and the prospects seem very favorable. In connection with the capture and utilization of sardines, a scombroid fish (*Trachurus picturatus*), locally called Spanish mackerel, is taken and canned.

At Astoria and Portland attention was given to the important fisheries for salmon and sturgeon and to the canning industry. The prevalence of unprecedentedly high water prevented a visit to the interesting wheel and other fisheries of the Upper Columbia River. Some very suggestive detailed statistics regarding the present and past condition of the salmon industry were secured at Astoria. A canvass among canners and others interested in the fishing industry and deeply concerned in the preservation of the salmon showed that while all looked to extensive artificial propagation as affording the most certain relief, practically all favored the establishing of a close time throughout April or August, or both.

INQUIRY REGARDING WHITING.

In the summer of 1893 an inquiry regarding the edible qualities of the whiting (*Merluccius bilinearis*) was made. This fish is a member of the cod family, and occurs in great abundance on the New England coast. It reaches an average length of about 20 inches. It is known as whiting, silver hake, and Old England hake. Attention has from time to time been drawn to the probable economic value of the fish, in the publications of the Commission. In a report on the fisheries of the New England States, printed in the Fish Commission Bulletin for 1890, the following reference to this fish was made:

Although the whiting, as it comes from the water, is one of the best flavored and most nutritious of our food-fishes, the difficulty of keeping it fresh and in good condition when iced has militated against its utilization to a large extent for market purposes. Often great quantities are taken in pound nets and floating traps, but

generally these fish have to be turned out of the nets, only to reenter perhaps on the next tide. Some effort has been made to market at least a portion of the catch, and it is to be hoped that a method will be discovered for utilizing quantities of this species. In view of its abundance and cheapness it seems pertinent to suggest the possibility of its profitable utilization by canning or smoking. Its delicate flavor should make it an excellent article of food when canned, or, if lightly salted and prepared like kippered herring and finnan haddies, a demand might be created which would consume great quantities of what is now essentially a waste product.

While small quantities are utilized in a fresh condition or for salting, in most places the whiting is regarded as having no market value, and fully nine-tenths of the quantities taken are discarded. It is especially abundant in the region of Cape Cod, Massachusetts, where it is taken in large numbers each year in pound nets set for mackerel and other fish. When this section was visited June 1-12, 1893, there was an exceedingly large body of whiting in Cape Cod Bay and the pound nets were filled with them; one net at Provincetown on June 9 contained 300 barrels, and some nets had been dismantled so that the trouble of having to turn the fish out might be obviated. 10

The abundance of the whiting at that time and its nonutilization prompted an inquiry into its possible food value and economic importance. According to the statements of the weir fishermen, there are often 400 to 500 barrels of whiting in some nets at one time, and in a single week as many as 2,000 barrels will be taken. Many of the fish must be caught a number of times, for as long as the school remains they continue to enter the traps. An estimated annual catch of 100,000 barrels would probably be below the actual figures.

The run of whiting in Cape Cod Bay usually begins in the latter part of May and continues about two weeks. The fish are in a spawning condition at this time. There is also another well-marked run in the fall. Scattering fish are taken throughout the pound-net season. The fish thus obtained are usually from 18 to 24 inches long and weigh about 2 pounds, although many smaller fish are taken. 11

It may be said that practically no use is made in the Cape Cod region of the whiting in a fresh state. A few are at times shipped to New York where they bring the same price as haddock, and to Boston where there is little market for them; small numbers are used for lobster bait. The opinion is unanimous as to the excellent food qualities of the whiting in a perfectly fresh condition. The flesh is very sweet and palatable, and the fish is generally regarded as equal to cod, haddock, and hake, and, by some, preferred to those fish. The fish is by some persons considered too soft to bear shipment well, with the present methods of preservation; others, however, say that when properly iced it keeps as well as any other fish. Objection is made to its use fresh as bait in the line fisheries on account of its softness.

In this region the whiting is generally regarded as a nuisance. Its advent interferes with the run of better fish, such as mackerel and herring, and no large catches of the latter are made while the whiting 12

remain. A great many are killed in emptying the nets, and the dead bodies often thickly cover the shores and bottom. They are also destructive to the nets, owing to slime which accumulates on the twine when large numbers of fish are crowded into the pounds.

Small quantities of salted whiting have been prepared for sale at Provincetown and other places on Cape Cod, although most of the fish thus preserved have been for home consumption. Mr. Henry T. Lewis, of Provincetown, pickled 80 barrels of whiting in 1892 and sent them to Cayenne, South America, on a whaler, where they sold for \$7 per barrel. In 1893 it was his intention to prepare several hundred barrels for the West Indian or South American trade.

When split and pickled the fish keep well, retain a good color, and will bear shipment to the tropics. When dry-cured, however, they become very hard, turn yellowish, owing to the oil they contain, and lose their market value.

Mr. Morgan, of South Truro, a fish-canner of much experience, states that the experiments made in canning whiting have shown that the fish is not well suited to that method of preservation; the flesh is flaky and breaks up in the canning process.

The possibility of utilizing whiting for salting was suggested, and it seemed probable that in Central and South America a market might be created for this cheap fish. It was, therefore, determined to secure an expression of opinion from a number of dealers and to have some samples of salted whiting prepared for a distribution with a view to test their edible qualities. Mr. W. A. Wilcox, agent of the Commission, who was then in the Cape Cod region, was instructed to make arrangements for the preparation of the fish, and Capt. Atkins Hughes, of North Truro, was engaged to select and cure them. It was intended to have them prepared in a number of different ways—as pickled, kench-cured, and smoked—but it was found feasible to have only the pickled fish prepared. Through some misunderstanding, the fish intended for pickling were not eviscerated and split in the best manner, and the samples presented a less inviting appearance than might otherwise have been the case. Several hundred pounds were distributed in Gloucester and Boston by agents of the office, and at the same time the following letter, in which the objects of the inquiry were explained, was addressed to the principal firms by the Commissioner:

The United States Fish Commission is desirous of securing an expression of your opinion as to the economic value of the fish known on the New England coast as the whiting, silver hake, or Old England hake. As you are doubtless aware, it occurs abundantly on our shores, and is taken in large quantities in traps and pound nets. Owing to real or supposed difficulties in shipping it to market in a fresh condition and the low price which it commands, only small quantities are utilized for food purposes, and in many places it is regarded as a nuisance. It has occurred to me that the financial condition of many of our fishermen might be materially improved if means could be devised to utilize the whiting, either in a fresh or prepared state; and it is with a view to secure the benefit of your experience and advice in this matter that this communication is addressed to you.

I am aware that efforts have long ago been made to introduce this fish into commerce and give it a permanent place in our fish trade; that prior to the expiration of the reciprocity treaty there was a limited trade in salt whiting with the British Provinces, and that small consignments of this fish have in recent years been sent to Brazil, the West Indies, and other places; but there has probably never been a better opportunity to make profitable use of this waste product than is now afforded by the reciprocity relations established between the United States and various other countries.

The Commission has recently had prepared at North Truro, Mass., a quantity of pickled whiting with a view to submit them to the principal dealers in Boston, Gloucester, and elsewhere and have their edible and commercial qualities determined. It is the intention to continue the inquiries and to ascertain the value of the fish for smoking, canning, etc. Within a short time an assistant of this office will wait upon you and present to you samples of the fish. Permit me to ask that you will kindly examine them and favor me with a written statement of your views.

The principal points on which your opinion is desired are the following:

- (1) The commercial importance of whiting prepared like the samples.
- (2) The food value of the whiting in a dry-salted and pickled state as compared with (1) cod, (2) hake, and (3) haddock.
- (3) The commercial value of dry-salted and pickled whiting in the United States and Canada, and the possibility of renewing a market for it in the latter country.
- (4) The commercial value of dry-salted and pickled whiting in the West Indies, Brazil, and other South American countries, and the possibility of establishing with them a remunerative trade.
- (5) The food and economic value of smoked whiting; its comparison with smoked herring.
- (6) The feasibility of preparing boneless whiting to supply a demand for cheap boneless fish.

Of the large number of responses received and variety of opinions expressed, the following, chiefly from leading firms of Boston and Gloucester, will be sufficient to illustrate the different views entertained regarding the special points referred to in the circular letter:

[Leonard A. Treat, wholesale fish-dealer, Boston.]

The rank of whiting, either in a dry-salted or pickled state, as compared with cod, hake, and haddock, would be about fourth. There would be no difficulty in renewing a market in Canada for whiting, and also for hake, haddock, and cod, if it were not for the tremendous duty on all our goods going into Canada. Give us reciprocity with Canada and there will be no question about a market for whiting and a great many other of our fish products. Smoked whiting would take its place in economic and food value alongside of smoked haddock and hake; it would be better than hake, perhaps not quite as popular as haddock. It is entirely feasible to market boneless whiting. It has been done and is being done whenever the whiting is put on the market at a lower price than hake. If whiting can be cured and marketed at a competing price with hake, it will find a place at once in the various markets of this country. As the years would roll around it would become more and more popular as its value became known, and ultimately would, in our opinion, rank fully up with cusk and haddock, if not equal to medium cod. This fish has but to be known to be appreciated. What might be done with the fish abroad is, in our opinion, an unknown quantity, a mere conjecture, as the value of our reciprocity relations with the various countries to the south of us has not been of such magnitude as to give it a passing notice. The truth of the matter is that it costs us so much to produce our goods here in this country, as compared with Canada, that notwithstanding the apparent advantage of our reciprocity relations with Brazil, etc., Canada and Newfoundland still hold the trade. Reciprocity in fish has not, so far as we know, materialized to the financial benefit of our salt-fish trade,

[Frederick F. Dimick, secretary Boston Fish Bureau.]

I have had a few of the silver hake which you sent me cooked and placed on my table. I found them very good eating, tasting very much like salt codfish. They were prepared for the table in the same way salt codfish usually are. There is a taste to them, however, that one who eats much codfish easily discovers, but I confess that I could hardly tell the difference.

[John Pow & Son, outfitters and wholesale fish-dealers, Gloucester.]

We have carefully considered your inquiry in regard to the whiting, or Old England hake, as we call them. They are quite common in the market as cheap fresh fish, but without any demand otherwise. In regard to their value for general trade as cured fish, we have doubts of their being handled with any success in any direction. They are of a long, slender, soft nature, very expensive to handle as far as labor is concerned. Fresh, they equal the hake in most ways of cooking and to some minds are as desirable as the haddock or cusk, but do not compare with the cod. Dried, and salted especially, they would be so thin and unattractive that they could not be sold for a price that they really would cost after the labor and expenses were put upon them. Efforts have been made years ago to handle them in different directions, but without success. The common hake, which is of a better substance, being harder, are much preferred to the whiting in quality and are much cheaper to handle. The common hake has a large liver, valuable sound, and considerable pea [spawn], all of which are of commercial worth. The cost of the common hake dressed and salted, after crediting the value of livers, etc., is much less than the whiting. We would answer your specific inquiries, therefore, as follows:

The commercial importance of the whiting as prepared in your sample, namely, in pickle, would be very small, indeed, and it is doubtful if any considerable market could be obtained for them. We do not think a market could be found in either the United States or Canada at a remunerative price. The whiting being of such a soft nature we think it would be impossible to process them in any way, either by smoking or canning, as it would leave a soft substance of very small value, for which it would be hard to secure a market. They are not very fat and would not smoke, as do the herring, and keep for transportation, though lightly smoked for immediate consumption they are very good, but even then without much commercial value. We have made no attempts at skinning or boning them, but think as the skin is quite tough and the flesh very soft the flesh would be torn and its worth proved very slight.

[Oscar Andrews, with Benjamin Low, wholesale salt-fish dealer, Gloucester.]

You have asked my opinion as to the introduction of whiting to the trade of this country for export. I was one of the partners of the house of Andrews & Co., who were in the shipping business in this city from 1878 until 1888. We did quite a business in Canada from 1881 until the expiration of the treaty in 1885. In 1882 we introduced the whiting to that trade and sold several hundred barrels pickled. They seemed to give perfect satisfaction in every case. At any rate, the parties who first took hold of them ordered again and again. We prepared them in exactly the same way as codfish, splitting and salting them in precisely the same way. The second year we split them on the backs, as we do mackerel, and it made trouble for the reason that they hurt near the bone. This was our own fault; we should have let good enough alone. We did not try to introduce these fish to the trade of the United States in 1882, as Canada took all that we prepared, and we could really have sold many more than we did there if we had salted more down while the school was on our coast. I think there is a party in this city who has been canning them for several years. There are no better eating fish than whiting. Every person who has ever eaten one of them broiled will agree with me on this point. They would make a very nice smoked fish, and would really be far superior to finnan haddie, but unfortunately they are a summer fish and would soon spoil if shipped any distance. As dried fish they would be a failure, for, owing to having a little fat in the flesh, they rust very quickly. I should say on the whole that whiting shipped fresh, packed in

ice, canned, or packed in barrels or small packages as pickled fish, would prove to be of great commercial importance.

[Lyon, Dupuy & Co., wholesale salt-fish dealers, Boston].

In regard to the value of whiting, we would say that our business with fish being confined entirely to the export trade to the West Indies, we can best give you our idea of the whiting as regards its value for shipping to such tropical and semi-tropical countries. *The fish fit to ship to such countries must be able to withstand a certain amount of hot weather, and we consider the whiting as being too soft to successfully do this, and much inferior to codfish in this respect. We consider that codfish would be so much preferred that no difference in price would cause whiting to be used in our trade. The meat of the whiting is so soft, watery, and tender that the skin can not be removed, and they are therefore useless as boneless fish. On account of these qualities people do not like the fish and will not buy them and dealers will not handle them. Therefore, their food value as compared with cod, haddock, etc., is not so great, especially as the latter are caught in sufficient quantities.*

[Capt. Atkins Hughes, weir fisherman, North Truro, Mass.]

As a food-fish, fresh, there is no ground fish that is better, in my opinion. As the weir men give them to anyone who comes for them, there are a good many eaten in this place and Provincetown. At some places on the Massachusetts coast, the fish-dealers protested so much against this practice of the weir men, on the ground that it injured their business, that the fishermen had to abandon their generosity. I mention this to show that the whiting are good fish and would be more generally used if the common people could get them. Their keeping qualities fresh are as good as any fish we ship away in ice. In 1893 not more than 200 or 300 barrels of whiting were utilized in the Cape Cod region, about 100 barrels being salted at Provincetown and the remainder shipped to the New York market. A good many whiting are now taken to Boston and sold to peddlers, but the regular dealers do not handle them.

[James G. Tarr & Bro., wholesale fish-dealers, Gloucester.]

We are able to state from practical experience that the whiting is only fit for use fresh or pickled for immediate consumption. We split and salted 3,000 pounds in 1891, carried them in salt pickle three months, and found upon examination they had shrunk in weight nearly one-half, and were turned a yellowish straw color on their faces. We soaked, dried, and smoked the lot, and when cured they were worthless, being like cardboard, dry and shriveled up, worthless for food. In cases they do a little better, but there is so much water in the fish that contents of cans get mushy, and we do not consider it profitable to use them.

[H. E. Woodward & Co., wholesale fish-dealers, Boston.]

The silver hake or whiting in our judgment can only be used when split and salted exactly as hake are. In that state could be exported same as hake, and might also be dressed for cheap boneless fish. We think of no other way of utilizing it.

THE FRESH-WATER PEARL FISHERIES.

In December, 1893, negotiations were opened with Mr. George F. Kunz, the well-known gem expert, with a view to have him make a thorough investigation of the fresh-water pearl fisheries of the United States and prepare a report on the subject for the Commission.

While the taking of fresh-water pearls is not a branch of the fisheries which possesses great importance because of the number of persons finding employment or the capital invested therein, the industry possesses much interest and the value of the output is in the aggregate large. The absence of even an approximately complete account of the

extent, methods, and other features of this fishery, and the opportunity of having the subject investigated by one so well informed as Mr. Kunz and at a purely nominal expense, were taken into consideration.

Mr. Kunz was already in possession of a large amount of important unpublished material which he had been gathering for many years. This was freely placed at the disposal of the Commission and served as a valuable basis for the future inquiries. Mr. Kunz also had access to the extensive records of Messrs. Tiffany & Co., the well-known New York jewelers, with whom he is associated.

In order to bring the matter up to date and secure uniformity in the information obtained, a circular form was prepared for Mr. Kunz's use, and sent out by him to all persons who had within recent years engaged in the pearl fishery or in buying and selling the pearls. The topics sought to be brought out by the schedule were as follows:

The pearl-bearing mussels:

- Nature of stream in which found; kind of bottom; character of water.
- Geological character of the district as to rock, soil, etc.
- General abundance of mussels.
- Size, shape, and position of the mussel beds.
- Local names of mussels.
- Habits of mussels.
- Enemies and fatalities to which mussels are exposed; nature and extent of destruction by muskrats, hogs, freshets, etc.
- Size, shape, and color of mussels.
- Species of mussels in which pearls are most common.
- Proportion of mussels in which pearls occur.
- Sizes, or other peculiarities, of shells in which pearls are found.

The pearls:

- Nature and origin of pearls.
- Position in mussel.
- Size, shape, and color of pearls.
- Relative value of pearls in different sizes, shapes, and colors.
- Markets for pearls.
- Prices for pearls.

The fishery:

- Method of taking the mussels.
- Description of apparatus used in taking mussels and in opening the shells.
- Methods of extracting the pearls.
- Treatment of pearls when found.
- Utilization of mussels after extraction of pearls or after opening.
- Principal occupations of mussel fishermen.
- Statistics of fishery in 1893: Fishermen, boats, apparatus, pearls.
- Statistics, complete or partial, for previous years.
- Period when pearl fishing was of greatest importance in district.
- History of origin and growth of fishery.
- Exhaustion of mussel beds; causes, rapidity.
- Do exhausted beds become replenished, and in what time?
- Is State protection of beds desirable or necessary?

The inquiries were begun in February, 1894, and by the close of the fiscal year, when they were still in progress, much interesting and useful data had been secured. The completion of the inquiry is expected during the next fiscal year.

THE MENHADEN FISHERY.

In the report of the division for 1892 reference was made to the desirability of undertaking a special inquiry regarding one of the controversial points that had arisen in the menhaden fishery, namely, the extent to which other fish besides menhaden are taken in the seines.

The plan proposed contemplated the assignment of agents to menhaden vessels fishing from various points on the coast, and the recording of the detailed results of each seine-haul during the season.

By the opening of the fishing season, in May, 1894, arrangements had been perfected for conducting an inquiry in accordance with the plan suggested in the report cited. The limited force available for this work, owing to the prosecution of extensive field inquiries in the Great Lakes, necessitated a curtailment of the original plan to the extent of making continuous observations on only two menhaden vessels. A number of menhaden firms consented to the use of their vessels, when the purposes of the investigation were made known. The offers accepted were those of Messrs. Luce Brothers, of Niantic, Conn., and Mr. A. J. Morse, of Hoffman's Wharf, Va., the former tendering the use of the steamer *Arizona*, of 103 tons; the latter the steamer *J. W. Hawkins*, of 125 tons. Mr. C. E. Latimer, a former employee of the Commission, was appointed to duty on the *Arizona*, and Mr. E. F. Locke, field agent, was assigned to the *J. W. Hawkins*. Owing to sickness, Mr. Latimer's services were discontinued shortly after he entered on the work, and Mr. W. P. Hay, teacher of zoology in the Washington High School, took his place.

Up to the end of the fiscal year the inquiry had progressed satisfactorily, and the indications were that by the close of the season more detailed and reliable information than had ever before been collected on this subject would be in the possession of the Commission.

SALMON IN COAST WATERS AND AT SEA.

A paper entitled "Notes on the capture of Atlantic salmon at sea and in the coast waters of the Eastern States" was issued in pamphlet form in May, 1894. The purpose of the article was to record some of the results of salmon culture, as evidenced by the capture of salmon in places remote from the rivers in which fry had been deposited; to solicit information from offshore and coast fishermen concerning the taking of salmon in their nets, and "to bring to their attention the opportunity they will thus have of increasing the knowledge of the movements of the salmon, of aiding in the determination of the results of fish-cultural operations, and of ultimately, if not immediately, benefiting themselves by supplying information that will conduce to the most effective application of artificial methods."

An edition of 500 copies of the article was printed. The paper was sent to persons engaged in the mackerel, menhaden, and other ocean fisheries, and to the operators of pound nets, traps, and other shore apparatus in the New England and Middle States, accompanied by a circular letter from the Commissioner directing attention to that part of the paper in which information was solicited.

Already numerous replies have been received recording the occurrence of salmon on various parts of the coast, and it is expected that in the next two or three years much valuable material will be obtained in this way.

INQUIRIES AT BOSTON AND GLOUCESTER, MASS.

The nature of the services performed by the local agents of the Commission at Boston and Gloucester has been fully explained and the importance of these inquiries has been referred to in previous reports of the division. At nominal salaries, Mr. F. F. Dimick, at Boston, and Capt. S. J. Martin, at Gloucester, have continued to render efficient service and to procure accurate data showing the operations of a large part of the New England fishing fleet.

The following table, based on Mr. Dimick's returns, shows that in the calendar year 1893 67,595,289 pounds of fish, having a value to the fishermen of \$1,595,902, were landed at Boston by American fishing vessels, in addition to which considerable quantities of lobsters, clams, and other products were received. More than half the aggregate weight of the fish landed represented haddock; of this species, over 31,229,000 pounds, valued at \$658,000, were brought in. Of cod, the next important fish, over 16,000,000 pounds, worth \$451,000, were taken. The receipts of hake were 11,590,000 pounds, having a value of over \$133,000. Georges Bank was the principal fishing-ground resorted to by vessels landing their fares at Boston; this famous bank yielded over 17,000,000 pounds of the fish shown in the table. The South Channel grounds are credited with over 13,600,000 pounds. Other important banks were Cashies, Jeffreys Ledge, Middle, La Have, and Western. Detailed figures for the different species and grounds are given in the table.

Summary by fishing-grounds of certain fishery products landed at Boston, Mass., in 1893 by American fishing vessels.

Fishing-grounds.	No. of trips from each ground.	Cod.		Cusk.		Haddock.	
		Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
<i>East of 66° W. longitude:</i>							
La Have Bank	101	1,368,000	\$36,989	539,500	\$7,658	1,125,700	\$22,550
Western Bank	68	823,300	21,194	185,000	3,233	212,400	3,819
Cape Shore	47	507,500	14,820	163,700	2,448	341,400	8,818
Gulf of St. Lawrence ..	2						
<i>West of 66° W. longitude:</i>							
Browns Bank	46	543,000	13,198	150,500	2,225	904,000	14,511
Georges Bank	547	4,221,700	122,145	598,200	8,615	10,524,300	230,647
Cashies Bank	189	1,117,600	31,639	1,524,400	22,533	1,283,600	24,616
Clark Bank	6	52,000	1,285	10,000	200	72,000	1,735
Fippenies Bank	14	48,400	1,063	23,500	299	82,000	1,718
Tillies Bank	7	12,500	399			35,000	800
Ipwich Bay	72	222,800	6,633	1,000	13	286,500	7,184
Jeffreys Ledge	492	773,900	22,460	212,750	2,958	2,390,300	52,626
Middle Bank	548	764,600	22,703	140,100	1,903	2,554,850	58,897
Off Highland Light	215	653,800	17,048	118,000	1,605	1,258,800	25,555
Off Chatham	81	172,000	4,690	6,000	113	707,700	14,158
South Channel	538	3,278,800	87,807	393,300	6,159	7,308,700	145,263
Nantucket Shoals	74	683,000	20,296	3,400	43	461,900	7,579
Shore, general	779	841,200	26,240	140,300	2,398	1,680,200	37,732
Total	3,826	16,075,290	451,209	4,237,050	62,403	31,229,350	658,208

Summary by fishing-grounds of certain fishery products landed at Boston, Mass., in 1893 by American fishing vessels—Continued.

Fishing-grounds.	Hake.		Halibut.		Pollock.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
East of 66° W. longitude:						
La Have Bank	780,000	\$8,539	151,100	\$14,808	128,800	\$1,791
Western Bank	301,500	3,315	747,500	75,065	30,500	481
Cape Shore	230,100	2,850	30,650	2,489	30,800	521
West of 66° W. longitude:						
Browns Bank	107,000	1,163	71,600	8,411	13,000	287
Georges Bank	1,272,100	14,845	202,910	20,593	64,100	978
Cashes Bank	2,302,400	27,890	13,040	1,309	47,000	690
Clark Bank	39,500	555	3,500	270		
Flippenes Bank	67,000	860	6,500	598	3,800	54
Tillies Bank	17,500	168			1,000	15
Ipswich Bay	21,700	247	400	40	1,000	10
Jeffreys Ledge	1,449,100	15,531	3,200	304	231,650	2,948
Middle Bank	1,142,000	13,491	6,435	593	65,950	900
Off Highland Light	560,900	6,627	11,385	1,151	20,900	283
Off Chatham	94,900	931	2,182	218	4,200	56
South Channel	2,464,700	27,782	113,450	11,995	84,900	1,065
Nantucket Shoals	38,700	482	400	57	22,500	349
Shore, general	695,300	8,509	10,200	1,111	138,500	1,635
Total	11,590,400	133,871	1,374,452	139,012	689,200	12,063

Fishing-grounds.	Mackerel.				Other fish.		Total.	
	Fresh.		Salted.		Pounds.	Value.	Pounds.	Value.
	Pounds.	Value.	Pounds.	Value.				
East of 66° W. longitude:								
La Have Bank							4,093,100	\$92,835
Western Bank					225	\$14	2,310,425	107,121
Cape Shore			316,400	\$17,207			1,620,550	49,159
Gulf of St. Lawrence			65,000	4,788			65,000	4,788
West of 66° W. longitude:								
Browns Bank					3,000	135	1,783,700	39,920
Georges Bank					156,825	10,275	17,040,135	408,098
Cashes Bank	10,500	\$935					6,204,540	100,312
Clark Bank							177,000	4,045
Flippenes Bank							231,200	5,192
Tillies Bank							66,000	1,382
Ipswich Bay							533,400	14,127
Jeffreys Ledge					5,105	305	5,068,005	97,132
Middle Bank					9,725	367	4,692,660	98,854
Off Highland Light					4,000	142	2,633,785	52,411
Off Chatham	22,700	1,636			64,450	1,078	1,074,132	22,878
South Channel					16,100	768	13,660,050	280,839
Nantucket Shoals							1,209,900	28,800
Shore, general	470,100	36,081	690,100	47,371	358,717	17,436	5,039,707	179,503
Total	503,300	39,252	1,077,500	69,366	618,147	30,518	67,595,289	1,595,903

The receipts of fish at Gloucester in 1893, landed from American fishing vessels, consisted of 29,478,000 pounds of fresh and 45,322,000 pounds of salt fish, valued at \$2,503,000. Over 38,500,000 pounds, or more than half the total receipts, consisted of fresh and salt cod, the salt cod amounting to about 34,000,000 pounds. The value of the cod at first hands was \$1,145,000. The next important fish was halibut, of which 8,418,000 pounds, worth \$656,000, were landed. Hake were taken in about the same quantities as halibut, but their value was much less; 8,400,000 pounds, valued at \$59,000, are shown in the statistics. Of mackerel, 7,715,420 pounds, with a value of \$503,887, were received. The most prominent fishing-grounds visited by the Gloucester vessels are the Grand Banks; here over 19,000,000 pounds of fish, having a value of \$572,000, were caught. Georges Bank yielded more than 14,100,000 pounds, valued at \$492,000. The details are shown in the following table, compiled from statistics furnished during the year by Capt. S. J. Martin.

164 REPORT OF COMMISSIONER OF FISH AND FISHERIES.

Summary by fishing-grounds of certain fishery products landed at Gloucester, Mass., in 1893, by American fishing vessels.

Fishing-grounds.	No. of trips from each ground.	Cod.				Cusk.			
		Fresh.		Salted.		Fresh.		Salted.	
		Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
East of 66° W. longitude:									
La Have Bank.....	92	431,000	\$8,367	571,770	\$20,522	350,000	\$5,004		
Western Bank.....	73	30,000	550	433,200	14,510	12,000	198		
Quereau Bank.....	163	2,000	80	433,260	11,773			7,000	\$158
Misaine Bank.....	1			32,000	1,040				
St. Peters Bank.....	7			26,000	734				
Green Bank.....	2								
Grand Bank.....	148			18,021,275	491,034				
Canso Bank.....	9			864,940	24,209				
Cape Shore.....	100			1,083,350	35,097	45,000	720	31,600	576
Gulf of St. Lawrence	35			909,330	26,405				
Iceland and Greenland.....	11			156,000	4,935				
Off Newfoundland.....	4			15,000	475				
Total.....	645	463,000	8,997	22,606,125	631,639	407,000	5,922	38,600	734
West of 66° W. longitude:									
Browns Bank.....	25	234,000	4,488	181,800	5,418	112,500	1,618	4,000	70
German Bank.....	1								
Georges Bank.....	672	1,090,360	24,484	10,213,472	372,924	369,600	5,567	82,000	1,892
Clarke Bank.....	1	3,000	60			35,000	578		
Cashes Bank.....	287	1,612,200	30,583			3,653,900	56,083		
Fippenies Bank.....	1					2,000	27		
Middle Bank.....	23	8,950	207			47,500	723		
Platts Bank.....	3			30,000	810			21,000	418
Jeffreys Ledge.....	43	40,900	924			94,000	1,460		
Off Chatham.....	9	4,000	72						
South Channel.....	18	36,000	580			119,000	1,789		
Nantucket Shoals.....	45			1,270,000	40,209	24,000	360		
Shore, general.....	1,415	686,007	21,350	72,000	2,056	7,620	96	28,000	630
Total.....	2,543	3,715,417	82,748	11,767,272	421,417	4,465,120	68,301	135,000	3,040
Grand total.....	3,118	4,178,417	91,745	34,373,397	1,053,056	4,872,120	74,223	173,600	3,774

Fishing-grounds.	Haddock.				Hake.			
	Fresh.		Salted.		Fresh.		Salted.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
East of 66° W. longitude:								
La Have Bank.....	271,000	\$2,586			655,000	\$4,563		
Western Bank.....					40,000	310		
Cape Shore.....	5,000	45	13,000	\$163			33,300	\$367
Iceland and Greenland.....							14,500	182
Total.....	276,000	2,631	13,000	163	695,000	4,873	47,500	549
West of 66° W. longitude:								
Browns Bank.....	247,000	2,218			88,000	612	3,000	38
German Bank.....					80,000	255		
Georges Bank.....	1,235,500	12,395	9,000	100	403,660	3,061	2,000	20
Clarke Bank.....					5,000	35		
Cashes Bank.....	633,350	5,861			6,216,500	42,254		
Fippenies Bank.....					8,000	68		
Middle Bank.....	10,700	237	8,000	101	113,000	844	83,000	388
Platts Bank.....								
Jeffreys Ledge.....	12,000	552			187,000	1,597		
Off Chatham.....	16,000	162			4,000	20		
South Channel.....	61,000	526			204,500	1,405		
Nantucket Shoals.....	8,000	72			18,000	98		
Shore, general.....	133,880	2,098	14,000	186	190,520	1,280	152,500	1,745
Total.....	2,359,430	24,111	31,000	387	7,468,200	51,559	190,500	2,191
Grand total.....	2,635,430	26,742	44,000	550	8,163,200	56,432	238,000	2,740

REPORT OF COMMISSIONER OF FISH AND FISHERIES. 165

Summary by fishing-grounds of certain fishery products landed at Gloucester—Continued.

Fishing-grounds.	Halibut.				Mackerel.			
	Fresh.		Salted.		Fresh.		Salted.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
East of 66° W. longitude:								
La Have Bank.....	705,935	\$56,197						
Western Bank.....	1,251,844	95,008	2,700	\$162				
Quereau Bank.....	2,532,720	222,060	2,000	100				
Misaine.....	63,000	2,655						
St. Peters Bank.....	197,980	14,131						
Green Bank.....	48,400	4,542						
Grand Bank.....	874,225	72,132	145,680	8,625				
Canso Bank.....				162				
Cape Shore.....	11,000	822	2,880	173			2,823,000	\$153,825
Gulf of St. Lawrence							750,400	53,108
Iceland and Greenland			1,673,200	98,078				
Off Newfoundland.....	122,250	7,257						
Total.....	5,807,354	474,804	1,829,000	107,190			3,573,400	206,933
West of 66° W. longitude:								
Browns Bank.....	8,900	548						
Georges Bank.....	753,025	72,218						
Casheo Bank.....	12,600	783						
Middle Bank.....	3,520	340					91,200	7,402
Jeffreys Ledge.....	160	16						
Off Chatham.....							44,000	2,445
Nantucket Shoals	3,900	347						
Shore, general.....					48,420	\$3,205	3,958,400	283,902
Total.....	782,105	74,252			48,420	3,205	4,093,600	293,749
Grand total.....	6,589,459	549,056	1,829,000	107,190	48,420	3,205	7,667,000	500,682

Fishing-grounds.	Pollock.				Other fish.			
	Fresh.		Salted.		Fresh.		Salted.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
East of 66° W. longitude:								
La Have Bank.....					3,000	\$360		
Iceland and Greenland							2,200	\$132
Total.....					3,000	360	2,200	132
West of 66° W. longitude:								
Browns Bank.....	3,000	\$21						
Georges Bank.....			3,000	\$30	1,000	120		
Jeffreys Ledge.....	161,300	1,222						
Off Chatham.....			158,000	2,688				
South Channel.....	2,000	15						
Shore, general.....	2,398,126	17,593			422,490	2,975	834,400	9,394
Total.....	2,564,426	18,851	161,000	2,718	423,490	3,095	834,400	9,394
Grand total.....	2,564,426	18,851	161,000	2,718	427,090	3,455	836,600	9,520

166 REPORT OF COMMISSIONER OF FISH AND FISHERIES.

Summary by fishing-grounds of certain fishery products landed at Gloucester—Continued.

Fishing-grounds.	All fish.					
	Fresh.		Salted.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
East of 66° W. longitude:						
La Hve Bank.....	2,416,535	\$77,077	571,770	\$20,522	2,988,305	\$97,599
Western Bank.....	1,333,844	96,066	495,900	14,672	1,829,744	110,738
Quereau Bank.....	2,534,720	222,140	442,200	12,036	2,976,920	234,176
Misaine Bank.....	63,000	2,655	32,000	1,040	95,000	3,695
St. Peters Bank.....	197,980	14,131	26,000	734	223,980	14,865
Green Bank.....	48,400	4,542			48,400	4,542
Grand Bank.....	874,225	72,132	18,166,955	500,459	19,041,180	572,591
Cause Bank.....			867,480	24,361	867,480	24,361
Cape Shore.....	61,000	1,587	3,086,320	190,201	4,047,820	191,788
Gulf of St. Lawrence.....			1,659,730	79,513	1,659,730	79,513
Iceland and Greenland.....			1,845,900	103,327	1,845,900	103,327
Off Newfoundland.....	122,250	7,257	15,000	475	137,250	7,732
Total	7,651,954	497,587	28,109,825	947,340	35,701,779	1,444,927
West of 66° W. longitude:						
Browns Bank.....	693,400	9,505	188,800	5,526	882,200	15,031
German Bank.....	30,000	255			30,000	255
Georges Bank.....	3,853,165	117,785	10,309,472	374,966	14,162,637	492,751
Clarks Bank.....	43,000	673			43,000	673
Cashes Bank.....	12,128,550	135,554			12,128,550	135,554
Fippies Bank.....	10,000	95			10,000	95
Middle Bank.....	183,970	2,361	91,200	7,402	274,870	9,753
Platts Bank.....			92,000	1,747	92,000	1,747
Jeffreys Ledge.....	495,360	5,771			495,360	5,771
Off Unathan.....	26,000	254	202,000	5,133	228,000	5,387
South Channel.....	422,500	4,405			422,500	4,405
Nantucket Shoals.....	53,900	877	1,270,000	40,209	1,323,900	41,086
Shore, general.....	3,887,063	48,597	5,059,300	297,913	8,946,363	346,510
Total	21,826,608	326,122	17,212,772	732,896	39,039,380	1,059,018
Grand total	29,478,562	823,709	45,322,597	1,680,236	74,801,159	2,503,945

It is intended to prepare in a short time a special discussion on the condition of the vessel fisheries of Massachusetts based on reports of the local agents at Boston and Gloucester. Material is at hand showing, for a series of years (1889 to 1894), the yield of different kinds of fish on each of the important banks resorted to by the vessels landing their fares in those cities, which, as has previously been stated, receive fully seven-eighths of the offshore vessel catch of New England.

REPORTS, SPECIAL PAPERS, ETC.

The published reports relating to commercial fisheries, issued from this division during the year, dealt chiefly with special subjects connected with the fisheries. A number of general reports, however, dealing with the fisheries of important geographical sections, were in course of preparation or of printing, and will be shortly published.

Among special data prepared by the division for use outside of the regular reports were statistical tables showing the extent of the fisheries of Maryland, for the Maryland Fish Commission, and printed in its report for 1893; information regarding the American mackerel fishery, for the Scotch Fishery Board, through the British embassy; a large series of detailed tables relating to the salmon industry of the Columbia River, for the use of the United States Fish Commissioner in a report to Congress on the condition of the industry.

A list of the articles issued, with a brief notice of their character, is as follows:

Report on the coast fisheries of Texas. (Report, 1889-1891, pp. 373-420, pls. 12-27.)

This report is based on field inquiries conducted in 1891, and is supplementary to the notice of the Texas fisheries contained in the report on the fisheries of the Gulf States, published in the Bulletin for 1891. The principal fisheries of the coast are first fully discussed, and then the fisheries are reviewed by geographical divisions. The paper is accompanied by 15 plates of the principal food-fishes of the coast waters of the State.

The oyster industry of Maryland. (Bulletin, 1892, pp. 203-297, pls. LVI-LXXI.)

The economic aspects of the oyster interests of the State having the most valuable oyster industry are considered in this paper. A history of the Maryland oyster-fishery from the earliest times is given, with an account of the legislation enacted for its regulation, the oyster-grounds, the methods pursued in oystering, oyster-culture, the oyster-police and the oyster-revenue services, the transporting, packing, and marketing trades, and detailed statistics of the industry. Fifteen plates showing fishing vessels, boats, appliances, and methods, and a colored chart indicating the position of the oyster beds, accompany the report.

The use of the proof sheets of this report was tendered the Maryland Bureau of Industrial Statistics, and the entire paper was printed in the report of that bureau for 1893.

The fyke nets and fyke-net fisheries of the United States, with notes on the fyke nets of other countries. (Bulletin, 1892, pp. 299-355, pls. LXXII-XCI.)

This article embodies the results of an original study of this group of fishing apparatus which had been in progress for several years. The fyke is one of the most generally used nets in the United States, and is also found in nearly every other country having important commercial fisheries. The paper defines the fyke net, gives the names by which it is known, explains the principle of its action, classifies and describes the different types, contains a geographical and statistical review of the fyke-net fisheries of the United States, and concludes with notes on the fyke net in other countries. In the fyke-net fisheries of the coast and lake States, 2,300 persons are shown to have been engaged, 25,700 nets used, and over 12,000,000 pounds of fish taken, the value of the catch being over \$300,000. Illustrations of 40 types of fyke nets employed in the United States and other countries are given.

Economic and natural-history notes on fishes of the northern coast of New Jersey. (Bulletin, 1892, pp. 365-380.)

The commercial fisheries of the northern part of the New Jersey coast are of great importance, and angling from the shore and from boats is also very extensively carried on during the summer months.

The paper represents the personal observations of the writer during parts of four years, and is chiefly based on a study of the pound-net fisheries. Pound nets of this section are more prominent than any other nets, and are the principal objects of the opposition to net fishing which exists on this coast. The article consists of a general review of the history and extent of the pound-net fishery, and of notes on the abundance, movements, and commercial value of the principal food-fishes of the region. About 50 species are separately mentioned, and for all the most important ones detailed figures are given showing the monthly catch in 1891 and 1892 at a pound-net fishery in Monmouth County.

Notes on the capture of Atlantic salmon at sea and in the coast waters of the Eastern States. (Bulletin, 1894, pp. 95-99, pls. 3 and 4.)

Some instances of the occurrence of Atlantic salmon off the coasts of Maine, Massachusetts, New Jersey, and Delaware are given in this paper. The taking of salmon at places remote from the mouths of rivers and off States having no salmon streams is of considerable interest to naturalists and fish-culturists, in view of the information afforded as to the oceanic migrations of this fish and owing to the efforts being made to introduce it into new waters. Reference is elsewhere made to this paper and to a special inquiry of which it served as a basis.

MISCELLANEOUS MATTERS, NOTES ON FISHERIES, ETC.

FISHERIES EXHIBIT AT THE WORLD'S COLUMBIAN EXPOSITION.

Opportunity was afforded the writer to inspect the exhibits of foreign countries in the fisheries section of the World's Columbian Exposition. A special study of the apparatus there displayed was made. Some of the notes and sketches taken were incorporated in the paper elsewhere referred to on the fyke nets and fyke-net fisheries of the United States and other countries. The foreign fishery exhibits which were especially noteworthy for their completeness or for special features were those of Canada, Norway, Russia, New South Wales, and Japan. These contained many objects offering valuable suggestions to the fishery interests of the United States as to apparatus, methods, preparation, and utilization of products, etc. The descriptive catalogues and reports issued by the Governments of Japan and New South Wales relating to the fishery exhibits and to the fisheries and fishery resources of those countries deserve mention.

Among the States whose official exhibits were worthy of special note were North Carolina, Wisconsin, Pennsylvania, California, Oregon, and Washington. Some of the foremost fishing States were, unfortunately, either entirely unrepresented in the fisheries building or were represented only by a few individual dealers or manufacturers.

THE WORLD'S FISHERY CONGRESS.

This congress, one of a series of international gatherings under the auspices of the World's Columbian Exposition, convened at Chicago October 16-19, 1893. As chairman of the section devoted to the con-

sideration of the commercial fisheries, the writer entered into correspondence with persons in this country and abroad with a view to secure their cooperation and attendance. He also delivered an address on the condition of the American fisheries at the opening of the section, presented papers on the southern spring mackerel fishery and the statistics of the United States fisheries; compiled a report on the fisheries of Japan, based on the official catalogue of the Japanese exhibit, and abstracted and arranged a paper on improvements suggested for the British fisheries.

Following is a list of papers relating to the economic aspects of the fisheries which are printed as a part of the proceedings of the congress as contained in the Bulletin of the Fish Commission for 1893:

- Fish nets: Some account of their construction and the application of their various forms in the American fisheries. By C. H. Augur.
- The sea and coast fisheries. By Daniel T. Church.
- Notes on the Irish mackerel fisheries. By W. S. Green.
- The fisheries of Canada. By L. Z. Jonas.
- The fishing industry of Lake Erie, past and present. By C. M. Keyes.
- The exhibit of pearls at the World's Columbian Exposition. By George F. Kunz.
- Foul fish and filth fevers. By J. Lawrence-Hamilton.
- Reforms and improvements suggested for the fisheries of Great Britain and Ireland. By J. Lawrence-Hamilton. (Abstracted and arranged by Hugh M. Smith.)
- Fishing in British Guiana. By J. J. Quelch.
- Remarks on the maintenance and improvement of the American fisheries. By Hugh M. Smith.
- Statistics of the fisheries of the United States. By Hugh M. Smith.
- The fisheries of Japan. Compiled by Hugh M. Smith.
- Our ocean fisheries, and the effect of legislation upon the fisheries. By J. M. K. Southwick.
- The decrease of fish in American waters, and some of the causes. By A. M. Spangler.
- The past and future of the fur-seal. By J. Stanley-Brown.
- Notes on the fisheries and fishery industries of Puget Sound. By James G. Swan.
- The fisheries of the Virginia coast. By J. T. Wilkins.

INTERNATIONAL FISHERY COMMISSION.

In July, 1893, the writer accompanied Mr. Richard Rathbun, the United States representative on the International Fishery Commission, to points in New Brunswick, Nova Scotia, and Quebec. In addition to the special inquiries of the commission, an opportunity was afforded by personal observation to acquire a knowledge of the methods of taking and curing fish at some of the most important fishing stations in the provinces named. In November the writer accompanied the commission to Gloucester, where several weeks were spent in interviewing the mackerel fishermen.

MARKET VALUE OF THE CARP.

Notwithstanding the carp has for many years been abundantly distributed over a large part of the United States, and extensively cultivated for home consumption, it is only recently that the fish has had sufficient abundance in public waters to warrant the prosecution of a special fishery or to give the fish a conspicuous position in the fish markets of the country. Of late, however, large quantities of carp

have been taken for market in Lake Erie and other lakes and rivers of the interior States, and the fish is now regularly exposed for sale and usually cited in the market quotations in all the large cities. The decrease in the output of whitefish and lake herring in Lake Erie and elsewhere has also had much to do with the rise of the carp as a commercial fish.

Of the many States in which the carp is now taken for home supply and for market there are few in which the introduction of the fish has been more successful or in which it has attained greater commercial importance than in Illinois. The stocking of the streams and ponds of that State was accomplished some years ago by the United States Fish Commission in cooperation with the State commission of Illinois. The fish has rapidly propagated and distributed itself, and is now a very important factor in the supply of fish food in the region, the increase of the fish in the Illinois River being especially noteworthy. The State fish commissioners in their report for 1890 refer to this fish as follows:

The success attending the introduction of carp-culture in Illinois can not be estimated in dollars and cents, and has never been fairly placed before the people. Adverse criticism has, in many instances, had the effect of creating an undue prejudice against the fish. Lack of care and ignorance as to the methods of culture have done much more to cause the impression that carp are not profitable to raise. Still, the facts are that a very large number of those who prepared ponds for their reception, and gave them ordinary care, are successfully producing a profitable supply of fish every year as food, and good food, at a comparatively trifling expense. In addition to this, evidences are numerous to show that our streams are full of these fish, and they are entering into the supply of food at almost every point where fish are taken for market. Hundreds of very large carp have been taken this season from the pools along the Illinois River, and the fishermen report very large catches from the river itself very often. These are the product of the planting by the commission of carp furnished by the United States Fish Commission, in the public waters of the State, a report of which plant, with list of streams planted, was published in a former report.

The information at hand indicates that the Illinois River is perhaps as well stocked with carp as any other stream in the United States. Numerous instances might be cited of the wonderful multiplication of the fish in the waters of the State, but a single reference to this river will be sufficient to show the abundance of the fish and its commercial importance. In August, 1893, Dr. S. P. Bartlett, field superintendent of the United States Fish Commission, brought to the attention of the office the following information:

At Meredosia, Ill., in Morgan County, a shallow lagoon 6 miles long and three-quarters of a mile wide at the average stage of the water communicates with the Illinois River. This lagoon is known as Meredosia Bay. In this bay, on August 9, a fisherman using a 900-yard seine caught 25,000 pounds of carp averaging 7 pounds apiece. Some of the fish weighed 20 pounds. On August 17 the same fisherman secured 12,000 pounds of carp in the same place. The fisherman received from 7 to 10 cents per pound for the fish that weighed 7 pounds

or over and 3 to 5 cents per pound for those under that size. He had an offer from New York dealers for all the carp he could catch at the rate of 3½ cents per pound in rough state.

The statistical inquiries of the Commission in the Great Lakes in 1894 disclosed a very large catch of carp in Lake Erie in the previous year. In nearly every county bordering on the lake relatively large quantities of carp were taken and sold, the aggregate catch being 627,000 pounds, valued at \$16,245. The principal part of the yield was obtained in the shallow water of the western end of the lake, Erie, Ottawa, and Lucas counties, in Ohio, having the largest catch. In Michigan, 41,900 pounds were taken; in Ohio, 581,360 pounds, and in Pennsylvania and New York, 3,740 pounds.

TWO VOYAGES TO REMOTE FISHING-GROUNDS.

In the report of this division for 1891 mention was made of the trip of a Gloucester vessel to Africa for mackerel. The continued scarcity of mackerel in the western part of the Atlantic Ocean prompted another experimental voyage of a Gloucester schooner to the coast of the Old World. On June 22, 1893, the *Nannie C. Bohlin*, of 124 tons, after baiting with menhaden, sailed from Newport for Stavenger, Norway, fitted with seines and lines suitable for taking the large mackerel which are found on that coast. The vessel arrived at her destination July 13, to find that the season had not yet opened. In a few days, however, the vessel sailed for the fishing-grounds, which consist of two banks lying between 120 and 160 miles off the coast. Some fish were secured with the seine at the start, but later the more primitive method of drailing was resorted to. The largest haul of the seine was reported to be only 6 barrels. Unfortunately for the success of this venture, the weather was unfavorable for fishing during most of the season, and only a few fish were observed schooling, and the vessel was forced to return home with only 59 barrels of mackerel. This small fare was, however, larger than the average catch of the fleet on the United States coast.

As exemplifying the sailing qualities of the new class of New England fishing schooners, it may be mentioned that this vessel accomplished the trip from Norway to Massachusetts—a distance of 4,400 miles—in 22 days, during a third of which time head winds were encountered. It will be recalled that the famous racing yacht *Valkyrie* required 30 days to make a passage that was 800 miles shorter. The *Bohlin* is the same vessel whose seaworthiness was specially referred to in the report of this division for 1891. A mackerel voyage to Norway made by the Gloucester schooner *Notice* in 1877 was likewise unsuccessful.

The halibut fishing schooner *Carrie W. Babson*, 86 tons, of Gloucester, in 1893 visited a region but rarely sought by United States fishing vessels. The schooner sailed May 29 for Labrador and Baffin Bay. In Davis Strait so much ice was met with that the fishing-grounds off

the northern part of Labrador could not be tested, and the vessel sailed for the west coast of Greenland, which was safely reached after the experience of much difficulty in crossing Davis Strait. On the shore of Greenland a comparatively good fishing season was passed, and the vessel returned to Gloucester on October 5 with about 80,000 pounds of fletched halibut, 21 barrels of fins, and 11 barrels of salmon and salmon trout. The captain of the vessel thinks this region offers advantages for profitable fisheries, and intends to resume his explorations of the coast of Greenland and the region north of Hudson Strait.

BOSTON FISH BUREAU.

This is an association of persons engaged in the fish trade, chiefly in Boston, Gloucester, and New York. In its aims and organization it occupies a unique position in the United States fishing industry. It is primarily intended to furnish its members with reliable, prompt, and private information regarding the catch, the receipts, and the general condition of the fish trade, but the entire fishery interests of the section are indirectly benefited, and it is, in fact, a fisheries intelligence bureau. The Commission has for many years received the confidential daily reports of the bureau. These contain much valuable information as to the movements of the fishing fleet, the abundance of fish, the condition of the different branches of the industry, the state of the markets, prices of fish, etc., and are very useful to the division. The annual reports of the bureau, compiled by the secretary, Mr. Frederick F. Dimick, while applying primarily to the New England vessel fisheries, also contain much information on important fisheries of other sections of the United States, as well as of foreign countries. The statistical and descriptive data with which these reports are filled make them extremely valuable for reference.

PROPOSED WORK OF THE DIVISION.

FISHERIES OF THE MINOR INTERIOR WATERS.

The investigation of the fresh-water fisheries of the rivers and lakes of the interior States, recommended in a previous report of the division, can probably be undertaken during the next fiscal year. The recent completion of statistical inquiries in all the coastal sections and in the basin of the Great Lakes makes the canvass of these minor waters opportune and desirable. It is anticipated that the extent of these fisheries will in the aggregate be enormous, and that some very interesting methods and apparatus will be found, of which little is now known outside of circumscribed limits. It will be the purpose of the division to pursue these inquiries as means and time will permit, until the fresh-water fisheries of each State and Territory shall have been covered. The small force of agents available for the field work will hardly be able to canvass the entire country in less than two seasons.

PREPARATION OF FISHERY PRODUCTS.

The Commission receives numerous inquiries as to the methods employed in smoking, salting, canning, and otherwise preparing or preserving fishery products for market. Especially in those sections in which the fisheries are undergoing rapid development is there great demand for information of this character. While the Commission has from time to time published much bearing on this subject, the material is scattered through a number of volumes and is not available for distribution. Even in the comprehensive quarto series of reports issued by the Commission this matter was not especially considered.

It is therefore proposed that, at as early a time as practicable, this division make a special investigation of this subject to serve as the basis for a comprehensive, practical report, which shall contain descriptions of the various processes of preserving fish and other economic water animals in the United States. To these may be properly added accounts of the methods adopted in other countries.

UTILIZATION OF WASTE PRODUCTS.

A topic of no little consequence to the commercial fishermen is the proper utilization of their catch and of the by-products resulting from the cleaning, curing, or canning of the catch. In nearly every important branch of the fisheries there is more or less waste of products having value as food, fertilizer, oil, etc. One of the most conspicuous cases in which a disregard for the value of refuse products results in a great loss to the fishing interests is that of the salmon-canning industry of the Pacific Coast. In this branch probably 20,000,000 pounds of salmon heads, tails, trimmings, and viscera are annually thrown away, which could, at a very slight cost, be converted into a high-class fertilizer, and would probably yield considerable quantities of a valuable oil. Numerous instances of this kind might be cited. In a previous discussion of this subject¹ the following statements were made:

The increased attention paid to the utilization of refuse products of fish in some parts of the United States, especially New England, where not many years ago they were generally thrown away, marks an advance in our industrial life. Every waste product of fish and other aquatic animals resulting from their cleaning, curing, and canning has a commercial value in a crude state or after further manipulation, but in most regions no regard is paid to anything but the actual flesh, and many thousands of dollars are thus annually lost to a class that is least able to afford it. As one instance of the loss our fishing interests are yearly incurring, mention may be made of the economic value of the roe of fishes as an article of food. Practically, the eggs of only two species of fishes—the sturgeon and mullet—are utilized in this country, but there is hardly a fish whose roe is not suitable to be made into a valuable caviar, which could meet with ready sale abroad as well as at home, and would be an important addition to our fishery output, in that it would represent the expenditure of little time and money and the sacrifice of no additional fish. In the utilization and appreciation of our resources we can emulate the Chinese to decided advantage.

¹Remarks on the maintenance and improvement of the American fisheries. Bulletin United States Fish Commission, 1893.

It is suggested that as soon as convenient, in connection with the other investigation previously referred to, a systematic inquiry be made in all the important fishing regions with a view to determine the extent to which waste products are utilized, the methods employed in so doing, the value of the secondary products, and to ascertain what other waste material not now employed might be rendered of value to the fishermen. Much information bearing on this subject is already in the possession of the office, but it is only in a special investigation that the matter can be thoroughly considered. The issuance of a report, in which the value of the various secondary fishery products is pointed out and the methods of preparing them for market shown, would be of great benefit to a large part of the fishing population. Dr. J. Lawrence-Hamilton, in a paper¹ presented to the World's Fishery Congress, at Chicago, in 1893, estimated that upwards of £2,000,000 (\$10,000,000) annually is lost to the fishermen of the United Kingdom owing to failure to work up the waste fishery products; and it is known that in the United States an immense loss results from this cause which could be easily averted.

FISHERIES INTELLIGENCE BUREAU.

The success which has attended the establishment of a fisheries intelligence service in Canada suggests the advisability of having a similar bureau in the United States. There seems no reason to doubt that great advantage would thus accrue to the coast fishing interests, and that such a service would be almost unanimously welcomed by fishermen, dealers, outfitters, and others.

The idea of a fisheries intelligence office seems to have first taken practical shape in Norway, where the service has attained great perfection and is recognized as being of inestimable benefit to the fisheries. The intelligence bureau of the Canadian fisheries department is organized on the plan of the Norwegian service, and is likewise regarded by the fishermen as an extremely valuable aid in their work.

The following brief outline of the organization and functions of the Canadian bureau is sufficient to show the scope and importance of the work:

The headquarters of this service is at Halifax, Nova Scotia. About 40 observers in the principal fishing centers of the maritime provinces communicate with the main office by means of a telegraphic cipher-code. The information conveyed consists chiefly of news concerning the weather; the movements of the fishing fleet; the presence, movements, and abundance of fish; the presence and abundance of bait, and other data intended to facilitate the operations of the fishermen. From Halifax the reports are sent out by telegraph to newspapers in the fishing towns, and to local agents, by whom they are posted in con-

¹Reforms and improvements suggested for the fisheries of Great Britain and Ireland. Bulletin United States Fish Commission, 1893.

spicuous places, as weather reports are displayed in the United States. The entire service is maintained at an annual expense of \$2,500, most of which sum represents telegrams. The observers are usually light-house keepers, customs officers, weather officials, and other employees of the Government, who are paid very small salaries—\$15 to \$25 annually—in addition to their regular compensation. In some places fishermen, telegraph operators, and other private persons are connected with the service, who receive more pay.

During a visit of the writer to a number of the New England and Canadian fishing centers in 1893 the importance of this subject was brought to his attention in many ways, and the desirability of instituting a bureau on the east coast of the United States, under the supervision of the Commission, was forcibly suggested to him. Fishermen, fish-dealers, and vessel-owners in Gloucester, Boston, and other fishing ports, who voluntarily mentioned the matter or to whose attention it was brought, spoke confidently of the value which such a bureau would have in certain important fisheries; and it would appear that the whale, mackerel, cod, herring, menhaden, halibut, haddock, and, probably, all other ocean fisheries would be greatly benefited.

The New England and Middle States would chiefly profit by the founding of such a service, although the vessel fishermen of the entire coast would receive valuable information. To properly equip the bureau, there should be at least 50 agents located at suitable coast points in each State, probably as far south as North Carolina, and the employment of a number of observers in the Canadian provinces in regions frequented by the United States fishermen would also be necessary. By relying chiefly on the services of light-house keepers, life-saving men, local fishermen, and others, to whom a nominal salary would be acceptable for the slight aid rendered in addition to their regular duties, the annual cost of the service would probably be under \$5,000. There are times each year when the daily saving to the fleet in time and fish, through the information furnished by such a bureau, would much more than counterbalance the entire expense of the service.