RareBK
SH
11
A15
1906

BUREAU OF FISHERIES

U. S. Bureau of Commercial Fisheries

REPORT OF THE COMMISSIONER OF FISHERIES FOR THE FISCAL YEAR 1906

AND

SPECIAL PAPERS

GEORGE M. BOWERS
Commissioner

BUREAU OF FISHERIES
LIBRARY
No. 43118
WOODS HOLE, MASS.

MARINE AND EARTH SCIENCES LIBRARY
OCT 16 1972
N.O.A.A.
U. S. Dept. of Commerce

LIBRARY
N.O.A.A.
U S Dept. of Commerce

WASHINGTON
GOVERNMENT PRINTING OFFICE
'72 5492

National Oceanic and Atmospheric Administration

Report of the United States Commissioner of Fisheries

ERRATA NOTICE

One or more conditions of the original document may affect the quality of the image, such as:

Discolored pages
Faded or light ink
Binding intrudes into the text

This has been a co-operative project between the NOAA Central Library and the National Marine Fisheries Service (NOAA Fisheries). To view the original document, please contact the NOAA Central Library in Silver Spring, MD at (301) 713-2607 x124 or www.reference@nodc.noaa.gov.

LASON
Imaging Contractor
12200 Kiln Court
Beltsville, MD 20704-1387
November 19, 2004

Blank page retained for pagination

CONTENTS.

REPORT OF THE COMMISSIONER OF FISHERIES FOR THE FISCAL YEAR ENDED JUNE 30, 1906. 28 p. (Issued December 31, 1906.)

THE DISTRIBUTION OF FOOD FISHES DURING THE FISCAL YEAR 1906. Bureau of Fisheries Document No. 613. (Issued March 12, 1907.)

THE FISHERIES OF ALASKA IN 1906. Comprising statistics and notes upon the fisheries in general, by John N. Cobb, and report of inspection of the salmon fisheries, by Howard M. Kutchin. Bureau of Fisheries Document No. 618, 70 p. (Issued May 16, 1907.)

STATISTICS OF THE FISHERIES OF THE NEW ENGLAND STATES FOR 1905. Bureau of Fisheries Document No. 620, 93 p. (Issued July 29, 1907.)

DREDGING AND HYDROGRAPHIC RECORDS OF THE U. S. FISHERIES STEAMER ALBATROSS FOR 1906. Bureau of Fisheries Document No. 621, 50 p. (Issued August 27, 1907.)

UNUTILIZED FISHES AND THEIR RELATION TO THE FISHING INDUSTRIES. By Irving A. Field. Bureau of Fisheries Document No. 622, 50 p. (Issued September 10, 1907.)

WHALEBONE: ITS PRODUCTION AND UTILIZATION. By Charles H. Stevenson. Bureau of Fisheries Document No. 626, 12 p. (Issued October 30, 1907.)

SOME OBSERVATIONS ON SALMON AND TROUT IN ALASKA. By F. M. Chamberlain. Bureau of Fisheries Document No. 627, 112 p. (Issued December 18, 1907.)

CULTURE OF THE MONTANA GRAYLING. By James Alexander Henshall. Bureau of Fisheries Document No. 628, 7 p. (Issued December 11, 1907.)

REPORT OF THE COMMISSIONER OF FISHERIES FOR THE FISCAL YEAR ENDED JUNE 30, 1906

DEPARTMENT OF COMMERCE AND LABOR

Document No. 72

Bureau of Fisheries Document No. 608

CONTENTS.

	Page.
Propagation and distribution of food fishes	5
Results of previous operations	5
Improvements in methods and appliances	6
Output and distribution of fish and eggs	6
Summary	6
The shad work	7
Rescue of fishes from overflowed lands	7
Car and messenger service	8
Allotments of fish and eggs to State fish commissions	8
Relations with foreign countries	9
New stations and improvements	10
Biological investigations and experiments	11
Explorations, surveys, and faunal studies	11
Lake McDonald	11
Northern Pacific and Japan	11
Fishes of the Philippine Islands	11
New England waters	12
Oyster experiments	12
Lynnhaven Bay	12
Louisiana	13
Sponge experiments	13
Fish diseases, water pollutions, etc	14
Marine biological laboratories	15
Canvasses of commercial fisheries	15
Notes on important fisheries	16
Boston and Gloucester	16
Mackerel	16
Halibut	17
Cod	17
Salmon	17
Swordfish and pollock	18
Whales	18
Lobsters	18
Oysters	18
Miscellaneous affairs	19
Operations of vessels	19
Publications and library	20
Fishery legislation	21
The American Fisheries Society	24
Inquiries in Newfoundland waters	24
Appropriations	25
Recommendations	25
Protection to fish life	25
New hatching stations	25
New marine biological stations	26
General expenses and salaries	26
New office building and national aquarium	27

Blank page retained for pagination

REPORT

OF THE

COMMISSIONER OF FISHERIES.

DEPARTMENT OF COMMERCE AND LABOR,
BUREAU OF FISHERIES,
Washington, December 1, 1906.

SIR: I have the honor to submit a report of the operations of the Bureau of Fisheries during the fiscal year ended June 30, 1906. The scope and progress of the work are presented in a review of the respective branches—namely, the propagation and distribution of food fishes, scientific investigation of subjects relating to aquatic life and the development of aquatic resources, and the collection of statistics and other information concerning the fisheries. It is asked that especial consideration be accorded the recommendations with which the report is concluded.

PROPAGATION AND DISTRIBUTION OF FOOD FISHES.

In total results the fish-cultural work of the Bureau in 1906 surpassed all previous records. The decline in the catch of shad in the rivers has continued, and consequently the take of eggs of one of the fishes formerly most conspicuous in the annual distributions was less this year than ever before; but the exceptional numbers of the salmons, of lake, rainbow, and steelhead trouts, of yellow perch and white perch, of flatfish and lobsters, with an average product of cod, whitefish, and pike perch, much more than offset the decreases. The species distributed numbered 36, including the lobster.

RESULTS OF PREVIOUS OPERATIONS.

Encouraging results of the efforts of the Government to maintain the fish supply by artificial means appear in reports from fishermen and fish culturists in all parts of the country. Although it is difficult to establish definitely the extent to which the hatcheries have affected

the condition of the commercial fisheries of the coastal waters and the Great Lakes, the renewed productiveness of old and abandoned fishing grounds and the abundance of fish on entirely new areas are strongly indicative. Unusual numbers of cod are reported all along the coast, and surprising catches have been made on inshore grounds. In spite of the growing scarcity of adult lobsters and the ruthless destruction of young and eggs during the last ten years, fishermen on the New England coast have been finding in their traps many more young lobsters than formerly; flatfish are much more numerous, especially small flatfish in the shallow waters along shore; and exceptional catches of whitefish were made this year in Lake Ontario and Lake Erie, which fishing firms operating there attribute wholly to the planting of artificially hatched fry. The stocking of smaller lakes and interior streams produces determinate and obvious results. Conspicuous instances are the present abundance of black-spotted trout in a lake in Yellowstone Park where formerly no fish were found; the size and quantity of trout caught by anglers in waters stocked from the Wytheville station; the phenomenal numbers of crappie and catfish taken and marketed from certain reservoirs in Texas, many of which are artificial, and the transformation of insignificant lakes in that State into valuable fishing preserves.

IMPROVEMENTS IN METHODS AND APPLIANCES.

In the interest of progress and improvement in appliances and methods of fish culture, experiments are at all times being conducted at one station or another and theoretical knowledge is tested by practical application. These efforts in 1906 dealt with the rearing of lobsters according to recently devised methods, the effect of cold storage upon eggs in refrigerator cases, the kind and quantity of fish food required under certain conditions, the volume of water to a given number of eggs at various ages, the number of brood fish to be allowed in a given area, the effect of light on eggs and fry, the destruction of algæ in trout ponds, the use of a salt solution for removing dead eggs, and the methods of measuring eggs.

OUTPUT AND DISTRIBUTION OF FISH AND EGGS.

Summary.—The fish-cultural work of the past year was conducted in 31 States and Territories. Three stations dealt with cod, flatfish, and lobsters; 12 with Atlantic and landlocked salmons, shad, striped bass, white perch, and yellow perch; 16 with whitefish, lake herring, lake trout, and pike perch; 12 with Pacific salmons, and 29 with rainbow trout, black-spotted trout, brook trout, grayling, black bass, crappie, sunfish, and various minor species. The output consisted of 397,556,725 fertilized eggs, 1,526,681,638 fry, and 7,596,246 yearlings,

fingerlings, and adults, or an aggregate of 1,931,834,609 fish and eggs. The species distributed, with the numbers of each, appear in the following table:

SUMMARY OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906.

Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Total.
Catfish		500	63,895	64,395
Shad	495,000	37,504,300		37,999,300
Whitefish	73,099,000	263,400,800		336,499,800
Bluefin whitefish		1,140,000		1,140,000
Lake herring	38,300,000	3,410,000		41,710,000
Chinook salmon	115,628,645	20,789,928	122,980	136,541,553
Silver salmon	239,180	6,445,574	23,140	6,707,894
Blueback salmon	122,500	9,923,680	9,500	10,055,680
Humpback salmon	2,000	1,528,504		1,530,504
Steelhead trout	113,000	2,038,879	178,056	2,329,935
Rainbow trout	401,400	395,415	1,398,755	2,195,570
Atlantic salmon		1,897,607	79,217	1,976,824
Landlocked salmon	204,000	481,144	75,677	760,821
Blackspotted trout	810,000	6,988,918	1,100,336	8,899,254
Scotch sea trout			504	504
Loch Leven trout		22,525	78,000	100,525
Lake trout	25,090,000	29,084,540	73,200	54,247,740
Brook trout	960,000	5,333,609	3,678,879	9,972,488
Golden trout		218,265		218,265
Grayling	592,000	415,000		1,007,000
Pike			15,000	15,000
Crappie and strawberry bass			86,755	86,755
Rock bass			41,257	41,257
Warmouth bass			2,375	2,375
Small-mouth black bass		155,160	40,446	195,596
Large-mouth black bass		90,300	434,272	524,572
Bream or sunfish			90,937	90,937
Pike perch	136,100,000	232,105,000		368,205,000
Yellow perch		161,943,000	3,065	161,946,065
Striped bass		2,351,000		2,351,000
White perch	5,400,000	176,690,000		182,090,000
Cod		159,492,000		159,492,000
Flatfish		285,049,000		285,049,000
Lobster		117,787,000		117,787,000
Total	397,556,725	1,526,681,638	7,596,246	1,931,834,609

The shad work.—This feature of the year's operations appears in discouraging contrast to the otherwise successful season. In some cases the hatcheries, even with the aid of the States, were unable to secure as much as half the number of eggs collected in their respective regions in the most unsuccessful previous season. On the Susquehanna River and tributaries the collections have gone steadily down from 209,992,000 in 1898 to 8,456,000 in 1906; on the Delaware and its tributaries they fell from 115,033,000 in 1901 to 242,000 in 1906; the take in the Potomac and its tributaries ranged from 68,724,000 in 1898 to 86,370,000 in 1903, and down to 12,696,000 in 1906. These conditions are emphasized by the fact that in the Albemarle Sound region the collections dropped from 75,400,000 in 1901 to 6,748,000 in 1905, but sprang at once to 25,771,000 in 1906, the first year of enforcement of the new law restricting the number of seines and pound nets in the sound and mouths of its tributaries.

Rescue of fishes from overflowed lands.—This work, along the Mississippi and Illinois rivers, was conducted on the same large scale as during the previous year. Owing to weather conditions, however, it was more successful this season on the Illinois than on the Mississippi,

where, from the Bellevue and North McGregor stations, were obtained the largest results in 1905. These operations could profitably be applied to three or four hundred times the territory now covered. Such extension would multiply the results possibly one or two thousand times. A desirable adjunct to the work would be a large pond-cultural station accessible to each river. This would not only facilitate the handling of the fish rescued from the sloughs, but would permit of the propagation of various indigenous species during seasons when high water prevails throughout the summer and rescue of the fishes is unnecessary.

Car and messenger service.—The distribution of the fish hatched and collected involved the paid transportation of the 6 cars of the Bureau over 82,308 miles and free transportation over 11,060 miles, a total of 93,368 miles. The 55 messengers traveled 217,686 paid miles and 108,757 free miles, or 326,443 miles in all. More concrete representation of the operations of the car and messenger service is the fact that fish were distributed in every State and Territory of the United States.

Allotments of fish and eggs to State fish commissions.—Of the 397,556,725 fertilized eggs in the output for the past year, 389,083,845 were sent to State fish hatcheries, to be hatched and planted under State supervision. Large numbers of fish also were thus distributed, as shown in the following table:

ALLOTMENTS OF EGGS AND FISH TO STATE FISH COMMISSIONS IN 1906.

State and species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
California:			
Chinook salmon	107,066,445		
Silver salmon	50,000		
Landlocked salmon	10,000		
Grayling	200,000		
Colorado:			
Blackspotted trout	200,000		
Brook trout			160,000
Connecticut:			
Lake trout	300,000		
Illinois:			
Pike perch		3,000,000	
Kansas:			
Rainbow trout			1,000
Maine:			
Landlocked salmon	100,000		
Lake trout	200,000		
Brook trout	300,000		10,000
Pike perch	1,500,000		
Maryland:			
Rainbow trout	50,000		
Brook trout			3,250
White perch	5,400,000		
Massachusetts:			
Rainbow trout	27,400		
Landlocked salmon	20,000		
Large-mouth black bass			650
Michigan:			
Landlocked salmon	10,000		
Lake trout	4,900,000		
Brook trout		161,191	
Grayling	100,000		
Pike perch	49,000,000	500,000	

ALLOTMENTS OF EGGS AND FISH TO STATE FISH COMMISSIONS IN 1906—Continued.

State and species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Minnesota:			
Rainbow trout			15,000
Black-spotted trout	150,000		
Missouri:			
Brook trout	100,000		
Grayling	50,000		
Pike perch	10,900,000		
Nebraska:			
Rainbow trout	95,000		
Brook trout			2,000
New Hampshire:			
Silver salmon	90,000		
Lake trout	500,000		
New York:			
Whitefish	5,000,000		
Lake trout	4,250,000		
Brook trout		170,000	
Pike perch	5,000,000		
Ohio:			
Whitefish	2,035,000		
Lake herring	35,300,000		
Oregon:			
Chinook salmon	7,714,000		
Pennsylvania:			
Whitefish	41,976,000		
Lake herring	2,000,000		
Rainbow trout	97,000		
Blackspotted trout	75,000		
Lake trout	6,500,000		
Large-mouth black bass			4,350
Pike perch	69,600,000		
Rhode Island:			
Grayling	50,000		
Large-mouth black bass			600
Utah:			
Brook trout	100,000		
Grayling	50,000		
Vermont:			
Lake trout	500,000		
Brook trout	50,000		
Washington:			
Whitefish	518,000		
Wisconsin:			
Whitefish	20,700,000		
Rainbow trout			15,000
Lake trout	7,000,000		
Wyoming:			
Steelhead trout	50,000		
Blackspotted trout		14,500	
Lake trout	50,000		
Grayling	50,000		
Total	389,083,845	3,845,691	211,850

Relations with foreign countries.—With the approval of the fishery authorities of Ontario the Bureau has continued to collect eggs in the Canadian waters of Lake Erie and Lake Superior. Early in June a special plant of 200,000 young lake trout was made on the Canadian side. The whitefish, lake herring, lake trout, pike perch, and other fishes previously planted in the international lakes have been beneficial to Canadian and American fishermen alike.

In compliance with requests received through diplomatic channels, 635,680 salmon and trout eggs were donated to the Government of Argentina, for which Government the Bureau also acted as agent in the purchase and shipment of 60,000 brook trout eggs. The results of previous plants in Argentine waters have been most satisfactory,

Some of the trout hatched from eggs sent by the Bureau in 1904 have been found spawning under natural conditions, while a brood stock reared from other eggs of the same shipment has become reproductive under domestication.

Eggs of whitefish, lake herring, chinook salmon, land-locked salmon, and lake trout, to the number of 3,560,000 in all, were shipped to New Zealand, where some species have been successfully introduced from other countries, and where the Government is taking active measures to acclimatize other valuable American fishes. These eggs were collected, packed, and transported at the expense of the New Zealand government.

In this connection attention is drawn to the Secretary's communication to Congress on February 14, 1906 (House Doc. No. 526, Fifty-ninth Congress, first session), in which is stated the importance of the exchange of fish and fish eggs with foreign countries, and request is made for express authority to continue the practice. The Secretary urgently recommended that the following clause be enacted by Congress, either as an independent act or as a part of the act making appropriations for the Bureau of Fisheries:

That the Secretary of Commerce and Labor is hereby authorized, in his discretion, to donate to foreign governments, upon official requests received from them, living fish and other water animals and their eggs, and preserved specimens thereof, when compliance with such requests will tend to promote such cordial relations between the Bureau of Fisheries and such foreign governments, or their fisheries departments, as will increase the efficiency of the Bureau of Fisheries.

As stated by the Secretary, the introduction into United States waters of a number of new water animals is now under consideration by the Bureau and will necessitate the invoking of assistance and cooperation from foreign governments. The early passage of this legislation is therefore greatly desired.

NEW STATIONS AND IMPROVEMENTS.

Notwithstanding many difficulties involved in the construction of the salmon hatchery in Alaska, which was undertaken in 1905 in accordance with an act of March 3 of that year, the work progressed sufficiently to make possible the taking of eggs that season. Besides a hatchery building with capacity for 25,000,000 eggs, there have been erected living quarters and office for the employees, a mess house, a storehouse, and landing piers. Only about one-half of the special appropriation for the establishment of this station has been used, and work upon a second station will be undertaken at an early date.

Improvements and repairs to stations during the year included the purchase of land and buildings at Bozeman, Mont.; a new hatchery building and a new dam at Battle Creek, Cal.; the completion of some 6 miles of wagon road and the construction of a sawmill and new pipe

line at the remote and inaccessible station at Baker Lake, Wash.; the building of retaining walls to provide against floods, the installation of new pumping machinery, and the erection of a new dwelling at Spearfish, S. Dak.; the preparation of plans and specifications for the repair of the stone basin and wharves at Woods Hole, Mass.; and the construction of a new residence for employees at Erwin, Tenn. The new station at Mammoth Spring, Ark., was completed.

BIOLOGICAL INVESTIGATIONS AND EXPERIMENTS.

The broad subject of the biology and experimental culture of useful and commercially important aquatic animals and plants, which represents the field of endeavor of the division of scientific inquiry, has in 1906, as heretofore, embraced investigations of various waters with reference to the life they support, the habits, food, enemies, diseases, and interrelations of the species, and the physical and chemical properties of the water. An important feature of the work was the continuation of certain experiments which have been in progress for some years addressed to a number of the leading economic species.

EXPLORATIONS, SURVEYS, AND FAUNAL STUDIES.

Lake McDonald.—A physical and biological survey of this lake and its outlet was made at the beginning of the fiscal year, while the steamer *Albatross* was at Yes Bay, Alaska, assisting in establishing the salmon hatchery at the head of Lake McDonald. An excellent map of the lake has been prepared, and the animal and plant life, including the plankton, was carefully studied and a number of important facts in the life history of young salmon established. In addition, a line of intermediate hauls with tow nets was made around Cleveland Peninsula and into Bradfield Canal.

Northern Pacific and Japan.—In May the *Albatross* was dispatched upon an extended cruise in the northwestern Pacific and Bering Sea to make certain investigations in the interests of the salmon fisheries of Alaska and the general questions of geographic distribution of Pacific fishes and the relations of the faunas of Alaskan and Japanese waters. Extensive and valuable collections were made along both American and Asiatic shores, and important data were secured regarding the run of salmon in the Aleutian and Commander islands and in Kamchatka, where a study was made also of the methods of the fisheries. At the end of June the work had been carried as far south as Hakodate, Japan.

Fishes of the Philippine Islands.—The United States Bureau of Insular Affairs exhibited at the St. Louis Exposition a large and important collection of fishes of the Philippine Islands which was later turned over to the Bureau of Fisheries. The collection was made at various places in the islands under the general direction of the Philip-

pine government and was exhibited at St. Louis for the purpose of calling attention to the rich fish fauna and the great number of useful fishes found in Philippine waters. A recently completed study of the collection, soon to be published, shows it to number more than 2,500 specimens and represent 296 species, of which 22 species and 2 genera prove to be new. Many of the species are or can become important food fishes.

New England waters.—In continuance of a general plan for physical and biological survey of the freshwater streams and lakes of the United States, attention was given in 1906 to Umbagog Lake, of the Rangeley chain. The physical conditions of the lake and the animal and plant life were studied, especially in their bearing upon the abundance and variety of the fish fauna.

The East Branch of the Penobscot River was visited in the fall and examined with reference to its importance as a spawning stream for salmon. It was found that although spawning beds formerly existed between Medway and Matagamon Lake, apparently no salmon resort there now.

OYSTER EXPERIMENTS.

Lynnhaven Bay.—The effort to establish as commercially feasible the method of fattening oysters which has been under experiment by the Bureau for several years resulted in an output in 1906 of 125 barrels of oysters of the highest grade, the value of which, increased by the process, was slightly more than enough to cover the cost of the work. The expenses involved are to a considerable extent fixed, whether the product be great or small, and in the case of the claire at Lynnhaven a production of twice or thrice the number of bushels fattened would but slightly increase the cost, leaving out of consideration the original value of the poor oysters. If the productiveness of the Lynnhaven claire can be doubled, as it is hoped will be shown during the coming year, the possible commercial profits should be very satisfactory, in view of the area involved; and when it is considered that the method of artificial fattening is designed for use in regions where oysters in many seasons do not fatten at all, it is believed that its perfection will mark an important step in oyster culture.

As the field is an entirely new one and many difficulties have had to be overcome, and as an entire season's operations are necessary to demonstrate the effects of any changes in the conditions, the development of the method has been slow. Two problems now confront the experimenter—the destruction, without injuring the oyster food, of low vegetable forms which find favorable conditions of life in the fertilized water, and the utilization of a greater proportion of the food contents of the claire than is now possible. Plans for attaining these ends, the last important difficulties to be overcome, will be put into effect during the ensuing season.

Louisiana.—At the request of the Louisiana Shell Fish Commission the Bureau, during the spring of 1906, undertook some investigations and experiments in oyster culture and related subjects in the waters of Louisiana. Experimental plants of oysters and of cultch of various forms were established in St. Bernard, Jefferson, and Terrebonne parishes, in the hope of developing some improvements in the methods heretofore employed and exhibiting the possibility of raising oysters in territory at present not utilized. In connection with this work there has been undertaken also a comprehensive study of Louisiana waters with reference to their productiveness of oyster food. The general failure of oysters in this region to fatten during the season of 1905–6 makes it important to study the cause of the phenomenon. The investigations in Louisiana will be continued over a period of several years.

SPONGE EXPERIMENTS.

A variety of unforeseen misfortunes have overtaken the experimental sponge farms of the Bureau during the past year, and the work has been seriously interfered with. Enough progress has been made, however, to encourage continued effort.

The disasters to the suspended sponges at several places and the comparative immunity of those on the bottom caused a return to the earlier method of planting on cement disks and other bodies placed on the bottom. Cuttings were fastened directly to the disks and to spindles of various material attached to the disks, and experiments were begun in growing sponges of special shapes to meet the market demands. Several attempts were made to transport live sponges by express, packed in boxes, and it was found that with proper care in packing they could be carried successfully on journeys not exceeding three days in duration. With proper precautions and the use of ice it is believed possible to carry live sponges from Florida to California. Further experiments will be made.

Upon the removal of the custodian of the plantation of Sugar Loaf Key, and the consequent loss of protection to the grounds, all of the sponges of merchantable size were stolen, and it was found necessary to abandon the locality for experimental purposes.

A heavy mortality among the planted sponges near Anclote Key was noted in last year's report and ascribed to low salinity of the water, a hypothesis supported by all the facts then apparent. Subsequent developments, however, seem to point to an infectious disease as the cause of the destruction, a thriving sponge plantation at Cape Florida having shown a marked change in condition after the planting in its vicinity of a consignment of unhealthy sponges from Anclote Key. The salinity of the water was normal at this time, and it appears very probable that the mortality was due to an obscure infection imported from the Gulf coast.

FISH DISEASES, WATER POLLUTIONS, ETC.

A number of investigations have been conducted by the Bureau to determine causes and remedies for epidemics and unfavorable conditions affecting both wild and domesticated fishes. This phase of the Bureau's work is regarded with much confidence by those in charge of State and private hatcheries, and advice and recommendations have been furnished in answer to numerous requests.

An important case was a heavy mortality among brook-trout fry at the State fish hatchery at Roxbury, Vt., where 1,200,000 out of 1,300,000 fry had died before the full absorption of the yolk sac. A fluctuating gaseous content of the water was found to be the cause of the trouble, which can be removed only by artificial correction of the water supply. At Bayfield, Wis., the death of many trout in the ponds of the State hatchery was found to be due to a bacterium which is peculiar to that species of fish and which has caused widespread destruction at a number of hatcheries. Experiments are being conducted to determine a means of destroying this organism, which was first discovered and isolated some four years ago by the pathologist of this Bureau.

Considerable work has been done during the year to determine the effects upon fishes of certain industrial wastes commonly discharged into streams in the Potomac drainage basin. The principal species experimented with were large-mouth black bass and yellow perch, typical fishes of the Potomac system. To support fish life the water must have a slightly alkaline reaction and in dealing with acid pollutions the results of the experiments are affected by the alkalinity of the water used as a diluent. In the present experiments the latter was in all cases Potomac service water, tested for alkalinity at frequent intervals. The degree of aeration also affects the results. City sewage and wastes of various kinds from paper and pulp mills, tanneries, and gas works were experimented with under various conditions of dilution and aeration. The gas-works wastes were generally fatal in extreme dilution, while most of the other materials lost their toxic qualities when mixed with greater or less quantities of Potomac water, especially when thoroughly aerated. The results of this work will have an important bearing upon legislative and other projects for the improvement of streams. The report will be published by the United States Geological Survey as part of a water-supply and irrigation paper entitled "The Potomac River Basin."

The west branch of the Penobscot River, in Maine, was examined for pollution from a pulp mill at Millinocket. Chemical tests revealed no contamination at that time, but the heavy coating of paper-mill refuse on rocks and other objects along shore which had been under water showed that the water has at times been seriously polluted.

MARINE BIOLOGICAL LABORATORIES.

The facilities of the marine biological laboratories were used for the investigation of a number of problems important in the work of the Bureau and marine biology in general. The tables were occupied as usual by investigators from various institutions of learning in the United States and for studies conducted at the special request of the Bureau.

At the Woods Hole laboratory the principal work conducted for the Bureau was the continuance of the biological survey of the neighboring waters and the tabulation of the results. The steamers *Phalarope* and *Fish Hawk* were employed in this service, their dredgings in Vineyard Sound and Buzzards Bay determining areas of distribution of species for the ultimate purpose of mapping these waters. Other investigations at the laboratory dealt with the physiological effects on fishes of changes in the density and salinity of water; the physiology of the digestive tract of certain fishes; the parasites of fishes, and the food value of certain hitherto unused or little-used fishes, crustaceans, and mollusks.

At Beaufort, N. C., the fauna is being studied by various specialists and investigations of economic importance are being conducted with reference to the commercial fishes of the region, the artificial propagation of sponges, and the culture of oysters and clams. These last inquiries are in continuation of work previously begun, which it is expected will extend over several seasons.

CANVASSES OF COMMERCIAL FISHERIES.

The statistical inquiries of the Bureau, which cover various sections of the country in turn from year to year, in 1906 included canvasses of the shad and alewife fisheries of North Carolina, the salmon fishery of Penobscot River and Bay, and all the fisheries of the New England States, besides the regular reports of the resident agents at Boston and Gloucester. The North Carolina inquiries were made at the request of the State authorities for the purpose of obtaining data to serve as a basis for legislation to preserve the shad and alewife fisheries, which have suffered a serious decline in recent years as the result of excessive and indiscriminate fishing. The information furnished from Boston and Gloucester, published as usual in monthly bulletins and an annual summary, and showing the catch by months and fishing grounds, is extremely valuable as bearing on the question of the dependence of American fishermen on the banks lying off the shores of the British provinces.

Detailed statistical reports on the fisheries of the Great Lakes, the New England States, the Hawaiian Islands, and the crab industry of Maryland, which were canvassed in 1905, have been published during the past year.

NOTES ON IMPORTANT FISHERIES.

Boston and Gloucester.—During 1905[a] American fishing vessels landed at Boston and Gloucester 202,014,565 pounds of fish, valued at $4,835,047. Of this amount 152,214,139 pounds were taken on fishing grounds off the coast of the United States, 17,165,083 pounds off the Newfoundland coast, and 32,608,343 pounds off the other British provinces. It will be noticed from the table that the amount taken off the coast of the United States exceeds that in other regions by 102,467,713 pounds, valued at $1,879,441.

QUANTITY AND VALUE OF FISH LANDED BY AMERICAN FISHING VESSELS AT BOSTON AND GLOUCESTER, MASS., IN 1905, FROM FISHING GROUNDS OFF THE COASTS OF THE UNITED STATES, AND OF NEWFOUNDLAND AND OTHER BRITISH PROVINCES.

Species.	United States.		Newfoundland.		Other British provinces.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Cod:								
Fresh	30,223,234	$779,289	59,295	$1,254	5,854,756	$120,925	36,137,285	$901,468
Salted	3,883,064	170,142	845,113	32,490	10,333,319	398,002	15,061,496	600,634
Cusk:								
Fresh	7,265,153	121,431	110	2	1,531,508	25,807	8,796,771	147,240
Salted	211,934	5,310	246	6	18,176	454	230,355	5,770
Haddock:								
Fresh	61,742,296	1,206,125	1,700	20	4,153,090	85,968	65,897,086	1,292,113
Salted	178,880	3,203	8,335	147	207,630	3,634	394,845	6,984
Hake:								
Fresh	18,364,261	255,704	10,800	209	4,405,674	46,760	22,780,735	302,673
Salted	59,302	857	64,965	838	294,619	4,472	418,886	6,167
Pollock:								
Fresh	20,261,264	191,264	882	8	147,370	1,417	20,409,516	192,689
Salted	858,581	12,463	9,927	158	763,953	10,983	1,632,461	23,604
Halibut:								
Fresh	898,625	74,587	1,175,394	86,306	877,024	74,680	2,951,043	235,573
Salted	176	11	498,741	30,579	14,769	819	513,685	31,409
Mackerel:								
Fresh	2,873,480	199,960	.....	.....	625,655	38,372	3,499,135	238,332
Salted	2,834,600	216,634	.....	.....	2,810,200	144,166	5,644,800	360,800
Herring:								
Fresh	366,120	9,290	6,515,960	207,317	.....	.....	6,882,080	216,607
Salted	25,000	375	7,973,616	156,385	570,000	5,625	8,568,616	162,385
Swordfish, fresh	2,009,130	109,547	.....	.....	.....	.....	2,009,130	109,547
Other fish:								
Fresh	172,040	807	.....	.....	.....	.....	172,040	807
Salted	14,000	245	.....	.....	.....	.....	14,000	245
Total	152,241,139	3,357,244	17,165,083	515,719	32,608,343	962,084	202,014,565	4,835,047

Mackerel.—The movements of mackerel during the early and middle part of the present season have been much as they were in 1905. In the spring months the fish were reported fairly plentiful, and several good catches were made; but in the latter part of June the schools suddenly disappeared and only a few fish were taken until the 27th of July, on which date 28 vessels obtained catches ranging from 18 to 250 barrels each. These fish were found off Cape Cod and on Middle Bank, and for a period of twenty days an occasional school was captured. About this time favorable reports came from the Gulf of St. Lawrence, and during the early part of August the indications for a fall catch were much better than at any time since June.

[a] Statistics of the fisheries represent the calendar year.

The catch of mackerel, including fresh and salted fish, for the calendar year 1905 amounted to 19,440 barrels of the former and 28,224 barrels of the latter, representing a value of $599,132. Of the total catch of fresh mackerel 15,964 barrels were taken in waters off the coast of the United States, the remaining amount, 3,476 barrels, in waters contiguous to the British provinces. The amount of salt mackerel taken by American vessels off the coast of the United States was very little more than the catch in waters off the British provinces, there being 14,173 barrels taken in the former region and 14,051 barrels in the latter.

Halibut.—The condition of the halibut fishery has changed but little in the past year, there being about the same number of vessels employed and these resorting to the same grounds as in the last few years. The grounds lie to the northward of Newfoundland and off Labrador, the most remote along the latter coast being in the vicinity of Cape Chidley. An occasional trip has been taken to banks lying off the coast of Greenland and Iceland. Unless new banks are discovered or halibut become more plentiful on the old grounds, this fishery in the Atlantic is likely to suffer a serious decline in the near future. The fishing grounds of the Pacific, however, continue to be prolific, and the annual catch there now largely exceeds the Atlantic product.

Cod.—From the waters of Alaska and Okhotsk Sea there were taken 14,568,000 pounds of cod, an increase of 4,364,000 pounds over the catch of 1904. The value of the catch is estimated at $665,560. The fish were landed at San Francisco and at Puget Sound ports, where they were cured, prepared for market, and shipped to various sections of the United States, several carloads finding a market in New England.

During the past year less cod were taken on the Grand Banks than in former years, many vessels resorting to fishing grounds off the coast of Labrador. Several large fares were caught in that region, and present aspects point to a larger fleet there in the coming season. Fishermen attribute the scarcity of cod on certain portions of the Grand Banks to the unusual amount of "white water" which appeared on several occasions during the summer of 1905, and they as a rule devote but little time to fishing on grounds where there are large areas of discolored water, having learned by experience to expect but few fish there.

Salmon.—The salmon pack of Alaska in 1905 amounted to 1,889,915 cases of canned salmon, 7,565,000 pounds of dry-salted and mild-cured salmon, or 102,098,330 pounds in all, with a value of $6,567,875. This output is an increase of 4,406,883 pounds over that of 1904. The pack of the Pacific coast States was equivalent to 1,426,228 48-pound cases,

with an approximate value of $6,000,000, and the British Columbia output is given as 1,167,460 cases, including "talls" and "flats," there being 1,103,229 cases of the former and 64,231 cases of the latter. Reducing the number of cases packed in flat form to the standard 48-pound cases, the output for British Columbia amounts to 1,135,345 cases, which makes a total of 4,450,588 cases, exclusive of salted salmon, for the entire Pacific coast. The total value of the product was over $17,000,000, about $13,000,000 being the approximate value of the American pack.

Swordfish and pollock.—Swordfish are steadily increasing in number. In 1905 the catch amounted to over 2,000,000 pounds, with a value to the fishermen of $109,547. In the same year pollock were very plentiful, 22,041,977 pounds, valued at $216,303, being landed at Boston and Gloucester, the principal markets.

Whales.—There is no improvement in the whale fishery, less sperm and whale oil being landed in 1905 than in the previous year. The 12,985 barrels of whale oil taken in 1905 is the smallest quantity since 1897, when the product was 13,650 barrels. Following this there was a steady increase for five years, but since 1902 the product has gradually fallen again.

The whaling fleet now consists of 42 vessels—13 schooners, 15 barks, 11 steamers, and 3 brigs—nearly all of which cruise in the North Pacific and Indian oceans, there being only 8 in the Atlantic.

Lobsters.—It is stated by fishermen that there is a slight increase in the yield of lobsters, and at no time thus far during the season of 1906 has there been noticed such a scarcity as was observed in 1904 and 1905.

Oysters.—The past year's legislation affecting the Maryland oyster grounds, bringing this State at last abreast of the other oyster-producing States in relation to its most valuable fishery, suggests some striking comparisons.

In Long Island Sound the oyster product has long been taken from planted grounds. More than twenty-five years ago the States of Connecticut and New York assumed control of the oyster bottoms within their boundaries and, under a system of rental or sale, made it to the interest of oyster men to cultivate the productive areas. As a result the output between 1880 and 1897 rose 522.3 per cent in quantity and 224.9 per cent in value in Connecticut, and 112.3 per cent in quantity and 35.8 per cent in value in New York, with a gain continuous to the present time. In New York the output in 1904 was 50 per cent greater than it was in 1897, while its market value exceeded that of the oyster product of any other State.

The history of the oyster fishery in the Chesapeake Bay region presents quite another aspect. The great natural resources, far superior to those of the more northern waters, seemed inexhaustible.

Until a few years ago practically no effort was made to increase the supply of oysters or to insure continued productiveness of the grounds. Then Virginia, realizing the needs of the fishery, instituted active cultivation of the beds, and succeeded in substantially increasing the supply. Maryland, however, took no action. During the period of such remarkable development in Long Island Sound, the Maryland oyster product fell 31.6 per cent in quantity and 39.2 per cent in value; in 1904 it was 39 per cent less than in 1897 and 3,182,639 bushels less than the product of Virginia, which it formerly exceeded.

More than a third of the oysters produced in Virginia in 1904 were from planted grounds. Of the 4,429,650 bushels constituting the Maryland product only 464,565 were from planted grounds. With the history of the neighboring portion of Chesapeake waters, these figures are forcibly suggestive of the enormous increase to be looked for when the immense natural resources of Maryland are developed and augmented by systematic cultivation.

YIELD OF OYSTERS IN THE UNITED STATES.

States.	Planted grounds.		Natural grounds.		Total.	
	Bushels.	Value.	Bushels.	Value.	Bushels.	Value.
New England States (1902):						
Massachusetts	75,586	$120,252	27,800	$13,430	103,386	$133,682
Rhode Island	536,029	570,390	72,000	17,662	608,029	588,052
Connecticut	2,035,878	1,453,830	45,656	17,752	2,081,534	1,471,582
Middle Atlantic States (1904):						
New York	3,199,602	3,680,830	129,730	99,522	3,329,332	3,780,352
New Jersey	1,277,022	1,274,723	858,105	417,230	2,135,127	1,691,953
Pennsylvania	90,000	90,000	28,700	14,290	118,700	104,290
Delaware	10,400	9,064	231,175	84,620	241,575	93,684
Maryland	464,565	301,650	3,965,085	2,116,024	4,429,650	2,417,674
Virginia	2,998,422	1,708,456	4,618,837	1,751,220	7,612,289	3,459,676
South Atlantic States (1902):						
North Carolina	.....	.....	1,022,813	268,363	1,022,813	268,363
South Carolina	.....	.....	689,700	118,460	689,700	118,460
Georgia	.....	.....	1,224,000	220,467	1,224,000	220,467
Florida, east coast	.....	.....	309,069	37,188	309,069	37,188
Gulf States (1902):						
Florida, west coast	.....	.....	579,587	124,108	579,587	124,108
Alabama	53,844	39,475	293,616	80,298	347,460	119,773
Mississippi	65,925	16,075	2,339,207	410,147	2,405,132	426,222
Louisiana	.....	.....	1,198,413	493,227	1,198,413	493,227
Texas	.....	.....	343,113	100,359	343,113	100,359
Pacific coast States (1904):						
Washington	191,208	402,012	.....	.....	191,208	402,012
Oregon	992	1,488	.....	.....	992	1,488
California	188,613	628,023	.....	.....	188,613	628,023
Total	11,188,086	10,296,268	17,971,636	6,384,867	29,159,722	16,680,635

MISCELLANEOUS AFFAIRS.

OPERATIONS OF VESSELS.

The steamer *Albatross* was sent to Alaska in the summer of 1905 to assist in the establishment of the salmon hatchery near Yes Bay. Upon her return the vessel underwent general repairs and overhauling, and in May, 1906, sailed for a cruise of scientific exploration in the northern Pacific Ocean and the Japanese Archipelago. These investigations were in progress at the close of the fiscal year. At the time of the

San Francisco disaster, in April, the *Albatross*, together with naval vessels there, performed efficient service in assisting the sufferers.

The work of the steamer *Fish Hawk* consisted of a continuation of a biological survey of Buzzards Bay and Vineyard Sound during the summer of 1905 and the customary shad-hatching work on the Delaware River in the spring of 1906. At the close of the hatching season in that stream the vessel was sent to Maine to test the feasibility of similar operations on the Kennebec and other northern rivers. This work was begun June 7.

The schooner *Grampus* was engaged as usual in the summer collecting lobster eggs along the Maine coast, but this work was interrupted by the detail of the vessel to carry representatives of the Bureau to Newfoundland upon duty connected with fishery questions in those waters. The demands upon the vessel in this cruise emphasized the necessity for thorough overhauling and the installation of auxiliary power if efficient service is to be obtained. During the winter months the crew were employed in fish-cultural work, and on April 4 the schooner again went into commission for the lobster work of the season of 1906.

PUBLICATIONS AND LIBRARY.

The President's order of January 20, 1906, and the legislation of the last Congress regarding the printing and binding of departmental publications effected the following changes in the plan of issue of the reports and special papers of the Bureau of Fisheries:

The volume known as the Annual Report of the Bureau has been discontinued, and will henceforth be represented by a brief report of the Commissioner of Fisheries to the Secretary of Commerce and Labor. The papers formerly published as appendixes to the Commissioner's report, with it constituting the annual report volume, are now issued as independent pamphlets, designated "Bureau of Fisheries Document," with a number carried in the regular series already maintained for the distribution of pamphlets.

The Bulletin of the Bureau of Fisheries, so far as its distribution by the Bureau is concerned, is now issued in bound form in a very limited edition intended primarily for the Bureau's offices and stations, for the specialists who are its correspondents and collaborators, for foreign fishery departments and authorities, for a few public institutions, and for exchange for technical periodicals at home and abroad. For all other purposes of the Bureau the miscellaneous papers composing the volume are issued as separate pamphlets, in varying editions measured by the demand for the subject-matter.

The increased number of separates available for distribution under the altered arrangement makes possible a more judicious and eco-

nomical distribution of the Bureau's publications than has heretofore been possible. Owing to the variety of subjects treated in the regular and special reports, these papers as a bound collection were inevitably distributed to a large number of applicants who had interest in but one or a few of the subjects. As separates they are susceptible to classification, and persons or institutions whose names appear on the mailing list may designate under the following heads the papers they wish to receive:

1. Annual Report of the Commissioner.
2. Fish culture: (*a*) Methods; (*b*) Distribution of fish and eggs; (*c*) Fish diseases and parasites.
3. Aquatic biology: (*a*) Economic investigations; (*b*) Explorations and surveys, the methods, apparatus, etc.; (*c*) Descriptions of species and faunal lists; (*d*) Morphological, physiological, and pathological studies.
4. Statistics and methods of the commercial fisheries.
5. Special subjects, such as oysters, game fishes, Alaska salmon inspection, investigations of popular interest, etc., to be designated by the applicant.

All of the pamphlet publications of the Bureau are, as heretofore, available for distribution upon request.

There were issued during the past year the bound volumes of parts i and ii of the Bulletin for 1903 (vol. xxiii), which was reserved for contributions resulting from the explorations of the *Albatross* in the Hawaiian Islands in 1901 and 1902; of the Bulletin for 1904 (vol. xxiv), and the Report for 1904, which are the last of their respective series that will be distributed in bound form; and 28 separate papers consisting of extracts from the above volumes and from the Bulletin for 1905.

The distribution of publications in 1906 amounted to 5,671 bound volumes and 18,062 pamphlets. Accessions to the library numbered 204 bound and 306 unbound.

FISHERY LEGISLATION.

An unusual number of measures relating to various branches of the fishing industry came before the first session of the Fifty-ninth Congress. Some of these became laws and will be administered by the Department; others were not reached for final consideration, but may be acted on at the next session.

The fisheries of Alaska were the subject of a comprehensive act passed June 26, 1906. The immense value of the Alaskan fishing interests, especially the salmon, and the necessity for protection and regulation in accordance with new conditions are recognized in the following provisions, which constitute the law: A tax on the products canned, salted, or otherwise prepared; the exemption from all taxation of those establishments which operate private salmon hatcheries and liberate fry at the rate of 1,000 for every 10 cases of salmon

canned; the prohibition of any trap, barricade, dam, or other fixed obstruction in any waters at any point where the distance from shore to shore is less than 500 feet, or within 500 yards of any salmon stream less than 500 feet wide at its mouth; the prohibition of any kind of net fishing which obstructs more than one-third the width of any stream, creek, estuary, or lagoon; the prohibition of the laying of any seine or other net within 100 yards of any other net, and of the setting of any trap or other fixed appliance within 600 yards laterally or 100 yards endwise of any other similar apparatus; the prescribing of a weekly close season for all kinds of net fishing; the authorizing of the Secretary of Commerce and Labor to restrict or altogether prohibit fishing in waters where there is evidence of overfishing, and to set aside as preserves any waters which he may deem desirable; the prohibition of the canning or salting of salmon dead more than forty-eight hours, and of the misbranding of any canned, salted, or otherwise preserved fish.

The invasion of Alaskan waters by Japanese fishermen in large numbers aroused protest which took form in a measure intended to prevent aliens from fishing within those limits. The report of the House Committee on Territories contained the statement that the bill was proposed "not by reason of the existence in the United States of any feeling of hostility toward the Japanese people, but because of the proximity of Japan to Alaska the Japanese fishermen fish more in Alaskan waters than all other aliens combined." The bill became a law on June 14, 1906.

The subject of the destructiveness of dogfish on the Atlantic coast was actively taken up by the Massachusetts Board of Fish and Game Commissioners, and in view of the impossibility of obtaining effective action by the numerous States concerned, appeal was made to the General Government. Many petitions from fishermen in all sections poured into Congress, and a bill was finally introduced providing for a bounty of 2 cents on every dogfish killed along the coast between Cape Hatteras and Eastport, Me. The Bureau's recommendations, however, were to the effect that instead of establishing the undesirable precedent of the proposed bounty, the extermination of the dogfish or the checking of its destructivness be sought by voting a sum of money to be used in "determining the most effective methods of reducing the numbers of dogfish and of capturing them in wholesale quantities; in demonstrating the economic value of dogfish as a source of fertilizer, oil, and leather, and the most suitable methods of utilizing them for such purposes; and in testing the usefulness of the dogfish as food when used fresh or prepared by salting, smoking, and canning; and in developing the domestic and foreign markets for such preparations." The bill was not reached for action.

American sponge fishermen have had reason for serious concern in

the recent invasion of their business by many hundreds of Greeks, who violate the Florida statutes by using diving apparatus and by bringing into the markets sponges under the legal size. Diving for sponges is prohibited in the interests of the permanency of the fishery, and the diversion of the industry into alien hands constitutes another grievance of the native fishermen. The matter was presented to Congress and occasioned much discussion, owing to the difficulty of legislating against the Greeks, whose operations are conducted beyond the the 3-mile limit; but after a hearing at which all interests were represented, a bill suggested by this Bureau was passed June 20, 1906, to go into effect May 1, 1907. This bill provides (1) that no sponges taken with diving apparatus in the Gulf of Mexico or Straits of Florida shall be landed, delivered, cured, or offered for sale at any port or place in the United States, with the exception that sponges so taken in water more than 50 feet deep between October 1 and May 1 of each year are exempt from the provisions of the act; (2) no sponges from said waters having a smaller maximum diameter than 4 inches shall be landed, delivered, cured, or offered for sale at any port or place in the United States; (3) the Secretary of Commerce and Labor is directed to enforce the act, and is authorized to call on the vessels of the Navy and Revenue-Cutter Service to assist him.

Another bill proposed, prohibiting aliens from gathering sponges within a marine league of United States coasts, failed of consideration.

The decline of the Maryland oyster fishery, which has long been evident, aroused a strong sentiment in favor of legislative action to promote cultivation of the oyster grounds. So much opposition was encountered when the matter was approached, however, that a bitter controversy has raged in the State for years, and not until the last session of the legislature was any actual step taken. Under the law passed at that time the oyster grounds in Maryland waters are to be subjected to a system of rental under supervision of a shellfish commission, and the United States Coast and Geodetic Survey and the Bureau of Fisheries were asked to assist in determining and mapping the natural oyster beds. Congress responded to the latter portion of this measure by appropriating $15,000 to meet the expenses of cooperation by these Government bureaus, and the survey is now in progress.

The "omnibus fish hatchery bill" combined a large number of acts proposed in both Houses and in some cases passed by the Senate, providing for the establishment of 23 new Government fish hatcheries and one combined hatchery and laboratory. These stations were to be located in as many States, and represented an outlay of $637,000. The bill was favorably reported by the House Committee on Merchant Marine and Fisheries, but was not reached for action by Congress.

THE AMERICAN FISHERIES SOCIETY.

The American Fisheries Society held its thirty-second annual meeting, July 25 to 27, 1905, at White Sulphur Springs, W. Va., at the request of the Commissioner of Fisheries, who desired that the society should inspect the newly constructed fish-cultural station at that place. The number of members in attendance was about 60, representing 21 States and Territories, and the proceedings covered the usual wide range of subjects—artificial propagation, protection and legislation, commercial and sport fishing, biological investigation, etc. Among the matters discussed by the society was a uniform classification of young fish as to size. The varying usage of different States and individuals had in the past caused confusion and made necessary some concerted action. By unanimous vote the following definitions were decided upon, and these have been generally adopted in Government, State, and private fish culture:

Fry=a fish up to the time the yolk sac is absorbed and feeding begins.

Advanced fry=a fish from the end of the fry period until it has reached a length of 1 inch.

Fingerlings=fish between the length of 1 inch and the yearling stage, the various sizes to be designated as follows: No. 1, a fish 1 inch in length and up to 2 inches; No. 2, a fish 2 inches in length and up to 3 inches; No. 3, a fish 3 inches in length and up to 4 inches, etc.

Yearlings=fish that are 1 year old but less than 2 years old from the date of hatching; these may be designated No. 1, No. 2, No. 3, etc., after the plan prescribed for fingerlings.

INQUIRIES IN NEWFOUNDLAND WATERS.

In response to the appeals of the New England fishing interests, and at the request of the Department of State, the Bureau detailed two representatives to visit Newfoundland waters in the schooner *Grampus* for the purpose of noting the conditions under which American fishermen were conducting the herring fishery on the treaty coast of that island, and of advising the Government regarding the effects of the new fishing regulations promulgated by the provincial authorities and aimed particularly at the New England fishermen. This service was conducted in conjunction with observations on the movements and abundance of mackerel on the shores of the British provinces, and an examination of the methods of fishing and preserving fishery products in that region. The officials of the fishery and customs services of Newfoundland courteously received the Bureau's representatives and accorded every facility for conducting the inquiries.

During the season 42 American schooners visited the southern and western coasts of Newfoundland to engage in the herring fishery under the rights conveyed by the treaty of 1818. These vessels brought home 44,805 barrels of salted herring and 24,305 barrels of

frozen herring, valued approximately at $208,500. Although the herring were less abundant than usual, the fishery was very successful financially to American fishermen. The season closed in December without having given rise to any special complications.

APPROPRIATIONS.

The appropriations for the Bureau of Fisheries for the fiscal year 1906 were as follows:

Salaries	$281,920
Miscellaneous expenses:	
Administration	12,500
Propagation of food fishes	240,000
Inquiry respecting food fishes	25,000
Statistical inquiry	7,500
Maintenance of vessels	50,000
Protection of salmon fisheries in Alaska	7,000
Purchase of additional land, improvements, and completion of stations at—	
Bozeman, Mont	6,000
Spearfish, S. Dak	11,000
Battle Creek, Cal	5,000
Construction and repair of roads and buildings at Baker Lake, Wash	5,000
Construction and repair of wharves and buildings at Woods Hole, Mass	10,000

In accordance with law the expenditures under these appropriations will be the subject of a special report.

RECOMMENDATIONS.

PROTECTION TO FISH LIFE.

It is imperative that those States in which no adequate legal provision exists for the preservation of the supply of valuable migratory fishes should awake to a sense of their responsibility and promptly enact the legislation necessary to insure that a certain proportion of each season's run shall be permitted to reach the spawning grounds and accomplish the spawning act. In the case of the shad, the striped bass, the Pacific salmons, and other anadromous and migratory species in various State and interstate waters, there is imminent danger of a repetition of the lamentable history of the sturgeon fishery in the coast rivers and the Great Lakes.

NEW HATCHING STATIONS.

The Bureau, with its present facilities for taking eggs and hatching and distributing food and game fishes, is unable to meet the constantly growing demands made by the States and the general public, and necessitated by the conditions in the Great Lakes, the interstate streams, and the coastal waters, for the conservation of whose resources the Federal Government has tacitly become responsible. The immense

area of the waters to be stocked, the vast magnitude of the commercial fisheries therein conducted, and the extent of existing or imminent depletion necessitate fish-cultural operations on an enormous scale, and tax far beyond their utmost capacity the hatcheries thus far established. The construction of a number of new hatching stations is therefore urgently required, and the passage of the general hatchery bill now before Congress is strongly advocated, with the proviso that the Bureau be authorized to build not more than five such stations annually.

The recommendation in my last report, that a specially equipped pond station be established adjacent to Washington, to take the place of the abandoned fish lakes, is renewed. The proper conduct of the fish cultural and biological work of the Bureau and the necessary experimentation require a hatching station within easy access of headquarters.

NEW MARINE BIOLOGICAL STATIONS.

Important questions affecting the aquatic resources of our Gulf and Pacific coasts await settlement pending the establishment of stations at which systematic and continuous observations and investigations can be conducted. The desirability of these laboratories has been repeatedly shown by the Bureau and need not be further dwelt on at this time. It is hoped that Congress will soon take affirmative action on the favorable reports of its committees. These stations may conveniently combine biological research with marine fish culture and will prove of lasting value to the fisheries.

GENERAL EXPENSES AND SALARIES.

The increased cost of all kinds of supplies and materials required in the fish cultural and other branches of the service, when taken in conjunction with the operation of new stations, the augmented output of the hatcheries, and the general expansion of the work, necessitates a substantial increase in the appropriations for the Bureau's maintenance, if the growing demands for the stocking and replenishment of public and State waters are to be met and the most effective operation of hatcheries and laboratories is to be accomplished. The increase of $21,500 in the general appropriations for the Bureau for the fiscal year 1908, as provided for in the estimates submitted, is the smallest amount under which the work can be expected to progress.

The technical and clerical force of the Bureau at Washington, at the outside stations, and in the car and vessel services, is in general remarkably efficient and zealous. The continued success of the various branches of the work, and the enviable reputation that the Bureau has established at home and abroad, depend on the ability, fidelity, and active cooperation of the subordinate employees. These are for the

most part underpaid, and many of them are receiving salaries that are entirely inadequate and much less than are paid for similar services in other departments and in private business. So great is this disparity that the Bureau is constantly losing most useful employees by official transfer and by separation from the service to enter State, municipal, or commercial employ. Therefore, in order to give proper recognition to employees and effect a deserved promotion, such as is now impossible with the small number of positions involved, a general advance of not less than 20 per cent is recommended in the compensation of all employees.

NEW OFFICE BUILDING AND NATIONAL AQUARIUM.

A building of adequate size, special construction, and suitable equipment for the operations of this Bureau in Washington, is a long-felt want of the Government fisheries service. With the present scope of the work the highest degree of efficiency can not be reached in the cramped and antiquated quarters now occupied; and with the growing demands upon all branches, their increased labors, and the consequent additions to the force of employees, the limitations of the present accommodations become constantly a more serious disadvantage. The importance of a new building can not be too strongly urged. It is essential to the welfare of the expanding service.

Other considerations in this connection present themselves. The importance of the fisheries of the United States, to which the Government for more than thirty-five years has given recognition in the form of direct substantial aid, makes it fitting that there should be at the national capital some permanent exhibit and representation of this branch of industrial activity. The establishment of a national aquarium has long been an ambition of those concerned with the administration of the Bureau, and this project received favorable consideration by the Department in 1903, when the Secretary said, in his first annual report:

> The Department has under consideration the question of establishing, in connection with the Bureau of Fisheries, a national aquarium of such size and architectural excellence that it will be a credit to the nation. Public aquaria are recognized as important aids to education and are among the most attractive and useful exhibits that can be maintained at public expense. An appropriation for such an aquarium will in due course be recommended.

Consideration is now asked for the erection of a building which shall combine the purposes of administration, experiment, exhibit, and exploitation. The fish-cultural work with its equipment of railroad tracks and cars, hatching apparatus, etc., and the scientific laboratories with the requisites of experimentation make it necessary for this Bureau to receive individual treatment in respect to its accommodations. A portion of a department building, or in fact anything but

a building for the exclusive occupancy of the Bureau, would not only not be at all suited to its needs but would prove a decided handicap. A public aquarium, however, would afford facilities of actual service in the fish-cultural operations and for practical experimentation of much public interest. In close connection with the headquarters of the Bureau the two features of the work would be mutually beneficial, and both could be maintained at a cost which would be a merely nominal increase over the expenses of one.

As a necessity of a Government enterprise of established usefulness it is earnestly recommended that Congress be asked to provide a new building for the Bureau of Fisheries commensurate with the requirements of the service; and in behalf of public educational interests and the attractiveness of the national capital, the recommendation contemplates a building, of size and design suitable for the offices, laboratories, and general equipment of the Bureau, which shall contain a public exhibit of fishes and other forms of aquatic life, with illustration of the methods of their culture and the fisheries they support.

Respectfully,

GEO. M. BOWERS,
Commissioner.

The SECRETARY OF COMMERCE AND LABOR.

O

THE DISTRIBUTION OF FOOD FISHES DURING THE FISCAL YEAR 1906

Bureau of Fisheries Document No. 613

Blank page retained for pagination

PREFACE.

The widespread demand for information concerning the stocking of waters by the Bureau of Fisheries indicates an interest on the part of the public which, in addition to the permanent value of the record from the fish culturist's standpoint, has led to the publication of an extended account of this work from year to year. Such details, however, are no longer included in the Annual Report of the Commissioner, but are presented as detached supplementary reports. Following is a record of the distributions of fish and eggs during the fiscal year 1906.

GEORGE M. BOWERS,
Commissioner.

JANUARY 17, 1907.

Blank page retained for pagination

CONTENTS.

	Page.
General aspects of the work	9
Species cultivated and distributed	9
Applications and allotments	11
Distribution	12
Summary by species	12
Summary by states	13
Stations and the output of each	13
Details of distribution	16
Catfish	17
Shad	18
Whitefish	19
Lake herring	20
Chinook salmon	20
Silver salmon	20
Blueback salmon	20
Humpback salmon	21
Steelhead trout	21
Rainbow trout	22
Atlantic salmon	28
Landlocked salmon	28
Blackspotted trout	30
Scotch sea trout and Loch Leven trout	34
Lake trout	35
Brook trout	36
Grayling	53
Pike	54
Crappie and strawberry bass	54
Rock bass	56
Warmouth bass	59
Small-mouth black bass	59
Large-mouth black bass	60
Sunfish or bream	72
Pike perch	75
Yellow perch	76
Striped bass	77
White perch	77
Cod	77
Flatfish	78
Lobster	78

Blank page retained for pagination

THE DISTRIBUTION OF FOOD FISHES DURING THE FISCAL YEAR 1906.

GENERAL ASPECTS OF THE WORK.

As shown in the annual reports of the Commissioner, the results of the fish-cultural work of the Bureau of Fisheries are yearly increasing in volume. The number of fish and eggs produced in 1906 was 172,359,570 more than the output for 1905, and the latter was 250,000,000 greater than any previous record. The increase during the past year was particularly in Pacific salmons, lake, rainbow, and steelhead trouts, yellow perch, white perch, flatfish, and lobsters. There was an average yield of cod, whitefish, and pike perch, and the shad plants even slightly exceeded those of the previous year, so successful was the hatching of the meager collections. The number of shad eggs taken, however, was the smallest in the history of the culture of this fish, falling as low as 242,000 in the Delaware River, which was formerly among the most prolific shad streams. Conspicuous decline appeared likewise in the Susquehanna and the Potomac; only in the Albemarle region was there any increase, and here the collections quadrupled those of the previous year—a most significant record in view of the fact that this was the first season of enforcement of a new state law regulating fishing in the waters below the mouths of shad streams. The immense and increasing numbers of seines and pound nets all along the coast in recent years have captured such great quantities of shad that few were left to reach the spawning grounds or to furnish eggs for the hatcheries—a condition becoming more and more marked, and doubly serious because this fishery has for many years owed its existence to artificial propagation of the species.

SPECIES CULTIVATED AND DISTRIBUTED.[a]

The fish-cultural work in 1906 dealt with the following species:

THE CATFISHES (SILURIDÆ):

* § Spotted cat, blue cat, channel cat (*Ictalurus punctatus*).
* § Horned pout, bullhead, yellow cat (*Ameiurus nebulosus*).
* Marbled cat (*Ameiurus nebulosus marmoratus*).
§ Black cat (*Ameiurus melas*).

[a] The fishes artificially propagated are designated thus, *; those simply collected and distributed, thus, §; those propagated as food for other fishes, thus, †; those propagated for ornamental purposes, thus, ‡; and introduced species, thus, ‖.

THE SUCKERS AND BUFFALO-FISHES (CATOSTOMIDÆ):

§ Buffalo-fishes, chiefly *Ictiobus bubalus*.

THE MINNOWS AND CARPS (CYPRINIDÆ):

† ‖ Carp (*Cyprinus carpio*).
‡ ‖ Goldfish (*Carassius auratus*).
‡ ‖ Tench (*Tinca tinca*). Cultivated variety, golden tench.
‡ ‖ Ide (*Leuciscus idus*). Cultivated variety, golden ide.

THE SHADS AND HERRINGS (CLUPEIDÆ):

*Shad (*Alosa sapidissima*).

THE SALMONS, TROUTS, WHITEFISHES, ETC. (SALMONIDÆ):

*Common whitefish (*Coregonus clupeiformis*).
*Bluefin whitefish (*Argyrosomus nigripinnis*).
*Lake herring, cisco (*Argyrosomus artedi*).
*Chinook salmon, king salmon, quinnat salmon (*Oncorhynchus tschawytscha*).
*Silver salmon, coho (*Oncorhynchus kisutch*).
*Blueback salmon, red-fish, sockeye (*Oncorhynchus nerka*).
*Humpback salmon (*Oncorhynchus gorbuscha*).
*Steelhead, hardhead, salmon trout (*Salmo gairdneri*).
*Rainbow trout (*Salmo irideus*).
*Atlantic salmon (*Salmo salar*).
*Landlocked salmon (*Salmo sebago*).
*Yellowstone Lake trout, cut-throat trout, black-spotted trout (*Salmo lewisi*).
*Colorado River trout, black-spotted trout (*Salmo pleuriticus*).
*Arkansas River trout, green-backed trout (*Salmo stomias*).
‖*Sea trout, salmon trout (*Salmo trutta*).
‖*Loch Leven trout (*Salmo trutta levenensis*).
*Lake trout, Mackinaw trout, longe, togue (*Cristivomer namaycush*).
*Brook trout, speckled trout (*Salvelinus fontinalis*).
*Golden trout, Sunapee Lake trout (*Salvelinus aureolus*).
*Canadian red trout (*Salvelinus marstoni*).
*Hybrid trout (*Salvelinus fontinalis*+*aureolus*).

THE GRAYLINGS (THYMALLIDÆ):

*Montana grayling (*Thymallus montanus*).

THE PIKES AND PICKEREL (ESOCIDÆ):

*Pike or pickerel (*Esox lucius*, *Esox reticulatus*).

THE BASSES, SUNFISHES, AND CRAPPIES (CENTRARCHIDÆ):

*§ Crappie (*Pomoxis annularis*).
*§ Strawberry bass, calico bass (*Pomoxis sparoides*).
*§ Rock bass, red-eye, goggle-eye (*Ambloplites rupestris*).
*§ Warmouth, goggle-eye (*Chænobryttus gulosus*).
*§ Small-mouth black bass (*Micropterus dolomieu*).
*§ Large-mouth black bass (*Micropterus salmoides*).
*§ Bluegill sunfish (*Lepomis incisor*).
§ Other sunfishes, chiefly *Eupomotis gibbosus*.

THE PERCHES (PERCIDÆ):

*§ Pike perch, wall-eyed pike, yellow pike, blue pike (*Stizostedion vitreum*).
*§ Yellow perch (*Perca flavescens*).

THE SEA BASSES (SERRANIDÆ):

*Striped bass, rockfish (*Roccus lineatus*).
*White perch (*Morone americana*).

THE CODS (GADIDÆ):

*Cod (*Gadus callarias*).
*Pollock (*Pollachius virens*).

THE FLOUNDERS (PLEURONECTIDÆ):

*Winter flounder, American flatfish (*Pseudopleuronectes americanus*).

CRUSTACEANS:

*American lobster (*Homarus americanus*).

APPLICATIONS AND ALLOTMENTS.

The first consideration in the distribution of the product of the hatcheries is to make ample return to the waters from which eggs have been collected. The remainder of the fish are sent to applicants throughout the country for stocking state waters, fishing preserves, private ponds and streams, etc., and are delivered free of charge to the applicant, at the railroad station nearest the point of deposit. Applications are yearly increasing in number, the 5,806 of the past year being 898 more than were received in 1905. The demand is now greater than the Bureau can meet with a single year's supply, especially the demand for the basses, crappie, and the catfishes.

Fishes are distributed at various stages of development, according to the species, the numbers in the hatcheries, and the facilities for rearing. The commercial fishes, such as the shad, whitefish, lake trout, pike perch, cod, etc., which are hatched in lots of many million, are necessarily planted as fry; it is customary to distribute them just before the umbilical sac is completely absorbed. Atlantic salmon, landlocked salmon, and various species of trout, in such numbers as the hatchery facilities permit, are reared to fingerlings from 1 to 6 inches in length; the remainder are distributed as fry. The basses and sunfishes reared at fish-cultural stations are distributed from the time the young rise from the spawning beds until they have reached such size as makes it impracticable to feed them in the hatcheries; the last lots distributed are usually fish 3 to 5 inches in length. The numerous kinds of fishes collected in overflowed lands—basses, crappie, sunfishes, pike and pickerel, catfishes, yellow perch, buffalo-fish, and others—are 2 to 6 inches in length when taken and distributed. Eggs are distributed only to state hatcheries or to applicants who have hatchery facilities.

The varying usage in the classification of young fish as to size has caused such confusion and difficulty that it became necessary for fish-culturists to adopt uniform definitions. Accordingly, at the meeting of the American Fisheries Society in July, 1905, the following were

decided upon, and have been adopted in government, state, and private fish culture:

Fry=a fish up to the time the yolk sac is absorbed and feeding begins.

Advanced fry=a fish from the end of the fry period until it has reached a length of 1 inch.

Fingerlings=fish between the length of 1 inch and the yearling stage, the various sizes to be designated as follows: No. 1, a fish 1 inch in length and up to 2 inches; No. 2, a fish 2 inches in length and up to 3 inches; No. 3, a fish 3 inches in length and up to 4 inches, etc.

Yearlings=fish that are 1 year old, but less than 2 years old from the date of hatching; these may be designated No. 1, No. 2, No. 3, etc., after the plan prescribed for fingerlings.

The difference in methods of hatching the different species is a determining factor in the supply of particular fishes available for distribution, and consequently of the number allotted to individual applicants. The area and character of the water to be stocked must likewise be considered; the water area that would receive a million pike perch fry would perhaps be assigned no more than 200 or 300 black bass 3 or 4 inches long, or four to eight times that many if the bass were planted as fry. The explanation is in the fact that pike perch can be propagated by the hundred million, while black bass, hatched by other methods or collected from overflowed lands, can be produced only in comparatively small numbers. The Bureau does not attempt to assign any applicant more than a liberal brood stock of the basses or sunfishes. With brook trout, which are distributed both as fry and fingerlings, assignments of fry are twenty-five to fifty times larger than assignments of fingerlings 3 to 4 inches long.

DISTRIBUTION.

The output of fish and eggs resulting from the past year's operations is summarized in the table below.

SUMMARY OF THE DISTRIBUTIONS OF FISH AND EGGS DURING THE FISCAL YEAR 1906, BY SPECIES.

Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Total.
Catfish		500	63,895	64,395
Shad	495,000	37,504,300		37,999,300
Whitefish	73,099,000	263,400,800		336,499,800
Bluefin whitefish		1,140,000		1,140,000
Lake herring	38,300,000	3,410,000		41,710,000
Chinook salmon	115,628,645	20,789,928	122,980	136,541,553
Silver salmon	239,180	6,445,574	23,140	6,707,894
Blueback salmon	122,500	9,923,680	9,500	10,055,680
Humpback salmon	2,000	1,528,504		1,530,504
Steelhead trout	113,000	2,038,879	178,056	2,329,935
Rainbow trout	401,400	395,415	1,398,755	2,195,570
Atlantic salmon		1,897,607	79,217	1,976,824
Landlocked salmon	204,000	481,144	75,677	760,821
Blackspotted trout	810,000	6,988,918	1,100,336	8,899,254
Scotch sea trout			504	504
Lock Leven trout		22,525	78,000	100,525
Lake trout	25,090,000	29,084,540	73,200	54,247,740
Brook trout	960,000	5,333,609	3,678,879	9,972,488

SUMMARY OF THE DISTRIBUTIONS OF FISH AND EGGS DURING THE FISCAL YEAR 1906, BY SPECIES—Continued.

Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Total.
Golden trout		218,265		218,265
Grayling	592,000	415,000		1,007,000
Pike			15,000	15,000
Crappie and strawberry bass			86,755	86,755
Rock bass			41,257	41,257
Warmouth bass			2,375	2,375
Small-mouth black bass		155,150	40,446	195,596
Large-mouth black bass		90,800	434,272	524,572
Sunfish or bream			90,937	90,937
Pike perch	136,100,000	232,105,000		368,205,000
Yellow perch		161,943,000	3,065	161,946,065
Striped bass		2,351,000		2,351,000
White perch	5,400,000	176,690,000		182,090,000
Cod		159,492,000		159,492,000
Flatfish		285,049,000		285,049,000
Lobster		117,787,000		117,787,000
Total	397,556,725	1,526,681,638	7,596,246	1,931,834,609

The following table is a summary of the distributions of fish and eggs in the respective states and territories, including donations to state fish commissions:

SUMMARY OF THE DISTRIBUTIONS OF FISH AND EGGS DURING THE FISCAL YEAR 1906, BY STATES.

State or Territory.	Number of fish and eggs.	State or Territory.	Number of fish and eggs.
Alabama	49,660	Nebraska	234,550
Alaska	6,638,550	Nevada	133,000
Arizona	2,700	New Hampshire	8,116,063
Arkansas	87,270	New Jersey	155,579
California	110,822,850	New Mexico	269,066
Colorado	6,779,097	New York	47,767,670
Connecticut	2,575,800	North Carolina	20,139,105
Delaware	501,072	North Dakota	8,379
District of Columbia	581,050	Ohio	305,053,480
Florida	6,700	Oklahoma	9,783
Georgia	104,170	Oregon	20,306,207
Idaho	143,959	Pennsylvania	127,115,611
Illinois	5,121,759	Rhode Island	17,077,400
Indiana	5,411,405	South Carolina	4,485
Indian Territory	8,100	South Dakota	3,537,994
Iowa	1,247,522	Tennessee	271,867
Kansas	21,931	Texas	81,237
Kentucky	1,536,105	Utah	549,100
Louisiana	6,700	Vermont	51,336,169
Maine	127,867,723	Virginia	35,483,186
Maryland	325,680,971	Washington	19,005,418
Massachusetts	424,430,450	West Virginia	1,124,434
Michigan	197,693,364	Wisconsin	32,161,988
Minnesota	6,929,202	Wyoming	1,061,550
Mississippi	51,345		
Missouri	11,275,878	Total	1,927,438,929
Montana	1,360,275		

STATIONS AND THE OUTPUT OF EACH.

The following table lists the stations operated in 1906 and shows the output of each. It may be noted that 2 stations were concerned with the culture of cod and lobsters; 2 with flatfish, 12 with Atlantic and landlocked salmon, shad, striped bass, white perch, and yellow perch; 16 with white-fish, lake herring, lake trout, and pike perch;

12 with Pacific salmons, and 29 with rainbow trout, blackspotted trout, brook trout, grayling, black bass, crappie, sunfish, etc.:

STATIONS OF THE BUREAU OF FISHERIES AND THE OUTPUT OF EACH IN THE FISCAL YEAR 1906.

Stations.	Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Baird, Cal.	Chinook salmon	25,743,770	3,488,552	
	Rainbow trout	19,500	7,715	138
Battle Creek substation	Chinook salmon	49,032,375		
Mill Creek substation	Chinook salmon	33,110,300		
Baker Lake, Wash.	Chinook salmon		44,953	
	Blueback salmon	122,500	3,285,130	
	Silver salmon		4,427,145	
Birdsview substation[a]	Chinook salmon		83,437	
	Blueback salmon			9,500
	Silver salmon	239,180	2,018,429	14,840
	Humpback salmon	2,000	969,990	
	Steelhead trout	103,000	540,000	
Battery station, Md.[a]	Shad		7,460,000	
	Striped bass		160,000	
	Yellow perch		93,000,000	
	White perch	5,400,000	176,640,000	
Boothbay Harbor, Me.	Cod		29,780,000	
	Lobster		90,000,000	
Bozeman, Mont.[a]	Rainbow trout			62,000
	Brook trout			91,600
	Blackspotted trout			908,000
	Steelhead trout			24,000
	Grayling	592,000	400,000	
Bryans Point, Md.[a]	Shad		10,928,000	
	Yellow perch		66,962,000	
Cape Vincent, N. Y.	Brook trout		545,000	
	Lake trout		4,875,000	
	White fish		23,700,000	
	Pike perch		8,000,000	
Central Station, D. C.	Brook trout		24,118	
	Rainbow trout		19,700	
	Lake trout		47,540	
	White fish		842,000	
	Shad		80,000	
	Pike perch		2,450,000	
	Yellow perch		1,981,000	
	White perch		500,000	
Clackamas Station, Oreg.	Rainbow trout			86,725
	Brook trout			257,178
	Blackspotted trout		11,543	5,586
	Steelhead trout	10,000	1,288,660	4,600
	Lake trout			66,920
	Chinook salmon	28,200	2,372,490	40,580
	Landlocked salmon			14,907
	Silver salmon			300
	Shad		129,000	
	Black bass (large-mouth)			210
Willamette substation	Rainbow trout			13,400
	Brook trout			5,100
	Blackspotted trout			54,000
	Lake trout			5,670
	Steelhead trout			35,783
	Chinook salmon		84,481	7,400
Big White Salmon substation.	Chinook salmon	7,714,000	6,678,415	
Little White Salmon substation.	Chinook salmon		8,040,100	
Rogue River substation	Chinook salmon		47,500	75,000
	Blackspotted trout		10,325	
	Steelhead trout		5,825	
Cold Springs, Ga.	Black bass (large-mouth)		15,000	117,180
	Warmouth bass			1,850
	Bream			18,755
	Catfish		500	550
Craig Brook, Me.[a]	Rainbow trout			48
	Brook trout		204,000	216,252
	Lake trout			504
	Scotch sea trout			246

[a] In addition to the above the following transfers were made:
Birdsview to Craig Brook, 757,500 blueback salmon eggs, and to other stations, 245,000 steelhead trout eggs.
Battery to other stations, 4,000,000 white perch eggs.
Bozeman to Nashua, 50,000 grayling eggs.
Bryans Point to Central Station, 2,406,000 yellow perch eggs and 88,000 shad eggs.
Craig Brook to Nashua, 154,800 brook trout, of which 69,700 remained undistributed on June 30, 1906.

STATIONS OF THE BUREAU OF FISHERIES AND THE OUTPUT OF EACH IN THE FISCAL YEAR 1906—Continued.

Stations.	Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Craig Brook, Me	Landlocked salmon		92,500	28,144
	Atlantic salmon		1,897,607	79,217
	Silver salmon			8,000
	Humpback salmon		558,514	
Duluth, Minn	Brook trout		142,000	
	Steelhead trout		81,200	53,000
	Lake trout	80,000	7,913,000	
	Whitefish		19,915,000	
	Bluefin whitefish		1,140,000	
	Pike perch		3,025,000	
Edenton, N. C	Shad	495,000	17,883,000	
Weldon substation	Striped bass		2,191,000	
Erwin Station, Tenn	Rainbow trout			330,539
	Brook trout			106,703
	Black bass (large-mouth)		21,200	2,835
	Black bass (small-mouth)			4,550
	Rock bass			1,900
	Bream			7,245
Fish Lakes, D. C.[a]	Black bass (large-mouth)		81,500	53,040
	Crappie			1,575
	Bream			1,707
	Catfish			482
	Yellow perch			1,000
Glen Eyre, Pa	Black bass (small-mouth)		84,300	
Gloucester, Mass	Cod		52,011,000	
	Flatfish		106,743,000	
	Lobster		15,000,000	
Green Lake, Me.[a]	Brook trout		1,026,000	11,345
	Landlocked salmon	204,000	390,500	
Leadville, Colo.[a]	Rainbow trout	10,000	9,000	185,005
	Brook trout	860,000	1,238,500	1,184,519
	Blackspotted trout	560,000	4,579,000	
Mammoth Spring, Ark	Rainbow trout			14,000
	Steelhead trout			46,000
	Black bass (large-mouth)			1,800
Manchester, Iowa[a]	Rainbow trout	242,000	330,000	135,240
	Brook trout			492,320
	Steelhead trout			175
	Lake trout			162
	Rock bass			16,908
	Yellow perch			365
	Pike perch		1,800,000	
Bellevue substation	Black bass (large-mouth)			27,250
	Crappie			37,000
	Catfish			6,000
	Yellow perch			100
	Pike			15,000
North McGregor substation	Black bass (large-mouth)			11,440
	Crappie			1,175
	Catfish			4,080
Nashua, N. H	Brook trout		365,000	7,950
	Steelhead trout			15,500
	Lake trout		75,000	
	Golden trout		218,265	
	Grayling		15,000	
	Landlocked salmon			82,640
Neosho, Mo.[a]	Rainbow trout	82,400		118,675
	Lake trout			740
	Black bass (large-mouth)		1,500	22,674
	Black bass (small-mouth)			755
	Rock bass			16,050
	Strawberry bass			13,292
	Pike perch		1,000,000	
Northville, Mich.[a]	Rainbow trout		29,000	
	Brook trout		492,991	21,000
	Steelhead trout		42,000	
	Loch Leven trout		22,525	
	Lake trout	24,260,000		
	Black bass (small-mouth)		6,000	36,900
Alpena substation	Lake trout		4,500,000	
	Whitefish		20,000,000	
Charlevoix substation	Lake trout		4,500,000	
	Whitefish		20,000,000	

[a] In addition to the above the following transfers were made:
Fish Lakes to Wytheville, 2,400 black bass, of which 1,495 remained undistributed on June 30, 1906.
Green Lake to other stations, 210,000 landlocked salmon eggs.
Leadville to other stations, 776,800 brook trout eggs.
Manchester to other stations, 584,200 rainbow trout eggs.
Neosho to other stations, 202,400 rainbow trout eggs.
Northville to other stations, 26,774,000 lake trout eggs.

STATIONS OF THE BUREAU OF FISHERIES AND THE OUTPUT OF EACH IN THE FISCAL YEAR 1906—Continued.

Stations.	Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Northville, Mich.—Continued.				
Detroit substation[a]	Whitefish	23,570,000	19,000,000	.....
	Pike perch	34,500,000	25,600,000	.....
Sault Ste. Marie substation	Lake trout	750,000	6,500,000	.....
	Whitefish	.....	20,000,000	.....
Put-in-Bay, Ohio[a]	Lake trout	.....	600,000	.....
	Lake herring	38,300,000	3,410,000	.....
	Whitefish	49,529,000	140,000,000	.....
	Pike perch	99,600,000	135,400,000	.....
Quincy, Ill	Black bass (large-mouth)	.....	.....	134,780
	Crappie	.....	.....	22,368
	Bream	.....	.....	34,250
	Catfish	.....	.....	57,445
	Yellow perch	.....	.....	2,200
St. Johnsbury, Vt.[a]	Brook trout	55,000	1,287,800	.....
	Steelhead trout	.....	91,694	.....
	Lake trout	.....	175,000	.....
	Landlocked salmon	.....	22,344	.....
	Black bass (small-mouth)	.....	32,900	.....
Pittsford substation	Brook trout	.....	.....	55,231
Swanton substation[a]	Pike perch	2,000,000	55,000,000	.....
San Marcos, Tex	Black bass (large-mouth)	.....	.....	60,975
	Rock bass	.....	.....	5,092
	Crappie	.....	.....	10,665
	Warmouth bass	.....	.....	525
	Bream	.....	.....	4,450
Spearfish, S. Dak.[a]	Rainbow trout	.....	.....	125,000
	Brook trout	.....	.....	737,000
	Blackspotted trout	250,000	2,400,100	78,000
	Loch Leven trout	.....	.....	78,000
Steamer Fish Hawk	Shad	.....	1,124,300	.....
Tupelo, Miss	Black bass (large-mouth)	.....	.....	1,600
	Crappie and strawberry bass.	.....	.....	8,700
	Bream	.....	.....	30,540
White Sulphur Springs, W. Va.	Rainbow trout	.....	.....	221,450
	Brook trout	.....	40,000	415,362
	Blackspotted trout	.....	.....	61,000
	Black bass (small-mouth)	.....	51,000	5,811
Lake Toxaway, N. C., substation.	Rainbow trout	73,500	.....	.....
	Brook trout	45,000	.....	.....
Woods Hole, Mass	Cod	.....	77,701,000	.....
	Flatfish	.....	178,306,000	.....
	Lobster	.....	12,787,000	.....
Wytheville, Va.[a]	Rainbow trout	24,000	.....	113,826
	Brook trout	.....	.....	133,560
	Black bass (large-mouth)	.....	21,200	23,140
	Rock bass	.....	.....	4,850
Yes Bay, Alaska	Blueback salmon	.....	6,638,550	.....

[a] In addition to the above the following transfers were made:
Detroit to other stations, 85,500,000 whitefish eggs.
Put-in-Bay to other stations, 25,407,000 whitefish eggs, and 7,000,000 pike perch eggs.
St. Johnsbury to Central Station, 20,000 brook trout eggs; to Nashua Station, 33,000 brook trout, all of which remained undistributed on June 30, 1906, and 8,000 small-mouth black bass, of which 4,500 remained undistributed on June 30, 1906; to Pittsford substation, 98,336 brook trout for rearing.
Swanton to other stations, 12,000,000 pike perch eggs.
Spearfish to other stations, 656,000 blackspotted trout eggs.
Wytheville to other stations, 270,000 rainbow-trout eggs.

DETAILS OF DISTRIBUTION.

The following tabulation shows, by species and waters stocked, all distributions of fish and eggs during the year ended June 30, 1906. The waters are grouped according to states and localities, which, with the exception of foreign countries, are arranged in alphabetical order. A total of 4,195,680 eggs was shipped to the governments of Argentina and New Zealand.

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906.

CATFISH.

State, locality, and disposition.	Fingerlings, yearlings, and adults.
Arkansas:	
Garfield, Lamkin Pond	100
Colorado:	
Dolores, Dolores River	200
Grand Junction, Grand River	350
Leadville, Derry's lakes	200
Limon, Dugout Creek Pond	200
Montrose, Haskill's lake No. 2	100
Olathe, ice pond	100
Paonia, ice pond	100
Georgia:	
Canton, Etowah River	250
Columbus, Talbot Pond	100
Holland, Barker Pond	150
Jonesboro, Gun Lake	100
La Grange, Hudson's pond	50
Lovejoy, Roan's pond	100
Lumpkin, Singer's pond	600
Pomona, Bermuda Lake	100
Rome, Moran Lake	300
Sunnyside, Darsey's pond	100
Idaho:	
Market Lake, Camas Creek	200
Payette, Washoe Ice Pond	150
Weiser, Weiser River	200
Illinois:	
Abingdon, Lake Edna	1,200
Aurora, Fox River	1,600
Baylis, Sykes's pond	400
Belleville, Heinemann's pond	600
Blanding, Mississippi River	1,000
Carlinville, Fish Club Pond	600
Carterville, Hampton's pond	300
Peyton's pond	300
Zimmerman's pond	300
Carthage, Graham's pond	400
Chesterfield, Bode's pond	300
Loper's pond	300
Collinsville, Oehler's pond	600
Danville, Fengen's pond	500
Soldiers' Home Lake	1,000
Decatur, Needham's lake	900
Pitner's lake	2,000
Sangamon River	600
Franklin, Hartland Lake	400
Seymour's lake	400
Galesburg, Rice Lake	1,200
Godfrey, Jackson's pond	300
Golden Hill, Whitford's pond	400
Greenville, Lindly's pond	900
Harristown, Twin Lakes	600
Homer, Salt Fork of Vermilion River	1,200
Lerna, Long Elm Pond	300
Litchfield, Shoal Creek	600
Marion, Hudgens Lake	300
Meredosia, Meredosia Bay	4,500
Metamora, Zimmerman's pond	1,200
Monmouth, Hardin's lake	1,200
Naperville, Goodwin's pond	400
O'Fallon, Cottonwood Lake	600
Ogden, Dresback's pond	400
Paris, Fish Club Lake	600
Parker, Heaton's pond	300
Webb's pond	300
Pleasant Hill, Emmert Lake	800
Rock Island, Prospect Park Lake	1,200
Rockefeller, Diamond Lake	400
Roseville, Lake Dixson	800
St. Jacobs, Frey's pond	100
Schoeck's pond	100
Sidell, Railroad Reservoir	1,200
Strasburg, Weber's pond	300
Table Grove, Old Krows Pond	800
Taylor Ridge, Harris Pond	800
Wataga, Loy's pond	1,600
Waverly, Cox's pond	400
Wayne City, Hagerty's pond	100
Indiana:	
Angola, Bass Lake	140
Crooked Creek	170
Boone Grove, Willow Lake	140
Brazil, Hunt's pond	100
Churubusco, Lindsey's lake	140
Cold Spring, Holmann's pond	100
Kimmel, Norris's lake	140
Marion, Andrew's pond	100
New Albany, Silver Creek Lake	300
Peru, Nash's pond	100
Talbot, Gerlach's pond	100
Indian Territory:	
Kiowa, Gresham's pond	100
Iowa:	
Afton, Afton Pond	75
Baxter, Turkey Lake	400
Bellevue, Mississippi River	1,000
Manchester, Maquoketa River	1,500
Mount Zion, Campbell's pond	300
Stanwood, Boling's lake	200
Sutherland, Yonde's pond	150
Kansas:	
Beeler, Pickerell's pond	85
Bellaire, Norton's pond	110
Council Grove, Neosho River	300
Garden City, Coffman's pond	90
Goodwin's lake	90
Hamilton's pond	90
Holcomb's pond	145
large pond	145
Silver Lake	90
West's pond	90
Great Bend, Miller's pond	85
Greely County, Stewart's pond	260
Lakin, French's pond	90
Kuhn's pond	90
Russell's pond	90
Lawrence, Glen Burn Pond	100
Liberal, Murphy's pond	85
Morrill, Cedar Lake	104
Reserve, Schmidt's pond	100
St. Francis, Burnham's pond	75
Timken, Smreka's pond	85
Wilson, Newbert's pond	100
Kentucky:	
Cave City, Vance's pond	100
Finchville, Hardin's pond	100
Glasgow, Flowers' pond	150
Hopkinsville, Cherry bottom Pond	100
Lily, Robinson Creek	200
St. Mary, Rolling Fork Creek	250
Shelbyville, Baker's pond	100
Wingo, Tartt's pond	200
Louisiana:	
Many, Ansecuw's pond	250
Spring Pond	250
Natchitoches, Chaplin Lake	300
Maryland:	
Deer Park, Williams' pond	100
Taneytown, Goulden's pond	300
Massachusetts:	
Haverhill, Crystal Pond	250
Minnesota:	
Alexandria, Lake Geneva	416
Bemidji, Mud Lake	266
Mississippi:	
Aberdeen, G. T. Jones' pond	200
M. A. Jones' pond	200
Como Depot, Dunlap's pond	250
Gloster, Wilkinson's pond	300
Missouri:	
Brandsville, Cone's pond	100
Chapin, Tune's pond	150
Rogersville, Huffman's pond	100
McHaffie's pond	100

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

CATFISH—Continued.

State, locality, and disposition.	Fingerlings, yearlings, and adults.
Montana:	
Cascade, Big Lake	150
Nebraska:	
Ashton, Jamrog's pond	75
Dickens, Braugh Lake	200
Grand Island, Evergreen Pond	150
Smith's pond	75
New Mexico:	
Alamagordo, Alameda Lake	300
Clayton, Clenequilla Creek	300
Portales, Crabtree's pond	89
Harrison's pond	89
Puckett's pond	89
Sam's pond	89
Thompson's pond	89
North Carolina:	
Reidsville, Iron Works Pond	150
Poplar Lake	150
North Dakota:	
Ellendale, Johnson's lake	332
St. John, Gordon Lake	375
Mud Lake	45
Ohio:	
Amanda, Miller's pond	100
Ansonia, Baughman's pond	150
Beckett, Muskingum River	100
Cambridge, Todd Pond	100
Holmesville, Burns's ponds	150
Kenton, Liles' pond	100
Marietta, Ohio River	100
Tiffin, Sexton's pond	200
Oklahoma:	
Eldorado, Drew's pond	100
Fort Sill, Medicine River	100
Goltry, Voss' pond	100
Marshall, McMeekin's pond	220
Stillwater, Yost Lake	150
Waukomis, Baker's pond	150
Pennsylvania:	
Arcola, Perkiomen Creek	200
Mohrsville, Becker's millpond	200
Dauberville Pond	200
Pennsylvania—Continued.	
Mohrsville, Irish Creek	400
Plum Creek	200
New Providence, People's pond	100
Pine Grove, Clarks Creek	232
Tryonville, Sugar Lake	200
South Dakota:	
Ardmore, Kricher's pond	125
Bellefourche, Bernard's pond	75
Buffalo Gap, Beaver Creek Mill Pond	225
Loyalton, Alexander's pond	95
Hancock's pond	125
Lundeen's pond	245
Salah's pond	145
Madison, Sunde's pond	100
Parkston, Bares' pond	100
Pringle, Thomas' pond	75
Tabor, Vyborny's pond	100
Utica, Peterka's lake	250
Tennessee:	
Centerville, Water Heights Pond	100
Donelson, Gillem Pond No. 2	150
Franklin, Mill Pond	200
Obion County, Morris's pond	150
Virginia:	
Bealeton, Botts's pond	100
Chilhowie, Bonham's pond	150
Remington, Rappahannock River	300
West Virginia:	
Tunnelton, Heathers Run	150
Wisconsin:	
Beaver Dam, Beaver Dam Pond	600
Brodhead, Sugar River	200
Wyoming:	
Gillette, Mayer's pond	75
Spaeth's pond	75
Green River, Green River	300
Newcastle, M. W. Lake	150
Total[a]	64,395

SHAD.

State, locality, and disposition.	Eggs.	Fry.
District of Columbia:		
Potomac River, Fish Lakes		80,000
Maine:		
Augusta, Kennebec River		964,800
Swan Island, Kennebec River		38,400
Maryland:		
Accokeek Creek, off mouth, in Potomac River		760,000
Battery Haul, Chesapeake Bay		4,110,000
Broad Creek, off mouth, in Potomac River		791,000
Bryans Point, Potomac River		43,000
Elk River, off mouth, in Chesapeake Bay		500,000
Havre de Grace, Chesapeake Bay		900,000
Pamunky Creek, off mouth, in Potomac River		817,000
Piscataway Creek, off mouth, in Potomac River		2,153,000
Swan Creek, off mouth, in Potomac River		1,103,000
Maryland—Continued.		
Western Flats, Chesapeake Bay		1,500,000
New Jersey:		
Washington Park, Delaware River		121,100
North Carolina:		
Albemarle Sound, Edenton Bay	40,000	
Bertie County, Salmon Creek		527,000
Comfort, Trent River		600,000
Edenton, Chowan River		846,000
Edenton Bay	231,000	1,152,000
Elizabeth City, Pasquotank River		600,000
Elliot, Six Runs River		596,000
Fayetteville, Cape Fear River		622,000
Gum Point, Albemarle Sound	168,000	3,509,000
Hertford, Perquimans River		470,000
Jacksonville, New River		579,000
Moltonville, Six Runs River		500,000
Newbern, Neuse River		704,000
Trent River		600,000
Newport, Newport River		500,000

[a] 4,662 fingerlings were lost in transit.

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

SHAD—Continued.

State, locality, and disposition.	Eggs.	Fry.
North Carolina—Continued.		
Plymouth, Albemarle Sound	.....	513,000
Plymouth, Roanoke River	.....	361,000
Pollocksville, Mill Creek	.....	460,000
Reedy Point, Albemarle Sound	.....	1,613,000
West of Capeharts Shore, Albemarle Sound	56,000	.....
Washington, Pamlico River	.....	1,317,000
Washington, Tar River	.....	464,000
Wilmington, Cape Fear River	.....	600,000
Oregon:		
Oregon City, Willamette River	.....	55,000
Virginia:		
Dogue Creek, off mouth, in Potomac River	.....	1,306,000
Little Hunting Creek, off mouth, in Potomac River	.....	861,000
Occoquan Creek, off mouth, in Potomac River	.....	947,000
Pohick Creek, off mouth, in Potomac River	.....	2,597,000
Suffolk, Nansemond River	.....	650,000
Washington:		
Snohomish, Lake Stevens	.....	74,000
Total [a]	495,000	37,504,300

WHITEFISH.

State, locality, and disposition.	Eggs.	Fry.
Michigan:		
Belle Isle, Detroit River	.....	17,000,000
Big Reef, Lake Michigan	.....	5,000,000
Charlevoix, Lake Michigan	.....	6,000,000
Charlevoix, Pine Lake	.....	4,000,000
Detour, Lake Huron	.....	6,000,000
Detroit, Belle Isle Aquarium	840,000	.....
Detroit, Lake St. Clair	.....	2,000,000
Fishermans Home, Lake Superior	.....	2,800,000
Forester, Lake Huron	.....	4,000,000
Grace Harbor, Lake Superior	.....	2,800,000
Irishmans Reef, Lake Michigan	.....	5,000,000
Manistique, Lake Michigan	.....	2,000,000
Marquette, Lake Superior	.....	4,200,000
North Point, Lake Huron	.....	5,000,000
Ontonagon, Lake Superior	.....	5,544,000
Round Island, Lake Superior	.....	3,000,000
Sault Ste. Marie, Hay Lake	.....	3,000,000
Scare Crow Island, Lake Huron	.....	11,000,000
Whitefish Point, Lake Superior	.....	6,000,000
Minnesota:		
Duluth, Lake Superior	.....	[b] 1,655,000
Grand Portage, Lake Superior	.....	2,000,000
New York:		
Caledonia, New York Forest, Fish, and Game Commission	5,000,000	.....
New York—Continued.		
Cape Vincent, Wilsons Bay	.....	18,200,000
Cooperstown, Otsego Lake	.....	841,800
Grenadier Island, Lake Ontario	.....	5,000,000
New York, New York Aquarium	30,000	.....
Tibbetts Point, Lake Ontario	.....	500,000
Ohio:		
Catawba Island, Lake Erie	.....	10,000,000
Isle St. George, Lake Erie	.....	20,000,000
Kelleys Island, Lake Erie	.....	40,000,000
Lakeside, Ohio Fish Commission	2,035,000	.....
Lakeside, Lake Erie	.....	10,000,000
Middle Bass Island, Lake Erie	.....	10,000,000
Port Clinton, Lake Erie	.....	20,000,000
Put-in Bay, Lake Erie	.....	30,000,000
Pennsylvania:		
Erie, Pennsylvania Fish Commission	41,976,000	.....
Washington:		
Bellingham, Washington Fish Commission	518,000	.....
Wisconsin:		
Aminicon River, off mouth, in Lake Superior	.....	2,000,000
Oshkosh, Wisconsin Fish Commission	20,700,000	.....
New Zealand:		
Wellington, New Zealand government	2,000,000	.....
Total [c]	73,099,000	263,400,800

[a] 100,000 fry were lost in transit.
[b] Of this plant 1,140,000 were bluefin whitefish.
[c] 56,200 fry were lost in transit.

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

LAKE HERRING.

State, locality, and disposition.	Eggs.	Fry.	State, locality, and disposition.	Eggs.	Fry.
Ohio:			New Zealand:		
Kelleys Island, Lake Erie		3,410,000	Wellington, New Zealand government	1,000,000	
Lakeside, Ohio Fish Commission	35,300,000		Total	38,300,000	3,410,000
Pennsylvania:					
Erie, Pennsylvania Fish Commission	2,000,000				

CHINOOK SALMON.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
California:			
Baird, McCloud River		3,488,552	
Brookdale, Santa Cruz County Hatchery	932,440		
Eel River, California Fish Commission	9,943,320		
Sisson, California Fish Commission	96,190,685		
Oregon:			
Astoria, Oregon Fish Commission	7,714,000		
Clackamas, Clackamas River		2,372,490	36,880
Portland, Lewis and Clark Exposition	48,200		11,100
Rogue River, Rogue River		47,500	75,000
Viento, Columbia River		7,212,000	
Little White Salmon River		828,100	
Willamette, Willamette River		34,481	
Washington:			
Baker Lake, Lower Baker River		44,953	
Birdsview, Grandy Creek		88,437	
Underwood, Columbia River		6,478,415	
Spring Branch		200,000	
Argentina:			
Buenos Aires, Argentine Government	300,000		
New Zealand:			
Wellington, New Zealand government	500,000		
Total	115,628,645	20,789,928	122,980

SILVER SALMON.

California:			
Brookdale, Santa Cruz County Hatchery	50,000		
Maine:			
East Orland, Alamoosook Lake			3,000
Craig Pond			1,000
Heart Pond			1,000
Toddy Pond			3,000
Michigan:			
Detroit, Belle Isle Aquarium	10,000		
New Hampshire:			
Laconia, New Hampshire Fish Commission	90,000		
Oregon:			
Clackamas, Clackamas River			300
Washington:			
Baker Lake Station, Lower Baker River		4,427,145	
Birdsview, Grandy Creek		900,000	14,840
Phinney Creek		1,118,429	
Argentina:			
Buenos Aires, Argentine Government	89,180		
Total	239,180	6,445,574	23,140

BLUEBACK SALMON.

Alaska:			
Yes Lake, Yes Lake		6,638,550	
Washington:			
Baker Lake Station, lower Baker River		3,285,130	
Birdsview, Grandy Creek			9,500
Argentina:			
Buenos Aires, Argentine Government	122,500		
Total	122,500	9,923,680	9,500

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

HUMPBACK SALMON.

State, locality, and disposition.	Eggs.	Fry.
Maine:		
Brunswick, Androscoggin River		75,000
Bucksport, Dead Brook		20,000
Harrimans Brook		5,000
Hurds Brook		5,000
Kents Brook		1,400
Smelt Brook		8,900
Wassons Brook		1,400
East Orland, Alamoosook Lake		40,000
Craig Brook		5,000
Heart Pond		5,000
Ellsworth, Union River		50,000
Gardiner, Kennebec River		50,000
Hallowell, Kennebec River		75,000
Orland, Leaches Brook		1,425
Narramissic River		45,000
Maine—Continued.		
Orland, Orland River		32,500
Phillips Brook		10,000
Saunders Brook		1,400
Stovers Brook		1,425
Penobscot, Pierces Creek		25,000
South Orrington, Mill Creek		12,564
Penobscot River		12,500
Surry, Patten Brook		25,000
Watervilie, Kennebec River		50,000
New York:		
New York, New York Aquarium	2,000	
Washington:		
Birdsview, Grandy Creek		969,990
Total	2,000	1,528,504

STEELHEAD TROUT.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Arkansas:			
Fulton County, Sharps Mill Pond			13,000
Mammoth Spring, Mammoth Spring			18,000
Iowa:			
Spirit Lake, Lake Okoboji			165
Michigan:			
Channing, Lake Helen		14,400	
Detroit, Belle Isle Aquarium	5,000		8
Indian River, Big Sturgeon River		14,000	
Rapid City, Torch Lake		19,000	
Sidnaw, Bonney Lake			6,000
Turtle, Thousand Island Lake		14,400	
Watersmeet, Clark Lake			10,000
Minnesota:			
Duluth, Canosia Lake			10,000
Eastern Branch of Lester River		6,000	
Lester River			5,000
Millers Creek			10,000
Pike Lake			7,000
Rush City, Rush River		5,000	
St. Louis County, Embarrass River		4,000	
Sucker River		8,000	
Tower, Trout Lake			5,000
Missouri:			
Chicopee, Current River			15,000
Montana:			
Bozeman, Mystic Lake			4,000
Deer Lodge, Rock Creek Lake			5,000
Divide, Big Hole River			5,000
Gallatin County, Bridger Creek			10,000
New Hampshire:			
Amherst, Baboosic Lake			6,500
Canobie Lake, Cobbetts Lake			5,000
Concord, Penacook Lake		9,900	4,000
Oregon:			
Clackamas, Clackamas River		1,213,920	4,600
Clear Creek		44,000	
Grants Pass, Applegate Creek		6,800	
Milwaukee, Fadden & Peters	10,000		
Portland, Lewis and Clark Exposition	48,000		
Rogue River Station, Elk Creek		5,825	
Willamette, Willamette River			19,783
Vermont:			
Barton, Crystal Lake		36,580	
Barton Landing, Willoughby Lake		35,114	
Chester, Lovell Lake		10,000	
Washington:			
Birdsview, Grandy Creek		250,000	
Phinney Creek		240,000	
Chehalis, Meyer's pond		3,420	
Everett, Spring Brook			7,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

STEELHEAD TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Washington—Continued.			
Hamilton, Carys Lake		50,000	
Seattle, Sammamish Lake		20,520	
Silver Beach, Whatcom Lake			8,000
Wisconsin:			
Grantsburg, Spirit Lake		8,000	
Lampson, Piling Lake		8,000	
Spooner, Calvert Lake		12,000	
Wyoming:			
Wolf, Wyoming Fish Commission	50,000		
Total [a]	118,000	2,038,879	178,056

RAINBOW TROUT.

Arizona:			
Flagstaff, Live Oak Creek			500
Upper Oak Creek			500
West Fork of Oak Creek			1,000
Grand Canyon, Bright Angel Creek			500
Arkansas:			
Decatur, St. Elmo Springs			10,000
Fulton County, South Fork Creek			2,000
Mammoth Spring, English Creek			2,000
Myatt River			3,000
Spring River			2,000
Monte Ne, Monte Ne Lake			10,000
Sulphur Spring, Butler Creek			6,800
Railroad Lake			7,200
California:			
Baird, McCloud River		7,715	138
Colorado:			
Aspen, Castle Creek			5,000
Buffalo, Lake Cheeseman			25,000
Cascade, Cascade Creek			5,000
Cimarron, Alex. Van Boxel	10,000		
Leadville, Middle Evergreen Lakes			25,000
School aquarium			5
Sugar Loaf reservoir			50,000
Malta, Musgrove's lake			20,000
Salida, Leo's pond		9,000	
West Cliff, De Weese Lake			24,850
Connecticut:			
Coscob, Coscob Brook			400
Georgia:			
Cartersville, Pine Log Creek			1,800
Clayton, Darnells Creek			840
Pine Mountain, West Fork of Chattooga River			1,000
Idaho:			
Cambridge, Rush Creek			2,985
Hay Spur Siding, Silver Creek			1,500
Hope, Pend d'Oreille Lake			3,200
Lake, applicant	10,000		
Mackay, Big Lost River			2,000
Pebble, Port Neuf River			1,500
Iowa:			
Charles City, Cedar River		25,000	
Cherokee, Little Sioux River		25,000	
Chester, Etna Creek		20,000	
Fresco, Turkey River		20,000	
Decorah, Canoe Creek		45,000	4,000
Trout Run			9,000
Twin Spring Creek			2,000
Elgin, Lehman Creek			3,000
Estherville, West Fork of Des Moines River		25,000	
Fayette, Volga River			20,000
Independence, Otter Creek		15,000	
Ionia, Wapsipinicon River		25,000	
Iowa Falls, Iowa River		25,000	
Lansing, Clear Creek			5,000
Manchester, Maquoketa River			15,000
Spring Branch			10,240
Nora Springs, Shell Rock River		25,000	
North McGregor, Bloody Run			15,000
Waukon, Paint Creek		20,000	3,500
Patterson Creek			8,500
Village Creek		20,000	8,000

[a] 10,500 fry and 1,002 fingerlings were lost in transit.

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

RAINBOW TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Kansas:			
Pratt, Kansas Fish Commission			1,000
Maine:			
East Orland, Craig Pond			48
Maryland:			
Adamstown, Tuscarora Creek			1,500
Baltimore, Maryland Fish Commission	50,000		
Bel Air, Claggetts Run			100
Cool Branch Run			300
Stony Creek			500
Stout Battle Creek			300
Cabin John Bridge, Bowie Creek		19,700	
Cumberland, Evitts Creek			1,500
Garrett County, McKenzie's pond			250
Hyattsville, Paint Branch			1,000
Kensington, Rock Creek			1,550
Mount Airy, *Molesworth's pond*			300
Oakland, Lake Seneca			2,000
McHenry Lake			300
Rocky Ridge, Owen Creek			1,500
Washington Grove, Carlyle's pond			442
Massachusetts:			
Gloucester, Haskell's Brook Reservoir			1,000
North Hatfield, Mill River			1,200
Saundersville, Quinsigamond River			1,200
Watuppa, Watuppa Lake			1,500
Wilkinsonville, Massachusetts Fish Commission	27,400		
Michigan:			
Hanover, Kalamazoo River		8,000	
Kalamazoo, Portage Creek		8,000	
New Buffalo, Spring Brook		6,000	
Otsego, Pine Creek		8,000	
Minnesota:			
Duluth, Minnesota Fish Commission—			
Colquet River			1,000
Gills River			2,000
Knife River			5,000
Pine River			2,000
Schultz Creek			1,000
Red Wing, Belle Creek			4,000
Missouri:			
Arlington, Gasconade River			4,000
Belton, Barr Pond			2,000
Billings, Estes' pond			1,200
Garoutte's spring			480
Bourbon, Blue Licht Spring			6,000
Blue Lodge Spring			1,200
Blue Springs River			1,913
Brazil River			1,912
Brookline, Cave Spring Pond			10,000
Club House, Current River			12,900
Crocker, Gasconade River			1,000
Schlichts Spring			1,200
Fanning, Elm Spring Ponds			1,000
Krebs' lake			10,000
Gates, James River			3,000
Goodman, McIntyre's pond			500
Monett, Railroad Reservoir			1,000
Myrtle, Eleven Point River			5,000
Neosho, McMahon's spring brook			125
Newburg, Little Piney Creek			3,500
Ozark, Finley Creek			8,000
Saint James, Meramec River			2,200
Meramec Spring			4,000
Schlichts, Schlichts Spring			8,500
Springfield, Gollinick's pond			500
James River			1,000
Montana:			
Columbia Falls, Deer Lake			750
Fish Lake			750
Deer Lodge, Rock Creek			2,000
Dillon, Alkali Creek			2,000
Blacktail Deer Creek			4,000
Fortine, Grave Creek			1,500
Griffith Creek			1,500
Gallatin County, Penwell Creek Ponds			20,000
Lewistown, Spring Creek			2,000
Missoula, Rattlesnake Creek			2,000
Pony, Willow Creek			2,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

RAINBOW TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Montana—Continued.			
Redrock, Ross Lake			2,500
Spring Run			2,500
Ward's spring run			3,000
Shelby, Moltz's creek			1,500
Stevensville, Spring Creek			1,500
Victor, Etna Pond			500
Nebraska:			
Chadron, Chadron Creek			1,000
Dead Horse Creek			1,000
Crawford, White River			30,000
Gretna, Nebraska Fish Commission	95,000		
Nevada:			
Austin, Big Creek			6,000
Callaghan Creek			6,000
Kingston Creek			6,000
Skull Creek			6,000
Upper Reese River			6,000
New Hampshire:			
Potter Place, Lake Mann			600
Warren, Baker River			1,500
West Swanzey, Spring Creek			1,000
New Jersey:			
Netcong, Lubber Run			1,000
New Mexico:			
Alamogordo, Shepherd's pond			200
Glorietta, Pecos River			400
Las Vegas, Sapello Creek			500
Trout Springs Lake			200
Maxwell City, Ponil Creek			500
Mountain Park, Wright's pond			200
Raton, Schwacheim Reservoir			500
Santa Fe, Power Reservoir			146
Springer, Moreno Creek			500
New York:			
New York, New York Aquarium	5,000		
North Carolina:			
Almond, Rattlesnake Creek			3,000
Brevard, Tanes Creek			1,000
Bushnell, Bunches Creek			800
Hazel Creek			1,000
Sugar Fork Creek			700
Yellow Creek			800
Cranberry, Little Elk Creek			1,800
Graphiteville, Mill Creek			1,000
Greensboro, Phipps' pond			800
Hominy, Bens Branch			600
Horse Shoe, French Broad River			1,250
Huntdale, Nolichucky River			15,000
Jackson County, Bad Creek			450
Georgetown Creek			1,500
Logans Creek			450
Nix Creek			450
Tributaries of Lake Fairfield			750
Lake Toxaway, Big Hogback Creek			450
Bold Branch			450
J. C. Burrows	73,500		
Deep Fork Creek			1,500
Double Bridges Creek			450
Fairfield Lake			3,500
Hogback Creek			450
Horse Pasture River			2,000
Jeems Creek			450
Lake Toxaway			2,500
Mill Creek			1,500
Sapphire Lake			2,000
Toxaway River			2,250
Tributaries of Lake Toxaway			7,650
Marion, Armstrong Creek			933
Brights Creek			800
Buck Creek			1,000
Bush Creek			934
Cedar Cove Creek			800
Clear Creek			1,733
Cove Creek			1,000
Jakes Creek			1,000
Little Bush Creek			933
North Fork of Catawba River			2,700
Buck Creek			1,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

RAINBOW TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
North Carolina—Continued.			
Marion, Sams Creek			933
Toms Creek			1,934
Woods Creek			800
Mount Sterling, Big Creek			13,500
Nebo, Mitchells Creek			1,000
Polkton, Lanes Creek			1,500
Raleigh, Smith's pond			500
Rutherfordton, Cone Creek			900
Stone Cutter Creek			900
Selica, Catheys Creek			1,000
Davidsons Creek			2,600
Spray, Medame Pond			800
Spruce Pine, Grassy Creek			1,000
North Toe River			2,200
Toe River			1,000
Thermal City, North Fork of Broad River			1,000
Topton, Bear Creek			600
Mountain Creek			700
Mantahalah River			2,000
Watauga County, Beaver Dam Creek			800
Waynesville, Allens Creek			2,000
Campbell's creek			800
Caney Fork Creek			1,200
Cataloochee Creek			1,000
Deep Gap Creek			800
Smather's creek			800
Sorrels Creek			600
Winston-Salem, Waughtown Pond			800
Zirconia, Green River			1,250
Oklahoma:			
Mangum, Moss Creek			500
Oregon:			
Carlton, Meadow Lake			4,000
Clackamas, Clackamas River			25
Clackamas County, Eagle Creek			4,000
Cottage Grove, Coast Fork of Willamette River			1,200
Row River			1,200
Forest Grove, Galer Creek			3,000
West Dairy Creek			3,000
Haines, Eilertsen's Lake			2,000
North Powder Lake			3,985
Vanpatten Lake			3,985
Hood River, Hood River			6,000
Lost Lake			3,000
La Grande, Grande Ronde River			4,000
Mill Creek			2,990
Oregon City, Canion Creek			4,000
Pendleton, Umatilla River			2,400
The Dalles, Eight Mile Creek			4,000
Union, Catherine Creek			3,000
Pennsylvania:			
Alexandria, Loop Run			1,200
Ashland, Blass Run			700
Brush Valley Creek			1,200
Hoffmans Creek			600
Little Mahanoy Creek			800
Pump Hollow Reservoir			500
Rattling Run			800
Summit Pond			500
Whitners Run			800
Bedford, Bobs Creek			800
Hammonds pond			300
Birdsboro, Beaver Run			500
Bruin, Bear Creek			600
Camal, Freeman Run			500
Mill Run			1,800
Miller Run			2,000
Otter Creek			2,750
Slate Run			2,200
Trout Run			1,000
Truman Run			1,000
Centralia, Brush Valley Creek			1,500
Clifton, Pond Creek			800
Trout Creek			1,000
Cogan Station, Mill Creek			3,500
Corry, Pennsylvania Fish Commission	97,000		
Coudersport, head of Allegheny River			600
Ice Pond			600

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

RAINBOW TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Pennsylvania—Continued.			
Dawson, Furnace Run Pond			500
Delta, Tributary of Scotts Run			600
East Mahanoy Junction, Lakeside Lake			1,500
Flowing Spring, Canoe Creek			1,200
Frackville, Blackberry Run			600
Kaufman Creek			800
Little Mahanoy Creek			800
Tower Run			500
Gaines Junction, Phoenix Creek			1,000
Pine Creek			1,250
West Branch of Elk Run			400
Galeton, Pine Creek			1,000
Girardville, Brush Valley Creek			1,000
Gordon, Little Mahanoy Creek			800
Mahanoy Creek			800
Great Bend, Trowbridge Creek			1,800
Hamburg, Plumb Creek			800
Hopewell, Steele Run			400
Jamison City, Sullivan Branch			500
Marienville, Maple Creek			1,500
Millstone Creek			2,800
Salmon Creek			2,800
Mount Joy, Donegal Pond			700
Quarryville, Aments Pond			300
Ralston, Rock Run			2,500
Reading, Willow Creek			800
Rising Springs, Decker Valley Creek			800
Elk Creek			1,200
Laurel Run			2,000
Penns Creek			2,000
Poe Creek			1,000
Sinking Creek			1,000
Synagogue Creek			800
Shade Gap, Mountain Run			500
Stauffers Run			300
Stewartstown, Fries Run			400
Tamaqua, Beaver Creek			700
Frantz Run			600
Millers Run			700
Roplich Run			600
Nesquahoning Creek			800
Owl Creek			600
Rabbit Run			600
Still Creek			800
Upper Rapid Run			600
Weldys Run			600
Wild Cat Run			800
Zimmermans Creek			600
Wheelerville, Elk Creek			3,200
Windber, Clear Shade Creek			2,300
Cub Run			2,000
Dark Shade Creek			2,000
Little Paint Creek			4,000
Pine Run			2,000
Roaring Fork Creek			2,000
Womelsdorf, Orphans Home Pond			600
York, Spring Brook			800
South Carolina:			
Rosmon, Estatoe Creek			800
South Dakota:			
Elmore, Spearfish Creek			45,000
Keystone, Iron Creek			1,500
St. Onge, False Bottom Creek			1,000
Tennessee:			
Blevins, Tiger Creek			800
Bolivar, Mitchell's pond			500
Brace, fork of Buffalo Creek			2,100
Butler, Pierces Mill Pond			18,000
Spring Branch			10,000
Carters Creek, Walters' pond			150
Dickson, Spring Pond			450
Doe, Doe Creek			20,000
Dunn, branch of Sugar Creek			1,050
Mockeson Creek			1,050
Sugar Creek			1,200
Fishery, Spring Branch			6,549
Fosterville, Barnes's lake			300
Graham, Piney River			1,500
Granger County, German Creek			26,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

RAINBOW TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Tennessee—Continued.			
Greeneville, Paint Creek			1,225
Hampton, Cave Springs			800
Doe River			1,200
Laurel Fork Creek			2,000
Simerly Creek			1,000
Stoney Creek			1,000
Holder, Wildwood Lake			6,000
Jackson, Waterworks Lake			1,000
Lyle, Mill Creek			1,500
McMinnville, Pine and Link creeks			30,000
Mountain City, head of Doe River			2,400
North Fork of Roans Creek			20,000
South Fork of Roans Creek			10,000
Newport, Mason's pond			300
Normandy, Duck River			1,500
Roan Mountain, Doe River			800
Heaton Creek			500
Sugar Hollow Creek			500
Rockwood, Tarwater's pond			10,000
Shell Creek, Shell Creek			500
Wilson Creek			500
Sherman Heights, Spring Lake			300
Tazewell, Chadwell's pond			600
Tazewell Pond			8,000
Vasper, Disney Lake			15,000
Virginia:			
Abingdon, Browning's pond			3,000
Alleghany, Dunlap Creek			600
Cleveland, Little Cedar Creek			1,200
Clifton Forge, Wilsons Creek			10,486
Fairwood, Fox Creek			1,250
Gate City, Big Moccasin Creek			10,000
Herndon, Ranes Branch			2,000
Hunters, Snake Den Creek			4,950
Leesburg, Lime Kiln Pond			3,000
Maidens, Leatherwood Creek			1,250
Middletown, Marlboro Creek			5,000
Mount Jackson, Mill Creek			30,000
Nethers, Hughes River			1,200
Newcastle, Granies Run			10,000
Rye Valley, South Fork of Holston River			15,000
Wilkinson's pond			4,000
Tazewell, Peery's pond			400
Troutdale, Big Helton Creek			2,000
Winchester, Mill Creek			1,000
Wytheville, Tates Run			76
Washington:			
Chehalis, Newaukum River			4,997
Davenport, Lone Pine Pond			1,000
Elma, Kenninan Lake			2,000
Everett, W. Newell	9,500		
Hood River, Rattlesnake Creek			3,000
North Yakima, Natches River			3,950
Pomeroy, Theinnert's pond			500
Republic, Copper Lake			500
Mud Lake			3,985
Scotia, Diamond Lake			1,500
Tacoma, Maplewood Springs			4,000
Rainbow Lake			9,992
Walla Walla, Mill Creek			3,000
Wilbur, Wild Goose Creek			1,000
Yelm, Des Chutes River			2,000
West Virginia;			
Beard, Laurel Run			2,500
Beury, Glade Creek			1,500
Charlestown, Evetts Run			12,000
Craddock, Hell Run			10,000
Davis, Blackwater River			2,000
Dobbin, Stony River			1,500
Elkins, Little Black Fork Creek			1,000
Hot Springs, Jackson River			2,000
Jones Spring, Mill Creek			186
Marlinton, Knapps Creek			50,000
Williams River			700
Martinsburg, Showers' ice pond			2,000
Tuscarora Creek			25,000
Porterwood, Pleasant Run			1,500
Ronceverte, Bell's branch			1,500
Talcott, Greenbrier River			1,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

RAINBOW TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
West Virginia—Continued.			
White Sulphur Springs, Howard Creek			900
Wilsondale, Twelve Pole Creek			1,500
Wisconsin:			
Alma Center, Bovee Creek			2,000
Beldenville, Rush River		25,000	
Elcho, Swamp Creek			2,000
La Crosse, Coon Creek			250
Kralls Creek			250
Menominee, Wilson Creek		15,000	
Neshkoro, White River			2,500
Soldiers Grove, Wisconsin Fish Commission:			
Bear Creek			2,900
Johnson Creek			1,600
Soldiers Grove Creek			4,250
Towerville Creek			2,600
Trout Creek			3,750
Tomah, Council Creek			250
Deer Creek			250
Dixon Creek			250
Mud Creek			1,750
Sparta Creek			250
Tar Creek			250
Withee, Withee Creek			1,900
Wyoming:			
Garland, Shell Creek			2,500
Sheridan, Hannah Creek			500
Wolf, Wolf Creek			35,000
Yellowstone Park, Gibbon River			10,000
Argentina:			
Buenos Aires, Argentine Government	24,000		
Total[a]	401,400	395,415	1,398,755

ATLANTIC SALMON.

Maine:			
Brownville, Pleasant River			22,000
East Orland, Alamoosook Lake			17
Passadumkeag, Penobscot River			57,200
Penobscot County, Penobscot River		1,897,607	
Total		1,897,607	79,217

LANDLOCKED SALMON.

California:			
Sisson, California Fish Commission	10,000		
Idaho:			
Caldwell, Boise River			5,000
Coeur d'Alene, Hayden Lake			750
Rathdrum, Spirit Lake			750
Maine:			
Auburn, Lake Auburn		9,750	
Taylor Pond		9,750	
Bangor, Phillips Lake			400
Belfast, Andrews Pond			300
Quantabacook Pond		12,000	400
Swan Lake			400
Bethel, Songo Lake			300
Bingham, Pierce Pond			450
Brooks, Passassgassakeag Pond			300
Camden, Alford Lake			400
Canaan Lake			400
Hobbs' pond			300
Carrabassett, Big Carry Pond			400
Spring Lake			500
West Carry Pond			375
Ellsworth Falls, King Pond		10,000	
Long Lake Pond		10,000	
Rift Pond		10,000	
Farmington, Chain of Ponds		15,000	
Clear Water Pond		15,000	4,900
Little Jim Pond			300
Mount Blue Pond			400

[a] 7,291 fingerlings were lost in transit.

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

LANDLOCKED SALMON—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Maine—Continued.			
Farmington, Sweets Pond		10,000	300
Varnums Pond		10,000	
Foxcroft, Sebec Lake		15,000	
Greenville Junction, Arnold Pond		5,000	
Crosby Pond		5,000	
Lower Wilson Pond		9,000	
Moosehead Lake		48,000	2,000
Prong Pond		8,000	
Rum Pond		8,000	
Shadow Pond		4,000	
Upper Wilson Pond		8,000	
Wilson Pond		10,000	
Hartland, Moose Pond			900
Morrill Pond			600
Kingman, Molunkus Lake			400
Monmouth, Maine Fish Commission	100,000		
Mount Desert Ferry, Long or Great Pond			500
Oquossoc, Rangeley Lakes			900
Portage, Portage Deadwater		13,300	
Presque Isle, Squawpan Lake			1,100
Princeton, Sysladobsis Lake		20,000	
Rockland, Alfords Lake		10,000	300
Mirror Lake			300
Sebago Lake, Sebago Lake		25,000	
Skowhegan, Lake George			400
Smyrna Mills, Umculcus Lake			500
Strong, Sweets Pond			400
Summit, Swift Creek		22,000	
Thorndike, Lake St. George			600
Union, Crawfords Lake			800
Washington County, Grand Lake		117,000	
Willimantic, Shippond Creek			3,648
Wilson Creek			3,569
Wilton, Wilson Lake			300
Winn, Duck and Junior lakes		20,000	
Winterville, St. Froid Lake			600
Massachusetts:			
Braintree, Kennel Club Pond			500
Pocasset, Tahanto Club	4,000		
Saundersville, Silver Lake			1,100
Wilkinsonville, Massachusetts Fish Commission	20,000		
Michigan:			
Munising, Cleveland Cliffs Iron Company	10,000		
Sault Ste. Marie, Michigan Fish Commission	10,000		
New Hampshire:			
Center Ossipee, Connor Pond			500
Dan Hole Pond			600
Concord, Penacook Lake			600
Coos County, Connecticut Lake			834
Enfield, Crystal Lake			500
Franklin, Webster Lake			500
Keene, Granite Lake			500
Lake Sunapee, Lake Sunapee			13,640
Manchester, Massabesic Lake			1,700
Newbury, Lake Sunapee			2,150
Penacook, Pickard Brook			250
Pike, Tarleton Lake			500
Potter Place, Johnson's pond			800
Pleasant Lake			500
Rumney, Stinson Lake			5,666
New York:			
Clear Water, Racquette Lake			1,200
Tuppe Lake, Lake Madeleine			600
North Carolina:			
Lake Toxaway, applicant	20,000		
Vermont:			
Barton, Willoughby Lake		6,000	
Essex County, Little Averill Pond		3,500	
Greensboro, Caspian Lake		9,500	
Norton, Little Averill Lake		3,344	
Washington:			
Ephrata, Moses Lake			5,395
Rosalia, Rock Lake			3,000
Argentina:			
Buenos Aires, Argentine Government	20,000		
New Zealand:			
Wellington, New Zealand Government	10,000		
Total[a]	204,000	481,144	75,677

[a] 24,200 fry and 14 fingerlings were lost in transit.

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

BLACKSPOTTED TROUT.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Colorado:			
Aspen, Brush Creek		20,000	
Callicotte's pond		10,000	
Hunter Creek		30,000	
Lilly Lake		10,000	
Maroon Creek and Lake		30,000	
Roaring Fork River		50,000	
Snow Mass Lake		15,000	
Antonito, Conejos River		25,000	
Basalt, Frying Pan River		30,000	
Berry's Ranch, Eagle River		50,000	
Boulder, North Boulder Creek		40,000	
Troutdale pond		15,000	
Buffers Spur, Buffers Lake		20,000	
Buena Vista, Chalk Creek		15,000	
Cottonwood Lake		10,000	
Carbondale, Crystal River		90,000	
Thomas' Lake		10,000	
Cebolla, Elk Creek		30,000	
Lower Cebolla Creek		30,000	
Lower Gunnison River		30,000	
Cedar Creek, Veo Creek		10,000	
Cimarron, Big Cimarron River		65,000	
Diehl Creek		10,000	
Little Cimarron River		50,000	
Clyde, Beaver Creek		40,000	
Collbran, Bear Lake		30,000	
Colona, Onion Lake		10,000	
Thompson Lake		20,000	
Colorada Springs, Baldwin pond		10,000	
Loesch's pond		5,000	
Parmer's pond		50,000	
Prospect Lake		20,000	
Trout Lake		20,000	
Creede, Rio Grande River		99,550	
De Beque, Coon Creek		15,000	
Cottonwood Lake No. 1		15,000	
Del Norte, Rio Grande River		24,875	
Delta, tributaries of Gunnison River		300,000	
Youngs Creek		10,000	
Delta County, Alexander Lake		25,000	
Barren Lake		50,000	
Carp Lake		12,000	
Forest Lake		12,000	
Rock Lake		20,000	
Dexter, Willow Creek		30,000	
Divide, Twin Lakes		10,000	
Eckert, Reservoir		10,000	
Florissant, Platt River		50,000	
South Fork of Platte River		50,000	
Fort Collins, Dowdy Lake		25,000	
North Fork of Cache La Poudre River		15,000	
Golden, Parfet's pond		5,000	
Grand County, Frazier River		40,000	
Grand River		25,000	
Grand Junction, Kahnah Creek		25,000	
Grand Lake, East Inlet of Grand Lake		10,000	
Grand Lake		105,000	
Grand River		30,000	
North Fork of Grand River		15,000	
North Inlet of Grand Lake		30,000	
Grand Valley, Parachute Creek		25,000	
Granite, Garrahan's pond		5,000	
Pine Creek		20,000	
Grant to Dome Rock, North Fork South Platte River		100,000	
Gunnison, Colorado Fish Commission	200,000		
Forest Home Lake		15,000	
Hillside, South Brush Creek		15,000	
Hot Sulphur Springs, Grand River		125,000	
Ivanhoe, Ivanhoe Creek		10,000	
Ivanhoe to Norrie, Frying Pan River		100,000	
La Jara, La Jara River		10,000	
Lake City, Lake Fork of Gunnison River		35,000	
Lake San Cristobal		20,000	
Upper Cebolla Creek		25,000	
Leadville, Arkansas River		25,000	
Lower Lake Creek		20,000	
Tennessee Creek		20,000	
Tennessee Creek and Arkansas River		50,000	

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

BLACKSPOTTED TROUT—Continued.

State, Locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Colorado—Continued.			
Lehman, Grand River		30,000	
South Fork of Grand River		30,000	
Stillwater Creek		10,000	
Lizard Head, Dolores River		5,000	
Loveland, Big Thompson River		60,000	
Fall River		20,000	
Lyons, Fern Lake		20,000	
St. Vrain River		100,000	
Marshall, South Boulder Creek		50,000	
Mesa, Mesa Lake		100,000	
Midland, Loshbaugh's lakes		10,000	
Mintern, Echo Lakes		10,000	
Monte Vista, Conejos River		24,875	
Montrose, Fisher Lake		10,000	
Hanks Creek		10,000	
Little Red Creek		10,000	
Morrison, Bear Creek		20,000	
Norrie, Frying Pan River		20,000	
Red Rock, Beaver Ponds		5,000	
Red Stone, Crystal River		75,000	
Ridgway, Ouray Gun Club Pond		10,000	
Rifle, Rifle Creek		15,000	
Salida, Arkansas River		50,000	
Foos Gutch Creek		20,000	
South Arkansas River		40,000	
Sellar, Sellar Lake		10,000	
Shoshone, Grizzley Creek		30,000	
Sloane, Frying Pan River		20,000	
Snipes, Cottonwood Lakes		40,000	
South Fork, South Fork of Rio Grande		9,950	
Stonewall, Las Animas River		50,000	
Tennessee Pass, Homestake Creek		30,000	
Thomasville, Fellows's lake		10,000	
Lake Alicia		160,000	
Little Lime Creek		10,000	
Spring Creek		15,000	
Victor, Victor Reservoir		25,000	
Woodland Park, Palmer Lake		155,000	
Woodland Park Lake		75,000	
Idaho:			
American Falls, Bonanza Lake			4,000
East Rock Creek			5,000
Bonners Ferry, Sink Creek			4,000
Clarksfork, Loon Lake			5,000
Goodrich, Cow Creek			5,000
Hay Spur Siding, Silver Creek			1,000
Idaho Falls, North Fork Creek			7,000
Snake River			7,000
Inkon, Rabbit Creek Pond			2,000
Kamiah, Spring Pond			1,000
Lenore, Wheeler's pond			1,000
Leonia, Leibrecht's pond			2,000
Lewiston, Waha Lake			5,000
St. Anthony, Kunz Pond			9,000
Soda Springs, Nedo Creek			8,000
Woodall's lake			7,000
Wallace, North Fork of Coeur d'Alene River			8,000
Minnesota:			
St. Paul, Minnesota Fish Commission	150,000		
Montana:			
Anaconda, Mill Creek			8,000
Armington, Big Otter Creek			5,000
Basin, Bison Creek			7,000
Boulder River			7,000
Belton, McDonald Lake			8,000
Billings, Lindsey's lake			5,000
Boulder, Muskrat Creek			7,000
Bozeman, Fish Creek			3,000
Flathead Creek			20,000
G. W. Sparr's ponds			10,000
W. B. Sparr's ponds			10,000
Story and Middle creeks			20,000
Browns Station, Big Hole Creek			5,000
Cherry Creek			5,000
B. and M. Siding, Belt Creek			10,000
Cascade, Big Spring			5,000
Fish Pond			1,000
West Hound Creek			5,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

BLACKSPOTTED TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Montana—Continued.			
Chinook, North Fork of Milk River			10,000
Conrad, Pondera Canal Reservoir			5,000
Craig, North Fork of Stickney Creek			5,000
Stickney Creek			5,000
Wenger Creek			5,000
Dillon, Cottonwood Creek			5,000
Jakes Creek			5,000
Rattlesnake Creek			15,000
Divide, Wise River			6,000
Dorsey, Allebaugh Creek			8,000
Fish Pond			4,000
Flint, Bluebird Lake			1,000
Florence, White Creek			4,000
Gallatin County, Bridger Creek			140,000
East Gallatin River			20,000
Ketterer's pond			10,000
Lyman Creek			20,000
Stone Creek			10,000
West Gallatin River			30,000
Gardiner, Crazy Lakes			7,000
Harlowton, American Fork Creek			8,000
Hopley Creek			8,000
Musselshell River			8,000
Helena, Big Prickly Pear Creek			7,000
Fish Dam			1,000
Heron, Elk Creek			7,000
Kalispel, Sliter's lake			1,000
Lewistown, Armells Creek			9,000
Casino Creek			7,000
Castle Creek			8,000
Flat Willow Creek			11,000
Livingston, Holliday's spring creek			5,000
Shields River			10,000
Spring Creek pond			5,000
Yellowstone River			8,000
Lodge Grass, Little Big Horn River			7,000
Rotten Grass Creek			7,000
Soap Creek			7,000
Martinsdale, Musselshell River			8,000
Marysville, Fish dam			1,000
Melrose, Canyon Creek			5,000
Missoula, Butler Creek			5,000
Grant Creek			10,000
Lavelly Creek			5,000
Rattlesnake Lakes			5,000
Spring Creek			3,000
Stevens's pond			1,000
Monarch, Otto Creek			5,000
Moore, Porter's pond			2,000
Neihart, Belt Creek			7,000
Middle Fork of Judith River			5,000
Norris, Power Co. Reservoir			7,000
Phillipsburg, Georgetown Lake			5,000
Pipestone, Pipestone Creek			8,000
Pony, South Willow Creek			7,000
Willow Creek			7,000
Prickley Pear Junction, Smelter Lake			3,000
Pryor, Pryor Creek			7,000
Red Lodge, Kurtzer's lake			3,000
Redrock, Ross Lake and Inlet			6,000
Scott's spring run			6,000
Ward's spring run			4,000
Salesville, Bear Creek			20,000
Le Bean's pond			10,000
Saltese, Dominion Creek			4,000
Packer Creek			5,000
Randolph Creek			5,000
St. Regis River			8,000
Silver Creek			5,000
Scribner, King's pond			3,000
Piney Creek			5,000
Stevensville, South Burnt Fork Creek			4,000
Thompson, Coleman Creek			4,000
Twodot, Big Elk Creek			8,000
Crooked Creek			7,000
Musselshell River			6,000
Victor, Sweat House Creek			5,000
Wolf Creek, Dearborn River			5,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

BLACKSPOTTED TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Montana—Continued.			
Wolf Creek, Lyons Creek			5,000
Woodville, Nes Perces Creek			7,000
Nebraska:			
Chadron, Beaver Creek		15,000	
Big Bordeaux Creek		20,000	
Chadron Creek		15,000	
Little Bordeaux Creek		15,000	
Nevada:			
Austin, Big Creek		10,000	
Birch Creek		10,000	
Callaghan Creek		10,000	
Kingston Creek		10,000	
Reese River		10,000	
San Juan Creek		10,000	
Skull Creek		10,000	
Sandy, applicant	25,000		
New Mexico:			
Chama, Chama River		15,000	
Espanola, Jemez Creek		20,000	
Glorieta, Mora Creek		20,000	
Panchuelo Creek		20,000	
Rio Pecos River		45,000	
Winsor Creek		20,000	
Las Vegas, Upper Gallinas River		20,000	
Raton, Sugarite Creek		10,000	
Santa Fe, tributary Pecos River		25,000	
Tres Piedras, Tusas Creek		25,000	
Vallesito River		25,000	
New York:			
New York, New York Aquarium	50,000		
Oregon:			
Big Butte, South Fork Big Butte Creek			5,000
Carlton, Meadow Lake			1,100
Clackamas, Clackamas River			1,143
Cottage Grove, Mosby Creek			5,000
Elgin, Looking Glass Creek			5,000
Medford, Bear Creek			4,000
North Yamhill, North Fork Yamhill River			10,000
Oregon City, Buckner Creek			1,143
Milk Creek		5,772	
Molalla River		5,771	
Portland, Lewis and Clark Exposition	300,000		
Rogue River Station, Elk Creek		10,325	
Sheridan, Willamina River			1,100
The Dalles, Fifteen Mile Creek			1,100
Washington County, Dairy Creek			10,000
Pennsylvania:			
Herrick Center, Pennsylvania Fish Commission	75,000		
Milford, Sawkill Creek			5,750
Pittsburg, Luna Park Hatchery	10,000		
South Dakota:			
Buffalo Gap, Beaver Creek		50,000	
Custer, Scott's pond		25,000	
Deadwood, Polo Creek		15,000	
Elmore, Spearfish Creek			40,000
Englewood, Box Elder Creek		20,000	
Criswell's pond		20,000	
Garden Pond		8,000	
Jim Creek		20,000	
North Fork of Little Rapid Creek		70,000	
South Box Elder Creek		70,000	
South Branch Whitewood Creek		30,000	
Galena, Bear Butte Creek		16,000	
Hermosa, Battle River		20,000	
Squaw Creek		20,000	
Hill City, Battle River		40,000	
Slate Creek		7,500	
Spring Creek		135,000	
Squaw Creek		20,000	
Upper Iron Creek		20,000	
Hot Springs, Cold Brook		7,500	
Cold Brook Pond		25,000	
Keystone, Battle River		15,000	
Grizley Creek		7,500	
Iron Creek		7,500	
Maitland, False Bottom Creek		25,000	
Mystic, Castle Creek			10,000
Piedmont, Little Elk Creek		6,000	

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

BLACKSPOTTED TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
South Dakota—Continued.			
Pringle, Cold Spring			10,000
Rapid City, Bennett's pond		21,000	
Box Elder Creek		20,000	
Rapid City, Canyon Creek		20,000	
Electric Light Co. Lake		8,000	
Lime Creek		6,000	
Rapid Creek		102,500	
Sickler's pond		8,000	
Spring Creek		20,000	
Rochford, Castle Creek		50,000	
Rosebud, Black Pipe Creek		35,000	
Roubaix, Hay Creek		8,000	
St. Onge, Spring Creek Lake		10,000	
Spearfish, Chicken Creek		5,000	
Cook's lake		30,000	
Cox Lake		25,000	
Crow Creek		50,000	
Spearfish Creek		605,000	10,000
Water Cress Creek		30,000	
Virgil, Artesian Lake		29,700	
Utah:			
Heber, Provo Creek		150,000	
Ogden, Cortez Reservoir		10,000	
Salt Lake City, Rockwood Springs		5,000	
Spring Creek		10,000	
Virginia:			
Clifton Forge, Wilson Creek			5,000
Sweet Chalybeate Springs, Sweet Springs Branch			5,000
Washington:			
Harrington, Wall Lake			1,800
Lakeview, Lake Steilacoom			5,000
McCormick, Rock Creek			5,000
Marble, Lake Maria			800
Milan, Colers Lake			2,000
Owen's lake			1,000
Northport, Rattlesnake Creek			4,400
West Virginia:			
Elkins, Little Black Fork Creek			15,000
Marlinton, Knapps Creek			2,000
Stony Creek			2,000
Swago Creek			1,000
Morgantown, Aarons Creek			15,000
White Sulphur Springs, Howards Creek			10,000
Wyoming:			
Buelah, Montana Lake		20,000	
Sand Creek		30,000	8,000
Cokeville, Spring Creek		10,000	
Crook County, Sand Creek		25,000	
Laramie, Laramie River		100,000	
Newcastle, Oil Creek		12,000	
Spence Lake		4,000	
Stockade Beaver Creek		28,000	
Sheridan, Beaver Lake		4,000	
Holmes's pond		4,000	
Nelson Lake		4,000	
North Spring Creek		4,000	
Piney Pond		18,500	
Spears Pond		4,000	
Wyoming Fish Commission		14,500	
Story Lake		4,000	
West Thumb, Duck Lake		200,000	
Fisheries Creek		127,600	
Yellowstone Park, Ice Pond		47,000	
Total[a]	810,000	6,988,918	1,100,336

SCOTCH SEA TROUT AND LOCH LEVEN TROUT.

Maine (Scotch sea trout):			
East Orland, Alamoosook Lake			504
Michigan (Loch Leven trout):			
Indian River, Big Sturgeon River		22,525	
South Dakota (Loch Leven trout):			
Savoy, Little Spearfish Creek			78,000
Total		22,525	78,504

[a] 12,050 fry and 6,250 fingerlings were lost in transit.

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

LAKE TROUT.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Connecticut:			
Windsor Locks, Connecticut Fish Commission	300,000		
Indiana:			
Michigan City, Lake Michigan			700
Iowa:			
Spirit Lake, Lake Okoboji			132
Maine:			
East Orland, Toddy Pond			246
Monmouth, Maine Fish Commission	200,000		
Newport, Lake Sebasticook		25,000	
Massachusetts:			
South Ashburnham, Naukeag Lake		25,000	
Michigan:			
Alpena, Hubbard Lake		100,000	
Big Point, St. Marys River		500,000	
Cedar Reef, St. Marys River		500,000	
Charlevoix Reef, Lake Michigan		2,460,000	
Detour, Lake Huron		1,400,000	
Eagle Harbor, Lake Superior		480,000	
Fish Island, Lake Superior		800,000	
Irishmans Reef, Lake Michigan		1,000,000	
Little Rapids, St. Marys River		450,000	
McCargoes Cove, Lake Superior		400,000	
Marquette, Lake Superior		1,145,000	
Munising, Cleveland Cliffs Iron Co	500,000		
North Point, Lake Huron		2,200,000	
Ontonagon, Lake Superior		1,320,000	
Paris, Michigan Fish Commission	1,750,000		
Pointe Aux Pins, St. Marys River		500,000	
Point Iroquois, Lake Superior		500,000	
Sault Ste. Marie, Michigan Fish Commission	3,150,000		
Hay Lake		1,350,000	
St. Marys River		500,000	
Scarecrow Island, Lake Huron		2,200,000	
Skillagille Reef, Lake Michigan		1,040,000	
Tobins Harbor, Lake Superior		800,000	
Washington Harbor, Lake Superior		795,000	
Whitefish Point, Lake Superior		800,000	
Minnesota:			
Duluth, Lake Superior		185,000	
Grand Portage, Lake Superior		301,000	
Susie Island, Lake Superior		387,000	
Two Harbors, Lake Superior		400,000	
New Hampshire:			
Fitzwilliam, Laurel Lake		25,000	
Laconia, New Hampshire Fish Commission	500,000		
New York:			
Auburn, Owasco Lake		20,000	
Caledonia, New York Fish Commission	1,250,000		
Charity Shoals, Lake Ontario		450,000	
Cold Spring Harbor, New York Fish Commission	1,000,000		
Cooperstown, Otsego Lake		34,200	
Dutch Point, Lake Ontario		750,000	
Fallsburg, Alta Lake		9,800	
Fullers Bay, Lake Ontario		360,000	
Grenadier Island, Lake Ontario		2,760,000	
McKeever, Adirondack League Club	200,000		
New York, New York Aquarium	10,000		
Saranac Inn, New York Fish Commission	500,000		
Taggart, New York Fish Commission	1,500,000		
Trout Hole, Lake Ontario		500,000	
Ohio:			
Kelleys Island, Lake Erie		600,000	
Oregon:			
Portland, Lewis and Clark Exposition			5,720
Pennsylvania:			
Conneaut Lake, Conneaut Lake		47,540	
Corry, Pennsylvania Fish Commission	5,000,000		
Glen Eyre, Blooming Grove Fishing Club	50,000		
Union City, Pennsylvania Fish Commission	1,500,000		
Vermont:			
Barton, Crystal Lake		30,000	
Willoughby Lake		35,000	
Essex County, Big Averill Lake		50,000	
Greensboro, Caspian Lake		30,000	
Island Pond, Echo Pond		30,000	
Roxbury, Vermont Fish Commission	500,000		

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

LAKE TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Washington:			
Bellingham, Samish Lake			11,520
Cheney, Badger Lake			3,997
Bonner Lake			4,000
Chapman Lake			3,995
Lakeview, American Lake			10,500
American and Gravelly lakes			13,560
Gravelly Lake			10,500
Pollard, Curlew Lake			4,830
Seattle, Washington Lake			3,500
Wisconsin:			
Bayfield, Wisconsin Fish Commission	7,000,000		
Iron River, off mouth Lake Superior		240,000	
Sand Island, Lake Superior		360,000	
Wyoming:			
Wolf, Wyoming Fish Commission	50,000		
Argentina:			
Buenos Aires, Argentine Government	80,000		
Canada:			
Rossport, Lake Superior		200,000	
New Zealand:			
Wellington, New Zealand government	50,000		
Total [a]	25,090,000	29,084,540	73,200

BROOK TROUT.

Colorado:			
Arrowhead, Vasquez Creek			12,000
Bailey, Deer Creek			15,000
Platte River		15,000	15,000
Berrys, Eagle River			29,500
Buffalo, Platte River		15,000	
Wellington Lake		200,000	
Carbondale, Beaver Dam Creek			15,000
Cassells, Platte River		15,000	
Cebolla, Gunnison River			25,000
Chase, South Platte River		15,000	
Cliff, Platte River		15,000	
Colorado Springs, Banning Lake		10,000	
Bison Creek		10,000	
East Beaver Creek		15,000	
Gould Creek		5,000	
Loesch Lake		10,000	
Middle Beaver Creek		5,000	
Ords Lake		5,000	
Swope's pond			14,970
Creede, B. C. Hosselkus	100,000		
Crooked Lake			10,000
Rio Grande River			3,000
Cripple Creek, Pisgah Lake		5,000	
Del Norte, Benet Creek			15,000
Dillon, Ten Mile Creek		15,000	
Divide, Midland Lake		5,000	
Oil Creek		15,000	
West Beaver Creek		10,000	
Eagle, Eagle River and Tributaries			20,000
Eldora, Lake Eldora		50,000	
Florence, Beaver Creek			10,000
Georgetown, Naylor Lake		5,000	
South Branch of Clear Creek		10,000	5,000
Grand Mesa Lake, Eggleston Lake			165,000
Grant to Dome Rock, Platte River			10,000
Grousemont, Platte River		15,000	
Gunnison, Gunnison River			35,000
Marling Lake			20,000
Gypsum, Eagle River and Tributaries			20,000
Gypsum Creek			4,500
Halls Spur, Steuben Creek			15,000
Hartsel, South Fork of South Platte River		15,000	
Hillside, Hendrickson's pond			9,950
Idaho Springs, Lake Edith		75,000	
Reservoir			8,000
Insmont, Rock Creek		10,000	
Iola, Gunnison River			15,000

[a] 101,000 fry and 538 fingerlings were lost in transit.

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings yearlings, and adults.
Colorado—Continued.			
Leadville, Colorado Fish Commission			a 100,000
Lake Creek			25,000
Musgroves Lake		187,000	
School Aquarium			19
Trout Pond			7,500
Twin Lakes			5,000
Upper Arkansas River			20,000
Zoeble's pond		126,000	
Lyons, St. Vrain River			149,850
Minturn, Eagle River			29,500
Monte Vista, Rock Creek			15,000
Muldoon, South Platte River		15,000	
Pando, Eagle River			34,500
Placita, Crystal River			50,000
Lilly Lake			10,000
Salida, Leo's ponds		48,400	
Shawnee, Platte River		15,000	
South Fork, South Fork Creek			50,000
South Platte, Wigwam Creek		10,000	
Thomasville, Colorado Fish Commission			a 60,000
Frying Pan River			10,000
Woods Lake		252,100	
Webster, Webster Lake		20,000	
West Cliff, De Weese Reservoir			18,000
Woodland Park, Reservoir			15,000
Connecticut:			
Bolton, Box Brook			800
Canaan, Blackberry Creek			8,000
East Hampton, Carter Brook			800
Dickenson Brook			800
Flat Brook			800
Green River			800
Muddy Cutter Creek			600
Saw Mill Brook			800
Goodspeeds, Cone Brook			500
Lewis Brook			500
Pine Brook			500
Sheepskin Creek			500
Tan Yard Brook			500
Wickham Brook			500
Greenwich, East Brother Brook			800
Guilford, Hayman's pond			5,000
New Haven, Crooked Brook			800
Norwalk, Barnum Brook			5,000
Stony Brook			5,000
Georgia:			
Clayton, Kelleys Creek			400
Idaho:			
Alexandria, Bear River			900
Bliss, Lake Willow			300
Lamb's pond			300
Syster's lake			300
Caldwell, Boise River			924
Hay Spur Siding, Silver Creek			1,500
Idaho Falls, Taylor Creek			900
Laclede, Callahan Creek			900
Lewiston, Lake Waha			5,985
Mackay, Big Lost River			2,400
Warm Spring Creek			1,200
Montpelier, Beaver Dam Lake			300
Mountain Home, Long Tom Reservoir			1,800
Pebble, Port Neuf River			1,800
Peck, Alder's pond			300
Big Canyon Creek			1,500
Priest River, Blue Lake			6,250
Rathdrum, Spirit Lake			6,940
Soda Springs, Trout Lake			300
Spencer, Beaver Creek			1,200
Sheridan Creek Pond			900
Troy, Anderson's Pond			300
Cherry Hill Pond			300
Wallace, Upper Fork Coeur d'Alene River			900
Illinois:			
Joliet, Francis Spring Creek			5,000
Indiana:			
Angola, Butler Creek		15,000	
Crooked Creek		15,000	

a The 160,000 brook trout fingerlings delivered to the Colorado Fish Commission were in exchange for rainbow trout eggs.

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Indiana—Continued.			
Angola, Fort Creek		15,000	
Waterhouse Creek		15,000	
Middletons, Lily Pond		10,000	
West Fountain Creek		11,000	
Iowa:			
Cresco, Baker Brook			500
Spring Brook			500
Decorah, Canoe Creek			1,900
Trout Run			1,900
Lansing, Clear Creek			3,000
Village Creek			10,000
McGregor, Bass Creek			1,000
Manchester, Spring Branch			5,000
Kansas:			
Pratt, Ninnescah River			500
Maine:			
Augusta, Cobbosseecontee Lake			2,000
Belfast, Andrews Pond			408
Quantabacook Pond		14,250	546
Swan Lake			546
Belgrade, Great Pond		25,000	
Sebago Lake			2,000
Bethel, B. Pond			800
Wright Brook		20,000	
Bingham, Austins Brook		13,500	
Carry Pond			1,000
Otter Ponds			800
Pierce Pond			1,200
Bluehill, Billings Pond		20,000	
Woods Pond		20,000	
Burnham, Johnson Creek		20,000	
Camden, Canaan Lake			1,200
Canton, Lake Anasagunticook		20,000	
Carrabassett, Spring Lake			800
Cumberland, Red Rock Pond		10,000	500
Dead River, Carry Pond			900
Dead River Pond		18,000	
Greens Pond			800
Dedham, Green Lake		100,000	
East Holden, Moulten Pond		15,000	
East Waterboro, Pickerel Pond			14,500
Sokokis Lake			14,500
Ellsworth, Blunts Pond			800
Mill Creek			1,200
Patten's Pond		25,000	
Rocky Pond			800
Farmington, Bishops Brook			10,000
Clear Water Lake		30,600	800
Maine Fish Commission Ponds			10,000
Mount Blue Pond			800
Sweets Lake			1,000
T. Pond		13,500	
Varnum Pond			900
Flagstaff, Spring Lake			900
Green Lake, Green Lake		4,000	11,345
Greenville Junction, Fitzgerald Pond		15,000	
Horse Shoe Pond		15,000	
Moosehead Lake		60,000	2,000
Northwest Pond		15,000	
Upper Wilson Pond		19,000	
Wilson Pond		40,000	
Hancock County, Branch Pond		50,000	
Holden, Holbrook Pond		25,000	
Phillips Lake		25,000	
Jackman, Attean Pond		19,800	
Katahdin Iron Works, Little Houstin Lake		44,800	
Kingfield, Whetstone Pond			900
Lisbon Falls, Little River		30,000	
Locke Mills, Indiana Pond			500
Onerset Pond			500
South Pond			500
Twitchell Pond			500
Monmouth, Maine Fish Commission	300,000		
Newport, Pillsbury Pond		15,000	
North Anson, Lake Emden			1,000
Norway, Round Pond			500
Oakland, Messalonskee Lake		20,000	
Oquossoc, Mooselookmeguntic Lake			6,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Maine—Continued.			
Orono, Hatcase Lake		15,000	
Parks Pond			800
Otis, Green Lake		100,000	
Portage, Portage Lake		20,000	
Presque Isle, Presque Isle Creek		19,000	2,000
Quaggy Joe Lake			1,000
Rangeley, Beaver Pond			800
Bed Room Pond		13,500	
Big Island Pond		13,500	
Gull Pond			2,000
L. Pond		13,500	
Loon Lake			900
Rock Pond		18,000	
Saddleback Pond		18,000	
Salmon Lake			1,000
Rockland, Branch and Meadow Brooks			1,000
Mirror Lake			800
Sebago Lake, Sebago Lake		65,000	
Skowhegan, Hayden Lake			800
South Paris, Penneesseevasser Lake			1,000
Shag Pond		15,000	
Washburn Pond		12,000	
Spencer, King and Bartlett lakes			900
Stratton, Round Mountain Lake			900
Strong, Sweets Pond			1,900
Summit, Swift Creek		25,000	
Unity, Sandy Creek		23,750	
Waldoboro, Cooney Brook		10,000	
West Paris, Abbott Pond		15,000	1,000
Shag Pond			1,000
South Pond		20,000	
Washburn Pond			800
Winterville, St. Froid Lake			1,200
Wiscasset, Crystal Pond			800
Maryland:			
Bel Air, Broad Run			400
Cabbage Run			300
Claggett's run			200
Deckmans Run			300
Stony Creek			200
Stout Battle Creek			200
Tobacco Run			300
Cumberland, Braddocks Run			500
Yergen's pond			250
Friendsville, Bear Creek			1,500
Garrett County, Piney Run			800
Savage River			1,500
Warner's pond			200
Hancock, Lanes Run			500
Oakland, Henrietta Lake			250
Lake Fordor			1,500
McHenry Lake			1,000
McLain's run			300
Maryland Fish Commission Pond			3,250
Oakleigh, Mine Bank Run			500
Rocks, Murphy's branch			700
Streets Branch			800
Smithburg, Beaver Creek			500
Little Antietam Creek			500
Marsh Run			350
Wallicks Run			350
Whitehall, Spring Branch			350
Massachusetts:			
Braintree, Kennel Club Pond			800
Cottage City, Paint Mill Brook			1,000
Fall River, Fall Brook			800
Greenfield, Barton Brook			800
Bennington's pond			700
Burrington's pond		10,000	
Groton, Baddacook Pond		10,000	
Monson, Meadow Creek		12,000	
Northampton, Parson Brook			1,200
Sutter Brook			1,200
Saundersville, Cobb Brook			1,000
Poor Farm Brook			1,000
Springfield, Thresher Pond			800
Watershop Pond		20,000	
West Barnstable, Hinckleys Ponds		12,000	
Williamsburg, Pine Grover Pond			800
Woods Hole, Pease's pond		12,000	

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

BROOK TROUT—Continued

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Michigan:			
Addison, Posey Creek		15,000	
Alpena, Brush Creek		15,000	
Charlevoix, Jordan Creek		10,000	
Clarenceville, Johnson's pond			1,000
Detroit, Michigan Fish Commission		161,191	
Fenton, Carter Creek		10,000	
Crab Creek		10,000	
Prestons Creek		10,000	
Grayling, Simpsons Lake		15,000	
Greenville, Dickerson Creek		12,000	
Holly, Buckhorn Creek			2,000
Hudson, Fellows Creek			1,000
Indian River, Pigeon River		18,800	
Morenci, Lime Creek			3,000
Silver Creek			3,000
New Buffalo, Perkins' brook		15,000	
Northville, Watercress Creek		5,000	
Owosso, Little Brook		10,000	
Plymouth, Orchard Hill Brook		5,000	
Roscommon, South Branch of Au Sable River			2,000
Town Line Creek			2,000
Shelby, Stony Creek			3,000
Trowbridge, Sturgeon River			4,000
Minnesota:			
Akely, Sent Lake Creek			500
Barker, Clear Creek		7,000	
Carson, Rocky Run		7,000	
Cascade, Cascade River		5,000	
Chicago Bay, Flute Reed Creek		7,000	
Chisholm, Branch of Sturgeon River		4,000	
Dover, Middle Branch of Whitewater Creek			15,000
Duluth, Millers Creek		9,000	
Spirit Lake Creek		9,000	
Tischer Creek		3,000	
West Branch of Lester River		1,000	
Grand Lake, Otter Creek		5,000	
Sunset Creek		5,000	
Holyoke, West Net River		5,000	
Kellogg, Snake and Indian creeks			500
Knife River, Gooseberry River		7,000	
Knife River		7,000	
Silver Creek		7,000	
Split Rock River		7,000	
Proctor, Clear Creek		7,000	
Saginaw, Dutches Creek		5,000	
Twin Valley, Coon Creek			15,000
Fossom Creek			15,000
Heiberg Creek			15,000
Wabasha, Cooks Valley Brook			500
Winona, Four Springs			500
Rollingstone Creek			15,000
Wrenshall, Black Hoof River		10,000	
Missouri:			
Cuba, applicant	10,000		
St. Joseph, Missouri Fish Commission	100,000		
Montana:			
Basin, Cottonwood Creek			1,800
Belgrade, Ross Creek Pond			500
Belt, Belt Creek			1,500
Flint's pond			300
Highwood Creek			1,500
Little Belt Creek			1,200
Belton, Lake Five			1,200
Big Timber, Boulder Creek			2,400
Boulder, Buffalo Creek			900
McDermott Creek			1,200
Bowler, Bennett Lake			600
Bozeman, Mystic Lake			4,000
Sparr's pond			500
Butte, Browns Gulch Creek			2,100
Upper Fish Creek			1,800
Cascade, Sheep Creek			1,500
Deer Lodge, Dog Creek			2,100
Irvine Lake			1,500
Dillon, Ashbaugh Creek			1,000
Fork of Blacktail Deer Creek			2,000
Divide, Woodward Lake			900
Gallatin County, Bridger Creek			10,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Montana—Continued.			
Gardiner, Sheep Mountain Lake			1,500
Glen, Willow Creek			1,500
Great Falls, Johnson Creek			600
Huson, Nine Mile Creek			1,800
Kalispell, Pierces Creek			2,400
Spring Creek			900
Youngs Creek			900
Lewistown, Chippeway Pond			400
Miles City, Tongue River			600
Missoula, Premeault Creek			900
Monida, Spring Pond			900
Neihart, Carpenter Creek			1,200
Pony, Lloyd's pond			300
Willow Creek			3,900
Redrock, Ross Lake and Inlet			300
Scott's spring run			300
Saltese, Big Sunday Creek			900
Copper Creek			900
Rainy Creek			900
Sappingham, Carleton's pond			600
Stevensville, Robertson's pond			900
Twin Bridges, Bear Gulch Creek			1,200
Nebraska:			
Chadron, Dead Horse Creek			35,000
Monowi, Murray's pond			300
South Bend, Nebraska Fish Commission			
Verdigris River			2,000
Nevada:			
Austin, Birch Creek			8,000
New Hampshire:			
Amherst, Shorom Creek		10,000	
Ashland, Big Brown Brook		15,000	1,200
Berlin, Success Pond			1,375
Bradford, Newberry Meadow Brook			1,200
Brookline, Bennett and Robbins brooks			800
Canaan, Bicknell Brook		15,000	
Hains Brook		12,000	
Carroll County, Heads Brook		20,000	
Center Ossipee, Dan Hole Pond			1,200
Colebrook, applicant	30,000		
Concord, Ash Brook			1,800
Thayer's pond			500
East Weare, One Stack Brook			1,200
Stark's pond			300
Epping, Brown Brook		12,000	
French Brook		10,000	
Exeter, Stockels Brook			1,200
Franklin, Call Brook		10,000	
Prescott's pond		10,000	
Grafton, Wild Meadow Pond and Brook			2,000
Greenfield, Alexander Brook			1,000
Cold Spring Brook		10,000	
Miller Creek		12,000	
Moran Brook		15,000	
Ritcherson Brook		15,000	
Groveton, Christine Lake		35,000	
Cold Spring Pond		15,000	
Stratford Bogs Pond			1,175
Hancock, Stevens Brook		10,000	
Hanover, Mink Brook			1,200
Hill, Mill Creek			1,000
Hillsboro, Ellenwood Brook			1,500
Keene, White Brook			1,000
Lebanon, Rix Brook			1,000
Manchester, Bowman Brook			1,000
Browns Brook			1,000
Damon Brook			1,200
Darrah Brook			1,200
Dumpling Brook			1,000
Farm Brook			1,000
Manter Brook			1,200
Mountain Brook			1,000
Nigger Brook			2,000
Patten Brook			1,000
Pierce Brook			1,000
Ray Brook			1,000
Reed Brook		15,000	1,000
Tannery Brook			1,000
Walker Brook			1,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
New Hampshire—Continued.			
Milford, Osgood Creek			1,000
Mount Major, Mill Brook		12,000	
Mount Vernon, Cole Brook			1,000
Nashua, Great Brook			1,200
Howe Brook		10,000	
Lund Brook			1,000
Newbury, Lake Sunapee			1,500
Newport, Cutts Brook		12,000	
Wentworth Pond			1,200
Penacook, Pickard Brook			800
Peterboro, Poor Farm Brook			800
Plymouth, Morse Brook			1,200
Portsmouth, Dearborn Brook		10,000	
Potter Place, Cold Brook			800
Cole Pond			998
Johnson's pond		10,000	970
Pleasant Lake			195
Reeds Ferry, Babboosic Brook			1,200
Riverdale, Smith's pond			800
Rumney, Clark Brook		15,000	
Sanbornville, Mountain Lake			450
Somersworth, Rollins Brook			1,000
Turber Brook			1,000
Sunapee Lake		[a]218,265	
Suncook, Heads Brook			1,000
Warren, Merrill Brook		12,000	1,750
West Derry, Dimple Pond			500
Wilton, Stocknell Pond			800
New Jersey:			
Blairstown, Sucker Pond Creek			600
Boundbrook, Green Brook			500
Branchville, Big Flat Brook and tributaries			3,500
Grenloch, Big Lebanon Creek			500
Hanover, branch of Rancocas Creek			1,000
Montclair, Verona Brook			600
Ogdensburg, Wallkill River			800
Orange, Mountainside Pond			450
Passaic, McDaniels Brook			500
Pattenburg, Mulhackaway Creek			300
Sparta, Sparta Brook			900
Two Bridges, Black Brook			1,000
Wenonah, branch of Big Timber Creek			300
Westwood, Waterford Pond			500
New Mexico:			
Alamogordo, Krause Lake			400
Chama, Chama River			7,000
Glorietta, Pecos River			6,000
Las Vegas, Upper Gallinas River			2,000
Santa Fe, tributary of Pecos River			2,000
New York:			
Antwerp, String Brook		10,000	
Apulia, Butternut Creek		50,000	
Babylon, Flagstaff Lake			150
Phelps Pond			1,800
Bayshore, Oaks Pond			400
Bessemer, Brown Pond		10,000	
Payne's pond		10,000	
Rites's pond		5,000	
Black River, Silver Dale Pond		5,000	
Bliss, North Branch of Wiscoy Creek		10,000	
South Branch of Wiscoy Creek		10,000	
Caledonia, New York Fish Commission		170,000	
Catskill, Kiskatom Creek			800
Chenango Forks, Dunhams Creek		10,000	
Hurlbert Creek		10,000	434
Saye Brook			433
Thomas Brook			433
Dryden, Beaver Creek			1,000
Mud Creek		10,000	
Virgil Creek		15,000	1,000
Eastport, Seatuck Lake			1,500
Ellicottville, Buffalo Creek		10,000	
Stone Pitcher Creek		10,000	
Whig Street Creek		10,000	
Fleischmanns, Mountain Rest Pond			100
Frankfort, Moyer Creek		50,000	
Halfway, Carpenter Brook		10,000	

[a]These were golden trout.

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
New York—Continued.			
Harford Mills, Hay Creek		15,000	
Hunter, Windham Creek			1,500
Long Lake West, Beldon Pond			900
Grass Pond			600
Mount Kisco, Maple Villa Creek			300
Mountain Dale, Braden Brook		10,000	
North Harford, Harford Creek		10,000	
North Java, Tonawanda Creek			100
Owego, Catatonk Creek		50,000	
Nanticoke Creek			600
Patterson, Croton River			1,000
Pelham Manor, Delancy Lake			250
Quaker Bridge, Quaker Run			800
Richland, Pekin Brook			400
Potter Brook			400
Sayville, De Bragga's pond			250
Sherburne, Handsome Brook			500
Springglen, Sandburg Creek			1,500
Syracuse, Mont Fredy Brook		10,000	
Utica, Willow Valley Pond			300
Vernon, Deans Brook		10,000	
Watertown, Mill Creek		15,000	
Waldo Creek		10,000	
North Carolina:			
Boonford, Junaluska Lake			300
Etowah, Willow Creek			500
Hendersonville, Big Willow Creek			1,100
Findlays Creek			400
Lake Toxaway, applicant	45,000		
Horse Pasture River			2,000
Indian Creek			1,500
White Water River			1,950
Marion, Clear Creek			450
Mitchells Creek			450
Toms Creek			700
Montezuma, Lindville River			40,000
Roanes Mills, Nartahalah River			460
Spruce Pine, North Toe River			4,800
Waynesville, Cold Creek			400
East Fork Pigeon River			1,000
Pigeon River			1,600
Shining Creek			600
North Dakota:			
Dickinson, Spring Creek Mill Pond			500
Ohio:			
Bellefontaine, headwaters of Mad River		15,000	
Canal Fulton, Spring Brook		15,000	
Freedom Station, Portage Pond		9,500	
Mansfield, Rocky Run		15,000	
Sites Lake		15,000	
Spring Run		15,000	
York, Miller's Spring		15,000	
Oregon:			
Athena, Umatilla River			924
Brooks, Clear Lake			5,000
Cazadero, Clackamas River			9,840
Dallas, Peal's pond			1,500
Derry, Richards Creek			1,500
Forest Grove, Patton Creek			4,992
Scroggins Creek			4,993
Hillsboro, Geisher's pond			1,000
La Grande, Beaver Creek			1,386
Five Points Creek			1,386
Jordan Creek			1,386
Ladd Creek			1,886
Morgan Lake			8,950
Milwaukee, Bonnett and Lechler Lake			1,500
Mount Angel, Beaver Creek			4,000
Oregon City, Abernathy Creek			8,000
Bee Creek			55
Blankus's pond			2,000
Busch's pond			1,500
Clear Creek			8,040
Milk Creek			8,055
North Fork of Molalla River			8,000
Pendleton, Umatilla River			3,196
Portland, Lewis and Clark Exposition			1,470
Scappoose, Big Springs			1,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906.—Con.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Pennsylvania:			
Abbottstown, Hafer's pond			300
Altoona, Homers Gap Creek			1,500
Juniata Shop Pond			200
Piney Creek			1,000
Spruce Creek			1,000
Ambler, Puffs Spring			400
Andreas, Mountain Brook			300
Pine Creek			300
Ashland, Broad Mountain Creek			500
Rattling Run			500
Ashley, Bow Creek			800
Pine Run			1,000
Atglen, Spring Creek			500
Austin, Freeman Run			800
Morris Run			800
Prouty Creek			900
South Fork Creek			800
Avondale, Pope's creek			300
Barber, Four Mile Run			500
Bear Creek, Bear Run			1,600
Silver Spring Run			300
Beaver, Windymere Pond			200
Bellefonte, Buffalo Run			1,500
Forked Spring			300
Logans Branch			1,300
McBrides Gap Run			700
Pleasant Gap Run			900
Spring Creek			3,700
Bodines, Slacks Run			500
Brookland, Brookland Trout Ponds			250
Cushing Creek			750
Bruin, Clear Creek			300
Silver Creek			1,200
Bushkill, Toms Creek			600
Cammal, Browns Run			500
Hyner Run			750
Young Womans Creek			1,250
Canton, Alba Creek			200
Bales Creek			200
Branches of Rock Run			600
Coons Creek			200
Dry Run			200
Fellows Creek			400
Hougland Branch Creek			500
Hounds Run			200
Locke Creek			200
Lye Run			200
Mays Creek			200
Meeker Creek			300
Minnequa Creek			200
Mill Creek			200
Morgan Creek			300
Pine Swamp Run			200
Rathbone Creek			400
Rush Run			200
Salt Spring Run			400
Schrader Branch			200
Spring Run			500
South Creek			200
Sugar Works Run			300
Tober Creek			200
Towanda Creek			780
Union Creek			200
Watts Creek			200
Williams Creek			200
Wilson Branch			200
Wynne River			200
Yellow Dog Run			200
Carbondale, Lyon Brook			500
Carlisle, Letort Creek			750
Centralia, Brush Valley Creek			400
Hells Kitchen Creek			800
Whiskey Mill Hollow Creek			400
Chester, Naemans Creek			600
Clarendon, Trousela Creek			1,250
Clifton, Ash Creek			500
Coburn, Elk Creek			1,000
Cogan Station, Little Gap Creek			600

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906.—Con.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Pennsylvania—Continued.			
Cogan Station, Roaring Run			585
Sugar Camp Creek			600
West Branch of Hoagland Run			600
Cogan Valley, Buck Horn Creek			600
Hamilton Creek			500
Hoaglan Run			600
Little Gap Creek			400
Long Run			800
Pine Run			300
Rader Branch			600
Rick Run			500
Roaring Run			100
West Branch of Hoagland Run			500
Wolf Run			500
Conneaut Lake, Browns Creek			300
Coudersport, Bells Run			300
Woodcock Run			300
Cresco, Big Bushkill River			1,500
Broadhead Creek			1,500
Cresson, Elmhurst Pond			200
Dallas, Abrams Creek			500
Danville, Blecher's pond			200
Devon, La Fountaine Pond			100
Du Bois, Anderson Creek			600
Baker Run			250
Bear Run			500
Big Anderson Creek			1,250
Burns Pond			250
Cold Run			400
Cupler Run			500
Irvin Run			250
Little Anderson Creek			900
Little Montgomery Creek			900
Painter Run			400
Rock Run			500
Stoney Run			700
Warrens Creek			750
Wolf Creek			400
East Mahanoy Junction, Hickory Run			400
Hosselsock Creek			300
Nigger Hollow Creek			300
Pine Creek			400
Rocky Run			300
East Stroudsburg, McMichaels Creek			800
Marshalls Creek			800
Wigwam Run			300
Ebensburg, James Creek			300
McBride Run			300
North Branch of Conemaugh Creek			300
Roaring Run			300
Emlenton, Crystal Pond			200
Frackville, Crystal Run			400
Little Mahanoy Creek			500
Gaines Junction, Elk Run			600
Johnsons Brook			500
Phoenix Creek			800
Pine Creek			1,500
Glen Union, Bakers Run			750
Mill Run			500
Shoemaker Run			750
Gordon, Leindermuths Creek			400
Mike Rices Creek			300
Rattling Run			750
Ravine Run			350
Great Bend, Coal Spring Brook			500
Green Hill, Lady Run Creek			1,000
Hallstead, Salt Lick Creek			800
Hamburg, Deglers Creek			300
Road Creek			300
Hollidaysburg, Piney Creek			1,500
Honesdale, Calkins Creek			800
East Branch			500
Hopewell, Mountain Creek			500
Sandy Run			400
Three Spring Run			400
Trout Run			500
Yellow Creek			1,600
Indiana, Gilhouser Run			600

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Pennsylvania—Continued.			
Indiana, Huffnagle Creek			600
Rochester's pond			200
Jamison City, Big Run			400
East Branch of Fishing Creek			1,000
Lead Run			400
West Branch of Fishing Creek			800
Keating Summit, Brown Hollow Creek			250
Cowley Run			1,000
Fair Run			300
Indian Run			550
Portage Creek			750
Sinnemahoning Creek			500
West Branch of Freeman Run			500
Landrus, Bobs Creek			600
Laporte, Floodwood Creek			375
Glass Creek			375
Loyal Sock Creek			625
Mill Creek			250
Pole Bridge Creek			250
Shannersburg Creek			375
Laquin, Branch of Schrader Creek			200
Lewisburg, Cherry Run			600
Fisher's branch			600
Panther Run			600
Rapid Run			600
Wickert Run			600
Ligonier, Four Creeks			1,000
Laughlingtown Run			600
Lynns Creek			600
McMullen Creek			300
Mill Creek			800
Old Colony Reservoir			200
Shield's pond			200
Lock Haven, Cedar Run			1,500
Cherry Run			500
Fishing Creek			2,000
Mahanoy City, Cadoras Creek			1,000
Elixir Creek			250
Hassensack Creek			1,250
Kleckner Run			250
Little and Big Wolf Creeks			400
Little Cadoras Creek			250
Locust Creek			1,100
Messer Run			800
Mill Creek			250
Monongahela Creek			250
Pine Creek			300
Silver Creek			500
Stony Run			1,000
Waste House Run			300
Wolfe Run			400
Mifflinburg, Cold Run			300
Half Way Run			400
Hildebrands Run			250
Limestone Run			250
Molle Hollow Run			300
North Branch of Buffalo Creek			1,000
Panther Run			300
Rapid Run			1,000
Raritan Run			300
Smiths Run			300
South Fork			300
Spring Drain Run			250
Sweitzer Run			300
Weiricks Gap Run			250
Yankee Run			400
Milroy, Laurel Run			750
Minersville, Big Creek			500
Mount Carmel, Little Roaring Creek			500
New Philadelphia, Beaver Creek			300
Big Creek			300
Cold Run			300
Lewistown Creek			300
Silver Creek Dam			1,000
Wolf Creek			400
Newtown Square, Fox Chase Lake			200
Northumberland, Johnson's Run			300
Orson, Bone Lake Creek			300
Independent Creek			1,500

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Pennsylvania—Continued.			
Paddy Mountain, Poe Creek			1,000
Paxinos, Irish Valley Creek			400
Phillipsburg, Six Mile Run			800
Pocono Summit, Beaver Creek			300
Georges Run			300
Raders Run			300
Tobyhanna Creek			800
Tunkhannock Creek			500
Wolf Spring Run			300
Pomeroy, Buck Run			300
Portage, Brenans Creek			1,500
Port Allegheny, Coleman Run			800
Combs Creek			1,000
Rock Run			500
Scaffle Lick Creek			800
Skinner Creek			2,750
Pottsville, Black Creek			500
Indian Run			400
Stony Creek			400
Ralston, Frozen Run			400
Pleasant Creek			600
Red Run			600
Rattling Run, Rattling Run			800
Redding, Browns Creek			300
Ohlinger Creek			400
Willow Creek			600
Rising Springs, Laurel Run			1,300
Penns Creek			2,500
Poe Run			100
Sinking Creek			1,500
Stone Creek			1,500
Synagogue Creek			500
Roaring Branch, Elk Run			300
Graves Run			500
Mill Creek			500
Salt Spring Run			500
Sugar Works Run			500
Rockwood, Laurel Creek			900
Neals Run			600
Roaring Run			600
Sabula, Sandy Creek			800
Satterfield, Bear Meadow Creek			295
Howe Run			290
Satterfield Creek			290
Scotland, Philomen Creek			750
Shade Gap, Yeatters Run			300
Sizerville, Indian Run			500
Little Parker Creek			500
Parker Creek			500
Snow Shoe, Beech Creek			1,500
South Fork of Beech Creek			1,500
Somerfield, Hall Run			500
Tub Run			600
Starrucca, Starrucca Creek			500
Stewartstown, Keesey Run			300
Trout Run			150
Stroudsburg, Cherry Creek			500
Marshall Creek			800
Pensyl Creek			600
Red Rock Run			300
Spruce Creek			800
Stony Run			300
Trout Creek			1,100
Wigwam Run			300
Summerhill, Laurel Run			500
Susquehanna, Canawacta Creek			500
Cold Spring Brook			500
Colwell Brook			500
Drinker Creek			2,000
Egypt Creek			500
Roaring Brook			500
Wildcat Creek			500
Tamaqua, Bear Creek			400
Brodes Creek			400
Bushy Run			250
Clouses Creek			300
Cold Run			400
Fedora Creek			600
Gerbers Run			650

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Pennsylvania—Continued.			
Tamaqua, Hills Run			250
Lively Creek			250
Lizzard Creek			400
Locust Creek			400
Mine Run			250
Moss Run			250
Mussel Creek			500
Neiferts Run			250
North Creek			300
Owl Creek			300
Stumpy Run			250
Tionesta, Hoovlers pond			200
Tower City, Clarks Creek			1,200
Trout Run, Trout Run			1,300
Troy, Bullard Creek			400
Chase Run			400
Dry Run			200
Fellows Creek			400
Griffin Creek			400
Kiff Run			600
Leonards Creek			400
Miller Run			200
Morgan Creek			400
Painter Run			400
Porter Creek			400
Rathbone Creek			200
Sugar Creek			400
Tioga River			800
Webbler Creek			200
Tyrone, Vanscoyoc Creek			500
Wheelerville, East Branch of Elk Creek			500
West Fork of Elk Creek			800
Whetham, Rattlesnake Run			1,250
Williamsburg, Biddle's pond			100
Clover Creek			500
McAllister Pond			100
Piney Creek			1,600
Snare Run			300
Spring Run			400
Springfield Run			300
Williamsport, Burtons Branch			300
Doughertys Run			800
Hagermans Run			500
Jones Creek			1,200
Mosquito Creek			800
Wolf Run			500
Yardley, Headley Creek			1,500
South Dakota:			
Big Stone, Geneva Creek			550
Camp Crook, Pie Creek			10,000
Custer, French Creek			75,000
Squaw Creek			30,000
Deer Lick, Beaver Creek			5,000
Elmore, Spearfish Creek			77,000
Fort Meade, Parker's pond			8,000
Gary, Lac Qui Parle Creek			200
Groton, McKee's lake			450
Rapid City, Marshall Creek			15,000
Rapid Creek			12,000
Rochford, Castle Creek			40,000
Roubaix, Bear Butte Creek			40,000
Elk Creek			20,000
Spearfish, Crow Creek			15,000
Higgins Creek			10,000
Spearfish Creek			125,000
Spring Creek			25,000
Sturgis, Cruickshank's pond			10,000
Deadman Creek			20,000
Wessington Springs, Trout Pond			300
Whitewood, Spring Creek			12,000
Tennessee:			
Fishery, Spring Branch			243
Greenville, Jennings Creek			1,190
Roan Mountain, Hampton Creek			15,000
Yellow Mountain Creek			10,000
Utah:			
Heber, Provo River			15,000
Murray, Utah Fish Commission	100,000		

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Utah—Continued.			
Ogden, Joseph Barker	100,000		
B. C. Hosselkus	100,000		
Salt Lake City, Lund Pond			3,000
Ogden River			6,000
Vermont:			
Bethel, Lake Ancel			1,400
Braintree, Greenville Mountain Brook		25,000	
Brattleboro, Bellows Brook			1,500
Coane Creek			1,000
McClure Brook			2,000
Newton Brook			600
Whetstone Brook		15,000	
Castleton, Radigan Pond		15,000	
Cuttingsville, Shrewsberry Pond			3,000
East Dummerston, Salmon Brook		20,000	
Essex County, Leach Pond		35,000	
Greensboro, Caspian Lake			3,650
Groton, Darling Pond		125,000	
Dexter's pond		800	
Hartford, Churchill Brook		10,000	
Holden, Furnace Brook			4,000
Hyde Park, Corry Pond		20,000	
Jamaica, Gorham Brook		12,000	
West Hill Brook		10,000	
Ludlow, Branch Brook		30,000	
Lyndonville, Dish Mill Brook		25,000	
Manchester, Battenkill River			9,000
Montpelier, Kinney Pond		35,000	
Langdon Pond		20,000	1,000
Mallory Brook			1,000
Martin Brook		20,000	
Stewart Brook		10,000	
Vincent Brook		15,000	
Yetter's pond		20,000	
Newbury, Mount Pulaski Pond			400
North Troy, Hunt's pond		5,000	
Norwich, Lake Mitchell			1,200
Passumpsic, Sherherd Gray Brook		15,000	
Pittsford, Furnace Brook			1,731
Hendrick's pond		20,000	
Sugar Hollow Brook			1,500
Proctor, Hospital Pond			500
Putney, Canoe Brook		20,000	
Randolph, Ayers Brook		25,000	
Branch of Ayers Brook		20,000	
Branch of White River			600
Chandler Brook		20,000	
Chandler and Adams Brooks		25,000	
Church Brook		10,000	
Eldredge's pond		20,000	
Grow Brook		25,000	
Gulf Brook		20,000	
Halfway Brook		25,000	
Howard Hill Brook		20,000	
Mafeba Lake		10,000	
Newbury and Meadow Brooks		40,000	
Peth Brook		20,000	
Spear Brook		20,000	
Roxbury, Lake Mansfield		100,000	
Vermont Fish Commission	50,000		
Rutland, Chittenden Reservoir			3,000
Cold River		60,000	
Mendon Creek			1,500
Saint Johnsbury, Frog Pond		20,000	1,000
Hoveys Pond		15,000	
Lawrence Pond		15,000	
Sharon, Crescent Pond		25,000	
South Ryegate, Eli Brook		30,000	
Stowe, Lake Mansfield			3,500
Swanton, Kelley Brook		15,000	
Tonnymon Brook		15,000	
Townshend, Shattuck Brook			2,000
Underhill, Clay Creek			2,000
Waterbury, West Branch			2,000
Wells River, Fish and Game Club Pond			2,000
West Hartford, Dimmick's ponds			1,000
Trout Creek			1,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Vermont—Continued.			
West Norwich, Lake Mitchell		125,000	3,450
White River Junction, Hazen's pond			400
Windsor, Slayton Brook			600
Woodstock, Evergreen Brook			1,000
Lakota Lake		15,000	
Meccawe Lake		15,000	
North Branch of Ottaqueechee River		12,000	
Virginia:			
Amherst, Big Piney River			1,500
Basic City, Jordan's pond			400
Lithia Springs			600
Big Island, applicant	25,000		
Christiansburg, Camp Creek			250
Cleveland, Brumley Creek			800
Red Creek			800
Clifton Forge, Smith Creek			15,500
Covington, Falling Spring Branch			500
Hayes Branch			500
Roaring Run			500
Craig County, Barbours Creek			15,000
Fishersville, Spring Brook			5,000
Gate City, Spring Brook			300
Healing Springs, Healing Springs Creek			300
Hunter, Difficult Run		24,118	
Leesburg, Big Spring			400
Lowmoore, Roaring Run			10,400
Norton, Clear Creek			665
Pugh, Georges Branch			800
Saltpeter Cave, Mayes Branch			15,000
Rudisell Branch			5,000
Turkey Hollow Branch			15,000
Saltville, Trembling Creek			1,000
Sugar Grove, Dickeys Creek			800
Swoope, Cabin Run			15,000
Thoroughfare, Broad Run			1,000
Vienna, Spring Branch			300
Winchester, Red Bud Creek			300
Washington:			
Almira, Fresh Water Lake			600
Blaine, Saving Creek			2,975
Centralia, Fir Creek			3,330
Nelson Creek			3,330
Scammon Creek			3,330
Coulee City, Three Lakes			900
Curlew, Beaver Lake			600
Mary Ann Creek			900
Elma, Cloqualium Creek			10,000
Twidwells Lake			570
Lakeview, Asylum Lake			570
Rap John Lake			580
Sequalichew Lake			570
Spanaway Lake			570
Steilacoom Lake			570
McMurray, Lake McMurray			13,900
Milan, Colers Lake			1,800
Mount Vernon, Lake Ten			3,925
Newport, Bead Lake			3,850
North Yakima, Batchelor Creek			8,560
Cowiche Creek			4,500
Stevenson Creek			5,960
Yakima River			9,900
Porter, Canns Channel			4,995
Porter Creek			4,995
Rosalia, Bonnis Lake			3,990
Scotia, Diamond Lake			1,500
Seattle, Aberfelty Pond			1,100
Dowamish Creek			4,334
Sawyer Lake			4,333
Walsh Lake			4,333
Spokane, Spokane River			8,000
Tacoma, Trout Lake			9,988
Vancouver, Salmon Creek			6,000
White Salmon, Upper White Salmon River			9,000
Wilkeson, Snells Lake			1,998
Winona, Rock Creek			1,200
Yelm, Des Shutes River			6,992
Elbow Lake			570

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
West Virginia:			
Bunker Hill, Bunker Hill Spring Run			10,000
Cloverlick, Clover Creek			10,000
Coalburg, Spring Pond			2,000
Culloden, Indian Fork Creek			20,000
Dan, Beaver Creek			10,000
Davis, Blackwater River			1,200
Red Run			525
Dickson, Twelve Pole Creek			10,000
Dobbins, Red Oak Creek			800
Durbin, Cheat River			600
Meadow Creek			40,000
Elkins, Little Black Fork Creek			8,000
Hambleton, Otter Creek			500
Harman, Horse Camp Run			800
Jones Spring, Mill Creek			100
Martinsburg, Opequan Creek			1,500
Mineral County, Hooper Run			800
Monongah, Spring Pond			300
Morgantown, Tibbs Run			500
North Mountain, Tulisis Creek			15,000
Oakhurst, Spring Branch			1,000
Preston County, Brookside Lake			500
Romney, Mill Creek			29,250
Turn Mill Run			1,000
Stillington, Stillings Creek			10,000
White Sulphur Springs, Howards Creek			36,650
Spring Branch			457
Whitmer, Gandy Creek		40,000	
William, Number Nine Creek			300
Wisconsin:			
Alma, Bear Creek			500
Deer Creek			500
Jans Valley Creek			500
Lee Valley Creek			500
Little Waumandee Creek			800
Rutschow Creek			500
Schultz Creek			500
Trout Creek			500
Wolf Creek			500
Alma Center, Cisna Creek			500
Falls Creek			500
South Branch Creek			800
Stockwell Creek			1,000
Amherst, Eens Creek			5,000
Sannes Creek			10,000
To-morrow Creek			15,000
Waupaca River			15,000
Arcadia, American Valley Creek			5,000
Cowie Creek			5,000
Danuser Valley Creek			5,000
Glencoe Creek			5,000
Irish Valley Creek			5,000
North Fork of Eagle Valley Creek			5,000
South Fork of Eagle Valley Creek			5,000
Thompson Valley Creek			5,000
Trout Run			5,000
Augusta, Bear Grass Creek			800
Coon Gut Creek			5,000
Darrow Creek			5,000
Diamond Creek			5,000
Ivy Creek			20,000
Know Nothing Creek			5,000
Sand Creek			5,000
Baldwin, Kinnickinnic Creek			1,200
Blair, Trumps Creek			10,000
Chippewa Falls, Duncan Creek			700
Drummond, Little Creek			450
Ellsworth, Rush Creek			1,000
Fairchild, McLaren Creek			500
Marvins Creek			500
North Branch Beef River			1,200
Scott Creek			500
Fifield, Spring Branch		5,000	
Fond du Lac, Parsons Creek			1,000
Fountain City, Bohris Valley Creek			500
Brandhorst Creek			500
Eagle Valley Creek			600
Kellers Creek			500

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Wisconsin—Continued.			
Fountain City, Oak Valley Creek			500
Schorpps Valley Creek			500
Yaegris Creek			500
Gordon, Wascott Creek		5,000	
Greenwood, Black Creek			475
Gile Creek			475
Norwegian Creek			700
Rocky Run			475
Hatley, Plover River			2,000
Hazelhurst, Wind Pudding Lake		5,000	
Hixton, Arno Creek			500
Beaty Creek			500
Carron Creek			500
Judkins Creek			500
Mason Creek			500
Sheldon Creek			500
Shurwood Creek			500
Tank Creek			500
Hudson, Trout Brook			5,000
Willow River			15,000
Independence, Borst Valley Creek			10,000
Travers Valley Creek			10,000
Ingram, Middle Fork of Maine Creek		5,000	
La Crosse, Kralls Creek			485
North Branch of Coon Creek			490
Lake Nebagamon, Blueberry Creek			700
Lampson, Trout Lake		5,000	
Lodi, Spring Creek			1,000
Willow Creek			1,000
Maiden Rock, Pine Creek			5,000
Menominee, Annis Creek			5,000
Coon Creek			800
Hall Creek			5,000
Hay Creek			5,000
Irving Creek			10,000
Johnson Creek			5,000
Little Elk Creek			5,000
Lynch Creek			5,000
McCarthys Creek			5,500
Rush Creek			5,000
Schafers Creek			5,000
Simmonson Creek			5,000
Smiths Creek			5,000
Stoner Creek			5,000
Torgerson Creek			5,000
Varney Creek			5,000
Merrillan, Arnold Creek			800
Mondovi, Brunett Valley Creek			500
Carl Creek			500
Cranberry Creek			500
Day Creek			500
Dover Creek			600
Elk Creek			500
Fifteen Creek			500
Glasspoole Creek			500
Harvey Creek			600
Hays Creek			500
Hicks Creek			500
Machmeier Creek			500
Merrit Creek			500
Modena Creek			500
Rock Creek			800
Schreimer Creek			500
Neshkora, Chaffee Creek			800
New Lisbon, White Creek			15,000
Norwalk, Slickman Creek			400
Swamp Creek			500
Twin Spring Valley Creek			400
Weilip Creek			400
Plymouth, Milwaukee River			1,750
Onion Creek			1,750
Princeton, Snake Creek			800
Rice Lake, Yellow River			1,000
Rosendale, Florida Brook			500
Sparta, Clear Creek			500
Coles Creek			1,000
Farmers Valley Creek			500
La Crosse River			1,200

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

BROOK TROUT—Continued.

State, locality, and disposition.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Wisconsin—Continued.			
Taylor, Pine Creek			500
Tomah, Council Creek			485
Derr Creek			485
Dixon Creek			485
Sparta Creek			485
Tar Creek			485
Union Center, North Warner Creek			5,000
Viroqua, Brookville Creek			425
Brush Creek			350
Cheathams Branch			350
Duck Egg Creek			200
Esofa Creek			200
Hinkst Creek			350
Hockabout Creek			350
Humphrey Branch			350
La Flash Creek			350
North Bad Axe Creek			700
Otter Creek			200
Pine Hollow Creek			350
Sees Creek			200
Sidie Creek			200
South Bad Axe Creek			425
Springville Creek			425
Spring Cooley Creek			200
Tinker Creek			300
Towerville Branch			300
Westby, East and West Weaster creeks			800
Whitehall, Elk Creek			15,000
Fly Creek			10,000
French Creek			800
Wilton, Dorsets Creek			500
Hibbard Creek			500
Posey Creek			500
Slaton Creek			500
Withee, Delay Creek			450
Wyoming:			
Albany County, Dale Creek			8,000
Buelah, Blake's pond			8,000
Montana Creek			15,000
Sand Creek			30,000
Cokeville, Smith Fork of Bear Creek			1,500
Fort Yellowstone, Indian Creek			15,000
Lava Creek			25,000
Willow Creek			15,000
Yellowstone Park, Willow Creek			45,000
Total[a]	960,000	5,333,609	3,678,879

GRAYLING.

State, locality, and disposition.	Eggs.	Fry.	State, locality, and disposition.	Eggs.	Fry.
California:			New York:		
Sisson, California Fish Commission	200,000	.....	New York, New York Aquarium	2,000	.....
Michigan:			Rhode Island:		
Detroit, Belle Isle Aquarium	30,000	.....	Carolina, Rhode Island Fish Commission	50,000	.....
Paris, Michigan Fish Commission	100,000	.....	Utah:		
Missouri:			Murray, Utah Fish Commission	50,000	.....
St. Joseph, Missouri Fish Commission	50,000	.....	Wisconsin:		
Montana:			Lake Nebagamon, H. Clay Pierce	30,000	.....
Madison County, Elk Lake	.....	350,000	Wyoming:		
Madison County, Picnic Creek	.....	50,000	Ranchester, Wyoming Fish Commission	50,000	.....
New Hampshire:			Wolf, applicant	30,000	.....
Lake Sunapee, Lake Sunapee	.....	15,000	Total	592,000	415,000

[a] 81,800 fry and 56,241 fingerlings were lost in transit.

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

PIKE.

State, locality, and disposition.	Fingerlings, yearlings, and adults.
Illinois:	
Blanding, Mississippi River	8,000
Iowa:	
Bellevue, Mississippi River	7,000
Total	15,000

CRAPPIE AND STRAWBERRY BASS.

State, locality, and disposition.	Fingerlings, yearlings, and adults.
Alabama:	
Demopolis, Webb's pond	150
Faunsdale, Hylton's pond	150
Selma, Brick and Tile Company's lake	275
Cotton Oil Company's pond	100
Flag Pond	150
Hogans Dam	150
Mullins Pond	150
Pretty Pond	150
N. Waller's pond	125
W. Waller's pond	100
Arkansas:	
Hope, Railroad Pond	200
Lake Village, Lake Chicot	1,255
District of Columbia:	
Washington, Shaw's pond	150
Illinois:	
Blanding, Mississippi River	18,000
Carbondale, Bryans Lake	100
Collinsville, Ohler's pond	1,000
Decatur, Moffitt's lake	18
Pitner's lake	400
Fillmore, Lane's pond	100
Hunt, Bowman's pond	100
Imbs, Hughes's lake	400
Mascoutah, Lincoln Lake	150
Millstadt, Tank Pond	100
Ogden, Dresback's pond	150
O'Fallon, Cottonwood Lake	100
Thomas Pond	100
Shepherd, Sni E'Corte River	300
Indiana:	
Anderson, Keller's pond	150
Attica, Hushaw Pond	100
Evansville, Graves's lake	100
Griese Lake	150
Fort Wayne, Wayne Lake	100
Indianapolis, Ashrose Lake	150
Kokomo, Muggs' gravel pit	100
Martinsville, Townsend's pond	150
Middleton, Spring Lake	150
Milton, Greens Fork Creek	300
Martindale Creek	250
Nolands Fork Creek	300
Symons Creek	250
West Fork of White River	300
New Albany, Silver Creek Lake	200
North Vernon, Muscatatuck River	300
Summitville, Simpson's pond	100
Terre Haute, Whitcomb's pond	250
Winona Lake, Winona Lake	275
Iowa:	
Bellevue, Mississippi River	17,000
Le Mars, Grimes's pond	200
Maynard, Volga River	300
Taylor County, Safley's pond	100
Winterset, Egy's pond	200
Kansas:	
Arkalon, Railroad Pond	100
Bavaria, Whitney's pond	200
Bird City, Curry's pond	125
Burlingame, Hoover's pond	100
Garden City, McCue's pond	100
Garnett, North Fork of Pottowatomie Creek	250
Pottowatomie Creek	250
Larned, Pawnee River	100
Manhattan, Eureka Lake	100
Mapleton, Noble's pond	100
Olathe, Chenutte Lake	150
Railroad Pond	150
Osage City, Nelson's pond	100
Penalosa, Lathern Pond	200
Soldiers Home, Lake Jennette	200
Toronto, Four Ponds	200
Zenda, Spring Lake	100
Kentucky:	
Bardstown, City Reservoir	400
Fair Ground Lake	150
Eminence, Bright's pond	50
Jones' pond	100
Frankfort, Blythe's pond	100
Fredonia, Ganer Lake	150
Young's lake	100
Hodgenville, Riggs Pond	100
Lebanon, Stock Farm Pond	100
Lexington, Lake Ellerslie	300
Lewis Pond	100
Mount Sterling, Highland's pond	150
Lake Corby	100
Paris, Ardery's pond	100
Tarr's pond	100
Pineville, Moss' pond	100
Scottsville, Punchen Creek	200
Sherman, Bagby's pond	200
Sparta, Baker's pond	100
Bond Lake	100
Carver Lake	100
Garvey Lake	100
Lewis' lake	100
Lost Branch	200
Records' lake	150
Samuel's lake	150
Vories' pond	100
Tip Top, Dickson's pond	100
Vanceburg, Kinniconick Creek	300
Winchester, New Lake	100
Spahr's pond	100
Winchester Lake	150
Witherspoon's pond	150
Louisiana:	
Athens, Atkins' pond	200
Avery Island, Willow pond	200
Coushatta, Bayou Coushatta	200
Keatchie, Morgan's pond	200
Swearengen's pond	200

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

CRAPPIE AND STRAWBERRY BASS—Continued.

State, locality, and disposition.	Fingerlings, yearlings, and adults.
Louisiana—Continued.	
Mansfield, Hewitt's pond	300
Minden, Krouse Pond	200
Natchitoches, Bowen's lake	200
Breazeale's lake	300
Chaplin Lake	200
Maryland:	
Silver Spring, Lee's pond	100
Minnesota:	
Fergus Falls, Swan Lake	200
Mississippi:	
Aberdeen, L. M. Jones's pond	200
M. A. Jones's pond	300
Tombigbee River	300
Crandon, Barnett's pond	200
Brooksville, Herron Pond	200
McLemon's pond	150
Corinth, Harden's pond	250
Moore's lake	900
Waukomis Lake	600
Crystal Springs, Dulaney's lake	200
Edwards, Lewis's pond	125
Oak Grover Pond	125
Fayette, McNair's pond	300
Iuka, Robinson's pond	250
Rienzi, Holt's pond	150
Tupelo, Moss Pond	250
Park Lake	3,300
Missouri:	
Conway, Newport's lake	150
Exeter, Cole's pond	100
Glen Echo, Lake McCreery	125
Neosho, Hickory Creek	862
Newburg, Little Piney River	500
Sparta, Highland Pond	17
Verona, Water Works Lake	150
Nebraska:	
Genoa, Beaver Creek	400
Grand Island, Balcom's pond	100
Ord, North Loup River	475
Wood Lake, Round Lake	300
New Mexico:	
Roswell, Artificial Lake	100
Haynes Lake	100
Lake Esther	150
Large's pond	100
Sante Fe, Irrigation Pond	25
New York:	
Richfield Springs, Young's Lake	200
North Carolina:	
Fremont, Hooks's pond	100
Haw River, Mill Pond	200
Manson, Nutbush Pond	100
Raleigh, Barabee's pond	100
Oklahoma:	
Beaver County, Ruth's pond	200
Hobart, Combs's pond	90
Harris's pond	90
Oklahoma City, Canadian River	2,000
Shawnee, Resort Lake	100
Tecumseh, Webb's pond	100
Yale, Taylor's pond	400
Pennsylvania:	
Arcola, Perkiomen Creek	150
Hamburg, Mill Creek	150
Pine Creek	150
Phoenixville, French Creek	200
Pickerning Creek	250
Royal Spring Creek	200
Stony Run	200
South Carolina:	
Fort Mill, Hall's pond	100
Spring Branch Pond	150
South Dakota:	
Hot Springs, Hot Brook	183
Tennessee:	
Burns, Mill Pond	200
Chattanooga, Chickamauga Creek	200
Chattanooga, Lookout Creek	200
Spring Creek	100
Franklin, Barren Fork of Lick Creek	200
Heiskell, Mill Brook Lake	150
Knoxville, Tennessee River	250
McEwen, Mill Pond	100
Mount Pleasant, Bigby Creek	250
Tracy City, Lone Rock Pond	200
Texas:	
Albany, Hubbard Creek	60
North Branch of Hubbard Creek	60
Reynolds Pond	40
Tail Creek	80
Taylor Creek	60
Allamoore, Bounds' pond	30
Amarillo, Amarillo Creek	100
Miller Creek	130
Annona, Cotton Oil Pond	80
Austin, Baker's pond	50
Bagwell, Ward's pond	40
Baird, McDonald's pond	50
Bertram, Gabriel Creek Pond	50
Big Springs, Round House Lake	100
Blossom, Hammond's pond	40
Booth, Dry Creek	125
Fairchild Creek	150
Brookston, Williams' pond	40
Brownwood, Camp's pond	40
Hopkins's pond	30
McChristy's pond	40
Cameron, Spring Pond	60
Canadian, Horse Creek	100
Cisco, Bedford's pond	50
Clarendon, Allan Creek	100
Sink Lake	70
Clarksville, Dinwiddie Pond	40
Coleman, Hords Creek	175
Howe Creek	50
Jim Ned Creek	150
Lake Florence	75
Corsicana, Corsicana Lake	100
Frost's pond	50
Dallas, Trinity Clubs Lake	190
Eastland, Connellee's pond	40
Elgin, Thomas' pond	100
Enloe, Anderson's pond	50
Eskota, Fork of Brazos River	100
Wilson Lake	50
Fort Worth, Railroad Lake	50
Frost, Saunders' pond	45
Gastonia, Smith's pond	50
Gatesville, Fishing Club's lake	50
Murray's pond	25
Goldthwaite, San Saba River	70
Graham, Arnold's pond	30
Chonelle pond	50
Fisher's pond	80
Gant's pond	40
Harmon's pond	75
Lebermann's pond	100
Norman's pond	75
Grapeland, Tyer Pond	80
Hempstead, Thatcher's pond	75
Honey Grove, Honey Grove Lake	150
Oil Mill Lake	50
Water Company's pond	60
Hubbard, Johnson's pond	40
Hunter, Rylands's pond	30
Hutchins, Trinity Rod and Gun Club's lake	200
Jacksboro, Knox's pond	50
Kaufman, Dalrymple's pond	20
Kemp, Anthony Pond	40
Kerrville, Gaudalupe River	400

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

CRAPPIE AND STRAWBERRY BASS—Continued.

State, locality, and disposition.	Fingerlings, yearlings, and adults.
Texas—Continued.	
Kerrville, Kerrville Lake	80
Lampasas, Fork of Lampasas River	70
Liberty Hill, North San Gabriel River	200
Llano, Perry's pond	25
Lockhart, Oatman's pond	30
Lott, Heinzlemann's pond	50
Hoelscher's pond	50
McKinney, McKinney Club Lake	100
Mabank, Eubanks Lake	50
Marshall, Bonita Lake	100
Mexia, Smith's pond	50
Miami, Huselby Creek	100
Midlothian, Lake Below	50
Mineral Wells, Barber's lake	50
Mt. Calm, Radney's lake	40
Water Works Lake	40
Nacogdoches, Artificial lake	40
Fern Lake	125
Home Pond	50
Horse Shoe Lake	50
Liles's pond	40
Long Lake	50
Mamie Ross Lake	40
Pine Lake	50
Reed's pond	40
Scoggin Mill Pond	105
New Boston, railroad reservoir	80
Palestine, Elkhart Lake	160
Hudson's lake	150
Phillips's pond	50
Pine Lake	100
Two Lakes	90
Palmer, Moore's lake	50
Paris, Gordon Lake	80
Hancock's pond	40
Stephenson Pond	30
Ulmer Lake	60
Williams Pond	40
Petty, Fielding Pond	60
Hembree's lake	40
Margrave's lake	30
Sportsman Lake	50
Pittsburg, Davis Pond	60
Dickson's pond	20
Plano, Spring Creek	100
Richland, Milligan Lake	100
Roscoe, Number Fifteen Pond	75
San Angelo, Ball's pond	80
Dove Creek	70
Keith's pond	40
Ranch Pond	40
Texas—Continued.	
San Antonio, San Antonio River	25
San Marcos, Blanco Creek	100
Sherman, Arnold's pond	50
Stamford, Bailey's pond	40
Broach's pond	40
Timbers Pond	40
Sulphur Springs, Lake Coleman	100
McDonald's pond	100
Taylor, Allison's pond	40
Burns's pond	80
Temple, Lake Polk	80
Railroad Lake	25
Tenaha, Mill Pond	30
Peddy's pond	50
Terrell, Railroad Lake	100
Thompsons, Irrigation canal	50
Thornton, Harrisons Pond	50
Tyler, Greenbrier Lake	60
Van Alstyne, Roach's pond	50
Vernon, Townsend's pond	40
Waco, Standefer's lake	50
Warren, Raymer's pond	50
Weatherford, Clear Lake	75
Whitesboro, Angling Club Lake	50
Wichita Falls, Clark's pond	100
Crescent Lake	150
Lake Wichita	150
Large Lake	200
Wills Point, Eastland Lake	25
Graham Lake	25
Wolfe City, Gin Pond	50
Rest Over Pond	50
Woodville, Bevil's pond	60
Bullock's pond	80
Chapman's pond	50
Virginia:	
Leesburg, Goose Creek	300
Powhatan, Brauer's pond	100
Richmond, Fishing Club Pond	250
Hermitage Pond	150
Meadow Pond	150
Varna Pond	150
Watkins Mill Pond	150
Suffolk, Wither's pond	150
Washington:	
Newport, Vane's lake	200
West Virginia:	
Huntington, Guyandotte River	250
Mud River	250
Huttonsville, Tygart Valley River	200
Total[a]	86,755

ROCK BASS.

Arkansas:	
Gillham, Center Grove Pond	200
Gravette, Island Home Pond	600
Paris, Schmidt's pond	200
Delaware:	
Wilmington, Nemones Lake	100
Georgia:	
Ringgold, Tiger Creek	200
Rome, North Rome Lake	100
Tunnel Hill, Sugar Creek	200
Tiger Creek	200
Idaho:	
Payette, Lattig's pond	100
Troy, Waller's pond	250
Illinois:	
Aurora, Fox River	300
Belleville, Heinemann's pond	100
Carlinville, Fish Club's pond	100
Carthage, Graham's pond	100
Illinois—Continued.	
Centralia, Edwards' pond	100
Dahlgren, Sullivan's pond	160
Danville, Fengen's pond	500
Soldiers Home Lake	1,000
Decatur, Needham's lake	100
Sangamon River	200
Edwards, Felton's pond	200
Godfrey, Jackson's pond	100
Golden Hill, Whitford's pond	100
Greenville, Lindley's pond	300
Imbs, Hughes's lake	1,000
Meredosia, Meredosia Bay	2,000
Milford, Evergreen Pond	200
Ogden, Dresback's pond	300
Paris, Fish Club's lake	100
Pleasant Hill, Emmert Lake	200
Saint Jacob, Schmitt's pond	100
Salem, Stone's ponds	100

[a] 8,020 fingerlings were lost in transit.

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

ROCK BASS—Continued.

State, locality, and disposition.	Fingerlings, yearlings, and adults.
Illinois—Continued.	
Sidell, Railroad reservoir	100
Tower Hill, Eiler's pond	100
Indiana:	
Brazil, Miller's pond	50
Charlestown, Beechwood Lake	50
Columbia City, Peabody's pond	150
Columbus, Willow Grove Pond	50
Cory, Nees's pond	50
Fairmont, Winslow Pond No. 2	100
Fort Wayne, Viberg Lake	100
Jasper, Hoffman's pond	50
Paoli, Craven's pond	75
Rich Valley, Glenview Pond	150
Rushville, McDaniel's pond	50
Sellersburg, Patrick's pond	50
Iowa:	
Afton, Kelley's pond	100
Clutier, Dovrak's pond	100
Simmonsen's pond	200
Creston, Sattler's pond	100
Summit Lake	100
Eddyville, De Long's pond	100
Manchester, Maquoketa River	275
Ricketts, Nemitz Pond	300
Kansas:	
Admire, Water's pond	100
Agra, Leake's pond	200
Cairo, Fish Lake	125
Canton, Hoyer's pond	95
Colby, Wallace's pond	100
Coldwater, Spring Pond	200
Comiskey, Troutman's pond	100
Garden City, Holcomb's pond	150
Robertson's pond	150
Simonds' pond	150
Garfield, Nat Pond	150
Haviland, Corrigan's pond	100
Hays City, Ruder's pond	95
Isabel, Harper's pond	100
Junction City, Whiskey Point Lake	300
Kelly, Sherrer's pond	100
Lakin, Warthen's pond	150
Lyndon, Yates's pond	100
McPherson, Anderson's pond	95
Oakley reservoir	95
Olmutz, Lewie Pond	78
Protection, Rodgers's pond	100
Russell, Gun Lake	95
Sabetha, Aeschelman's pond	100
Tribune, McGinnis's pond	78
Record's pond	78
Williamsburg, Ranch Pond	150
Zenda, Klein's pond	100
Kurt's pond	100
Weingart Pond	100
Zurich, Sutor's pond	78
Kentucky:	
Dixon, Canning Factory Pond	100
Early Times, Frey's pond	100
East View, Hart's pond	100
Eminence, Crabb's pond	100
Dale's pond	100
Moncallo Pond	100
Rock Pool	100
Swinney's pond	100
Frankfort, Scruggs' pond	100
Hatcher, May's pond	100
Helena, Brough's pond	150
Hernando, Jack Radford's pond	75
Hopkinsville, Adams's pond	100
East Fork of Little River	200
Lawrenceburg, Carpenter's pond	100
Lebanon, Carrico's pond	100
London, McKee Pond	200

State, locality, and disposition.	Fingerlings, yearlings, and adults.
Kentucky—Continued.	
Louisville, Silver Lake	900
Wagner's pond	100
Robard, Eakins' pond	105
Saloma, Rainbow Pond	100
Shelbyville, Duvall's pond	150
Masons Home Pond	150
Upton, Bowler's pond	100
Hazel's pond	100
Winchester, McCord's pond	125
Wingo, Thornbrough Pond	200
Louisiana:	
Homer, Keener's pond	250
New Orleans, Breaux Pond	300
Saint Martinsville, Lake Ferdinand	250
Maryland:	
Ammendale, Hughes' pond	100
Prince George County, Fish Lake	150
Rosecroft, Reynolds' pond	100
Michigan:	
Gagetown, Bingham's pond	150
Mississippi:	
Aberdeen, Jones' pond	200
Smith's pond	150
Blue Mountain, Lowrey & Berry's pond	100
Fayette, Bent's pond	100
Duncan's pond	100
McGinty's pond	150
Gloster, Dye's pond	100
McLain's pond	250
Guntown, Mitchell's pond	100
Parker's pond	100
Macon, House Pond	150
Jones' pond	150
Ratliff, Turner's pond	150
Ripley, Robinson's pond	100
Tupelo, Turner's pond	150
Waynesboro, Fedora Lake	100
Missouri:	
Carthage, Knell's pond	200
Conway, Bennett's ponds	900
Eldorado Springs, Stewart's pond	300
Glasgow, Steinmet Pond	150
Grant City, Coy's pond	100
New Hampton, Toombs' pond	150
Randolph, Tuggle's pond	800
Rogersville, Brazeal's pond	100
Rolla, Stahr's pond	100
Seligman, Railroad reservoir	200
Nebraska:	
Milligan, Cerveny's pond	100
New Mexico:	
Alamogordo, Shepherd's pond	150
Carlsbad, Pecos River	200
Santa Fe, Irrigation Pond	100
New York:	
Highland Mills, Cromwell Lake	125
North Carolina:	
Biltmore, Ashworth's pond	100
Popular Spring	150
North Dakota:	
Kathryn, Silsand's pond	100
Ohio:	
Akron, Healing Lake	35
Ansonia, Indian Lake	100
Cleveland, Heffner's pond	40
Preyer's pond	40
Spring Pond	40
Dayton, Bridgman's pond	100
East Liverpool, Ross Meadows Pond	40
Georgetown, Bohls' pond	100
Evans' pond	100
Mount Liberty, Winter's pond	55
Sardinia, Bohl's pond	100

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

ROCK BASS—Continued.

State, locality, and disposition.	Fingerlings, yearlings, and adults.
Ohio—Continued.	
Shelby, Barnes Pond	35
Springfield, Rockfield's pond	100
Wickliffe, Armington's pond	35
Pennsylvania:	
Bradford, Gurganious' pond	100
Dawson, Spring Grove Lake	100
Enon Valley, Little Beaver Creek	300
Fairfield, Middle Creek	500
Mud Run	400
Homewood, McKissick's pond	100
Rimerton, Tidal Mill Pond	150
Smiths Ferry, Moody's pond	100
Wehrum, Whyte's pond	100
South Carolina:	
Clover, Patrick's pond	60
Easley, Murphy's pond	150
White's pond	150
Enoree, Thornton's pond	75
Fair Forest, Martin's pond	75
Greenville, Carpin Pond:	75
Curetons Lake	150
Easley Road Pond	75
McSwayne's pond	75
Lancaster, Gills creek	75
Richburg, Hicklin's pond	60
Wylie's pond	60
Spartanburg, Cleveland's pond	75
Little's pond	75
Whitney Pond	250
Taylor's mill pond	75
Tirzah, Allison Creek	60
Welford, Berry's pond	100
White Stone, Lee's pond	60
South Dakota:	
Armour, Bos Pond	70
Le Cocq's pond	70
Buffalo Gap, Schneider's reservoir	100
Fairfax, Schochemaier's pond	100
Harrold, Medicine Creek Pond	250
Hartford, Wall Lake	300
Loyalton, Oban's pond	150
Stevenson's pond	150
Orient, Sebring's pond	150
Plankington, Stoddard's pond	150
Saint Lawrence, Morrow's pond	100
Tennessee:	
Big Sandy, Davis's pond	150
Chattanooga, Chickamauga Creek	300
Chattanooga, Lookout Creek	300
Spring Creek	200
Centerville, Rochell's pond	150
Knoxville, Tennessee River	400
Lawrenceburg, Rohling's pond	150
Lewisburg, Taylor's pond	150
Selmer, Warrens Park Pond	100
Slayden, Gilmore's pond	150
Sweetwater, Hornell's pond	100
Texas:	
Athens, Burnett's pond	70
Bettie, Efurd's pond	100
Big Spring, Eureka Lake	225
Rock Bluff Pond	225
Brownwood, McChristy's pond	120
Texas—Continued.	
Brownwood, Smith's lake	150
Burnet, Big Tank	75
Calvert, Field's lake	66
Catharge, Elm Lake	75
Halls Lake	150
Horse Shoe Lake	150
Railroad Lake	125
Round Lake	200
Collinsville, Ground's pond	75
Colorado, McKenzie's pond	50
Cooper, Wright's pond	75
Dawson, Connor's pond	120
Enloe, Gin Pond	100
Fort Worth, Gillespic's pond	50
Gordon, Goodwin's pond	100
Graham, Burch's pond	66
Eichelberger's pond	66
Paint Pond	68
Heidenheimer, Mosley's pond	120
Honey Grove, Schwarzrock's pond	100
Hubbard, artificial lake	100
Mill Pond	100
Kaufman, Dalrymple's pond	200
Nelson's lake	75
Lometa, Sand Pond	75
Lott, Peters's pond	68
Mabank, Lewis's pond	50
Spring Creek	75
Marlin, Waterworks reservoir	66
Merkel, Hamm's pond	60
Midland, Greendale Pond	75
Orange, Link's pond	75
Otto, Artificial lake	66
Paris, Johnson's pond	100
Pritchett, Welborn's lake	200
Putnam, Harwell's pond	100
Rogers, Pruden's pond	120
Sacul, Railroad pond	100
San Angelo, Lake Hall	200
Peden's pond	50
Santo, Daniels's pond	100
Sipe Springs, Stewart's lake	60
Sweetwater, Red Bluff Pond	75
Willingham's pond	75
Waco, Miller's pond	66
Weatherford, Tate's pond	50
Utah:	
Lund, Gifford's spring	100
Virginia:	
Gordonsville, Oak Hill Pond	100
Lynchs, Anthony's pond	150
Pennington Gap, Johnson's pond	150
Rapidan, Ice Pond	100
Salem, Martin's pond	100
Somerset, Nicol's pond	100
Thaxton, Sublett's pond	100
Timberville, Andes' pond	100
West Virginia:	
Milton, Harshbarger Pond	200
Wisconsin:	
Richfield, Schulties' pond	83
Total[a]	41,257

[a] 3,543 fingerlings lost in transit.

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

WARMOUTH BASS.

State, locality, and disposition.	Fingerlings, yearlings, and adults.
Alabama:	
Andalusia, Riley's pond	175
Eufaula, Clayton's pond	100
Toney's pond	100
Epes, Green Pond	100
Hilman's pond	100
Kerr Lake	100
Fitzpatrick, Colemans Creek	160
Garland, Bonanza Pond	65
Ozark, Kirkland's pond	200
Prattville, Chambliss Pond	200
Pratt Pond	100
Florida:	
Sneads, Spooner's pond	100
Weirsdale, Lake Weir	100
Georgia:	
Coleman, Jones's pond	200
Savannah, Norwood's pond	50
Texas:	
McKinney, Fish Club Lake	300
Mexia, Wolverton's pond	75
San Antonio, San Antonio River	50
Stamford, Orr's pond	100
Total	2,375

SMALL-MOUTH BLACK BASS.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Connecticut:		
Buntam, Bantam Lake		200
Goodspeeds, Basham Lake		200
Delaware:		
Felton, Lynchs Pond		86
Seaford, Clear Brook Pond		86
Idaho:		
Bellevue, Muldoon Lake		225
Indiana:		
Angola, Crooked Lake		1,500
Fox Lake		1,500
Lake James		3,000
Dunkirk, Moore's lake		1,400
Lima, Pigeon River		1,500
Monticello, Tippecanoe River		1,500
New Albany, Terstegge's pond		400
Iowa:		
New Hampton, Little Cedar Creek		250
Kentucky:		
Bowling Green, Gasper River		225
Danville, Dix River		200
Hanging Fork Creek		200
Elkhorn, Elkhorn Creek		400
Glasgow, Beaver Creek		225
Preston, Slate Creek		250
Maine:		
Fryeburg, Lovells Pond		200
Poland, Range Ponds		250
Maryland:		
Cambridge, Blackwater River		129
Chain Bridge, Potomac River	5,000	
Hagerstown, Antietam Creek	4,000	
Conococheague Creek	3,000	
Monkton, Gunpowder River	4,000	
Massachusetts:		
Cushman, Mill River		250
Falmouth, Long Pond		200
Spectacle Pond		200
Great Barrington, Hayes Pond		200
Haverhill, Lake Attitash		200
Millbury, Singletary Pond		200
Orleans, Fresh Pond		250
Readville, Ponkapog Pond		300
Turtle Pond		300
Springfield, Fryes Pond		150
Vineyard Haven, Old House Pond	1,500	
West Barnstable, Joshua Pond	2,000	
Woods Hole, Long Pond		200
Michigan:		
Big Rapids, Chippewa Lake		500
Birmingham, Pine Lake		1,000
Doster, Warners Lake		1,400
Ellsworth, Six Mile Lake		1,400
Northville, Cooley Lake	2,000	
Long Lake	2,000	
Orchard Lake, Pine Lake	2,000	
Sidnaw, Lake Bergland		200
Watersmeet, Bass Lake		200
Crooked Lake		200
Duck Lake		200
Island Lake		200
Minnesota:		
Bemidji, Lake Bemidji		200
Duluth, Eagles Nest Lake		400
Spring Lake		200
McGregor, Bass Lake		200
Ogema, White Earth Lake		200
Missouri:		
Galena, James Fork of White River		755
New Hampshire:		
Keene, Lake Spofford	2,000	
Peterboro, Mountain Pond		150
Wolfboro, Lake Wentworth		200
Woodsville, Lake Gardner	2,000	
New Jersey:		
Alloway, House's pond		107
Bernardsville, Lademos Pond		100
Blairstown, Blue Mountain Lake	4,500	
Chatham, Baldwins Pond		200
Ogdensburg, Little Pond		110
South Dennis, Clints Mill Pond	350	
Spring Lake, Spring Lake		107
Sussex, Lake Rutherford	4,500	
Sussex County, Lake Grinnell	4,000	
White Lake	4,000	
New York:		
Addison, Canisteo River		180
Akron, West Shore Pond		100
Amsterdam, Glen Wild Reservoir		200
Bath, Lake Keuka		200
Chenango Forks, Chenango River		250
Cuba, Cuba Lake		180
Elmira, Canisteo River		200
Chemung River		200
Eldridge Lake		100
Tioga River		200
Fallsburg, Alta Lake		200

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

SMALL-MOUTH BLACK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
New York—Continued.		
Glens Falls, Glen Lake	.....	200
Hammondsport, Waneta Lake	.....	180
Hemlock, Honeoye Lake	.....	150
Huntington, Rosemary Lake	8,000	.....
Hurleyville, Anawana Lake	2,200	.....
Liberty, White Lake	.....	200
Medina, Glenwood Lake	.....	180
Newburgh, Orange Lake	8,000	150
Norwich, Chenango Lake	.....	200
Richfield Springs, Youngs Lake	.....	200
Rockland, Lake Florence	2,200	.....
Schenevus, Schenevus Creek	.....	250
Springwater, Hemlock Lake	.....	150
Ticonderoga, Paradox Lake	.....	150
West Pawling, Whalley Pond	8,000	.....
West Point, Lusk Reservoir	.....	200
North Dakota:		
Bottineau, Lake Metigoshe	.....	230
Jamestown, Spiritwood Lake	.....	400
St. John, Main's lake	.....	192
Pennsylvania:		
Bushkill, Forest Lake	.....	100
Lake Taminent	.....	100
Chester, Ridley Creek	.....	129
Ellwood City, Conniquenessing Creek	.....	84
Glenloch, Fetters Mill Pond	1,600	.....
Grove City, Barmore Lake	.....	70
Heathville, Sandy Creek	.....	71
Huntingdon, Raystown Branch of Juniata River	.....	300
Lebanon, Laudermilches Dam	3,000	.....
Swatara Creek	3,000	.....
Paxinos, Geise's dam	.....	100
Pottstown, French Creek	900	.....
Susquehanna, Susquehanna River	11,000	.....
Uniontown Reservoir	.....	70
Williamsport, Susquehanna River	.....	180
Wyoming, Harveys Lake	.....	200
Rhode Island:		
Providence, Sneach Pond	900	.....
Watchaug Pond	900	.....
South Dakota:		
Roberts County, Big Stone Lake	.....	105
Vermillion, Rose Lake	.....	200
Watertown, Lake Kampeska	.....	250
Tennessee:		
Belleview, Big Harpeth River	.....	1,268
Little Harpeth River	.....	1,266
South Harpeth River	.....	1,266
Vermont:		
Brandon, Lake Hortonio	4,000	.....
Brattleboro, West River	2,000	.....
Vermont—Continued.		
Castleton, Bomoseen Lake	700	.....
Hardwick, Dog Pond	2,500	.....
Johnson, Lake Eden	2,500	.....
Ludlow, Echo Lake	700	.....
Lyndonville, Lilly Pond	1,200	.....
Marshfield, Winooski River	1,200	.....
North Derby, Memphremagog Lake	700	.....
Poultney, Lake St. Catherine	700	.....
South Londonderry, West River	700	.....
Wallingford, Tinmouth Pond	2,000	.....
Wardsboro, Great Pond	2,000	.....
West Danville, Joes Pond	2,000	.....
Williamstown, Cutter Pond	700	.....
Virginia:		
Ashby, Shenandoah River	4,000	.....
Covington, Jackson River	12,000	.....
Emporia, Mitchells Pond	.....	100
Gate City, Big Moccasin Creek	.....	250
Garrett, Batte's pond	2,000	.....
Luray, Hawksville Creek	.....	350
North Garden, Hardware Pond	.....	450
Overall, South Fork of Shenandoah River	.....	350
Providence Forge, Silver Lake	2,000	.....
Rock Castle, Finch's pond	2,000	.....
Washington:		
Rainier, Inman Lake	.....	200
West Virginia:		
Charlestown, Shenandoah River	4,000	.....
Cherry Run, Potomac River	3,000	.....
Great Cacapon, Great Cacapon River	4,000	.....
Hinton, Greenbrier River	1,000	.....
Martinsburg, Opequan Creek	.....	1,000
Pence Springs, Greenbrier River	1,000	.....
Uffington, Monongahela River	.....	600
Wisconsin:		
Elcho, Clear Lake	.....	200
Elkhorn, Duck Lake	.....	250
Lake Geneva, Geneva Lake	.....	250
Rhinelander, Bass Lake	.....	400
Jennie Webber Lake	.....	200
Tamerack Lake	.....	200
Spread Eagle, Spread Eagle Lake	.....	200
Total[a]	155,150	40,446

LARGE-MOUTH BLACK BASS.

Alabama:		
Allenton, Beaver Pond	.....	400
Mill Pond	.....	400
Andalusia, Fegan's pond	400	.....
Gantt Pond	400	.....
Mill Pond	800	.....
Paggett Pond	400	.....
Riley's pond	500	.....
Alabama—Continued.		
Attalla, Big Wills Creek	.....	1,000
Bessemer, Big Fish Pond	.....	1,000
Quarry Lake	.....	600
Birmingham, Country Club Lake	.....	750
Brent, Affonee Creek	1,200	.....
Brewton, Fish Pond	.....	250

[a] 19,050 fry and 7,570 fingerlings were lost in transit.

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

LARGE-MOUTH BLACK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Alabama—Continued.		
Brierfield, Little Cahaba River	.....	750
Calcis, Kelleys Creek	.....	4,000
Camden, Miller's pond	.....	400
Centerville, Avery Pond	200	.....
Crystal Branch Creek	400	.....
Dothan, Crawford's pond	2,000	.....
Mill Pond	1,000	.....
Wilson Lake	1,000	.....
Estelle, Anona Pond	.....	400
Eufaula, Brick Yard Pond	600	.....
Evergreen, Murder Creek	.....	500
Fayette, Gravlee's pond	.....	500
Shepherd's pond	.....	300
Florala, Lake Jackson	.....	300
Ft. Payne, Big Wills Creek	.....	500
Garland, Bonanza Pond	.....	200
Goodwater, Grimes' lake	.....	500
Gordo, Goings Creek pond	.....	500
Kingston, Cherry's pond	1,000	.....
Letohatchee, Roger's pond	2,200	.....
Lowndesboro, Dickson's pond	.....	40
Mobile, College Lake	.....	300
Montevallo, Mahone Creek	.....	750
Shoal Creek	.....	750
Montgomery, Whetstone Lake	.....	1,000
Morris, Waterworks Pond	.....	1,500
Myrtlewood, Morgan's pond	.....	250
Paint Rock, Dry Creek	.....	1,000
Rutherford, Harden's lake	.....	200
Selma, Baynes' pond	.....	50
Cades Lake	.....	800
Carothers Pond	.....	500
Mullen's lake	.....	50
Swansea, Little Warrior Creek	.....	800
Talladega, Choccolocco Creek	.....	1,750
Talladega, Groce's lake	.....	500
Plowman's pond	.....	500
Valley Head, Big Wills Creek	.....	2,000
Whitney Mill Pond	.....	1,000
Arizona:		
Flagstaff, Lake Mary	.....	200
Arkansas:		
Alma, Big Clear Creek	.....	1,500
Atkins, Point Remove Creek	.....	1,500
Eldorado, Joiner's pond	.....	100
Lake Village, Lake Chicot	.....	265
Magnolia, Waller's pond	.....	100
Malvern, Gannel's pond	.....	100
Mammoth Spring, Warm Fork Creek	.....	1,800
Rogers, White River	.....	1,500
Russellville, Illinois Creek	.....	200
Poynters Lake	.....	1,500
Washington, Bois d'Arc Creek	.....	150
Colorado:		
Canon City, Arkansas River	.....	188
Laveta, Hamilton's lake	.....	315
Trinidad, Monument Lake	.....	200
Wray, Oliver Creek Reservoir	.....	250
Connecticut:		
Goodspeeds, Basham Lake	.....	200
Moodus Reservoir	.....	250
Norwalk, Nashes Pond	.....	250
Silt Mill Pond	.....	300
Sharon, Mudge Pond	.....	300
Windsor Locks, Connecticut Fish Commission for Quassapaug Lake	.....	400
Winsted, Highland Lake	.....	300
Delaware:		
Ellendale, Mill Pond	.....	150
Milford, Haven Mill Pond	.....	150
Newark, Christian Creek	.....	200
Willmington, Shortlidge Pond	.....	300
Florida:		
Hernando, Lake Trata Apopka	.....	1,000
Martel, Carter's pond	.....	1,000
Monticello, Two Mile Branch	.....	900
Santos, Lake Medonna	.....	1,000
Sneades, Spooner's pond	.....	1,000
Weirsdale, Lake Weir	.....	1,500
Georgia:		
Adairsville, Pine Log Creek	.....	80
Amsterdam, Minitonka Lake	.....	1,000
Wataga Creek	.....	2,000
Andersonville, Coogle Pond	.....	1,000
Ashburn, Massey's pond	.....	1,200
Athens, Water Works Pond	.....	1,000
Lake Chulnota	.....	1,000
Middle Oconee River	.....	2,000
Atlanta, Browns Mill Pond	.....	1,000
Bulls Sluice Lake	.....	3,000
Fair Oaks Lake	.....	2,000
High Rock Springs Pond	.....	1,000
Augusta, Game Preserve Club Pond	.....	2,000
Reds Creek	.....	2,000
Spring Hill Pond	.....	1,500
Avera, Spring Branch	.....	1,000
Beach, Howard Pond	.....	1,200
Butler, Bartletts Mill Pond	.....	400
Fickling's pond	.....	1,000
Clayton, Dotson's pond	.....	1,000
Johnson's pond	.....	2,000
Cochran, Reeve's pond	.....	300
Commerce, Jackson's pond	.....	1,000
Crest, Mill Pond	.....	1,000
Crawford, Edwards Mill Pond	.....	1,000
Crawfordville, Hordens Creek	.....	1,000
Kendricks Pond	.....	400
Sherrers Creek	.....	1,000
South Branch Little River	.....	1,000
Cuthbert, Seeley's pond	2,000	.....
Danforth, Screams Branch	.....	1,000
Dawson, Cheenubee Creek	.....	1,000
Decatur, Morgan's pond	.....	500
Orphanage Pond	.....	1,000
South River	.....	2,000
Demorest, Lake Demorest	.....	2,200
Duluth, Irrigation Pond	.....	1,000
Empire, Parker's pond	.....	600
Experiment, Redding Pond	.....	500
Fitzgerald, Troup's pond	.....	800
Forsyth, Lake View Pond	.....	1,500
Oaklawn Pond	.....	1,500
Gainesville, Little River	.....	1,000
Grantville, Factory Pond	.....	800
Greensboro, Mill Pond	.....	1,000
Heardmont, Witch Pond Creek	.....	1,000
Hogansville, Daniel's pond	.....	160
Jones's pond	.....	440
Jefferson, Oconee Pond	.....	1,200
Leary, Joiner Lake	800	.....
Lizella, Hall's pond	.....	1,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

LARGE-MOUTH BLACK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Georgia—Continued.		
Louisville, Ogeechee River		4,000
Macon, Sparks's pond		600
Marshallville, Baldwin's pond		1,000
Edwards's pond		1,000
Midland, Midland Lake		1,000
Milledgeville, Banks's pond		500
Water works pond		1,000
Millen, Nesbit Place Pond		2,000
Oak Mountain, McKnights Mill Pond		200
Paschal, Gorman's mill pond		1,000
Pine View, Spring Pond		300
Ringgold, Hacketts Creek		160
Riverdale, Creel Pond		1,000
Rome, Simpson's pond		80
Social Circle, Lake Louise		400
Sparta, Buffalo Creek		2,000
Stone Mountain, Venable Lake		1,000
Sulphur Springs, Lookout Creek		2,120
Sycamore, Ray's pond		800
Tallulah Falls, Camp Creek		75
Thomasville, Ochlochnee Creek		2,000
Thomson, Factory Pond		1,000
Upatoie, Jenkins's pond		1,000
Warrenton, Aldred's pond		450
McGregor's pond		1,000
White Plains, Stapleton's pond		1,000
Whitesburg, Pulp Mill Pond		440
Winder, Justice Pond		500
Yatesville, Mill Pond		1,000
Idaho:		
Payette, Wahe Slough		750
Illinois:		
Abingdon, Lake Edna		80
Antioch, Bluff Lake		150
Channel Lake		300
Grass Lake		150
Lake Marie		300
Petite Lake		750
Armington, Burt's pond		120
Atlanta, Funks Lake		240
Aurora, Fox River		680
Barry, Holland's pond		200
Baylis, Village Lake		200
Belleville, Crescent Mill Pond		110
Fish Lake		120
Gintz Pond		110
Perrin's lake		120
Wangelin's pond		110
Benton, Illinois Central Pool		125
Blanding, Mississippi River		2,150
Buffalo, Artificial Lake		300
Mill Pond		360
Bush, Coal Company's pond		435
Carbondale, Coal Company's pond		360
Etherton's pond		100
Lake Dillinger		120
Thompson Lake		540
Carlinville, Fish Club Ponds		50
Railroad Reservoir		180
Reineke's pond		120
Weidner's pond		120
Carter, Brosel's pond		125
Illinois—Continued.		
Carterville, Number One Pond		250
Peyton's pond		50
Zimmerman's pond		50
Charleston, Hodgen's pond		120
Clinton, Weldon Springs Lake		300
Cobden, Hunsaker's pond		250
Collinsville, Coal Company's pond		625
Oehler's pond		50
Craneville, Norton Lake		100
Decatur, Fish Lake		450
Johns' pond		300
Moffitt's pond		20
Needham's pond		600
Riverside Pond		600
Sangamon River		100
Wilson's lake		300
Deer Park, Emerald Lake		120
Doltons Station, Lake Berg Pond		300
Du Quoin, Dunn Lake		180
East St. Louis, Bluff Side Lake		370
Edwardsville Junction, Flagg pond		60
Edwardsville Junction, Paddock's pond		60
Effingham, Silver Moon Lake		120
Elgin, Fox River		600
Flora, Cunningham's pond		300
Galesburg, Prince's pond		225
Rice Lake		80
Greenville, Lindley's pond		150
Moulin's pond		120
Hettick, Ribble's pond		120
Highland, Bauman's pond		60
Lentwiler's pond		60
Schmidt's pond		60
Schott's pond		120
waterworks pond		120
Jacksonville, Davis' pond		120
Morgan Lake		240
Reservoir		120
Routt Pond		120
Russell's pond		60
Jerseyville, Carlin's pond		120
Johnson City, Big Muddy Coal Co's pond		500
Joliet, Hickory Creek		450
Sugar Creek		450
Kimmundy, Donovan's pond		110
Frisco Lake		105
I. C. Pond		120
Lake County, Long Lake		450
Lake Forest, Swift's lake		600
Lake Villa, Crooked Lake		450
Moon Lake		600
Lanesville, Whittemore's pond		300
Lemont, Quarry Pond		150
Loami, Jacob's pond		120
Marion, Holland's pond		240
Mascoutah, Lincoln Lake		110
Mattoon, Ruthenwald Lake		120
Miles, Subblefields Lake		120
Milstadt, Clear Lake		100
Eckert's pond		100
Kecks Pond		100
Long Pond		200
Seegars Pond		100
Weyhaupt Pond		100
Wirth's pond		100

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

LARGE-MOUTH BLACK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Illinois—Continued.		
Monmouth, Hardin's lake		80
Morris, Mettle Creek		292
Mount Olive, Mt. Olive Lake		180
Mount Pulaski, Salt Creek		150
Mount Vernon, City Reservoir		240
Patton's pond		224
Naperville, Goodwin's lake		40
Neoga, branch of Copperas Creek		120
New Berlin, Brown's pond		60
Smith's pond		60
New Burnside, Heaton's pond		25
Oakland, Annin's pond		180
Paris, Fish Club's lake		100
Pontiac, Vermilion River		600
Princeton, Weise's pond		75
Ramsey, Welch's pond		120
Rochester, Mallard Lake		60
Rockefeller, Diamond Lake		75
Rock Island, Prospect Park Lake		80
Roseville, Lake Dixson		40
Round Lake, Round Lake		450
Salem, Deer Lick Lake		420
Warner's pond		250
Shepherd, Sni E'Carte River		500
Shipman, Olmsted's pond		120
Sparta, Illinois Southern Lake		300
Wilson's pond		120
Springfield, Smith's pond		60
Strasburg, Weber's pond		50
Table Grove, Old Krows Pond		40
Taylor Ridge, Harris' pond		80
Taylorville, Browns Pond		100
Tunnel Hill, Kincannon's pond		200
Scout's pond		150
Wataga, Loy's pond		80
Wauconda, Bangs Lake		600
Wilmington, Kankakee River		600
Woodstock, Crystal Lake		450
Xenia, Baity's lake		120
Indiana:		
Advance, North Pond		250
Albion, Little Muncie Lake		300
Long Lake		300
Pleasant Lake		300
Silver Lake		60
Anderson, Spring Lake		150
West Brook Fishing Club's pond		450
Angola, Lake Gage		225
Lake James		300
Snow Lake		225
Attica, Hunter Pond		150
Wabash River		300
Brazil, Peifel's pond		100
Castleton, White River		750
Cedar Lake, Cedar Lake		675
Cold Springs, Evans Pond		100
Columbus, View Pond		300
Converse, Mississinewa River		300
Cory, Hazel Lake		150
Evansville, Hauck's pond		150
Rhinelander Lake		150
Scheegman's pond		200
Fairmount, Gravel Pit		150
Perrill Pits Pond		150
Fort Wayne, Viberg Lake		525
Goshen, Shipshewana Lake		225
Indiana—Continued.		
Greencastle, Mill Creek		150
Greensburg, Miers Pond		100
Kentland, Orchard Lake		150
Kewanna, Bruce Lake		525
Knightstown, Watts Lake		150
La Porte, Fish Trap Lake		150
Pine Lake		225
Stone Lake		225
Larwill, Cedar Lake		225
Ligonier, Diamond Lake		300
Marion, Bish's pond		150
Middlebury, Mud Lake		225
Stone Lake		225
New Albany, Silver Creek		150
Noblesville, Cicero Creek		250
Pierceton, Hadon Lake		150
Ridinger Lake		225
Plymouth, Pretty Lake		300
Rochester, Manitau Lake		225
Sellersburg, Mill Lake		150
Somerville, Martins Lake		150
Spencer, West Prong Fish Creek		150
Vernon, Muscatatook River		200
Vincennes, Robesons Lake		200
Walkerton, Lake Koontz		150
Whiteland, Bluff Creek		150
Williamsport, Wabash River		300
Indian Territory:		
Ardmore, Ardmore Club Lake		150
Coal Mine Pond		100
Hickory Creek		250
Claremore, Peck's pond		250
Fort Gibson, Grand River		1,500
Fort Towson, Wright Pond		100
Marietta, Eddleman's pond		150
Muskogee, Napps Pond		600
Tulsa, Ice Pond		100
Vinita, Chamberlin's pond		600
Darrough's pond		500
Vinita, Hawkins Pond		500
Robinson Pond		500
White Lake		1,200
Welling, Illinois River		1,500
Iowa:		
Amana, Amana Lake		280
Iowa River		880
Oil Mill Pond		185
Arcadia, Bohling's pond		150
Bellevue Mississippi River		2,200
Chester, Beaver Creek		250
Upper Iowa River		300
Clear Lake, Clear Lake		300
Colfax, Skunk River		400
Creston, Summit Lake		250
Decorah, Upper Iowa River		350
Earlville, Garretts Mill Pond		600
Eldora, Iowa River		300
Elgin, Turkey River		300
Hampton, Beeds Lake		250
Harlin, Bisgard's pond		100
White's pond		100
Homestead, Noe's lake		250
Hopkinton, Maquokota River		250
Independence, Wapsipinicon River		300
Kirkman, Fish pond		150
Lake View, Wall Lake		375
Le Mars, Gehren's pond		150
Lime Spring, Upper Iowa River		300
Marble Rock, Shell Rock River		250
Onawa, Blue Lake		200
Waterville, Paint Creek		250
Westfield, Gant's lake		150

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

LARGE-MOUTH BLACK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Iowa—Continued.		
West Liberty, Cedar River		300
Yorktown, Yorktown Reservoir		250
Kansas:		
Alma, Mill Creek		375
Amiot, Knight's lake		100
Benedict, Monroe's pond		100
Bucklin, Handy's pond		100
Branch of Kiowa River		250
Burlingame, Dragoon Creek		300
Cawker City, Oak Creek		400
Chanute, Barker's pond		100
Courtland, Warner's pond		275
Elbing, Henry Creek		300
Ellsworth, Henry's pond		60
Englewood, Antelope Creek		300
Erie, Canville Creek		250
Fredonia, Smalls Lake		200
Barnett, Cedar Creek		200
Girard, Higgle's Lake		150
Goodland, Beaver Creek		225
Fork of Smoky Hill River		250
Havensville, McKee's pond		250
Hill City, Wildhorse Creek Pond		300
Holton, Rafter's Lake		250
Junction City, Whiskey Point Lake		65
Kent, Brandy Pond		200
Lakeview, Lake View		250
Larned, Pawnee River		250
Lincoln Center, Marshall Creek		350
Logan, Spring Pond		100
Lyndon, Salt Creek		300
Marion, Cottonwood River		375
North Cedar, Wunder's pond		250
Osage City, Dragoon Creek		150
Walah Lake		200
Peabody, City Park Pond		100
Cotton Creek		250
Spring Branch		250
Phillipsburg, Railroad Pond		250
Pittsburg, Peterson's pond		250
Rock Creek, Edward's pond		250
Sabetha, Echo Lake		150
Scott, Beaver Creek		375
Ladder Creek		150
Selden, Prairie Dog Creek		275
Soldiers' Home, Lake Jennette		530
Stockton, Noyce's lake		250
Topeka, Wakarusa River		250
Vesper, Smiley's pond		200
Wilson, Hell Creek		300
Zenda, Dange's pond		150
Harberts Pond		150
Weinschank's pond		100
Kentucky:		
Anchorage, Crystal Spring Lake		150
Baileys Switch, Big Richland Creek		250
Barbersville, Cumberland River		300
Goose Creek		250
Riley's pond		100
Bardstown, Rodgers Run		250
City Reservoir		370
Bloomfield, Hays Pond		100
Bowling Green, Barren River		225
Drakes Creek		425
Gasper Creek		225
Buchanan, Big Sandy River		250
Cadiz, Grace's lagoon		150
Little River		210

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Kentucky—Continued.		
Catlettsburg, Big Sandy River		250
Cave City, Young's pond		100
Covington, Blazes Lake		100
Munker's lake		200
Crittenden, Collins Pond		100
Danville, Dicks River		250
Dixon, Brill's pond		90
Elizabethtown, Linde's pond		100
Erlanger, Abe Furst Pond		150
Rouse's pond		200
Franklin, Covingtons Pond		100
Drakes Creek		250
Lewis Pond		150
Upper Drakes Creek		225
Fredonia, Crider's lake		150
Easley Pond		90
Hill's pond		90
Kirkpatrick Pond		150
Mill Creek		150
Munroe Pond		150
Slick Bank Pond		90
Wyatts Pond		90
Young's lake		150
Fulton, Beard's pond		125
Glasgow, Beaver Creek		550
Peters Creek		225
Greensburg, Green River		250
Lake Greenbrier		200
Hodgenville, Hayes' pond		100
Nolin River		250
South Fork of Nolin River		200
Hopkinsville, West's pond		200
Howell, Wilson's pond		150
Johnson Station, Richardson's pond		100
Keysburg, Woods Lot Pond		250
Kings Mountain, Fishing Creek Pond		150
Lancaster, Evans Lake		250
Garrard County Lake		250
Lake Placid		700
Lake Toga		200
Latonia, Mother of God Cemetery Lake		260
Lawrenceburg, Bond's pond		200
Lebanon, Cleaver's pond		100
Rolling Fork Creek		250
Lexington, Lake Ellerslie		300
London, Laurel River		250
Louisa, Big Sandy River		250
Ludlow, Lagoon Pond		200
Moberly, Hisle's lake		150
Mount Sterling, Slate Creek		250
Munfordville, Swiss Grove Pond		150
Newport, Maple Lake		200
Sycamore Pond		200
Nortonville, Oak Hill Pond		150
Oil City, Beaver Creek		250
Owensboro, Blue Grass Pond		100
Coot's pond		100
Paint Lick, Lackey Pond		100
Paris, Clay Pond		200
Connell's pond		100
Crawford's pond		150
Ferguson's ponds		250
Hume's pond		100
Jacobs' pond		100
Leer's pond		100
Owsley's pond		100
Redman's pond		150
Rice's pond		150
Taylor's pond		150

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

LARGE-MOUTH BLACK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Kentucky—Continued.		
Paris, Toolins' pond		150
Ussery's pond		150
Preston, Barnes' pond		100
Richmond, Lake Reba		500
Saint Marys, Rolling Fork River		300
Scottsville, Gatewood's pond		40
Long Creek		120
Shelbyville, Reynolds' pond		200
Sparta, Eagle Creek		200
Sechrest's lake		150
Two Mile Creek		200
Springfield, Springfield Reservoir		400
Stanford, Water Works Reservoir		200
Stewart, Russell's pond		125
Sulphur, Rickett's pond		100
Trenton, Morton's pond		150
Vanceburg, Kinniconick Creek		250
Williamsburg, Cumberland River		300
Winchester, Wheeler Lake		200
Wills Pond		100
Woodbine, Lake Placid		250
Louisiana:		
Burton, Heins' pond		100
Berry, Chapin's pond		150
Hertzog's lake		150
Frierson, Frierson Pond		150
Keithville, Clingmans' pond		100
Natchitoches, Breazeale's lake		200
Chaplain Lake		200
Klie's lake		250
Scarborough's lake		200
New Orleans, City Park Lake		200
Pearl River, Ozone Pond		100
Quitman, Snell's pond		100
Maine:		
Poland, Range ponds		250
Maryland:		
Allegany County, Potomac River	1,500	
Town Creek		300
Bel Air, Lake Fanny		25
Bucklodge, Spring Branch		100
Chestertown, Chester River		200
Whalands Pond		150
Chevy Chase Lake, Chevy Chase Lake		300
Cumberland, Town Creek		200
Great Falls, Potomac River	10,000	
Motters, Monocacy River		150
Rocks, Deer Creek		25
Roxbury, Antietam Creek		100
Sycamore Island, Potomac River	10,000	
Taneytown, Beaver Branch		250
Massachusetts:		
Greenfield, Deerfield River		250
Kingston, Indian Pond		200
Mount Hermon, Nelson's pond		250
Plymouth, Massachusetts Fish Com		
Billington Sea Lake		250
Kings Pond		200
West Pond		200
Sandisfield, Sigmond Pond		300
Massachusetts—Continued.		
South Hanson, Thornton Pond		100
Webster, Chaubunagungamaug Lake		250
Peter Pond		250
Michigan:		
Alpena, Hubbard Lake		200
Long Lake		400
Cheboygan, Long Lake		600
Crystal Falls, Lake Mary		60
Frederic, May Lake		250
Hanover, Fairwell Lake		225
Round Lake		225
Harrison, Long Lake		250
Howell, Pardee Lake		200
Jackson, Portage Lake		225
Johannesburg, Clear Lake		300
Klinger Lake, Klinger Lake		300
Lincoln, Clear Lake		250
Lum, Lusted's lake		200
Manitou Beach, Devils Lake		225
Muskegon, Wolf Lake		200
Pentoga, Chicagon Lake		60
Maggie Lake		60
Mahoney Lake		60
Rose Center, Buckhorn Lake		250
Rose City, Indian Lake		200
Ypsilanti, Frain Lake		200
Murry Lake		250
Portage Lake		200
Strawberry Lake		200
Minnesota:		
Aitkin, Hanson Lake		240
Alexandria, Carlos Lake		240
Darling Lake		240
Lake Agnes		240
Lake Henry		240
LeHomme Dieu Lake		240
Bemidji, Lake Bemidji		140
Browns Valley, Lake Traverse		300
Duluth, Eagles Nest Lake		50
Spring Lake		50
Excelsior, Christmas Lake		540
Glenwood, Ruddock's pond		230
Hokah, Lake Como		200
Lake Elmo, Lake Elmo		240
Lake Dille, Prairie Lake		240
McGregor, Bass Lake		200
Mankado, Lake Washington		300
Ortonville, Big Stone Lake		300
Owatonna, Straight River		300
Tyler, Lake Hendricks		250
Walker, Little Lake of the Woods		240
Mississippi:		
Abbeville, Turner Lake		150
Aberdeen, Artificial Lake		150
Dead River		175
Horse Shoe Lake		100
Jones' pond		150
Tombigbee River		250
Brandon, Buchanan's pond		150
Brooksville, Brickyard Pond		125
Clarksdale, Sunflower River		175
Clinton, Oaks Lake		150
Corinth, Berry's pond		100
Bills' lake		100
Crystal Spring, Ashley's pond		150
Darling, Bear Lake		150
Fayette, Mile Creek		250
Race Track Branch		125
Gloster, Fish Lake		125
McLain Lake		250

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

LARGE-MOUTH BLACK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Mississippi—Continued.		
Hazelhurst, Brittain's pond		150
Houston, Hall's pond		150
Ittabena, Rolluck Lake		250
Jackson, Country Club Lake		175
McNarr's lake		150
Learned, Learned Gin Pond		125
Mill Pond		125
Smith's pond		125
Lexington, Cane Creek		150
Maben, Railroad Reservoir		150
Macon, Frith Lake		150
Howards Lake		150
Maddox, Moon Lake		175
Magnolia, Minnehaha Creek		200
Memphis, Mississippi River		125
Meridian, Water Works Reservoir		150
Money, Blue Lake		150
New Albany, Gin Mill Pond		100
Lowrey's pond		75
Okolona, Sansom's pond		300
Philadelphia, King's pond		150
Raymond, North's pond		125
Ratliff's pond		125
Sandersville, Morgan's pond		125
Sessums, Castil's pond		150
Shuqualak, Anderson's pond		150
Clopton's pond		150
Starkville, Deans' pond		125
Sudduth's pond		125
P. G. Sudduth's pond		125
West Point, Snider's pond		150
Yazoo City, Wolf Lake		175
Missouri:		
Argyle, Spring Pond		300
Aurora, Flat Creek		200
Honey Creek		200
James Fork of White River		250
Belton, Wright's pond		130
Bois D'arc, Sac River		200
Clinton, Fishing Club Lake		1,000
Excelsior Springs, Wale's lake		300
Fanning, Elm Spring		200
Galena, Flat Creek		100
James Fork of White River		200
Glen Echo, Lake McCreery		40
Goodman, McAntire's lake		200
Grandview, Gill's pond		700
Henley, Fish Lake		300
Hughesville, Shelton's ponds		250
Joplin, Hewitt's pond		500
Silver Creek		150
Zink Co.'s reservoir		250
Lisle, Knott's lake		260
Moundville, Elm Lake		150
Neosho, Crescent Lake		800
Hickory Creek		2,500
Queen City, Schmidt's pond		95
Randolph, Barnes' pond		150
Raytown, Sechrest's pond		150
Richards, Richardson's pond		500
Richland, Silver Lake		164
Saint Clair, Indian Creek	1,500	
Tiptonford, Hewitt's pond		200
Montana:		
Great Falls, Missouri River		475
Helena, Lake Sewell		350
Nebraska:		
Albion, Beaver River		250
Belgrade, Old River Bed Bayou		250
Nebraska—Continued.		
Dickens, Braugh Lake		250
Genoa, Beaver Creek		125
Harrison, Ring's pond		1,000
Herman, Raver's pond		100
Lodgepole, Lodgepole Creek		375
McCook, Doyle's pond		125
Millard, Blum's pond		125
Orleans, Republican River		375
Verdigris, West's lake		150
Wood Lake, Duck Lake		250
New Hampshire:		
Plymouth, Loon Lake		300
New Jersey:		
Alloway, House's pond		225
Bound Brook, Green Brook		200
Bridgeton, Sheppards Mill Pond		445
Chatsworth, tributary of Roberts Branch		145
Cranford, Railway River		300
Egg Harbor, Harrisville Lake		300
Park Lake		145
Harrisonville, Oliphant Lake		145
Hartford, Rancocas River		200
Matawan, Arrow Pond		100
Avery's pond		150
Morris Plains, Davenport's pond		250
Mullica Hill, Kier's lake		145
Netcong, Bear Pond		150
Paterson, Greenwood Lake		200
Rochelle Park, Cromwell Pond		100
Sewell, Sunset Lake		145
Tomlin, Warrington's lake		145
Williamstown, Brooklyn Pond		300
New Mexico:		
Carlsbad, Pecos River		325
Lordsburg, Kerr's pond		150
Moriarty, Indian Lake		150
Roswell, Ranch Lake		125
Santa Rosa, Deep Lake		50
Tucumcari, Plomas Pond		100
Wagon Mound, Jorosa Creek		200
Watrous, Ramer's Lake		250
New York:		
Alden, Hallmans Pond		100
Craryville, Copake Lake		450
Dover Plains, Lake Ellis		250
East Worcester, Hudson's lake		200
Fallsburg, Kiamesha Lake		500
Iona Island, Highland Lake		100
Irvington, McKim's lake		300
Ithaca, Cayuga Lake		250
Lancaster, Cayuga Creek		300
Larchmont, Park's pond		200
Millerton, North Pond		300
Rudd Pond		300
Otisville, Winters Pond		100
Ramapo, Portage Lake		300
Rockville Center, Wright's pond		150
Round Lake, Round Lake		250
Southampton, Minnesunk Lake		300
Nippaug Lake		300
Sullivan County, Island Lake		200
Montgomery Lake		200

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

LARGE-MOUTH BLACK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
New York—Continued.		
Sullivan County, Washington Lake		200
Westtown, Lockenhurst Pond		150
North Carolina:		
Apex, Alfords Lake		100
Norris Lake		100
Belmont, Catawba River		100
Browns Summit, Paul River Mill Pond		150
Buckhorn, Buckhorn Creek Pond		100
Fayetteville, Jumping Gully Pond		100
McDonald's pond		100
Stewarts Creek		100
Fountain, Jefferson's pond		100
Fremont, Hooks Pond		100
Greensboro, Cotton Mills Pond		100
Swamp Pond		100
Kenley, Bailey's pond		100
Laurinburg, Juniper River Pond		100
Lytch's pond		100
Leaksville, Bents Lake		100
Lewiston, Thompsons Mill Pond		100
McFarlan, Moore's pond		100
Marion, Glade Creek		100
North Fork of Catawba River		150
Maxton, Spring Pond		100
Mebane, Lake Weda		150
Tates Mill Pond		150
Mount Airy, Johnsons Creek		200
Mount Gilead, Black Creek		150
Clarks Creek		600
Little River		300
Murphy, Hiwassee River		75
Nashville, Lillie Pond		150
Raleigh, Bushley Branch		100
Neuse River		100
Richardson Pond		100
Riverside Pond		500
Rosindale, Clarks Mill Pond		100
Stovall, Webster Pond		100
Wilson, Marsh Swamp		100
North Dakota:		
Binford, Willow Lake		390
Bottineau, Bear Lake		240
Lake Metigoshe		1,080
Buffalo, Artesian Lake		275
Denbigh, Fresh Water Lake		300
Ellendale, Johnson's lake		240
Cayuga, Tewaukon Lake		240
Inkster, Forest River		300
Kenmare, Des Lacs Lake		300
Oakes, Lake View		240
Palermo, Clear Lake		240
Ray, Cottonwood Lake		300
Rolla, Jones' lake		240
Saint John, Gordon Lake		80
Lake Carpenter		300
Miller's lake		240
Oak Lake		240
Underwood, Crooked Lake		480
Williston, Kettle Lake		240
Zahl Lake		240
Ohio:		
Akron, Lake Pippin		25
Chippewa Lake, Chippewa Lake		200
Ohio—Continued.		
Cleveland, Chagrin River		300
Cuyahoga Falls, Springfield Lake		300
Geauga Lake, Geauga Lake		540
Harmons Pond		285
Georgetown, Day's lake		100
Spring Lake		100
Hudson, Mud Brook Pond		250
Lakeville, Odells Lake		300
Newark, North Fork of Licking River		200
Niles, Mahoning River		300
Meander Creek		300
Mosquito Creek		300
Plainville, Wood's lake		200
Rock Creek, Grand River		350
Springfield, Cliff Lake		150
Union, Stillwater River		250
Wapakoneta, Auglaize River		300
Oklahoma:		
Agra, Katy Reservoir		100
Ames, South Pond		125
Anadarko, Washita River		300
Avard, Lake Avard		175
Bison, Springdale Pond		100
Charley, Salmon's pond		75
Drummond, Faber's pond		125
Earlsboro, Turner's pond		100
El Reno, Blake's pond		400
Erick, McCarty's pond		150
Fort Sill, Blue Beaver Creek		250
Medicine River		250
Geronimo, Spring Lake		100
Gotebo, Walnut Creek		150
Hobart, Boxley's pond		75
Proctor's pond		75
Hunter, Lakeside Pond		125
Locust Grove Pond		125
Mangum, Moss Branch		100
Spring Creek		100
Trotter's spring		100
Nellie, Calame's pond		225
Oklahoma City, Cooks Lake		100
Delmar Garden Lake		250
Sheppard's pond		250
Steanson's pond		100
Pawnee, Myerdirk's pond		124
Wheeler's pond		124
Quay, Moore's pond		65
Spencer, Crutcho Creek		350
Stillwater, Brixeys Pond		100
McFarland's pond		100
Tangier, Big Spring		125
Weatherford, Jansen's pond		100
Wellston, Norris' pond		100
Oregon:		
Allendale, Inside Lake		210
Pennsylvania:		
Allenwood, White Deer Hole Creek		250
Altoona, Lakemont Lake		250
Arcola, Perkiomen Creek		350
Skippack Creek		200
Ashland, Dark Corner Creek		150
Dornsife Creek		150
Bear Creek, Bear Lake		100
Bedford, Bennings Creek		250
Raystown branch of Juniata River		250
Brillhart Station, branch Codorus Creek		100
Bushkill, Deer Lake		190

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

LARGE-MOUTH BLACK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Pennsylvania—Continued.		
Bushkill, First Pond		90
Forest Lake		190
Lake Taminent		240
Peter's pond		90
Second Pond		90
Third Pond		90
White's pond		90
Cambridge Springs, Conneaut Lake		75
Carlisle, Mountain Creek		150
Centralia, Mill Hollow Creek		150
Chambersburg, Conococheague Creek		200
Chester, Longbothem's pond		150
Clearfield, Susquehanna River		450
Collegeville, Perkiomen Creek		700
Skippack Creek		200
Coolbaughs, Pond Creek		150
Conneaut Lake, Conneaut Lake		250
Corry, Pennsylvania Fish Commission		4,350
Danville, Susquehanna River		400
Du Bois, McCracken Dam		300
Pentz Run		250
Sandy Creek		500
Twin Lakes		150
Easton, Delaware River		150
Ellwood City, Conniquinessing Creek		300
Entriken, Raystown Branch of Juniata River		300
Frackville, Mud Run Creek		150
Glatfelters, Codorus Creek		150
Glenmoore, Marsh Creek		150
Halistead, Susquehanna River		300
Hollidaysburg, Juniata River		600
Honesdale, Elk Lake		200
Hopewell, Raystown Branch of Juniata River		300
Hosensack, Hancock Dam		300
Huntingdon, Juniata River		300
Stone Creek		250
Irvineton, Brokenstraw Creek		250
Johnstown, Ullerys Pond		300
Karthaus, West Branch of Susquehanna River		300
Laporte, Zelestia Pond		125
Loysville, Shermans Creek		200
Weavers Dam		150
Markleton, Casselman River		250
Meadville, Cussewago Creek		150
French Creek		150
Woodcock Creek		150
Mechanicsburg, Conodoquinet Creek		200
Milton, branch Susquehanna River		200
Mount Carmel, Brush Valley Creek		150
Myerstown, Swatara Creek		150
Nisbet, Susquehanna River		150
Neshaminy Falls, Neshaminy Creek		100
New Freedom, Keeneys' pond		100
New Oxford, Little Conewago River		125
Oaks, Perkiomen Creek		200
Schuylkill River		200
Pennsylvania—Continued.		
Orbisonia, Augwick Creek		550
Oreland, Allen's pond		100
Port Royal, Juniata River		300
Tuscarora Creek		250
Radnor, Morrells' dam		100
Rahns, Perkiomen Creek		600
Reading, Tulpehocken Creek		150
Riddlesburg, Raystown Branch of Juniata River		300
Rising Springs, Penns Creek		300
Sinking Creek		250
Rowland, Big Corilla Lake		150
Big Tink Lake		200
Little Corilla Lake		150
Lake Teedyuscung		150
Roberts's pond		150
Saxtons' pond		150
Tanners Lake		150
Saint Peter, French Creek		150
Saltillo, Sidling Hill Creek		250
Schwenksville, Branch Creek		200
Perkiomen Creek		200
Scranton, Ford's lake		250
Lake William		250
Little Cobbs Pond		250
Mud Pond		100
Selinsgrove, Penns Creek		250
Shamokin, Bear Valley Creek		200
South Danville, Susquehanna River		150
Springmount, Perkiomen Creek		200
Susquehanna County, Quaker Lake		250
Telford, Branch of Perkiomen Creek		500
Thompson, Wrighter Lake		100
Titusville, Oil Creek		150
Tower City, Wiconisco Creek		250
Washington, Shields's pond		250
Water Works Pond		500
Waterford, Lake Laboeuff		450
Watsontown, Susquehanna River		500
Wheelerville, Elk Lake		150
Windber, Young's lake		100
Yerkes, Perkiomen Creek		200
York, Beaver Creek		150
Bermudian Creek		150
Big Conewago Creek		150
Kreutz Creek		150
Little Conewago		150
Mill Creek		150
Zieglersville, Swamp Creek		150
Rhode Island:		
Providence, Rhode Island Fish Commission, Sneach Pond		300
Westerly, Rhode Island Fish Commission, Pawcatuck River		300
South Dakota:		
Aberdeen, Kock Branch Pond		210
Alpena, Knox Lake		75
Blunt, Jane's pond		100
Bonesteel, Lucas's pound		100
Willow Creek		250
Britton, Nine Mile Lake		210
Six Mile Lake		210
Stokes's pond		125

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

LARGE-MOUTH BLACK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
South Dakota—Continued.		
Carthage, Raesly's pond		250
Delmont, Schafers' pond		100
Forestburg, Briggs' lake		250
James River		225
Gary, Cobb Creek		200
Monaghan Creek		200
Gettysburg, Sandell's lake		75
Harrold, Medicine Creek		150
Highmore, Box Elder Creek		100
Stoner's pond		250
Willow Pond		150
Huron, James River		300
Young's pond		200
Kimball, Kuazn's lake		100
Mansfield, Erikson's pond		75
Person's lake		166
Walberg's pond		210
Miller, Streuif's lake		400
Mitchell, Firesteel Creek		200
James River		450
Northville, Martin's pond		125
Orient, Gardener's pond		75
Parker, Vermillion River		300
Parkston, Frederich's pond		250
Hoffman's pond		250
Reuning's pond		100
Piede's pond		300
Pierre, Jeffries's pond		450
Willow Creek		450
Plankinton, City Pond		160
Donegan's pond		225
Mott's lake		75
Redfield, Twin Lakes		210
Vermilion, Vermilion River		300
Woonsocket, City Lake		250
Floyd Lake		75
Truddan's pond		150
Yankton, James River		300
Rhine Creek		250
Tennessee:		
Ashland City, Sycamore Creek		120
Cave Springs, North Chickamauga	1,500	
Centerville, Beaver Dam Creek		150
Clarksville, Anderson's pond		150
Cleveland, Parks' lake	400	
Columbia, Duck River	2,500	
Dunlap, Sequatchie River	2,000	
Estill Springs, Elk River	1,000	
Gallatin, China Lake		250
Johnstone Lake		250
Jackson, Pearson's pond		200
Johnson City, Watauga River	3,500	
Knoxville, Hodges' pond		40
Veneer's pond		40
Lewisburg, Boyetts Pond		300
McEwen, Hurricane Creek		200
Madisonville, Spring Branch		40
Maryville, Pistol Creek	2,400	
Montgomery County, The Lake		250
Murfreesboro, Stones River	1,000	300
Nashville, Bryans Bayou	1,500	
Hill Pond		800
Oakdale, Emory River	1,500	
Okolona, Buffalo Creek	1,500	
Dikeville, Farmer's pond	400	
Pulaski, Big Creek		250
Buchanan Creek		250
Richland Creek		250
Saint Bethleham, Slaughter's pond		150
Somerville, Dickson's pond		75
North Fork of Wolf River		175
Sweetwater, Klaines Lake		25
Townsend, Little River		120
Waverly, Big Richland Creek		150
Hurricane Creek		150
Trace Creek		200
Tributary of Duck River		150
Whitwell, Sequatchie River	2,000	
Texas:		
Annona, Clear Lake		500
Swantown Pond		250
Athens, Button Willow Pond		125
Lake Conell		150
Atlanta, Big Lake		450
H. E. Granberry's pond		100
S. G. Granberry's pond		100
Big Springs, Birdwell's pond		200
Blooming Grove, Miller's lake		150
Blossom, Cotton Oil Co. Pond		200
Williams' pond		120
Bonham, Artificial Lake		200
Chaney's pond		120
Ragdale's pond		120
R. & B. Club Pond		200
Ryon's lake		200
Bowie, Boedeker's pond		250
Brenham, Fisher's pond		100
Brownwood, Alderson's pond		100
Andrews's pond		125
Club Lake		300
Davis' pond		250
Fin and Feather Club Lake		500
Ford's pond		125
Hardman's pond		150
Henley's lake		150
Lane's lake		300
Lee's pond		125
McConnell's pond		250
Mountain Lake		400
Smith's lake		300
Taber's lake		400
Thomas' lake		125
Timmins' lake		300
Watts' pond		125
Weakley's lake		150
Wolf's lake		125
Buda, Onion Creek		200
Calvert, Enterprise pond		300
Peter's pond		150
Valley View Pond		150
Carthage, Clear Lake		200
Gary Lake		100
Roberts Lake		100
Round Lake		100
Smith's lake		100
Spring Lake		100
T. & G. R. R. Co. Lake		40
Caldwell, Jones' lake		150
Canadian, Horse Creek Lake		500
Washita River		500
Canyon City, Harp Lake		300
Running Water Lake		500
Chandler, Twin Lake		300
Childress, Horse Head Lake		300
Cisco, Fee's pond		150

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

LARGE-MOUTH BLACK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Texas—Continued.		
Clarendon, Bitter Creek		100
Home Lake		150
Clarksville, Bluff Lake		150
Bonoho's ponds		900
McMaster's pond		300
Sivley's pond		150
Cleburne, Country Club Lake		500
Converse, Schrimer's pond		200
Corsicana, Allen's pond		200
Artificial pond		150
Fish Club Lake		1,000
Liberty Hall Lake		200
Mulkey's pond		200
Taho pond		200
White's lake		200
Wilson's pond		100
Elgin, Free's pond		100
Lasher's pond		200
Peters Mill Lake		200
Elkhart, Elkhart Lake		1,000
Fairbanks, Hillendah's pond		150
Fort Worth, Clear Fork of Trinity River		500
Gillespie's pond		250
Headquarters Lake		200
Lake Pierce		200
Lake Virgie		200
Lake Winfield		200
Martin's lake		200
Oak Lake		400
Railroad Lake		50
Suters' pond		100
Godley, Nolands River		500
Goliad, Lott Lake		300
Gonzales, Thanheiser's pond		150
Goodwin, Guadalupe River		600
Granbury, Giles's pond		120
Grand Saline, Kings Retreat Pond		200
Kingston's pond		200
Richardson's pond		300
Groesbeck, Sanders' pond		150
Wilson's lake		150
Henderson, Greer Lake		300
Henrietta, Marshall's pond		200
Higgins, Mugg's pond		150
Honey Grove, Fin and Feather Club Lake		400
Hubbard, Bolton Lake		150
Johnson's pond		100
Noll's lake		300
Tate's pond		150
Priddy's pond		200
South Fork Pond		150
Hutchins, Farmers Club Lake		400
Fin and Feather Club Lake		500
Inez, Lake Leona		300
Jefferson, Rowell's lake		400
Jericho, Lakeside Reservoir		300
Lyon's pond		300
Kilgore, Barton Lake		200
Kopperl, Moss Lake		100
Kyle, Plum Creek		300
Lake Victor, Gerens Lake		50
Lampasas, Millican's pond		150
Laredo, Aguilares Chacom Ponds		500
Laredo, San Juanito Estrella Chacom Ponds		1,000
Livingston, Moore Lake		50
Lockhart, Oatman's pond		60
Long Lake, Brush Lake		400
Dollar Lake		400
Long Lake		400
MacCracken Lake		400
Wash Lake		400
Longview, Grigsby's pond		700
McDade, Westbrook's pond		200
McKinney, McKinney Club Lake		50
Shain's ponds		800
Mart, Curry's pond		150
Mesquite, Range Pond		150
Mexia, Hughes' pond		150
Point Enterprise Pond		150
Womack Pond		125
Miami, East Cantonment Pond		100
Miles, Dalton's pond		150
Missouri City, Bewalt Lake		300
Mount Calm, Dyers' pond		100
Ferguson's pond		150
Lattimer's pond		100
Stovall's pond		100
Willie's pond		125
Mount Vernon, Hills Pond		150
Naples, Womack's pond		150
Otto, Fenske's pond		100
Hope Pond		300
Pursche's pond		150
Overton, Baldwin Lake		200
Beckwith Pond		200
Boatright Lake		300
Brown Lake		300
Hickey Lake		200
Parr Lake		200
Smith Lake		300
Sunrise Lake		200
Paige, Erwin's pond		150
Fush's pond		200
Kieschnick's pond		200
Middleton Springs		300
Palestine, Cartmell's lake		200
Evergreen Lake		150
Halporns Lake		150
Reuter's lake		400
Spring Park Lake		700
Two Lakes		50
Wallace's lake		150
Pampa, Fire Guard Pond		500
Paris, Gordon Lake		1,150
Pine Creek		400
Pearsall, Schreiner Reservoir		150
Pecos, Toyah Creek		500
Petty, Margraves lake		150
Petty Lake		150
Pilot Point, Jackson's pond		50
Pittsburg, Holt's pond		150
Smith's pond		100
Port Lavaca, Paladora Creek		800
Pritchett, Welborne's lake		200
Quanah, Artificial Lake		200
Bell's pond		150
Lake Damsite		400
Russell's lake		200
San Angelo, North Concho River		1,600
San Antonio, Delling's lake		200

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

LARGE-MOUTH BLACK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
Texas—Continued.		
San Antonio, Georges Lake		250
Le Vert's lake		300
Moore Lake		50
Satchers Lake		200
Vernon's lake		400
West End Lake		500
Seguin, Geronimo Creek		400
Guadalupe River		1,000
Seymour, Grigman's lakes		250
Sherman, Artificial Lake		120
Lyon's pond		100
Noel Pond		125
Rudasill's lake		150
Stanford, Goodwin Lake		75
Swenson's Pond		200
Willow Paint Creek Lake		150
Stone, Gun and Rod Club Lake		400
Strawn, Lake Dorothy		200
Lake Ruth		200
Taylor, Bland's Lake		150
Temple, Lake Polk		200
Railroad Lake		100
Terrell, Asylum Pond		200
Cate Pond		200
Cattle Ranch Pond		150
Country Club Lake		1,000
Fogleman Pond		200
Grinnan's Pond		200
Laudry Lake		200
Muckleroy's Pond		200
Overton's Pond		300
Railroad Lake		150
Ranch Pond		200
Texarkana, Rodgers' Pond		400
Waterworks Pond		200
Thurber, Thurber Lake		300
Timpson, Curve Lake		300
Valley View, Lees' Lake		200
Van Vleck, Mathews' Lake		300
Waco, Bletsch's Pond		150
O'Connell's Lake		200
Walnutsprings, Massey's Lake		75
Stiendaugh's Lake		75
Weatherford, Bly Spring Branch		125
Clear Lake		500
Whitesboro, Rue's Pond		100
Wichita Falls, Holiday Creek Lake		500
Wortham, Brown's Pond		125
Lake Manning		150
Longbotham's Pond		150
Smith's Pond		150
Vermont:		
Rutland, Lake Bomoseen		200
Virginia:		
Ashburn, Goose Creek		1,000
Ashland, Luck's pond		75
Bracey, Davis Pond		100
Buffalo Junction, Blanks Pond		200
Pools Mill Pond		200
Callaghan, Dunlaps Creek	3,333	
Covington, Jackson River	3,333	
Culpeper, Muddy Run		800
Nalls Dam		800
Dry Fork, Sandy River		150
East Radford, Little River	2,000	
Wolf Creek	2,000	
Farmville, Burgers Pond		100
Virginia—Continued.		
Fries, New River	2,000	
Gate City, Copper Creek		250
Lexington, North River		250
Whistle Creek Dam		200
Louisa, Bucks Pond		800
Luray, South Branch of Shenandoah River		300
Marion, Middle Fork of Holston River	4,000	
Martinsville, Electric Pond		350
Leatherwood Creek	1,000	
Marrowbone Creek	1,000	
Smith Pond	1,000	
Smith River	4,000	
Mitchell, Rapidan River		800
Nelson, Aarons Creek		300
Norfolk, Lake Bradford		750
Lake Smith		1,200
Little Creek		750
Norton, Bear Creek	1,200	
Occoquan, Occoquan River		800
Orange, Rapidan River		800
Petersburg, Pannill's pond		1,150
Swift Creek		1,150
Rapidan, Rapidan River		800
Rockfish, Hardwick's lake		100
Rocky Mount, Black Water River	1,000	
Pig River	1,000	
Shawsville, South Fork of Roanoke River	1,000	
Strasburg, North Branch of Shenandoah River		300
Timberidge, North River		200
Vesuvius, Morel Creek		100
Warrenton, Rappahannock River		800
Williamsburg, Kings Mill Pond		100
Winchester, Back Creek		100
Washington:		
Creston, Hunters Lake		100
Curlew, Beaver Lake		200
Myers Falls, Pinkston Lakes		200
Newport, Shearer's lake		200
Vane's lake		350
Republic, Howard's lake		150
Yelm, Clear Lake		200
West Virginia:		
Bellington, Tygarts Valley River		600
Clarksburg, Fork of Monongahela River		225
Elkins, Tygarts Valley River		600
Elm Grove, Big Wheeling Creek		650
Fairmont, Buffalo Creek		300
City Reservoir		100
Tygarts Valley River		600
West Fork of Monongahela River		300
Great Cacapon, Cacapon River		600
Hinton, Blue Stone River	8,334	
Huntington, Guyandotte River		260
Mud River		260
Kearneysville, Opequon Creek		300
Little Falls, Monongahela River		200
Logan, Guyandotte River		260

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

LARGE-MOUTH BLACK BASS—Continued.

State, locality, and disposition.	Fry.	Fingerlings, yearlings, and adults.
West Virginia—Continued.		
Martinsburg, Back Creek		1,250
Opequon Creek		300
Matoaka, Widemouth Creek		250
Morgantown, Cheat River		300
Moundsville, Camp Grounds Lake		200
Romney, South Branch of Potomac River		600
Shenandoah Junction, Cress Creek		300
Shepherdstown, Potomac River		1,850
Talcott, Greenbrier River		520
Terra Alta, Lake Terra Alta		200
Uffington, Monongahela River		500
Wisconsin:		
Athelstane, Elbow Lake		280
Brodhead, Sugar River		125
Colgate, Lake Five		200
Durand, Bear Lake		250
Thompsons Lake		250
Eagle River, Sand Lake		100
Stone Lake		100
Eau Claire, Altoona Lake		150
Elkhorn, Lauderdale Lakes		200
Wisconsin—Continued.		
Menomonie, Menomonie Lake		250
North Lake, North Lake		190
Rhinelander, Eby Lake		200
Rice Lake, Rice Lake		100
Solon Springs, Bass and Twin lakes		100
Lake St. Croix		100
Wolf Lake		100
Sparta, Perch Lake		100
Walnarth Pond		100
Spooner, Seymour Lake		100
Spread Eagle, Spread Eagle lakes		60
Sussex, Lake Keesus		200
Wausau, Big Rib River		100
Wyoming:		
Carter, Patterson Lake		250
Hanna, Sederlins' Lake		200
Sheridan, Brundage Pond		250
Dowlin's reservoir		375
Spring Lake		375
Sherman, two reservoirs		150
Upton, Medeine Springs		250
Total[a]	90,300	434,272

SUNFISH OR BREAM.

State, locality, and disposition.	Fingerlings, yearlings, and adults.
Alabama:	
Allenton, Futch's pond	200
McWilliams' pond No. 1	200
McWilliams' pond No. 2	200
McWilliams' pond No. 3	200
McWilliams' pond No. 4	200
Rowell's pond	200
Bessemer, Water Works Pond	60
Billingsley, Grimes' pond	100
Birmingham, Anderson's pond	100
Calcis, Kelleys Creek	200
Camden, Lowler's pond	400
Caldwell, Morris Spring	75
Sanders's pond	75
Clio, Pippin's pond	100
Coaling, Johnsons Pond	60
Collinsville, McMahan's pond	75
Elamville, Percyer Pond	100
Estelle, Clover Valley Pond	125
Ethelville, Hancock's pond	400
Eufaula, Hudson's pond	200
Eutaw, Mill Pond	100
Fort Deposit, Sampley's pond	100
Fort Payne, Artificial Lake	75
Towers's lake	75
Garland, Bonanza Pond	150
Geneva, Johnson Branch	100
Hartsells, Mitchell's pond	70
Hillsboro, Garnett's pond	70
Huntsville, Finney's pond	70
Inverness, Cope's pond	200
Jacksonville, Cotton Mills Reservoir	100
Lincoln, Norris Pond	100
Sawyer's pond	100
Alabama—Continued.	
Livingston, Hendley Pond	100
Jackson's pond	100
Montgomery, Jacksons Lake	200
Newton, Factory Pond	100
Opelika, Bailey's pond	150
Browning's pond	100
Dunbar's pond	150
Spring Pond	150
Oxford, Dulin's pond	100
Ozark, Adams' pond	100
Carroll's pond	100
Pine Apple, Spring Pond	200
Pine Hill, Hare's pond	200
Prattville, Smith's pond	100
Rutherford, Harden's lake	90
Seale, Anderson's lake	100
Talladega, Horton's pond	100
Spring Pond	100
Threenotch, Mary Van Pond	100
Valley Head, Ellison's mill pond	75
Whitney, Green's pond	75
Arkansas:	
Magnolia, Emerson's pond	600
Morrillton, Reid's pond	1,000
Rector, Abney's pond	200
Saint Joe, McNair Pond	100
Thompson Dill's pond	100
District of Columbia:	
Soldiers' Home, South Pond	400
Florida:	
Quincy, Lillian Springs Pond	100
Georgia:	
Amsterdam, Attapulgus Creek	200
Atlanta, East Lake	200
Lakewood Lake	100
Rivers' pond	100
Athens, Hodgson's pond	100
Augusta, Augusta Game Preserve Club Pond	200

[a] 100 fry and 22,652 fingerlings were lost in transit.

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

SUNFISH OR BBEAM—Continued.

State, locality, and disposition.	Fingerlings, yearlings, and adults.
Georgia—Continued.	
Box Springs, Lake Mohignac	300
Buford, Allen's pond	100
Cairo, Tired Creek	200
Chipley, Jenkins Spring	100
Clayton, Giles' pond	100
Ledbetter's pond	100
Colbert, Carither's pond	100
Columbus, Blanchards Mill Pond	150
Columbus, Shorter Pond	125
Crawfordville, Ashbury's pond	100
Boswell Pond	100
Jordans' pond	100
Ogeechee River	200
Reids Pond	100
Cusseta, McMurran's pond	100
Dalton, Artificial Lake	75
Hill's lake	75
Lukens Lake	75
Miller's pond	75
Doerun, Edwards' pond	100
Duluth, McClure's pond	135
Experiment, Redding's pond	250
Louks' pond	300
Fitzgerald, Spring Pond	200
Forsyth, Lake View Pond	100
Oaklawn Pond	150
Fort Valley, Hickory Creek	150
Gainesville, Lake Warner	135
Greenville, Maffetts' pond	300
Greenwood, Amis' pond	100
Grovetown, McCoy Pond	100
Hamilton, Swint's pond	100
Harlem, Brickyard Pond	100
Irwinville, Clements' pond	200
Jefferson, Bennett's pond	100
Louisville, Erin Mill Pond	200
Macon, Gates' pond	100
Recreation Club Pond	200
Riggins Mill Pond	200
Waterman's pond	200
Marietta, Freyer's pond	50
Marshallville, Lake Clara	150
Pharr's pond	125
Mitchell, Hawkins' pond	100
Norcross, Barre's pond	100
Summerour's pond	100
Norwood, Bradshaw's pond	100
Palmetto, Railroad Pond	200
Paschal, Leonard's pond	125
Mill Pond	180
Poulan, Cotton Mills Pond	100
Powder Springs, Bingham's pond	150
Raleigh, Bowden's pond	100
Sandersville, Harris's pond	100
Savannah, Norwood's lake	200
Sparta, Alkin Pond	100
Stillesboro, Jackson's pond	200
Stinson, Williams Branch	100
Thomaston, Piney Woods Branch	100
Trice's pond	100
Thomson, Sills Creek Pond	100
Tifton, Youman's pond	200
Upatoie, McKee's ponds	275
Valdosta, Longview Lake	100
Walker County, McFarlands Lake	75
Warrenton, Kitchens Pond	100
Maner's pond	100
Mathews' pond	100
Pecan Pond	200
Winchester, Lowe Place Pond	100
Winder, Causey's pond	100
Flanigan's pond	100
Yatesville, Dumas' pond	100

State, locality, and disposition.	Fingerlings, yearlings, and adults.
Illinois:	
Abingdon, Lake Edna	300
Aurora, Fox River	1,500
Baylis, Sykes' pond	300
Belleville, Hienemann's pond	200
Carterville, Hampton's lake	200
Carthage, Grayham's lake	200
Chesterfield, Bode's pond	100
Loper's pond	100
Collinsville, Oeheler's pond	200
Decatur, Needham's pond	200
Sangamon River	200
Franklin, Hartland Lake	300
Seymour's lake	300
Galesburg, Rice Lake	300
Golden Hill, Whitfords Pond	200
Greenville, Lindly's pond	600
Harristown, Twin Lakes	100
Homer, Salt Fork of Vermilion River	900
Lerna, Lone Elm Pond	100
Litchfield, Shoal Creek	200
Monmouth, Hardin's lake	300
Naperville, Goodwin's lake	300
O'Fallon, Cottonwood Lake	100
Ogden, Dresback's pond	300
Harris, Fish Clubs Lake	100
Parker, Eaton's pond	200
Webb's pond	200
Pleasant Hill, Emmert Lake	600
Rockefeller, Diamond Lake	300
Rock Island, Prospect Park Lake	600
Sidell, Railroad Reservoir	500
Summerfield, Wittmer's pond	100
Taylor Ridge, Harris' pond	300
Watага, Loy's pond	300
Waverly, Cox Pond	300
Indiana:	
Batesville, Stockinger's pond	100
Flora, Reprogle's pond	100
Mentor, Ubelhor's lake	100
Middletown, Spring Lake	100
Kansas:	
Junction City, Whiskey Point Lake	240
Kentucky:	
Alexander, Rankin's pond	100
Finchville, Maple Pond	75
Pickett's pond	75
Frankfort Armstrong's pond	75
Fredonia, Brasher's pond	100
Glasgow, Mayfield's pond	100
Spring Pond	100
Glasgow Junction, Shipley's pond	100
Hopkinsville, Davie's pond	100
Lawrenceburg, Johnson's pond	75
Lexington, Lake Ellerslie	300
Louisville, Silver Lake	800
Mayfield, Axsom's lake	200
Mt. Sterling, Prewitt's pond	150
Wyat's pond	100
Pewee Valley, Kice's lake	150
Pineville, Moss' pond	100
Richmond, Ross' pond	100
Shelbyville, Maplehurst Pond	75
Sparta, Brown's pond	100
Eagle Creek	250
Gibson Pond	150
Kemper's pond	150
McHatton Lake	150
Mason Lake	100
Moore's lake	150
Springfield, Brundy's pond	100
Tiptop, Dickson's pond	100
Trenton, Crutchfield's pond	100
Gillian's pond	150
Jones' pond	200
Wilson's pond	200

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

SUNFISH OR BREAM—Continued.

State, locality, and disposition.	Fingerlings, yearlings, and adults.
Louisiana:	
Quitman, Snell's pond	1,000
Maryland:	
Berwyn, Paint Branch Pond	200
Mississippi:	
Baldwyn, Stubbs' pond	500
Bay St. Louis, Belma Pond	700
Bay Springs, Spring Brook	250
Brookville, Crescent Pond	200
Robertson's pond	200
Corinth, Waukomis Lake	700
Fayette, Cottage Home Pond	200
Guntown, Bryson's pond	150
Green's pond	200
Hattiesburg, Hemphills Pond	150
Hazlehurst, Hazlehurst Lake	1,640
McCool, Thompson's pond	300
Maben, Thomas' pond	300
Macon, Douglas' pond	200
Mill Pond	150
Stevens' pond	200
Mayhews, Walker's pond	150
Myrtle, Sunny Side Pond	280
Nesbitt, Dean's pond	300
Wilson's pond	300
Newton, Byrd's pond	250
Okolona, East Lake	700
Okolona Pond	600
Round Lake	1,000
Walton's pond	600
Oxford, Pasture Pond	300
Pickens, Bridgforth's pond	250
Ratliff, Turner's pond	200
Shuqualak, Anderson's pond	200
Summerland, Williams' pond	300
Tupelo, Aucker's pond	150
Park Lake	20,000
Wiggins, McNeal's pond	600
Woodville, Johnson's pond	600
Missouri:	
Cape Girardeau, Mt. Auburn Pond	200
Conway, Miller's pond	100
Glen Echo, Lake McCreery	900
New Mexico:	
Lordsburg, Ownby's pond	200
New York:	
Highland Mills, Cromwell Lake	150
North Carolina:	
Balsam, Ensley's pond	300
Brevard, Ivey Pond	400
Carthage, Maple Leaf Lake	35
Durham, Markham's pond	50
Hendersonville, Huger Place Pond	500
Rhetts' pond	800
Staton pond	500
High Point, Vestal's pond	35
Laurinburg, Shoe Heel Pond	45
Nashville, Bailey Pond	45
Oxford, Woodleaf Pond	45
Raeford, Upland Pond	35
Raleigh, Barabee's pond	50
Ridgeway, Crowder's pond	35
Stovall, Currier's pond	100
Gregory's pond	100
Walton Pond	45
Topton, Sweetwater Pond	300
Waynesville, Campbell's pond	100
Ohio:	
Allinnce, Lake Park Lake	150
Akron, Adamson's pond	100
Lake Pippin	165
Cleveland, Bole's pond	160
Chillicothe, Ellensmere Lake	1,090
East Liverpool, Cartright's pond	100
Terrace Park, Dapper's pond	100
Zanesville, Werner's pond	100
Oklahoma:	
Crescent, Kelley's pond	135
Hunter, Hahn's pond	135
Pennsylvania:	
Naomi Pines, Naomi Lake	100
New Bethlehem, Pine Run	250
Reading, Holls' lake	400
Saint Peters, French Creek	200
South Carolina:	
Cowpens, Brown's Reservoir	80
Louise Pond	80
Enoree, Brickyard Pond	300
Greenville, Pride's pond	100
Spartanburg, Bomar Pond	150
Fernwood Pond	200
Oakwood Spring Branch	100
Reservoir	100
Spartan Mill Pond	200
Taylors, Chick Springs Lake	200
Yorkville, Allison Creek Pond	150
South Dakota:	
Huron, Pearl Creek	180
Tennessee:	
Chattanooga, Kenwood Lake	250
Erwin, Erwin Pond	800
Franklin, Big Harpeth River	300
Johnson City, Melvin's pond	500
Soldiers Home Lake	1,250
Knoxville, Tennessee River	300
McEwen, McEwen Mill Pond	100
Maryville, Taylor's pond	75
Medon, Bond's pond	200
Nunnelly, Piney and Mill Creeks	500
Pulaski, Pigeon Roost Creek	250
Texas:	
Avery, Miller's pond	50
Bettie, Efurd's pond	150
Burlington, McAtee's pond	100
Carthage, Bristow Lake	200
Brushy Lake	200
Crane Lake	200
Coleman Lake	200
Duck Lake	200
Spring Lake	200
Whitney's pond	100
Clifton, Artesian Pond	50
Eskota, Roux's pond	100
Fort Worth, Gillespie's pond	50
Graham, Ford's pond	75
Kaufman, Phillip's pond	100
Kerrville, Noll's pond	50
Longview, Railroad Pond	200
McKinney, McKinney Club Lake	150
Maybank, Tharp's pond	50
Palestine, Two Lakes	75
Panhandle, Lill's pond	100
Pittsburg, Davis' pond	80
Dickson's pond	150
Pritchett, Welborn's lake	150
Quanah, Artificial Lake	1,000
San Antonio, San Antonio River	150
Sweetwater, Hoyter's pond	100
Terrell, Railroad Lake	200
Virginia:	
Farmville, Ligon's pond	200
Scottsville, Jones' pond	300
Williamsburg, Jones' pond	300
West Virginia:	
Parkersburg, City Park Lake	157
Wellsburg, Point Breeze Pond	200
Total[a]	90,937

[a] 6,010 fingerlings were lost in transit.

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

PIKE PERCH.

State, locality, and disposition.	Eggs.	Fry.
Connecticut:		
Bristol, Tuttles' pond		400,000
Canaan, Housatonic River		400,000
Lake Pannahecornock		300,000
Lake Washining		300,000
Twin Lakes		300,000
Illinois:		
Carbondale, Thompsons's lake		500,000
Hillsboro, Riley's Rest Pond		500,000
Ingleside, Illinois Fish Commission—		
Fox Lake		1,000,000
Grass Lake		500,000
Petit Lake		500,000
Pistakee Bay		500,000
Pistakee Lake		500,000
Shepherd, Sni E Carte River		1,000,000
Indiana:		
Angola, Fox Lake		500,000
Howard Lake		500,000
Honor Lake		500,000
Burket, Lake Palestine		500,000
Knox, Bass Lake		500,000
Monticello, Tippecanoe		800,000
Warsaw, Center Lake		500,000
Chapman's Lake		500,000
Pike Lake		500,000
Winona Lake		500,000
Iowa:		
Manchester, Maquoketa River		300,000
Waterloo, Cedar River		500,000
Kentucky:		
McBrayer, Salt River		500,000
Saint Mary, Rolling Fork		500,000
Vanceburg, Salt Lick Creek		500,000
Maine:		
North Belgrade, Maine Fish Commission	1,500,000	
Massachusetts:		
Millbury, Singletary Lake		400,000
Pittsfield, Onota Lake		400,000
Pittsfield, Pontoosuc Lake		400,000
Southbridge, Quinebaug River		400,000
Michigan:		
Allegan, Dumont Lake		500,000
Detroit, Michigan Fish Commission	49,000,000	
Detroit, Belle Isle Aquarium	500,000	
Devils Lake, Devils Lake		500,000
Hopkins, Herlain Lake		500,000
Howell, Pardee Lake		500,000
Ironwood, Triplett Lake		125,000
Lincoln, Michigan Fish Commission, West Twin Lakes		500,000
New Richmond, Kalamazoo Lake		500,000
Michigan—Continued.		
New Richmond, Kalamazoo River		800,000
Pontiac, Cass Lake		800,000
Port Huron, Lake Huron		6,000,000
Roberts Landing, St. Clair River		5,000,000
West Bay City, Saginaw Bay		10,000,000
Minnesota:		
Alexandria, Union Lake		125,000
Browns Valley, Big Stone Lake		150,000
Browns Valley, Lake Traverse		150,000
Carlton, Club Lake		125,000
Deerwood, Serpent Lake		150,000
Fergus Falls, Wall Lake		150,000
Saginaw, Grand Lake		125,000
Saint Peter, Lake Emily		125,000
Saint Peter, Lake Jefferson		300,000
Virginia, Little Fork River		175,000
Missouri:		
Arlington, Gasconade River		800,000
Newburg, Little Piney River		200,000
Saint Joseph, Missouri Fish Commission	10,000,000	
New Hampshire:		
Canobie Lake, Canobie Lake		400,000
Canobie Lake, Corbett's pond		600,000
Canobie Lake, Island Pond		600,000
Colebrook, Lake Umbagog		400,000
Keene, Spofford Lake		800,000
New York:		
Caledonia, New York Fish Commission	5,000,000	
Mouth of Scotch Brook, St. Lawrence River		2,700,000
New York, New York City Aquarium	500,000	
Ohio:		
Catawba Island, Lake Erie		20,000,000
East Orwell, Grand River		800,000
Isle St. George, Lake Erie		20,000,000
Kelleys Island, Lake Erie		20,000,000
Locust Point, Lake Erie		10,000,000
Middle Bass Island, Lake Erie		20,000,000
Put-in Bay, Lake Erie		32,800,000
Pennsylvania:		
Allenwood, South Creek		500,000
Allenwood, White Hole Creek		500,000
Beavertown, Middle Creek		800,000

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

PIKE PERCH—Continued.

State, locality, and disposition.	Eggs.	Fry.
Pennsylvania—Cont'd.		
Cambridge Springs, Lake Conneaut		300,000
Eagles Mere, Eagles Mere Lake		300,000
Eagles Mere, Lewis Lake		500,000
Erie, Pennsylvania Fish Commission	69,600,000	
Marion, Back Creek		550,000
Marion, Conococheague Creek		550,000
Meadville, Cussewago Creek		500,000
Melton, West Branch of Susquehanna River		800,000
Montrose, Jones Lake		300,000
Watsontown, West Branch of Susquehanna River		800,000
South Dakota:		
Parkston, James River		500,000
Parkston, Pony Creek		500,000
Vermont:		
Boltonville, Tickleneck Pond		400,000
Burlington, Lake Champlain		1,000,000
Burlington, Winooski River		2,400,000
Gander Bay, Lake Champlain		2,000,000
Goose Bay, Lake Champlain		2,000,000
Highgate Spur, Lake Champlain		3,000,000
Maquam Bay, Lake Champlain		1,200,000
Marsh Bay, Lake Champlain		600,000
Missisquoi Bay, Lake Champlain		4,200,000
Vermont—Continued.		
Missisquoi River, off East Branch, in Lake Champlain		3,000,000
Missisquoi River, off Middle Branch, in Lake Champlain		3,000,000
Missisquoi River, off mouth, in Lake Champlain		7,200,000
Missisquoi River, off South Branch, in Lake Champlain		11,650,000
Saint Albans Bay, Lake Champlain		2,950,000
Sheldon Junction, Silver Lake		1,000,000
Vergennes, Otter Creek		1,500,000
West Milton, Lake Champlain		1,800,000
Virginia:		
Mount Jackson, North Fork of Shenandoah River		500,000
West Virginia:		
Hinton, Greenbrier River		680,000
Wisconsin:		
Bright, Popple River		175,000
Greenwood, Black River		350,000
Greenwood, Cawley Creek		175,000
Greenwood, Eau Claire River		175,000
Greenwood, Popple River		175,000
Lampson, Twin Lakes		125,000
Rhineland, Lake Reif		150,000
Total[a]	136,100,000	232,105,000

YELLOW PERCH.

District of Columbia:		
Soldiers' Home, North Pond		500
Illinois:		
Buffalo, Mill Pond		400
Carlinville, railroad reservoir		200
Jacksonville, Russell's pond		250
Orleans, Stroun's pond		250
Springfield, Smith's pond		
Iowa:		
Manchester, Maquoketa River		365
Maryland:		
Accokeek Creek, off mouth, in Potomac River	6,472,600	
Battery Haul, Chesapeake Bay	19,500,000	
Broad Creek, off mouth, in Potomac River	8,222,750	
Bryans Point, Potomac River	7,402,000	
Cecil County—		
Elk River	3,000,000	
North East River	10,500,000	
Maryland—Continued.		
Chase, Dundee Creek	1,500,000	
Eastern Flats, Chesapeake Bay	25,000,000	
Harford County, Swan Creek	10,000,000	
Piscataway Creek, off mouth, in Potomac River	10,847,000	
Swan Creek, off mouth, in Potomac River	6,565,000	
Washington County, Antietam Creek	1,156,000	
Western Flats, Chesapeake Bay	23,500,000	
Minnesota:		
Bemidji, Bemidji Lake		100
New Jersey:		
Grenloch, Bell's lake		75
Murray Hill, Spring Pond		100
Paterson, Jackson's pond		50
New York:		
Highland Mills, Cromwell Lake		125
Ohio:		
Willoughby, East Branch of Chagrin River		300

[a] 170,000 fry were lost in transit.

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

YELLOW PERCH—Continued.

State, locality, and disposition.	Eggs.	Fry.
Pennsylvania:		
Arcola, Perkiomen Creek		25
Ashland, Engles Creek		50
Muncy Valley, Eaglesmere Lake		75
Virginia:		
Dogue Creek, off mouth, in Potomac River	7,220,000	
Herndon, Potomac River	412,500	
Little Hunting Creek, off mouth, in Potomac River	7,382,000	
Virginia—Continued.		
Occoquan Creek, off mouth, in Potomac River	3,851,250	
Pohick Creek, off mouth, in Potomac River	9,000,000	
Pursellville, Minnehaha Creek	412,500	
Total [a]	161,943,000	3,065

STRIPED BASS.

State, locality, and disposition.	Fry.
Maryland:	
Battery Haul, Chesapeake Bay	160,000
North Carolina:	
Weldon, Roanoke River	2,191,000
Total	2,351,000

WHITE PERCH.

State, locality, and disposition.	Eggs.	Fry.
Connecticut:		
Norwalk, Norwalk Reservoir		225,000
Winsted, Brookside Lake		315,000
Delaware:		
Rehoboth, Lake Gerar		500,000
District of Columbia:		
Fish Lakes, Potomac River		500,000
Maine:		
Readfield, Parkers' pond		135,000
Maryland:		
Baltimore, Maryland Fish Commission	5,400,000	
Battery Haul, Chesapeake Bay		61,095,000
Berlin, Trap Creek		500,000
Cecil County—		
Elk River		10,000,000
North East River		4,555,000
Chase, Dundee Creek		450,000
Eastern Flats, Chesapeake Bay		2,100,000
Elk River, off mouth, in Chesapeake Bay		26,000,000
Havre de Grace, Chesapeake Bay		4,000,000
Maryland—Continued.		
Swan Creek, off mouth, in Chesapeake Bay		25,940,000
Western Flats, Chesapeake Bay		39,000,000
Massachusetts:		
Athol, Queen Lake		180,000
Millbury, Singletary Pond		135,000
South Chelmsford, Baptist Pond		180,000
Whitinsville, Whitin's pond		135,000
New Hampshire:		
Canaan, Spectacle Pond		135,000
Claremont, Crescent Lake		180,000
Lakeport, Lake Winnepesaukee		180,000
Vermont:		
Saint Albans, Great Back Bay		250,000
Total [b]	5,400,000	176,690,000

COD.

State, locality, and disposition.	Fry.
Maine:	
Boothbay Harbor—	
Atlantic Ocean	2,910,000
Booth bay Harbor	3,039,000
Outer Boothbay Harbor	1,967,000
Georgetown—	
Casco Bay	2,007,000
Sheepscott Bay	668,000
New Harbor, New Harbor	1,112,000
Orrs Island, Casco Bay	2,224,000
Pemaquid, Johns Bay	3,806,000
Maine—Continued.	
South Bristol—	
Christmas Cove	3,511,000
Johns Bay	906,000
Southport—	
Atlantic Ocean	2,910,000
Boothbay Harbor	4,427,000
Sheepscott River	293,000
Massachusetts:	
Buzzards Bay	6,465,000
Gloucester, Atlantic Ocean	46,741,000

[a] 450,000 fry were lost in transit.

[b] 600 fingerlings were lost in transit.

DETAILS OF DISTRIBUTION OF FISH AND EGGS DURING THE FISCAL YEAR 1906—Con.

COD—Continued.

State, locality, and disposition.	Fry.	State, locality, and disposition.	Fry.
Massachusetts—Continued.		Massachusetts—Continued.	
Jobs Neck, Vineyard Sound	8,420,000	Weepecket Islands, Buzzards Bay	1,055,000
Quicks Hole, Vineyard Sound	15,295,000	Woods Hole—	
Robinsons Hole, Vineyard Sound	28,457,000	Eel Pond	3,138,000
Rockport, Atlantic Ocean	5,270,000	Woods Hole Harbor	316,000
Tarpaulin Cove Light, Vineyard Sound	10,798,000		
Waquoit Bay, Vineyard Sound	3,757,000	Total	159,492,000

FLATFISH.

Massachusetts:		Massachusetts—Continued.	
Edgartown, Katama Bay	4,677,000	Tarpaulin Cove, Vineyard Sound	1,657,000
Falmouth, Great Pond	5,798,000	Waquoit Bay, Waquoit Bay	18,949,000
Gloucester, Atlantic Ocean	2,363,000	West Falmouth, West Falmouth Harbor	4,506,000
Gloucester Harbor	93,752,000	Woods Hole, Eel Pond	3,702,000
Gosnold, Tarpaulin Cove	3,263,000	Little Harbor	5,628,000
Hadley Harbor, Hadley Harbor	13,202,000	Woods Hole Harbor	23,547,000
Lackeys Bay, Lackeys Bay	3,021,000	Rhode Island:	
Vineyard Sound	20,198,000	East Greenwich, East Greenwich Harbor	17,025,000
Manchester, Atlantic Ocean	10,628,000		
North Tisbury, Lamberts Cove	4,822,000	Total	285,049,000
Quissett, Quissett Harbor	24,360,000		
Tarpaulin Cove, Vineyard Sound	10,617,000		
Vineyard Haven, Lagoon Pond	13,301,000		

LOBSTER.

Maine:		Maine—Continued.	
Biddeford, Biddeford Pool	1,500,000	Westport, Sheepscott River	1,500,000
Boothbay, Linekins Bay	1,500,000	Wood Island Harbor, Gulf of Maine	5,000,000
Bristol, Johns Bay	1,500,000	York Harbor, Gulf of Maine	1,000,000
Marsh Isle Harbor	1,500,000	Massachusetts:	
Muscongus Sound	2,000,000	Boston, Atlantic Ocean	1,200,000
New Harbor	1,000,000	Boston Bay	279,000
Brooklin, Herricks Bay	3,500,000	Cohasset, Atlantic Ocean	2,000,000
Cape Porpoise, Cape Porpoise Harbor	1,000,000	Cuttyhunk, Buzzards Bay	300,000
Gulf of Maine	5,000,000	Davis Ledge, Boston Bay	279,000
Cross Island, Northeast Harbor	1,000,000	Devils Back Buoy, Boston Bay	374,000
Northwest Harbor	1,000,000	Gloucester, Atlantic Ocean	2,600,000
Cushing, Pleasant Gut	2,000,000	Graves Whistling Buoy, Boston Bay	508,000
Cutler, Haycocks Harbor	1,500,000	Hardings Ledge, Boston Bay	186,000
Deer Island, Webb Cove	1,500,000	Jobs Neck, Vineyard Sound	1,053,000
Dukes Island, Gulf of Maine	1,000,000	Lackeys Bay, Vineyard Sound	244,000
Eastport, Johnsons Bay	4,000,000	Lamberts Cove, Vineyard Sound	350,000
Friendship, Muscongus Sound	1,000,000	Magnolia, Atlantic Ocean	500,000
Georges Island, Atlantic Ocean	1,500,000	Manchester, Atlantic Ocean	1,400,000
Georgetown, Sheepscott River	2,000,000	Marblehead, Atlantic Ocean	1,000,000
Gerrish Island, Gulf of Maine	5,500,000	Martins Ledge, Boston Bay	508,000
Kennebunk Beach, Gulf of Maine	2,500,000	Mishaum Point, Buzzards Bay	899,000
Kittery Point, Gulf of Maine	3,000,000	Nahant, Atlantic Ocean	800,000
Machias, Lakemans Harbor	2,000,000	Plymouth, Plymouth Harbor	472,000
Matinicus, Matinicus Bay	3,500,000	Point Allerton Bay, Boston Bay	515,000
Monhegan, Atlantic Ocean	500,000	Quissett Harbor, Buzzards Bay	860,000
New Harbor, Frenchmans Bay	500,000	Robinsons Hole, Buzzards Bay	2,777,000
New Harbor	500,000	Rockport, Atlantic Ocean	2,000,000
North Haven, North Haven Cove	1,000,000	Scituate, Boston Bay	467,000
Orrs Island, Casco Bay	6,500,000	Tarpaulin Cove, Vineyard Sound	1,200,000
Pemaquid, Damariscotta River	1,500,000	Thieves Ledge Whistling Buoy, Boston Bay	515,000
Port Clyde, Atlantic Ocean	250,000	Whistling Buoy, Plymouth Harbor	472,000
Prospect Harbor, Frenchmans Bay	4,500,000	Winthrop, Boston Bay	279,000
Rockland, Rockland Harbor	3,000,000	Woods Hole, Vineyard Sound	50,000
Saco Bay, Gulf of Maine	1,000,000	Woods Hole Harbor	200,000
St. George, Port Clyde Harbor	1,500,000	New Hampshire:	
Small Point, Horse Island Harbor	1,500,000	Hampton, Atlantic Ocean	1,700,000
Small Point Harbor	1,000,000	New Castle, Atlantic Ocean	1,800,000
Smutty Nose Island, Gulf of Maine	1,000,000	Total	117,787,000
Southport, Maddox Cove	1,500,000		
Tenants Harbor, Tenants Harbor	5,000,000		
Vinal Haven, Carvers Harbor	250,000		

O

REPORT ON THE FISHERIES OF ALASKA.

By JOHN N. COBB.

REPORT ON INSPECTION OF THE SALMON FISHERIES.

By HOWARD M. KUTCHIN.

Bureau of Fisheries Document No. 618.

Blank page retained for pagination

PREFACE.

The annual inspection of the Alaska salmon fisheries affords an opportunity for collection of statistics and observation of all the fisheries and fishery resources of the district. This information for 1905 was embodied in a report published separately from the inspection report for that year; all the data for 1906, however, have been brought together in the following pages. The Report of Inspection of the Salmon Fisheries, by Mr. Howard M. Kutchin, special agent, dealing with the conduct of the salmon fisheries from the standpoint of the laws controlling the methods of fishing, protection of salmon on the spawning beds, etc., and required annually by law, is this year presented in conjunction with statistical and other information concerning the salmon as furnished by Mr. John N. Cobb, assistant agent, whose report covers the entire subject of Alaska fisheries in their commercial aspect.

GEORGE M. BOWERS,
Commissioner.

Blank page retained for pagination

CONTENTS.

	Page.
The fisheries in general	7–12
Employees	8
Investment	8
Products	9
The salmon industry	12–44
Statistics and notes on the industry	12–23
Catch	12
Canning	13
Pickling	17
Mild-curing	19
Dry-salting	21
Smoking	22
Freezing	22
Fresh salmon	22
Hatcheries	23
Report of inspection of the salmon fisheries	25–44
List of plants operated in 1906	25
Southeast Alaska	26
General conditions	26
Notes upon various localities	26
Central Alaska	29
Orca	29
Kasilof	29
Karluk	29
Uyak	29
Alitak	30
Chignik	30
Western Alaska	31
Kuskokwim River	32
Nushagak Bay	32
Nushagak River	32
Snake River	32
Igushik River	33
Wood River	33
Kvichak River and Bay	36
Naknek River	39
Ugaguk River	40
Ugashik River	40
Bear River	41
Nelsons Lagoon	42
Japanese fishing vessels	42
Recommendations	43
Reservation of Eyak River and Lake	43
Salting of salmon bellies	43
Use of gaff-hooks in Chilkoot and Chilkat rivers	43
Closing of Wood River and establishment of hatchery	43
Vessel for use in salmon inspection	44

Page.
Other fisheries..... 45–70
Cod..... 45
Fishing stations..... 45
Statistics..... 46
Vessel fishing..... 47
Hatching..... 48
Halibut..... 48
Statistics..... 50
Vessel fishing..... 51
Herring..... 52
Statistics..... 53
Fertilizer and oil..... 54
Aquatic furs..... 56
Beaver..... 56
Muskrat..... 56
Land otter..... 56
Sea otter..... 57
Fur seal..... 58
Miscellaneous aquatic mammals..... 59
Miscellaneous fishery resources..... 59
New laws in force in 1907..... 66
Protection and regulation of Alaska fisheries..... 66–70
Prohibition against aliens..... 69
Pure-food law..... 70

THE FISHERIES OF ALASKA IN 1906.

The history of the fishing grounds, methods of fishing, and statistics for the period of this government's ownership of Alaska were treated at length in a preceding report. The present purpose, therefore, is to deal with the conditions and extent of the fisheries of the district in the year 1906 only, taking up no details but such as are necessary to show changes that have occurred since the previous year.

As in the reports for 1905, the district is considered in the four geographic sections which are generally recognized, as follows: Southeast Alaska, embracing all that narrow strip of mainland and the numerous islands adjacent, from Portland Canal northwestward to and including Yakutat Bay[a]; Central Alaska, everything on the Pacific, or south side, from Yakutat Bay westward, including the Aleutian chain; Western Alaska, the shores of Bering Sea and islands in this sea; and Arctic Alaska, from Bering Strait to the Canadian border.

The fisheries of Western, Central, and the greater part of Southeast Alaska were canvassed by the assistant agent. A considerable part of the statistics relating to the salmon fisheries was compiled from the reports sent in by the canneries and salteries; statistics of the yield of fur seals from the Pribilof Islands were obtained through the courtesy of the agent at the fur-seal islands, while figures for the remainder of the fur seals and the other aquatic furs (except sea otter) and skins, also the whalebone, walrus ivory, heads, and hides, and shells were obtained from the customs-house records at Juneau.

THE FISHERIES IN GENERAL.[a]

Heretofore almost all the fishery products of Alaska have been marketed outside the district, the natives and few white residents consuming but a small portion. During the last few years, however, there has been a steady increase in the white population, and for certain products, such as fresh and smoked salmon, trout, black cod, redfish, and crabs there is now a considerable local demand. Salmon has always been and is yet the principal element in the yield, but more and more attention is being paid each year to the other resources. Many of these, however, are still totally neglected.

[a] In the 1905 report Yakutat Bay was included in Central Alaska, but as this arrangement created a little confusion it has been changed.

EMPLOYEES.

The number of persons employed in the fisheries of Alaska in 1906 was 12,357, of whom 4,542 were engaged directly in fishing, 7,246 in the canneries, salteries, and at other shore work, and 569 employed on the transporting vessels. This total is a gain of 890 over the number employed in 1905. The small number of transporters for the large number of transporting vessels is explained by the fact that in the salmon fishery the employees, who are taken from the home port to the plant in Alaska in sailing vessels and serve as sailors on the voyage, become the fishermen during the fishing season and are counted as such, hence could not be counted also as transporters.

Southeast Alaska leads in the number of fishermen and transporters and Western Alaska in the number of shoresmen. In the total number of persons employed Western Alaska is first, followed by Southeast and Central Alaska in the order named. Whites predominate in fishing and transporting, while Chinese are in the lead as shoresmen. The Chinese have decreased in number slightly since 1905, the Japanese have increased slightly, and there has been a large increase in the number of natives employed.

EMPLOYEES IN THE ALASKA FISHERIES IN 1906.

How engaged.	Southeast Alaska.	Central Alaska.	Western Alaska.	Total.
Fishermen:				
Whites	757	609	1,541	2,907
Natives	1,345	192	88	1,625
Japanese	10	.....	.....	10
Total	2,112	801	1,629	4,542
Shoresmen:				
Whites	445	190	1,098	1,733
Natives	871	93	301	1,265
Chinese	664	470	1,360	2,494
Japanese	285	274	1,195	1,754
Total	2,265	1,027	3,954	7,246
Transporters:				
Whites	199	143	142	484
Natives	54	8	23	85
Total	253	151	165	569
Grand total	4,630	1,979	5,748	12,357

INVESTMENT.

The total investment in the fisheries was $8,835,458. In 1905 the total investment reported was $22,038,485. The explanation of this great discrepancy is (1) that this year the item of cash capital (in 1905 this item alone amounted to $12,013,200) has been eliminated entirely; it has always been a rather indefinite factor, apt to lead to misunderstanding and confusion, and it served no useful purpose, the greater part of it really being included in property values. And (2) a revaluation of the canneries has been made, a very material reduction being made in some of them. Nearly every other item in the table shows an increase over the corresponding item in 1905. In total investment Western Alaska leads, having slightly over one-half of the whole.

APPARATUS AND CAPITAL EMPLOYED IN THE ALASKA FISHERIES IN 1906.

Items.	Southeast Alaska.		Central Alaska.		Western Alaska.		Total.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
Fishing vessels:								
Steam and other power..	6	$21,300					6	$21,300
Tonnage	134						134	
Outfit		8,090						8,090
Sailing	14	8,950	3	$5,400			17	14,350
Tonnage	135		98				233	
Outfit		4,185		850				5,035
Transporting vessels:								
Steamers and launches..	73	303,025	26	238,250	45	$766,300	144	1,367,575
Tonnage	1,780		1,268		3,450		6,498	
Outfit		37,877		23,000		62,500		123,377
Sailing	10	93,350	16	396,200	30	708,500	56	1,198,050
Tonnage	7,695		16,828		37,577		62,100	
Outfit		2,820		7,800		13,400		24,020
Boats	1,228	149,930	575	67,446	939	309,725	2,742	527,101
Apparatus, vessel fisheries:								
Purse seines	4	3,400					4	3,400
Lines		3,167						3,167
Guns			50	600			50	600
Apparatus, shore fisheries:								
Haul seines	76	19,750	43	16,755			119	36,505
Purse seines	118	41,500					118	41,500
Gill nets	319	42,140	44	6,550	929	78,880	1,292	127,570
Dip nets	2	4	2	4			4	8
Traps	33	78,000	13	19,500	19	29,750	65	127,250
Lines		7,237		2,825				10,062
Spears	200	150					200	150
Shore and accessory property		1,763,509		928,001		2,504,838		5,196,348
Total		2,648,384		1,713,181		4,473,893		8,835,458

PRODUCTS.

The total quantity of products secured was 167,408,453 pounds, valued at $9,071,090. In 1905 the value of the products was $7,711,981, over which 1906 shows a gain of $1,359,489. Except for fertilizer and oil, the weights shown are round weights, or the weight of products when first taken from the water. Southeast Alaska leads in variety of products, but Western Alaska is first in quantity and value, owing to the enormous quantity of salmon canned. Two species of fish occur in the tables this year for the first time, viz, black cod (*Anoplopoma fimbria*), and redfish, or red cod (*Sebastodes melanops*). Crabs have also become a marketable commodity in both Southeast and Central Alaska. Walrus ivory, hides and heads, and whalebone are the only products reported from Arctic Alaska. The fisheries of this region, except so far as the natives are concerned in supplying their own wants, are totally neglected and probably will continue to be for some years to come, or until there is a resident white population along these bleak shores. Salmon, cod, whitefish, etc., have been reported there. It was found an impossibility to secure anything like accurate data as to the persons employed or the investment, either in the hunting of aquatic animals (except sea otter in general and seals on the Pribilof Islands), which is prosecuted in conjunction with the hunting of land animals and is general among the natives, or in the fisheries, because the natives who participate are nomadic in their habits.

PRODUCTS OF THE ALASKA FISHERIES IN 1906.

Species.	Southeast Alaska.		Central Alaska.		Western Alaska.		Arctic Alaska.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Black cod:										
Fresh	54,900	$215							54,900	$1,515
Salted	3,493	120							3,493	120
Cod:										
Fresh	4,500	220							4,500	220
Frozen	13,286	664							13,286	664
Salted	5,653	227	4,168,579	$110,473	250	$12			4,174,482	110,712
Tongues, salted			7,000	350					7,000	350
Eulachon, salted	193	11	155	5					348	16
Halibut:										
Fresh	3,347,578	125,607							3,347,578	125,607
Frozen	529,550	21,047							529,550	21,047
Salted	321,803	11,554							321,803	11,554
Smoked	1,100	110							1,100	110
Herring:										
Fresh	445,100	2,506							445,100	2,506
Salted	1,294,550	15,368	112,000	2,800					1,406,550	18,168
Smoked	67,249	2,219							67,249	2,219
Redfish	8,800	499							8,800	499
Salmon:										
Fresh—										
Humpback	21,000	660							21,000	660
King	582,502	30,254							582,502	30,254
Sockeye	14,200	710							14,200	710
Frozen—										
Coho	45,084	4,500							45,084	4,500
Dog	58,946	5,800							58,946	5,800
King	3,338	300							3,338	300
Sockeye	21,000	1,100							21,000	1,100
Canned—										
Coho	5,366,741	292,150	670,540	35,075	1,058,070	54,884			7,095,351	382,109
Dog	8,541,325	362,291			8,021,455	367,944			16,562,780	730,235
Humpback	21,142,265	979,488	207,220	9,564	1,291,290	57,899			22,640,775	1,046,951
King	149,692	8,314	510,965	28,300	1,344,200	79,608			2,004,857	116,222
Sockeye	14,701,543	908,986	29,357,835	1,711,952	51,902,760	2,999,937			95,962,138	5,620,875
Mild-cured—										
King	1,268,450	65,747			26,450	2,260			1,294,900	67,007
Pickled—										
Coho	145,530	5,642							145,530	5,642
Dog	27,000	554			35,370	996			62,370	1,550
Humpback	661,120	13,852							661,120	13,852
King					271,890	8,058			271,890	8,058
Sockeye	22,950	685	123,120	4,754	3,380,130	91,653			3,526,200	97,092

Dry-salted—										
Dog	1,486,240	16,969							1,486,240	16,969
King					24,000	1,260			24,000	1,260
Sockeye			23,926	364					23,926	364
Smoked—										
Dog	20,530	1,190							20,530	1,190
Sockeye			100	6	400	23			500	29
Salmon bellies, pickled:										
Dog	28,500	150							28,500	150
Humpback	1,209,350	13,188							1,209,350	13,188
King					20,425	185			20,425	185
Sockeye			12,350	121					12,350	121
Trout:										
Dolly Varden	7,000	560							7,000	560
Rainbow	12,200	1,185							12,200	1,185
Steelhead, fresh	6,800	302							6,800	302
Steelhead, frozen	17,269	1,720							17,269	1,720
Fertilizer:										
Herring	1,348,000	16,850							1,348,000	16,850
Salmon	672,000	8,400							672,000	8,400
Oil:										
Cod			1,800	84					[a] 1,800	84
Herring	657,495	21,917							[b] 657,495	21,917
Salmon	328,755	10,959							[c] 328,755	10,959
Clams, canned	8,000	500							[d] 8,000	500
Crabs	1,800	90	1,200	80					[e] 3,000	170
Aquatic furs and skins:										
Beaver	406	2,272	385	1,926	745	4,422			[f] 1,536	8,620
Muskrat			159	101	293	201			[g] 452	302
Otter—										
Land	1,733	7,225	1,372	5,124	1,167	4,269			[h] 4,272	16,618
Sea	15	954	125	3,875					[i] 140	4,829
Seal—										
Fur	2,238	8,094	1,344	1,344	86,862	445,147			[j] 90,444	454,585
Hair	21,528	5,783	1,177	320	30,447	6,229			[k] 53,152	12,332
Walrus					200	40			[l] 200	40
Walrus:										
Ivory	343	65	29	29	6,570	4,208	4,381	$2,823	11,323	7,125
Heads							70	65	[m] 70	65
Whalebone			90	10			8,854	42,232	8,944	42,242
Shells	60	5							60	5
Total	64,690,703	2,981,078	35,201,476	1,916,657	67,502,974	4,128,235	13,305	45,120	167,408,453	9,071,090

[a] Represents 240 gallons.
[b] Represents 87,666 gallons.
[c] Represents 43,834 gallons.
[d] Represents 1,000 bushels.
[e] Represents 1,000 crabs.
[f] Represents 1,536 skins.
[g] Represents 3,611 skins.
[h] Represents 1,709 skins.
[i] Represents 28 skins.
[j] Represents 15,074 skins.
[k] Represents 17,684 skins.
[l] Represents 20 hides.
[m] Represents 3 heads.

STATISTICS AND NOTES ON THE INDUSTRY.

As a whole the season of 1906 was a very fair one to the fishermen, so far as the salmon catch was concerned, while financially it was especially favorable to the packers of the cheaper species. In Bristol Bay there was a good run of humpback salmon. Such a run, according to the fishermen, usually occurs every fourth year. In Southeast Alaska the run of cohos was exceptionally good, this, the fishermen say, being the case every third or fourth season.

CATCH.

The number of salmon taken and the apparatus used are shown below:

TABLE SHOWING, BY SPECIES AND APPARATUS, THE CATCH OF SALMON IN 1906.

Apparatus and species.	Southeast Alaska.	Central Alaska.	Western Alaska.	Total.
	Number.	*Number.*	*Number.*	*Number.*
Seines:				
Coho, or silver	309,154	23,738	.....	332,892
Dog, or chum	1,157,139	.....	.....	1,157,139
Humpback, or pink	5,722,877	.....	.....	5,722,877
King	1,122	3,640	.....	4,762
Sockeye, or red	1,502,389	4,068,582	.....	5,570,971
Total	8,692,681	4,095,960	.....	12,788,641
Traps:				
Coho, or silver	256,708	93,485	1,500	351,693
Dog, or chum	355,048	.....	466,632	821,680
Humpback, or pink	1,377,439	64,100	352,526	1,794,065
King	4,335	16,858	6,530	27,723
Sockeye, or red	615,261	1,487,606	791,166	2,894,033
Total	2,608,791	1,662,049	1,618,354	5,889,194
Gill nets:				
Coho, or silver	91,609	.....	206,110	297,719
Dog, or chum	58,522	.....	1,222,043	1,280,565
Humpback, or pink	99,496	.....	91,561	191,057
King	30,956	7,869	138,343	177,168
Sockeye, or red	353,383	441,491	10,224,060	11,018,934
Total	633,966	449,360	11,882,117	12,965,443
Lines:				
Coho, or silver	2,500	.....	.....	2,500
King	58,174	.....	.....	58,174
Total	60,674	.....	.....	60,674
Spears:				
Sockeye, or red	52,823	.....	.....	52,823
Grand total	12,048,935	6,207,369	13,500,471	31,756,775

Only five forms of apparatus—seines, traps, gill nets, lines, and spears—were employed, and of these gill nets caught but a few more

than seines, while each took more than twice as many as the traps. The catch with lines and spears was comparatively small. In number of fish caught, Western Alaska slightly leads Southeast Alaska. Of the total catch of 31,756,775 fish, 984,804 were cohos, 3,259,384 dogs, 7,707,999 humpbacks, 267,827 kings, and 19,536,761 sockeyes. Western Alaska leads in the catch of sockeyes and dogs, while Southeast Alaska ranks first in cohos, humpbacks, and kings.

CANNING.

The season of 1906 was a very good one, owing to the large pack—the best since 1903—and to the remunerative prices received for the low-grade species. Owing to the agitation in regard to conditions prevailing in the meat-packing plants of Chicago and elsewhere, a distrust of all American canned goods—including salmon—was engendered in Europe, which for a few months materially curtailed the sales of sockeye salmon, the principal species shipped to that part of the world; but the foreign consumers' mistaken idea that the conditions stated to be prevailing in the meat-packing establishments existed in even the remotest connection with the canning of salmon in Alaska was soon dispelled, and the volume of orders gradually became normal. Great care is almost universally exercised in the selection of the salmon to be packed, especially the high-grade species which the foreign consumer demands.

The earthquake and fire in San Francisco in April seriously inconvenienced some of the canneries whose headquarters were in that city and whose vessels had not yet left for Alaska. The outfit of the Williams cannery of the Alaska Packers' Association, on the Ugashik River, was destroyed, and arrangements were hastily made to operate the plant as a saltery, but when the Coffey Creek cannery of the association was burned down on May 31, a portion of its saved outfit was transferred to the Williams plant, which was then operated as a cannery. The chief inconvenience to the other cannerymen was in the dispersal of their Chinese employees. Eventually this was overcome, however, and all the plants were operated as usual, Indians being secured for the most part in place of the missing orientals. Besides the Coffey Creek cannery of the Alaska Packers' Association, on Kvichak Bay, in Western Alaska, fire destroyed also the Kasaan Bay cannery of the Porter Fish Company in Southeast Alaska.

A few hundred cases of red salmon which had been cooked but once were put up by several of the canneries this season as an experiment. The cans were cooked for one hundred minutes. An objection to this process is the difficulty experienced in testing the cans, the only method being to watch the tops. If there is a leak, the top will sink; if the can is air-tight, the top will swell, collapsing in a few days.

A very good method of bringing light-weight cans to the proper standard is now in use at one of the canneries. Instead of filling up the can with salt water, as is the general custom, a soup made from salmon is used. Great care is exercised in the preparation of this, it being strained carefully several times.

Employees.—The fishermen engaged in 1906 numbered 3,405, of whom more than two-thirds were whites. All the rest, with the exception of 10 Japanese, were Indians. The cannery employees numbered 6,868, among whom the Chinese were most numerous, the Japanese almost as many. The transporters numbered 474, and comprised 395 whites and 79 Indians. In all, 10,747 persons were employed in the salmon-canning industry.

EMPLOYEES IN THE SALMON-CANNING INDUSTRY IN 1906.

How engaged.	Southeast Alaska.	Central Alaska.	Western Alaska.	Total.
Fishermen:				
Whites	441	413	1,487	2,341
Indians	941	97	16	1,054
Japanese	10	.....	.....	10
Total	1,392	510	1,503	3,405
Shoresmen:				
Whites	305	147	989	1,441
Indians	803	88	208	1,189
Chinese	664	470	1,359	2,493
Japanese	276	274	1,195	1,745
Total	2,048	979	3,841	6,868
Transporters:				
Whites	150	125	120	395
Indians	48	8	23	79
Total	198	133	143	474
Grand total	3,638	1,622	5,487	10,747

Investment.—Of the transporting vessels, there were 116 steamers and launches, valued at $1,211,375, and 45 sailing vessels, valued at $1,145,650. Most of the sailing vessels are utilized in Western Alaska, where, owing to the lack of established lines of regular communication with the rest of the world, it is necessary for the cannery operators each season to bring up all their employees and supplies and in the fall to carry back home the employees and the finished pack. The vessels remain at anchor in the vicinity of their respective canneries throughout the season. Gill nets were the most numerous kind of apparatus, there being in all 1,183, the most of them in Western Alaska. Purse seines to the number of 112 were employed, these exclusively in Southeast Alaska, while haul seines to the number of 90 were used in Southeast and Central Alaska. Of traps, 60 in all were used, distributed as follows: Southeast Alaska, 29; Central Alaska, 13; and Western Alaska, 18. There was a decrease of 2 in Southeast Alaska and of 10 in Central Alaska, and an

increase of 4 in Western Alaska, or a total decrease of 8 as compared with 1905. The total investment amounted to $8,102,771, of which more than one-half was in Western Alaska. The item of cash capital has been eliminated entirely.

There were 47 canneries in operation (20 in Southeast Alaska, 8 in Central Alaska, and 19 in Western Alaska), compared with 42 in 1905, a gain of 6 in Southeast Alaska, a loss of 1 in Central Alaska (due to the placing of Yakutat in Southeast Alaska instead of Central Alaska, as was done in 1905), and a loss of 1 in Western Alaska. Canneries with two separate lines of machinery, but all under the one roof, have heretofore been enumerated as two canneries; in this report, however, all such plants will be considered one cannery, a method deemed more proper and less liable to misunderstanding. The number of plants in Southeast Alaska does not mean that new canneries have been built since 1905, but that that many of the establishments in reserve were operated this season. There are still 6 reserve canneries in that region which were not operated in 1906.

VESSELS, BOATS, APPARATUS, AND SHORE PROPERTY EMPLOYED IN THE SALMON-CANNING INDUSTRY IN 1906.

Items.	Southeast Alaska.		Central Alaska.		Western Alaska.		Total.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
Canneries	20		8		19		47	
Transporting vessels:								
Steamers and launches	48	$291,825	26	$238,250	42	$681,300	116	$1,211,375
Tonnage	1,560		1,268		3,110		5,938	
Outfit		29,182		23,000		60,000		112,182
Sailing	8	92,150	10	377,000	27	676,500	45	1,145,650
Tonnage	7,674		16,604		35,462		59,740	
Outfit		2,500		5,000		12,000		19,500
Boats	643	108,770	315	58,336	898	303,730	1,856	470,836
Apparatus:								
Haul seines	52	15,700	38	15,505			90	31,205
Purse seines	112	39,500					112	39,500
Gill nets	237	27,650	43	6,450	903	77,580	1,183	111,680
Traps	29	64,500	13	19,500	18	28,750	60	112,750
Spears		150						150
Shore and accessory property		1,512,409		858,696		2,376,838		4,747,943
Total		2,184,336		1,601,737		4,216,698		8,002,771

Output of the canneries.—The table of products shows, with size and style of can, the quantity and value of each species packed. Western Alaska leads in the total quantity and value of pack, with 978,735 cases, valued at $3,560,272; followed by Southeast Alaska and Central Alaska in the order named. Sockeyes, or red salmon, as they are generally known in Alaska, occupy first place in the output, with 1,500,730 cases, valued at $5,620,875, nearly half of this coming from Western Alaska. Humpbacks, or pink salmon, were second, with 349,767 cases, valued at $1,046,951; the greater part of these being packed in Southeast Alaska. Dog or chum salmon were packed in Southeast and Western Alaska alone, and amounted to 254,812

cases, valued at $730,235. The greater part of the coho pack was put up in Southeast Alaska, while the greater part of the king salmon packed was made in Western Alaska. The total pack of all species amounted to 2,246,989 cases, valued at $7,896,392.

TABLE SHOWING, BY SPECIES AND SIZES OF CANS, THE OUTPUT OF SALMON FROM THE CANNERIES IN 1906.[a]

Species.	Southeast Alaska.		Central Alaska.		Western Alaska.		Total.	
	Cases.	Value.	Cases.	Value.	Cases.	Value.	Cases.	Value.
Coho, or silver:								
½ pound flat	3,217	$6,588					3,217	$6,588
1 pound flat	15,944	63,487					15,944	63,487
1 pound tall	64,988	222,075	10,316	$35,075	16,278	$54,884	91,582	312,034
Total	84,149	292,150	10,316	35,075	16,278	54,884	110,743	382,109
Dog, or chum:								
1 pound tall	131,405	362,291			123,407	367,944	254,812	730,235
Humpback, or pink:								
½ pound flat	2,940	4,851					2,940	4,851
1 pound flat	2,618	8,378					2,618	8,378
1 pound tall	321,155	966,259	3,188	9,564	19,866	57,899	344,209	1,033,722
Total	326,713	979,488	3,188	9,564	19,866	57,899	349,767	1,046,951
King:								
½ pound flat	189	397					189	397
1 pound tall	2,207	7,917	7,861	28,300	20,680	79,608	30,748	115,825
Total	2,396	8,314	7,861	28,300	20,680	79,608	30,937	116,222
Sockeye, or red:								
½ pound flat	49,541	125,395					49,541	125,395
1 pound flat	36,763	161,793					36,763	161,793
1 pound tall	164,263	621,798	451,659	1,711,952	798,504	2,999,937	1,414,426	5,333,687
Total	250,567	908,986	451,659	1,711,952	798,504	2,999,937	1,500,730	5,620,875
Grand total	795,230	2,551,229	473,024	1,784,891	978,735	3,560,272	2,246,989	7,896,392

[a] All pound cases contain 48 one-pound cans; the half-pound cases contain 48 half-pound cans.

Comparison of pack of 1905 and 1906.—The following table is a comparison of the pack of 1905 and 1906. The latter year exceeded by 339,022 cases and $1,591,721 the pack of 1905. A most notable feature of this table is the large increase in the quantity of the cheaper grades of salmon packed. In 1905 there were packed 41,972 cases of dog, or chum, salmon, valued at $113,056, while in 1906 254,812 cases were packed, valued at $730,235, an increase in quantity of 212,840 cases and in value of $617,179. The pack of humpback, or pink, salmon increased from 168,597 cases, valued at $498,194, in 1905 to 349,767 cases, valued at $1,046,951, in 1906, a gain of 181,170 cases and $548,757. The pack of cohos also increased 42,833 cases and $166,234. As compared with 1905 the pack of sockeye salmon in 1906 shows a decrease of 86,613 cases, but an increase in value of $285,328. The pack of king salmon dropped off slightly, for reasons noted elsewhere.

Taking the "one-pound tall," which is the common size can, as a basis of comparison, it is seen that there has been a uniform increase

in 1906 in the value of the case over that of 1905. In 1905 cohos averaged $3.20 per case, while in 1906 the average price was $3.63. During the same period dog, or chum, salmon increased from $2.69 to $2.87 per case; humpback from $2.95 to $3; king salmon from $3.28 to $3.78, and sockeye salmon from $3.38 to $3.77 per case.

COMPARISON OF THE OUTPUT OF THE SALMON CANNERIES IN 1905 AND 1906.

Species.	1905.		1906.	
	Number of cases.	Value.	Number of cases.	Value.
Coho:				
½ pound flat	1,032	$1,754	3,217	$6,588
1 pound flat	394	1,340	15,944	63,487
1 pound tall	66,484	212,781	91,582	312,034
Total	67,910	215,875	110,743	382,109
Dog, or chum:				
1 pound tall	41,972	113,056	254,812	730,235
Humpback:				
½ pound flat			2,940	4,851
1 pound flat			2,618	8,378
1 pound tall	168,597	498,194	344,209	1,033,722
Total	168,597	498,194	349,767	1,046,951
King:				
½ pound flat			189	397
1 pound flat	4,248	17,585		
1 pound tall	37,877	124,414	30,748	115,825
Total	42,125	141,999	30,937	116,222
Sockeye:				
½ poundflat	25,830	46,674	49,541	125,395
1 poundflat	18,725	67,410	36,763	161,793
1 poundtall	1,542,788	5,221,463	1,414,426	5,333,687
Total	1,587,343	5,335,547	1,500,730	5,620,875
Grand total	1,907,967	6,304,671	2,246,989	7,896,392

PICKLING.

The pickling of salmon is a much older industry than that of canning, although it has never attained such proportions. For several seasons past the prices realized have ranged very low, and as a result a number of the salteries were forced to shut down, while the others materially reduced their output to conform to the new conditions. While the prices received in 1906 were a little better, it is probable that but few of the operators made a profit. The season showed quite a revival in the packing of humpback bellies. For some few years the Southeast Alaska salteries devoted a good part of their efforts to the salting of these, but the price finally dropped so low that the industry was almost entirely abandoned during the previous three seasons.

Employees.—During 1906 362 persons (of whom 164 were fishermen, 172 shoresmen, and 26 transporters) were engaged in the pickling industry, Southeast Alaska leading slightly, followed by Western Alaska.

EMPLOYEES IN THE SALMON PICKLING INDUSTRY IN 1906.

Occupation and race.	Southeast Alaska.	Central Alaska.	Western Alaska.	Total.
Fishermen:				
Whites	57	.....	54	111
Indians	38	15	.....	53
Total	95	15	54	164
Shoresmen:				
Whites	37	3	101	141
Indians	22	5	3	30
Japanese	1	.....	.....	1
Total	60	8	104	172
Transporters:				
Whites	22	.....	4	26
Grand total	177	23	162	362

Investment.—There were 20 salteries (13 in Southeast Alaska, 2 in Central Alaska, and 5 in Western Alaska). In addition, some of the canneries also salted their surplus catch, and this has been included in the present figures, although the men and investment could not be separated from the cannery statistics. In Western Alaska one new saltery was built on Kvichak Bay, while the saltery at Nelsons Lagoon, which had been closed since 1903, was reopened. The saltery at Bear River, however, was closed. A trader on the Kuskokwim River is reported to have chartered a San Francisco schooner and, with an outfit of 2,000 barrels, engaged in pickling salmon on the river, but it was impossible to verify this. In Central Alaska two small salteries were operated at Kodiak.

The investment in the pickled-salmon industry amounted to $297,020, of which the greater part was in Southeast Alaska.

VESSELS, BOATS, APPARATUS, AND SHORE PROPERTY EMPLOYED IN THE SALMON PICKLING INDUSTRY IN 1906.

Item.	Southeast Alaska.		Central Alaska.		Western Alaska.		Total.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
Salteries	13	.....	2	.....	5	.....	20	.....
Transporting vessels:								
Steamers and launches	9	$31,250	.....	.....	2	$5,000	11	$36,250
Tonnage	107	.....	.....	.....	9	.....	116	.....
Outfit	.....	3,200	.....	.....	.....	500	.....	3,700
Sailing	1	200	2	$2,500	3	32,000	6	34,700
Tonnage	5	.....	45	.....	2,115	.....	2,165	.....
Outfit	.....	200	.....	800	.....	1,400	.....	2,400
Boats	74	18,760	12	1,425	41	5,945	127	26,130
Apparatus:								
Haul seines	10	1,950	5	1,250	.....	.....	15	3,200
Purse seines	6	2,000	.....	.....	.....	.....	6	2,000
Gill nets	11	1,240	.....	.....	26	1,300	37	2,540
Traps	3	12,000	.....	.....	1	1,000	4	13,000
Shore and accessory property	.....	132,100	.....	3,000	.....	38,000	.....	173,100
Total	.....	202,900	.....	8,975	.....	85,145	.....	297,020

Output.—The pack amounted to 16,926 barrels and 3,389 half barrels, with a total value of $139,838. Sockeye salmon formed by far the greater part of this pack, and most of these were put up in Western Alaska. In Southeast Alaska humpback, or pink, salmon are the principal item in the pack.

TABLE SHOWING, BY SPECIES, THE QUANTITY SALMON PICKLED IN 1906.

Species.	Southeast Alaska.		Central Alaska.		Western Alaska.		Total.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
Coho, or silver.....barrels..	539	$5,642	.....	.....	.....	.....	539	$5,642
Dog, or chum.....barrels..	100	554	.....	.....	131	$996	231	1,550
Dog bellies.....do....	30	150	.....	.....	.....	.....	30	150
Humpback, or pink:								
Half barrels.....	74	270	.....	.....	.....	.....	74	270
Barrels.....	2,409	13,582	.....	.....	.....	.....	2,409	13,582
Total.....	.....	13,852	.....	.....	.....	.....	.....	13,852
Humpback bellies:								
Half barrels.....	308	1,848	.....	.....	.....	.....	308	1,848
Barrels.....	1,119	11,340	.....	.....	.....	.....	1,119	11,340
Total.....	.....	13,188	.....	.....	.....	.....	.....	13,188
King.....barrels..	.....	.....	.....	.....	1,007	8,058	1,007	8,058
King bellies:								
Half barrels.....	.....	.....	.....	.....	25	113	25	113
Barrels.....	.....	.....	.....	.....	9	72	9	72
Total.....	.....	.....	.....	.....	.....	185	.....	185
Sockeye, or red:								
Half barrels.....	10	45	.....	.....	2,072	13,125	2,982	13,170
Barrels.....	80	640	456	4,754	11,033	78,528	11,569	83,922
Total.....	.....	685	.....	4,754	.....	91,653	.....	97,092
Sockeye bellies .....barrels..	.....	.....	13	121	.....	.....	13	121
Grand total.....	.....	34,071	.....	4,875	.....	100,892	.....	139,838

MILD-CURING.

For some years there has been a heavy demand for smoked salmon in Germany, Austria, Russia, and Sweden, where the salmon supply is small. About 1892 the foreign dealers began buying Columbia River frozen salmon, which for several seasons they used on a small scale by thawing, splitting, salting, and smoking; but they at last gave up their efforts, because the fish would not stand the processes after being thawed. The coast shippers then began experiments in slack-salting king salmon especially for the smoking process abroad.

As had been known to the smokers for several years, hard-salted fish were of no use for smoking, the free use of salt driving the very best juice and flavor from the fish and making them dry and tasteless. After two years of expensive, and ofttimes discouraging, experiments, the salmon packers perfected a product now known as "mild-cured." By this process the fish are packed in a weak brine, in which they

retain their juice and flavor, and then are removed to cold storage. The result, even after eight or ten months, is almost fresh fish, which when properly smoked have a very rich flavor.

In packing mild-cured salmon for smokers only the very largest fish are used, usually those weighing over 20 pounds. Thus all but king salmon are eliminated, the other species being too small; and the bigger the fish the better, as the large sides make a nice slice when cut up and do not dry out too much in the process of salting, which usually requires about three days.

King salmon are abundant in the waters of Alaska, being found in many of the rivers, particularly the Unuk, Stikine, Taku, Ugashik, Kvichak, and Nushagak, during the breeding season, while during the rest of the year, in Southeast Alaska, and probably in other portions, they are to be found in the numerous bays, lagoons, straits, and sounds. They spawn during the months of May and June in southeast and central Alaska, and in June and July in Bristol Bay. When not breeding they are feeding upon the herring, and are especially abundant then in the vicinity of Point Comano on Cleveland Peninsula, and in Frederick Sound, Seymour Canal, Taku Inlet, and Gastineau Channel. According to Mr. Walter S. Elwell, who has fished for some years in Tenakee Inlet, off Chatham Strait, there was a run of kings in the inlet in the fall of 1905 and the spring of 1906, the first run he had ever noticed there.

During the winter of 1904–5, when a big run appeared in the lower portion of southeast Alaska, several dealers at Ketchikan shipped large quantities fresh to Puget Sound ports. These shipments drew the attention of the Pacific coast representatives of certain German firms to the possibility of securing supplies for mild-curing from Alaskan waters in order to eke out the inadequate supply from the Columbia and other rivers, and an investigation was made during the summer and fall of 1905, with the result that when the run began during the early part of 1906 ten firms and individuals engaged in the business, and these gave employment to 145 fishermen, 24 shoremen, and 8 transporters. The shore property used in the industry had a value of $12,250, while 5 launches, valued at $6,550, and 150 boats, valued at $6,270, were used. The apparatus employed consisted of 63 gill nets, which were used in the breeding season, and were valued at $12,450, and $80 worth of trolling lines, which were used when the fish were feeding. The pack amounted to 1,103 tierces, containing 885,600 pounds of cured fish, valued at $65,747, in Southeast Alaska, and to 23 tierces, containing 18,400 pounds of cured fish, valued at $1,260, in Western Alaska. The number of fish utilized amounted to 56,300, about 50 being required to the tierce. The greater part of the pack was made during the months of May, June, and July.

At times the competition for fish was quite keen. In May and June the Juneau and Douglas packers paid 75 cents each for all red-meated

fish weighing over 17 pounds, 35 cents each for all under 17 pounds, and 25 cents each for white-meated kings of any weight. In the vicinity of the Stikine River 60 cents each was paid for red-meated fish and 10 cents each for white-meated. The white-meated kings are not desired, but the packers are compelled to take them, as the fishermen will not fish for the red-meated fish only. The packers in the vicinity of the Taku estimate that there will be 7 white-meated kings to every 100 red-meated ones, while in the vicinity of Ketchikan about 25 per cent of the catch is said to consist of white-meated fish. The largest king handled at Ketchikan in 1905 weighed 77 pounds, while the largest king handled at Juneau in 1906 weighed 47 pounds. The average weight all over Southeast Alaska appears to be between 20 and 25 pounds.

The method of curing was to take off the head and remove the entrails; split the fish down the middle, and take out the backbone, leaving the fish in two halves; scrape out the blood vessels, and put the fish into ice water for about 30 minutes, and then salt it down in tierces with fine (dairy) salt. Each tierce contained about 800 pounds of cured fish or about 50 fish as taken from the water.

DRY-SALTING.

Dog salmon is the chief species treated in this manner, and nearly the entire product is shipped to Japan. During the Japanese-Russian war the Japanese fishermen were very much hampered by the dangers and uncertainties of fishing off the island of Saghalien and the Amur River section of Siberia, and there was consequently a large demand for Alaska dog salmon. This demand reached its height in 1905, when 7,280,234 pounds of dog salmon, valued at $115,643, were prepared and shipped to Japan. Three Japanese vessels visited Southeast Alaska that year and bought fish from American fishermen, the vessel crews curing these, while other vessels visited islands in the Aleutian chain and caught and cured their own fish, trusting to the remoteness of their scene of operations to escape detection. The prices realized in 1905 were fairly good, the ruling price in December being about $37 to $38 per ton f. o. b. ship's tackle Japan.

As the Saghalien grounds now belong to the Japanese, while they are negotiating, with very good prospect of success, with the Russians for fishing rights in the Amur River section, their fishermen are now enabled to supply the greater part of the home market for this class of fish themselves, consequently the demand in 1906 for Alaska dog salmon was very light. Another factor adverse to the sale of our fish is the new tariff on fish put in force by the Japanese government. Under its provisions the only fish entitled to free entry are those caught or taken by Japanese fishermen on board Japanese ships. All other fish are subject to a duty of 2 yen per 100 kin, or $0.996 per 132.9 pounds (approximately $1 per 133 pounds).

Under the above adverse conditions the quantity of dry-salted dog salmon prepared in 1906 amounted to only 1,107,680 pounds, valued at $16,969. Fortunately this decrease was more than counterbalanced by the great increase in the output of canned dog salmon.

SMOKING.

But one concern, the Juneau Packing Company of Juneau, is equipped for smoking on a large scale, and since the close of the fishing season of 1905 this company has prepared and shipped 20,530 pounds of smoked dog salmon, valued at $1,190. The same company also smokes other species at this plant, particularly herring. A few salmon are smoked and disposed of locally at several other points, but the quantity is exceedingly small. If a good market can be built up for this product, Alaska will be greatly benefited, for the supply of dog salmon seems to be inexhaustible.

FREEZING.

The preparing of frozen salmon began in 1902 at Taku Harbor, in Southeast Alaska, and the original establishment is still the only one engaged in the business. The pack does not vary much from year to year. The greater part of the salmon and trout prepared is shipped to Europe.

Quite a falling-off appears in the quantity of king salmon frozen in 1906 as compared with 1905. This, as well as the decrease shown during the same period in the pack of canned king salmon, is due to the great demand for king salmon from the mild-cure packers. The latter seemed to be able and willing to pay almost any price in order to secure the fish, and the canners and freezers were forced to be content with the few fish caught in their own traps, or what their own net fishermen could bring in. This competition has proved very beneficial to the fishermen, however, for before 1906 there was but a limited demand for king salmon. In Southeast Alaska the king salmon appear first and the fishermen can devote their entire attention to them, for sockeyes and humpback salmon do not appear until the run of kings has slackened.

FRESH SALMON.

But little attention, except to the supplying of the extremely small local demand, was paid to the marketing of salmon fresh until the winter of 1905. About the middle of January of that year king salmon were observed in large numbers in the vicinity of Ketchikan, and the Indians caught many for their own consumption. Several persons in Ketchikan saw the possibilities of the business and sent out launches to buy up all the fish possible, thus making a market for all the fish caught and offering incentive to the business of catching them, the

more so as the salmon were feeding voraciously on the herring, and a trolling line fitted with a nickel spoon, and a cheap row boat, was all the outfit that was required. The run lasted until May 18 and during this time 271,644 pounds, valued at $15,600, were shipped to Puget Sound ports. The enterprise was continued on a much wider scale in 1906, buyers being stationed at Ketchikan, Wrangel Narrows, Juneau, and Douglas, and as a result 23,032 king salmon, weighing 575,802 pounds, and valued at $29,584, were shipped to Puget Sound ports, an increase over 1905 of 304,158 pounds and $13,984.

There is a small local demand for fresh fish in the larger towns of Southeast Alaska, and it is estimated that in 1906 the following quantities of salmon, in addition to other fishes, were thus disposed of: King salmon, 6,700 pounds, valued at $670; sockeye salmon, 14,200 pounds, $710, and humpback salmon, 21,000 pounds, $660.

HATCHERIES.

Four salmon hatcheries were operated during the season of 1906–7—the Fortmann hatchery, on Naha Stream, and Karluk hatchery, on Karluk River, both owned by the Alaska Packers' Association; the Klawak hatchery, on Klawak Lake, owned by the North Pacific Trading and Packing Company; and the Yes Lake hatchery, on McDonald Lake, owned by the Bureau of Fisheries. No report has been received from Mr. John C. Callbreath in regard to his hatchery on Etolin Island, and it is assumed this was not operated.

The Yes Lake hatchery, which was only partially completed at the beginning of the season of 1905–6, and was consequently operated under great disadvantage, is now in excellent condition to handle eggs and fry.

After the Klawak hatchery had liberated about one million fry in the season of 1905–6, the flumes conveying water to the plant were carried away by a flood, and the rest of the eggs (about two million) were deposited in the waters of the lake.

At Karluk this year the experiment of feeding the young fry with the trimmings from the filling machines in the association's canneries on Karluk spit was tried. It is said that it worked successfully.

The Bureau of Fisheries will establish a hatchery on Afognak Island, in Central Alaska, in 1907.

As the hatching season lasts from about September until the following August, it has been found best to represent the fiscal year in tabulating the data. The table shows, for each hatchery, the number of eggs taken and fry liberated in 1905–6, and the eggs taken in 1906–7. None of the hatcheries found difficulty in securing eggs in 1906. The number of female salmon on the spawning beds was very large, and every hatchery secured more eggs than in the previous season.

OUTPUT OF THE SALMON HATCHERIES OF ALASKA IN 1905–6 AND 1906–7.

Hatcheries.	1905–6.				1906–7.		
	Sockeye.		Coho.		Sockeye.	Coho.	Steelhead trout.
	Eggs taken.	Fry liberated.	Eggs taken.	Fry liberated.	Eggs taken.	Eggs taken.	Eggs taken.
Karluk	36,933,000	28,236,412	.....	.....	38,679,200	.....	.....
Fortmann	68,715,000	67,643,000	2,424,000	1,837,000	105,420,000	30,000	.....
Yes Lake	7,031,480	6,638,550	.....	.....	58,210,000	.....	182,000
Klawak	2,800,000	2,300,000	.....	.....	3,600,000	.....	.....
Total	115,479,480	104,817,962	2,424,000	1,837,000	205,909,200	30,000	182,000

REPORT OF INSPECTION OF THE SALMON FISHERIES.

The annual inspection of the salmon fishery of Alaska was made in 1906 during the period from June to October, and was conducted upon the usual plan, the agents visiting the various localities so far as possible in person. The customary observations and inquiries were made to ascertain the condition of the streams and the methods of fishing, to discover any illegal practices or nonconformity to law, and to recommend measures for the protection and promotion of the salmon industries. The inspection in southeast Alaska, except at Dundas Bay and Yakutat, was made by the agent, Mr. Howard M. Kutchin. The assistant agent, Mr. John N. Cobb, canvassed these two localities and central and western Alaska, the revenue cutter *Rush* being assigned to his service through the courtesy of the Treasury Department.

LIST OF PLANTS OPERATED IN 1906.

The following plants were operated during this season:

Name.	Location.
Southeast Alaska:	
Canneries—	
Alaska Packers' Association	Pyramid Harbor.
Do	Wrangell.
Do	Loring.
Northwestern Fisheries Co	Dundas Bay.
Do	Santa Ana.
North Pacific Trading and Packing Co	Klawak.
Pacific Coast and Norway Packing Co	Petersburg.
Metlakahtla Industrial Co	Metlakahtla.
Columbia Canning Co	Chilkoot Inlet.
Thlinket Packing and Trading Co	Funter Bay.
Pillar Bay Packing Co	Point Ellis.
Yakutat and Southern Railway Co	Yakutat.
F. C. Barnes	Lake Bay.
Geo. T. Myers & Co	Sitkoh Bay.
Shakan Salmon Co	Shakan.
Taku-Alaska Packing Co	Taku Harbor.
Fidalgo Island Packing Co	Ketchikan.
Porter Fish Co	Kasaan Bay.
Pacific-American Fisheries	Chilkat Inlet.
C. A. Burckhardt & Co	Yes Bay.
Salteries, etc.—	
Juneau Packing Co	Juneau.
John H. Mantle	Etolin Island.
Geo. Whitman & Co	Shineha.
Fred Brockman	Sarkaar.
James Thompson	Skowl Arm.
Mrs. A. E. King	Sunny Point.
Millar Brothers	Hunter Bay.
Alaska Fish and Development Co	Pleasant Bay.
Rasmus Engee	Stikine River.
Alaska Fish and Herring Co	Wrangell Narrows.
C. B. Ferguson	Dall Island.
Pacific Cold Storage Co	Taku Harbor.
Mild curing plants, 10.	
Fresh salmon dealers, 5.	

Name.	Location.
Central Alaska:	
Canneries—	
Alaska Packers' Association	Chignik Lagoon.
Do	Alitak Bay.
Do. (2)	Karluk.
Do	Kasilof.
Northwestern Fisheries Co	Chignik Bay.
Do	Uyak Bay.
Do	Orca.
Salteries—	
Alaska Commercial Co	Kodiak.
Blodgett & Blinn	Do.
Western Alaska:	
Canneries—	
Alaska Packers' Association (3)	Nushagak Bay.
Do	Kvichak Bay.
Do. (2)	Naknek River.
Do	Ugashik River.
Northwestern Fisheries Co	Nushagak Bay.
North Alaska Salmon Co	Do.
Do	Kvichak River.
Do	Lockonock River.
Do	Ugaguk River.
Naknek Packing Co	Naknek River.
Alaska Fishermen's Packing Co	Nushagak River.
Red Salmon Canning Co	Ugashik River
Columbia River Packers' Association	Nushagak Bay.
Union Packing Co	Kvichak River.
Alaska-Portland Packers' Association	Nushagak Bay.
Alaska Salmon Co	Wood River.
Salteries—	
Peter Nelson	Egushak River.
L. A. Pedersen	Kvichak Bay.
Northwestern Packing Co	Do.
Lagoon Salmon Co	Nelsons Lagoon.

SOUTHEAST ALASKA.

General conditions.—The season in Southeast Alaska was quite satisfactory as a whole, although at the outset it was feared there would be a bad failure. Especially was the run of humpbacks bad, and several of the formerly best streams were almost destitute of fish. Later, however, there were good runs, which continued quite late, and the result was rather more than an average pack. The red salmon run was generally scant throughout Southeast Alaska, and spawning fish in the lakes (except at Naha) were unusually scarce.

There was a notable falling off in the dry-salting of dog salmon, mainly on account of weakness in the Japanese demand for this variety of fish. For this reason, and because of the lack of pink salmon, more of dog salmon was put into cases than ever before, and the advance of prices indicates that this was profitably done.

Notes upon various localities.—In several instances unusually heavy packs were made, Funter Bay and Sitkoh Bay being conspicuous in this respect. On the other hand Loring and Wrangell fell short of their customary output. These two commonly put up many more salmon than any other Southeast Alaska plants.

The Kasaan Bay cannery was destroyed by fire just at the close of operations and a good part of the pack was lost in the flames.

Funter Bay, which relies wholly upon traps for its supply of fish, had the biggest season ever known there and in addition to running at full capacity throughout the season was able to sell large numbers of fish to canners less fortunately situated.

In the Lynn Canal country the run of red salmon was almost the lightest ever known, and the canneries at Pyramid Harbor, Haines, and Chilkat Inlet were forced to depend in large measure upon Icy and Chatham straits for their supply.

The very great shortage of red salmon in the Lynn Canal region justifies the apprehension that the streams there have been fatally overfished. The canning plants that did not depend upon traps in distant waters made a poor showing, and at no time in the season was the run of sockeyes abundant enough to afford profitable employment for the fishermen. At the Chilkoot River, which has been good in the past for 60,000 fish or more, only about 35,000 were taken, and in the Chilkat the run was relatively light. In the open waters of the Canal gill-net fishermen had very poor picking, and the red salmon pack for the three canneries (four have been successfully operated there in the past) proved almost the smallest on record. The probable explanation of this condition is to be found in the method practiced on those rivers by the natives. The Chilkoot River is but a little more than a mile in length from the mouth to the lake. The stream is narrow and full of rocks and rapids. The Indians erect platforms on the banks and in the stream at every available point and hook the fish with gaffs as they try to struggle by in the shallow water. In late years with decreasing runs very few fish have succeeded in getting to the lake. The same condition is true, though in less degree, of the Chilkat. As these lakes are practically the only spawning ground for Lynn Canal salmon, the result is seen in the steadily diminishing numbers. The practice mentioned is not contrary to existing law, and the only remedy would seem to be the exercise of the authority conferred upon the Secretary of Commerce and Labor to close both streams for the restoration of these fisheries, permitting the natives to continue to take salmon by the means described only for their domestic use. They now sell the major part of their catch to the canneries, and the evil of the excessive fishing is accompanied by that of badly mutilated fish, due to the tearing effect of the gaff hooks. Many fish are thus rendered unsalable and are wasted, as the improvident natives will not even take them back to their villages to dry.

The Taku Harbor cannery of the Pacific Cold Storage Company was leased and operated by the Taku-Alaska Packing Company. The Chilkat Inlet cannery of the Alaska Fisheries Union is now owned

and operated by the Pacific-American Fisheries. A number of canneries that shut down last year reopened this season. The Pyramid Harbor and Wrangel canneries of the Alaska Packers Association resumed operations. The Northwestern Fisheries Company made a pack at its Santa Ana cannery, which had not been operated before since it came into possession of this company. The Porter Fish Company, of Portland, Oreg., leased and operated the cannery of the Kasaan Bay Company at Kasaan, which did not pack last season. This cannery was burned down just at the close of the season. The Porter Fish Company also had an operating interest in the cannery of the Shakan Salmon Company at Shakan. The Fidalgo Island Packing Company reopened its plant at Ketchikan. The plant of the Northwestern Fisheries Company at Yes Bay, which had not been operated by that company, was purchased and operated by C. A Burckhardt & Company.

Before the season began a new cannery building was erected at Dundas Bay, the machinery moved into it, and the old cannery building turned into a warehouse. The first red salmon was caught on June 27, the first coho on July 1, and the first humpback on July 11. The red salmon came in late and the run was not so abundant as in previous years. The height of the season for both reds and humpbacks was from August 7 to 12. The principal red salmon fishing grounds on Cross Sound are Dundas, Bartlett, and Taylor bays, and the trap in Icy Straits. On the outside, or ocean shore, the principal red salmon fishing grounds are Kochtaheen, Serge Bay, Takahanis, Cape Edwards, and Cape Spencer. The principal humpback fishing grounds are Lizzianski Straits, Port Althrop, and the trap in Icy Straits.

The only cannery at Yakutat is owned by the Yakutat and Southern Railway Company. The principal fishing grounds are the Seetuck, Anklen, and Ankow rivers, Ankow Slew and Yakutat Bay. A railroad 10 miles in length connects the cannery with Seetuck River (also Ankow River, by way of Lost River, which the railroad crosses), and the fish are landed from the boats and loaded on gondola cars at certain places, thence to be hauled to the cannery by the locomotive.

Red, humpback, and coho salmon are the principal species taken, but few king salmon being secured. Humpbacks vary much in size. Those from the Seetuck River average 12 or 13 to the case, those from the Anklen River 16 to the case, while those caught in Humpback River, Yakutat Bay, run 20 to the case. The first red salmon taken from the Seetuck River was on June 1; the first one from the Anklen River was on June 4; the first from Yakutat Bay was on June 12, and the first from Ankow Slew was on June 18, all much earlier dates than prevailed in 1905. The first humpback was received from the Seetuck River on June 19, an unusually early date.

CENTRAL ALASKA.

The salmon fisheries of Southeast and Western Alaska are so much more important than those of Central Alaska that only a small proportion of the time available for the canvass was devoted to the latter section. The data for Central Alaska were collected in the course of a few brief visits, and are less complete than for the remainder of the district.

Orca.—The one cannery operated on Prince William Sound is at Orca, and is owned by the Northwestern Fisheries Company. The earliest Alaska run of salmon occurs on this sound, and on June 22 the cannery had packed slightly over half of its total outfit. The run dropped off later, it is reported, and finally the cannery shut down with several thousand cases of its 40,000-case outfit still unfilled. The first king salmon was taken on May 3, and the first red salmon on May 9. The principal fishing grounds early in the season are the Delta of Copper River, and off Chilkat, just back of Kyack. In July the principal fishing is carried on at Miners River, Billys Hole, and Chinigua, all in Prince William Sound.

Kasilof.—The fishing season at Kasilof, on Cook Inlet, was over before this place was reached in the canvass. The cannery building, which is owned by the Alaska Packers' Association, burned down on July 12, 1905. It was rebuilt this spring and outfitted for 45,000 cases, of which it is understood about 35,000 to 40,000 cases were filled.

Karluk.—Two canneries of the Alaska Packers' Association were operated here. The first fish, a red salmon, was taken on June 5, but the run did not begin until about July 17. From that date until the last visit of inspection the run had continued unabated. In addition to supplying his own canneries, the superintendent had sent to the association's cannery at Chignik 53,000 red salmon, and to the one at Alitak enough to make 8,940 cases. At the association's hatchery on Karluk River, on June 24, there were still about 20,000,000 fry in the ponds and hatching troughs, about 6,000,000 fry having been deposited in the river. About 18,000 spawners were then in the corral, preparatory to the next season. On August 18, when this place was again visited, it was estimated that the hatchery had secured 36,000,000 eggs.

Uyak.—The Northwestern Fisheries Company formerly operated two canneries at this place, but one burned down in June of last year, and probably will not be rebuilt. Extensive repairs and improvements were this season made to the remaining cannery. The first fish, a red salmon, was taken on June 8, but, as at Karluk, the main run did not begin until July 19, and this run was continuing unabated in August. As the run was too large to handle at one stage, 85,799

red salmon were sent to the company's cannery at Chignik. It was the expectation of the superintendent at this time to have his whole outfit of 55,000 cases, with the exception of several thousand flat cans, for which his machinery proved to be unsuitable, packed within a very few days. The principal fishing grounds frequented by the Uyak fishermen are Karluk Beach, Red River (Ayaluku River), Little River, and Ugonic.

Alitak.—But one cannery is located here, and that is owned by the Alaska Packers' Association. It was outfitted for 35,000 cases, of which 29,000 cases were left over from last year's disastrous season, and 6,000 cases taken from the Karluk outfit. The cannery was somewhat hampered in its operations by the fact that its ship had not left San Francisco at the time of the earthquake and fire, and its cannery crew was thus broken up. Of the original 80 Chinese who had signed, but 30 could be found when the ship sailed. Enough Indians were subsequently secured on Kodiak Island to fill their places.

All of the fishing is carried on in Olga Bay, from the cannery to the head of the bay. The first fish, a red salmon, was taken on July 3. The fish usually begin to run heavily about July 15, but this year they did not arrive in numbers until about July 29. On August 17 they were still running near the head of Olga Bay, and as nearly 30,000 cases of the outfit had then been packed, the canners hoped to finish fishing in about a week. Not all of the salmon packed at this cannery were caught by its fishermen, however; about 8,940 cases were packed from fish sent to Alitak by the Karluk canneries of the same association. Quite a few humpbacks were to be seen in the bay. Their favorite spawning grounds are said to be in Horse Marine Lagoon and Big Stream. No use is made of them at the cannery. Cohos begin to run the latter part of August, about the time the cannery closes. They are said to run mainly into Silver Salmon Bay, which is about 3 miles above and on the same side as the cannery. A small and short stream, with a lake at its head, empties into this bay. The cannery people state that king salmon do not run in this bay. A few steelheads are seen in the spring.

Chignik.—Two canneries were operated on Chignik Bay and Lagoon—one owned by the Alaska Packers' Association and the other by the Northwestern Fisheries Company.

The fishery conditions at this place were very far from satisfactory. For years these two canneries, and another which was in operation for a time, fought each other fiercely, with the result that the lagoon and bay were full of trap nets, as many as 28 having been in use in 1904. In 1905 the two canneries then operating came to an agreement and the number of traps was reduced to 8, 4 for each. In 1906

this number was still further reduced, and there are now 7 in use, of which each cannery owns 3, while the remaining one is owned jointly and the fish divided. All of these traps were located in the lagoon and practically what is Chignik River. To an observer at the lower end of the lagoon, looking up, it seemed as though the lagoon were completely blocked, the end of one trap extending out beyond the end of the next from the opposite shore. In sailing up the lagoon one was compelled to steer a zigzag course in order to round the outer ends of the various traps. Owing to the ambiguity of the old law as applied to bays and lagoons, and the fact that the new law was passed at the height of the fishing season, no legal move was made against the offenders. It is recommended, however, that they be warned for next season to conform to the new law, which is clearly violated by the present conditions. All of the traps have "corrals," or double hearts.

The trap nets were put in on June 6 or 7, and the first fish, a red salmon, was secured on June 8. The run was rather light until about July 5, but from that date until July 26 both canneries were pushed to the utmost to handle the great quantity of fish pouring in. On several occasions, according to the superintendent of the Northwestern Fisheries cannery, all the fish could not be handled, and the excess were turned out of the traps. From the 12th to the 18th of July was the height of the season. The superintendent stated also that the fish were larger than usual this season, averaging about 10 to the case while the run was at its height. As the run slackened the fish decreased in size. The last fishing day was August 14, after which the traps were removed. Both canneries packed their full outfits, and both received shipments from Kodiak Island. The Northwestern Fisheries Company received from its Uyak cannery 85,799 red salmon, while the Alaska Packers' Association cannery received 53,000 red salmon from sister canneries at Karluk. Early in the season the mess house of the Alaska Packers' Association cannery burned down, and it was with much difficulty that the rest of the buildings were saved.

WESTERN ALASKA.

In accordance with instructions for a more thorough inspection of Bering Sea than any other region, the period from June 30 to August 10 was given to this portion of the work. The itinerary included visits to every river in which salmon fishing was carried on, ascent of the Wood and Kvichak rivers to the lakes at their head, and examination of these lakes as far as possible in order to find out where the salmon spawning beds were located and the possibility of establishing hatcheries if suitable sites could be found.

A considerable part of the time was devoted to measuring and weighing salmon of each species taken at each of the various fisheries in Bering Sea, in the course of which work several thousand salmon were handled. In the resulting data the Bureau has comparative weights and measurements of salmon from every river and bay in Bristol Bay.

Kuskokwim River.—During a visit to the Naknek River, in August, information was received that a trader on the Kuskokwim River had chartered the schooner *Wing and Wing*, of San Francisco, and with an outfit of 2,000 barrels was engaged in salting salmon on the river. This was not verified by personal observation or inquiry on the part of the assistant agent, owing to the lateness of the season and the difficulty of making a special trip to the Kuskokwim in the revenue cutter at that time.

Nushagak Bay.—This bay, in which the greater part of the fishing is carried on, is about 35 miles long and from 5 to 15 miles in width. Sand bars and mud flats, which are visible at low water, occupy the greater part of its area. Four rivers debouch into it—the Nushagak, Wood, Egashak, and Snake.

Nushagak River.—With the exception of the lower 20 or 30 miles, but little is known of this river.

According to Captain Hemming, master of the cannery ship *Electra*, who a few years ago made a trip to the headwaters, the Nushagak River is about 200 miles long to the first lake—a large one; larger than Aleknagik Lake, on Wood River, which is about 24 miles in length. Beyond the first lake are three other smaller lakes, all connected by short stretches of river. The largest tributary of the river is the Malchatna, which enters it about 100 miles from the mouth. There are also several smaller tributaries, two of these being Tikchik River and Portage Creek. Captain Hemming says that the winter he was there the small tributaries did not freeze up completely, there always being some running water in them. There are three or four Indian villages on the Nushagak, Kakuak being the largest. A launch drawing 3 to 3½ feet of water can navigate about 120 miles from the mouth; it is necessary to use a bidarka to go into the upper reaches. There are four rapids, around two of which a portage must be made. The Indians catch salmon in these rapids with spears and dip nets. The season Captain Hemming was there many salmon were to be seen in the section of river connecting the first and second lakes and in the first lake and the main river. The river on its lower course is large and carries a great quantity of water, generally muddy, into the head of Nushagak Bay.

Snake River.—This tributary is about 30 miles in length, very crooked, and has its rise in a single lake close by Aleknagik Lake. There is an Indian village on the river just below the lake, and the natives catch large numbers of red salmon in the stream.

Igushik River.—This river is about 50 miles in length and enters the bay about 4 miles above Nicholl's Hills. So far as known it has its source in two lakes—Amanka and Ualek. A short distance below the first lake there are rapids and a small falls. The quite large Indian village of Yacherk is located here, and the natives do most of their fishing in the rapids, catching a good many red salmon in the season. Mr. Peter Nelson operates a saltery on the river about 10 or 12 miles above its mouth. There is a small Indian village close by the saltery.

Wood River.—Wood River, from its mouth to the first lake, Aleknagik, is about 24 miles in length. Its width at the mouth is about three-fourths of a mile, and thence it varies from 200 to 600 yards for about 15 miles. From here it narrows very much until at the lake entrance it has a width of about 50 yards. About 10 miles from the mouth it receives as a tributary the Maklau River, which is said to be about 8 miles in length. A gasoline launch drawing slightly over 3 feet of water was able to reach Aleknagik Lake in July. Although the boat scraped sand bars once or twice on both trips, it in each instance slipped over them. The influence of the tide extends to the lake, and at high tide about 4 feet of water could be carried right into the lake.

Aleknagik Lake is about 24 miles long, the general direction being northwest by west, and has an average width of about 2 miles. It has several small tributaries, one close by the outlet, a small Indian settlement being located alongside. On the northern shore, about 6 miles from the head, is the most important feeder of the lake, a stream about 50 yards wide at the mouth and 3 or 4 feet deep. Just at the mouth the water runs like a mill race, but a few hundred yards up there is a gentle current. I followed this stream, walking along the bank for some distance, and eventually reached a high ridge where, by climbing a tree, I was able to see the second lake. The river itself was about 10 miles long, quite winding, but appeared to have no waterfalls. The natives claim that there is a waterfall on this stream, but, according to trustworthy information, a party of prospectors from Nushagak several years ago penetrated into the lake in a fishing boat with very little trouble. As the whole of the second lake was not visible from the ridge, and it was impossible to cover the remaining distance on foot, the length of the lake was not ascertained. It seemed to have a northeast trend. At the mouth of the stream is an Indian village.

Beyond the second lake lies another, connected with it by a stream, and there are intimations from native sources of even more beyond these. There is an Indian village at the head of the second lake.

On both trips to this section close watch was kept for signs of spawning salmon. On the lower river but few salmon were seen and these near Aleknagik Lake. In the small lagoon at the foot of the lake the

Indians of the village located here were fishing with a small gill net and averaging about 20 to 30 red salmon each night. These fish were remarkably clean looking, with no visible signs of disease or rough usage. A family occupying the village near the head of the lake were getting a few red salmon each day with spears. At several places along the lake shore were racks which had been used in previous seasons for drying salmon, and at each of these spots close observation was made for signs of salmon. Only about a dozen in all were seen, however. It is possible, but hardly probable, that the greater part of them were in the deep waters of the lake at this time. During August and September some of the Indians from the Nushagak visit this lake and catch and dry spawning salmon and use them as food for their dogs during the winter. Inquiry of the Indians in the settlement at the foot of the lake developed the fact that the greater part of the season's run had passed up between the 10th and 15th of July. As a whole, they considered the season a very meager one, and were considerably exercised over the poor outlook for a winter's supply of food.

This river has heretofore been the favorite resort of the red salmon of the Nushagak, but this season the run was exceedingly light, the fishermen complaining that the fish went up the Nushagak River instead. Seven traps were operated on the river, and many of the fishermen ascribe the diminished run to this fact. Several of these traps have large "corrals," or double hearts, in which the imprisoned fish can be retained in times of abundance until they can be utilized at the cannery, and thus the trap be operated continuously. The traps are put in about June 20 and are removed the latter part of July. The catch from them is relied upon by the canneries to supplement the more important trap and gill-net fisheries of Nushagak Bay. In consequence, when there is a large run in the bay, the canneries are so pushed to handle the catch from their immediate vicinity that no effort is made to utilize those in the river traps, and if the run in the bay continues the fish in the river traps are released, except in the case of the traps with the "corrals," in which they are retained for some time on the possibility that the run on the bay may decrease sufficiently to bring the river-caught fish into demand. In 1905 there was a large run of red salmon in Nushagak Bay and Wood River, so large in fact that the gill netters on the bay were limited as to the number they could turn over to the canneries daily. Consequently the Wood River fish, which were the ones caught farthest from the canneries, and hence the most expensive to transport, were not utilized until late in the season, when the main run had passed out of the bay. In 1905 four traps operated on that river furnished over 800,000 red salmon, but many thousand more were turned out of the nets when it was seen that they could not be used. The present season these same

traps, utilizing every fish caught, produced but slightly over 200,000 red salmon. From the other three traps about 100,000 red salmon were obtained, making about 300,000 taken this season in all of the Wood River traps.

Several complaints were made that certain traps extended too far into the stream, but the assistant agent's investigations do not sustain this charge. A number of gill nets also are operated in the lower reaches of the river, some, according to the trap men, to the full width of the river.

The following companies operated canneries on the bay this season: Alaska Packers' Association (3), Alaska-Portland Packers' Association, Northwestern Fisheries Company, Alaska Fishermen's Packing Company, North Alaska Salmon Company, and Columbia River Packers' Association, one each. The Alaska Salmon Company operated a cannery on Wood River just above its mouth.

There were seven traps operated in the bay. The gill net is the principal form of apparatus used. The gill netters operate principally in the lower bay, but some go as high up as Lewis Point on the Nushagak River and about 10 miles up the Wood River when the fish reach these rivers.

The fish began to run very early in this section, the first king salmon being taken on June 7, the first dog salmon on June 10, the first red salmon on June 11, and the first coho on July 11. According to the older cannery men this was the earliest appearance of the red salmon in twenty years, while dog salmon were never before known to come in so early. King salmon ran larger and in greater numbers than usual. The greater part of the red salmon pack was made between June 19 and July 9. The fish ran very steadily, except from July 3 to 9, when a big run passed up the river. Nearly all of the red salmon caught in June were taken below Point Ekuk, the fish not coming into the rivers until in July. The dog salmon run was very heavy from the beginning. It is the custom in Bristol Bay to pack dog salmon under a pink salmon label. Only the early run is put up and these fish are firm and in good condition. This season, however, several canneries continued packing dog salmon until the end of the season, although the late run presented a very repulsive appearance. About every fourth year there is a very good run of humpbacks, and fortunately for the cannerymen it occurred this season. It was early seen that the red salmon run was going to be a short one, so after the middle of July most of the canneries proceeded to make up the deficiency with humpbacks. The coho pack is usually a small one and this season was no exception. The reason, however, is not so much the lack of fish as the fact that the canneries are generally shut down in the middle of the run. Late in the season the cannery men sometimes, when the pack is light, put up some of the small king salmon under a coho label.

Red salmon generally run up the Nushagak River as far as Lewis Point, and then circle back and go up Wood River. The fishermen claim that this season the fish continued right on up the Nushagak. King and dog salmon nearly all run up the Nushagak River alone. The humpbacks are said to run everywhere when they appear, although but few seem to frequent Wood River as a general thing. In 1905 the fish clung very closely to the left-hand shore, but this season the major part of the runs went up along the right-hand shore or the sand bars in the middle of the bay. A southeast wind, according to the fishermen, is necessary to bring the fish into Nushagak Bay.

Gill-net fishermen employed by the Alaska Salmon Company in the early part of July caught four red salmon, none of which had a dorsal fin. In 1904 fishermen employed by the same company caught some red salmon which had the upper part of the tail cut off, apparently with a sharp instrument.

Kvichak River and Bay.—Previous to this season the inspection of the fisheries of this river ended at the cannery of the Union Packing Company, several miles above its mouth, but this year it was extended the whole length of the river and a few miles into Lake Iliamna, the first of the two lakes of the Kvichak chain. The river is about 80 miles in length, varies from 100 yards to a mile in width, and discharges a great quantity of water. The influence of the tide is felt 30 miles from the mouth. The current is very swift, running in places as much as 7 miles an hour. The upper half of the river is filled with low, grassy islands, the channel in many places being quite narrow. If the left-hand channel is followed when more than one passage is presented, navigation will be found safe and simple. In a launch drawing 3 feet of water Lake Iliamna can be reached with very little difficulty, the only bad spots encountered being elsewhere than in the left-hand channel. The lead heaved very frequently on the journey up, in nearly every instance, showed over 2 fathoms of water. Were it not for several shoals about 7 miles from the head of the river, a boat drawing 6 feet of water could doubtless pass easily into the lake at almost any stage of the river, and it is possible that a passage could be found around these shoals if it were sought for. The river has a number of small tributaries, none of which was visited, however.

There are several Indian villages near the mouth of the river, and one, Kaskanak, about 5 miles from the lake. At the latter the Indians use wicker salmon traps, which operate on the principle of a fyke net. They are made of flexible twigs, secured by means of birch-bark wythes. The first section is about 8 feet in length, and has a square mouth, the extreme width of which is 31 inches. From the outer rim twigs run toward the center, but do not meet, a space

about 6 inches in diameter being left open. A few small green branches are secured to the inside of this opening in order to give the appearance of an opening in the grass. Another and smaller section, conical in shape, is inserted into the rear of the first section, and in the back of this is a door which can be opened when the trap is raised and the fish taken out. The lead, which is made in 3-foot sections, is also of wickerwork. There were 5 of these traps scattered along the banks of the river from a mile below Kaskanak village to the lake.

It was impossible, owing to the lack of time and a suitable boat, to carry the investigation further than Lake Iliamna. According to trustworthy information this lake, which is said to be the largest in Alaska, is about 90 miles long and about 30 miles wide. About midway on the northern side is a tributary, Noghelem River, 20 miles in length, connecting Lake Iliamna with Lake Clark, the latter itself being about 80 miles long and with an average width of about 10 miles. The northeastern end of Lake Iliamna extends to within 17 miles of Iliamna Bay on Cook Inlet, between which bodies of water there is an overland trail, and this route is frequently followed by Indians, traders, and prospectors in going from Cook Inlet to Bristol Bay. There are 5 Indian villages on, or in the immediate vicinity of Lake Iliamna, practically all of which are dependent upon the run of salmon for the winter's supply of food for themselves and their dogs. Mr. Emil Anderson, a prospector from the Nushagak, who made the above passage in July of this year, states that the Indians on Lake Iliamna had a fair season, but the reverse was the case with the Indians of Kaskanak village. At the time of the visit to the latter place the chief reported that the season just closed had been most disastrous, although they had fished faithfully with their wicker traps.

Mr. J. P. Haller, president of the North Alaska Salmon Company, two years ago made the trip from Bristol Bay to Cook Inlet, via Lake Iliamna, during the month of August. According to his statement, he journeyed up the right-hand shore of the lake and about 12 or 15 miles from the outlet he found a small stream leading up into a fair-sized lake, which was a seething mass of spawning fish. At the head of the main lake, where most of the Indian villages are located, he found thousands of salmon drying, while plenty were to be seen in the river ascending to the lake above. He thinks that the red salmon spawn all along the shores of Iliamna Lake, especially at the head, but that a great part of the fish go up into a long and narrow arm extending out from the upper part of the lake and into Lake Clark. But few spawning fish were to be seen in the Kvichak River, or in the lake near the outlet.

The Lockonock River enters near the head of Kvichak Bay. It has its source in a lake, and is chiefly noted for its king salmon run.

The branch cannery of the North Alaska Salmon Company is located on this river near its mouth.

During the season of 1906 there were operated in this section two canneries of the North Alaska Salmon Company, a double cannery of the Alaska Packers' Association at Kogiung, the cannery of the Union Packing Company, and the saltery of the Northwestern Packing Company. While the double cannery of the Alaska Packers' Association at Coffey Creek was being prepared for operation, fire—said to be of incendiary origin—broke out about midnight of May 31, and destroyed all but the mess and bunk houses and provision storehouse, 7 persons losing their lives.

Four traps were operated in the Kvichak River this season—two by the Alaska Packers' Association, about 25 miles from the mouth; one by the North Alaska Salmon Company, about 12 miles from the mouth; and one by the Union Packing Company a short distance above the mouth of the river, all but the latter being built with corrals. Part of the last-named trap fell down about the middle of July and the part still standing was removed soon thereafter. The season was a disastrous one, hardly enough fish being secured to pay for the labor of operating the nets. The Alaska Packers' Association also operated a trap on the bay just below their Kogiung cannery. It met with a little better success than the river traps.

The greater part of the fishing for the canneries of this region is carried on in the bay. With the exception of the one trap mentioned above, gill nets are used exclusively. When fishing in the lower bay, large house lighters and vessels are moored in convenient places and the fishermen live aboard these, the fish being taken to the canneries on the run boats.

There was a very good run of king salmon this year. The run of humpbacks was better than usual, but some of the fish were so small that 40 were required to make a case. The first good run of red salmon began on July 5 and ended on July 8. About the middle of July another fair run came in, which lasted two days. The rest of the season the supply of red salmon was exceedingly poor. According to one of the superintendents, since 1900 there have been three good seasons (1900, 1902, and 1903) in this section, and four bad ones (1901, 1904, 1905, and 1906).

According to the superintendent of the Alaska Packers' Association canneries in this section, the young red salmon pass Kogiung, near the head of the bay, from the first to the middle of June, on their way to the sea. At this time they are from 3½ to 4 inches in length, and are just beginning to show the pink color. Many are caught in buckets by the Chinese employed at the canneries, who dry them for food. In 1905 there was an unusually large run of these young fish, but this year the run was not nearly so large as

usual. The superintendent thinks that these fish are about 22 months old from the time the spawn was first extruded.

Naknek River.—But little is known of the Naknek River for more than 10 or 15 miles from its mouth. A trip to Naknek Lake, at its head, which was planned for August, had to be abandoned on account of the stormy weather. It is said that the river is about 45 miles long, while the lake itself is even longer. With the exception of a short series of rapids, up which it is possible to haul a boat with a rope from the shore, the river is navigable for small craft. Several white men who visited the lake in October, two years ago, report having seen the shores lined with dead salmon.

This season the Alaska Packers' Association operated two canneries, and the Naknek Packing Company one, on Naknek River, while Mr. L. A. Pedersen, formerly superintendent for the Naknek Packing Company, built and operated a saltery on the bay shore several miles west of the mouth of the river. The plant of the Naknek Packing Company was formerly what is known as a "double cannery," i. e., two separate lines of machinery under what is practically one roof, but early in the season one of the lines of machinery was removed. It is the intention of the company to tear down and reconstruct the plant this fall.

Fishing is carried on in the lower 4 miles of the river and on the outside above and below the mouth of the river. A number of lighters and house barges are anchored in the vicinity of those owned by the Kvichak Bay canneries, and the fishermen from both sections work over the same ground. Gill nets alone are used. According to the fishermen, the fish are generally taken on half tide, both ebb and flood, almost none being taken on high tide, and the fishing runs about the same, night or day. There was less cause for complaint with the conditions on this river than on any river in Alaska inspected this season.

A fair, but late, run occurred here, both companies packing their guarantees. The saltery, however, had but poor success. The first red salmon was canned on June 22, but some were seen several days before that time. The first king salmon was canned on June 21, the first humpback salmon and dog salmon on July 17 (both were in the river before this date, however), while the canning of all four species ceased on the same date—July 31. After canning ceased one man from each cannery still continued fishing, the catch being utilized by the cooks. Only humpbacks and a few silver, or coho, salmon were secured, each boat averaging from 20 to 30 fish per day. According to the superintendent of the Alaska Packers' Association canneries here, the salmon come from the westward, and the Naknek generally gets the first run, the same run usually appearing in the Kvichak River a few hours later. The best fishing is generally from the 3d to the 12th or 14th of July.

The Alaska Packers' Association superintendent on the Naknek River sent 45,000 red salmon to the association's cannery on the Ugashik River in order to help out the latter's pack. The Naknek Packing Company sent 45,000 red salmon to the Red Salmon Canning Company on the Ugashik.

Owing to the very poor run on the Ugashik River, 50 of the fishermen from the Alaska Packers' Association cannery on that river were sent up to fish off the mouth of the Naknek River and in Kvichak Bay. They operated from a large house barge and the catch was towed in lighters and scows to the cannery.

Ugaguk River.—According to the natives, this river is about 80 miles long from the mouth to Lake Becharof, at the head. The lake itself is about 45 miles long and 15 miles wide; and the river is navigable for small boats to within 10 miles of the lake, whence there is a succession of rapids, around which it is necessary to portage. King Salmon River, the principal tributary, enters about 7½ miles from the mouth, is about 60 miles in length, and has its rise in a lake.

There are two canneries located on this river, owned, respectively, by the North Alaska Salmon Company and the Alaska Packers' Association, but only the former was operated this year. Both plants are about 6 miles from the mouth of the river. Fishing is carried on from about 3 miles above the cannery to the South Spit, near the mouth. Gill nets only are employed. According to the fishermen, the first of the flood is the best fishing time. Fishing began on June 18 and ended about July 28. The first red salmon was seen in the native set nets on June 10. The run of red salmon this season was the best in the last four years. The first king salmon was caught on June 18, but king salmon were in the river before this date. This species is found in scattering lots all through the season, especially in King Salmon River, which it frequents. Dog salmon are received at the cannery only during the first couple of weeks, as after that time they are so few in number that it does not pay the canneries to bother with them. Here, as well as everywhere else in the Bristol Bay region, the dog salmon are canned under a pink salmon label. A few coho salmon run up the river, but so late that it is not possible to can any.

Ugashik River.—This river has its rise in a chain of two lakes, but, with the exception of that portion below the upper cannery, about 25 miles, it is very little known to the whites. It has two known tributaries—King Salmon River, which enters through the left bank about 17 miles from the bar at the mouth, and Dog Salmon River, which enters through the left bank about 37 miles from the bar. From Smoky Point to the capes at the mouth the river widens very greatly, being about 20 miles across at the mouth.

Of the four canneries located on this river but two—the Williams cannery of the Alaska Packers' Association and the cannery of the Red Salmon Canning Company—were operated this season. The original outfit of the Williams cannery was destroyed in the San Francisco earthquake and fire, and it was then outfitted as a saltery, but later, when the Coffey Creek cannery of the association burned down, it was decided to take a part of so much of the outfit as was saved and operate the Williams cannery with it. Mr. L. A. Pedersen, who built and operated a saltery on Kvichak Bay, also had a small salting crew at the Bristol Packing Company's cannery.

The first fish, a king salmon, was caught on the 4th of June, but the canneries did not operate until later. The red, king, and dog salmon usually come in about the same time. Fishing for the canneries began on June 22 and ended on July 29. The run this season, as for five seasons past, was poor, and it looks very much as though the river was almost exhausted. In 1901 the catch of red salmon amounted to 769,002 fish, in 1902 to 1,640,973, in 1903 to 1,703,536, in 1904 to 564,492, in 1905 to 432,779, and in 1906 to about 152,140 fish, the same number of canneries being operated each year but 1906. Had it not been for the supplies of fish sent from the canneries on the Naknek River and the fishing carried on by the Ugashik fishermen in Kvichak Bay, the pack of the Ugashik canneries would have been very small. It is possible that one small cannery might make a pack, as was done this season on the Ugaguk. It would be an excellent thing if this river could be closed to all fishing for four or five years, so that it could be replenished, but it is hardly probable that there will ever again be a run large enough to permit the operation of the four large plants now located on the river.

Only gill nets are used in this river, and fishing is carried on almost entirely in the wide portion of the river near its mouth. According to the superintendent of the Alaska Packers' Association cannery, it is impossible to tell from which direction the fish come when entering the river—one season they will all be on one side of the river, and possibly the next season all on the other side. A southwest wind will generally bring them into the river. He considers the ebb tide as the best fishing time, but fishing is carried on at all times. The salmon appear to run as much at night as in the daytime. The young fry on their way to the sea generally come down the river in May.

Bear River.—The Peninsular Packing Company's saltery at this place did not operate this season. There is said to be a fine run of cohos in this river in July and August, and trout are plentiful. There is an Indian village on the river, but the superintendent of the saltery at Nelsons Lagoon stated that he had this year made an agreement with the Indians to open a store at the latter place, and in return

they will remove to the vicinity of the lagoon. This is said to be the finest big-game region in the whole district of Alaska.

Nelsons Lagoon.—This place has not heretofore been visited by official salmon investigators owing, it has been reported, to the alleged dangerous navigation in its vicinity. The cutter, however, had practically no trouble this year in finding the place. The saltery building is visible some miles out to sea, and when the cutter arrived off the mouth of the lagoon plenty of water was found within 2 miles of the shore, while a line of buoys was visible marking the channel into the lagoon.

The lagoon runs southwest by south, is 6 miles in length and about 2 miles in width. At its western end debouches the Nelson River, which is about a mile wide at its mouth, and about 18 miles from the mouth divides, both branches having their rise in lakes. There is an easy portage from the lakes to Pavlof Bay, on the Pacific side of the peninsula, and this route is used frequently by both whites and Indians.

The Lagoon Salmon Company this season operated the saltery which is located on Egg Island just inside of the mouth of the lagoon. This saltery was first operated in 1902. It was run in 1903 and then closed down for two seasons. The saltery force arrived at the lagoon on May 24. Fishing began on June 15, when red and king salmon were caught, and closed on July 18, with both species comprised in the last catch. The height of the fishing was from July 1 to 18. The saltery had a successful season, packing nearly its whole outfit, and utilizing red, king, and dog salmon. Of reds, 52 fish were required to fill a barrel; of kings 15, and of dogs 50. Silver or coho salmon ran in the lagoon in August, but too late to be utilized.

Gill nets and one trap net were used in fishing. The trap was in the upper part of the lagoon, on the left-hand shore, about one-half mile from the mouth of Nelson River. It was put in on June 15 and taken out on July 18.

Japanese fishing vessels.—At Unalaska, on August 14, Mr. Henry Dirks, a trader on Atka Island, who has a branch store on Attu Island, stated that of the four Japanese fishing schooners which the revenue cutter *Perry* found fishing around Attu Island last summer, and which, after their shore shacks were burned, were ordered to depart within twenty-four hours, two returned a day or two after the *Perry* left and resumed fishing again. Previous to being driven away the schooners had caught and salted 7,500 salmon, while of the two which returned one got between 6,000 and 7,000 salmon and the other practically none. In September a Japanese vessel, possibly one of those which were driven away, visited Attu Island and secured 15,000 coho salmon. Mr. Dirks knew of no Japanese vessels visiting either of the islands this year.

RECOMMENDATIONS.

The following recommendations are respectfully submitted:

1. That Eyak River and Lake, on Prince William Sound, be declared a salmon spawning reservation, either for future use as a salmon propagating plant to be conducted by the government, or that the adjacent waters may thereby be naturally reinforced. The closing of the river and lake to commercial fishing would not seriously affect the packing interest, as the resources of the river have been so greatly reduced by excessive fishing in the past that they do not now afford a material addition to the salmon supply of the region.

2. That the salting of salmon bellies, by the processes that do not now make any use of the other part of the fish and thereby entail a shocking waste of valuable food material, be prohibited. The practice is unquestionably inimical to the perpetuity of the fisheries.

3. That the Indian practice of taking salmon from the Chilkoot and Chilkat rivers with gaff hooks and selling them to the canneries be prohibited. The method not only seriously affects the permanent resources of the whole Lynn Canal region, but not uncommonly mutilates the fish so that they are unfit for use by the packers. The natives might still be permitted to take in this manner what are needed for their domestic use.

4. That Wood River be closed to commercial fishing, and that a salmon hatchery be established on the chain of lakes at its head.

This stream is, in the Nushagak region, the principal thoroughfare of the red salmon to their spawning beds, and the fishing methods practiced in it are the source of much complaint. The fish traps seem to be the most important cause contributing to the poor run of red salmon in 1906, and many complainants urge that such apparatus be prohibited altogether. The canneries would unquestionably be benefited by the closing of the stream. By far the greater quantity of the fish they handle come from Nushagak Bay, and a good run there overtaxes the canneries' capacity. The fish in Wood River then have to be released, as in 1905. When, on the other hand, there is a poor run in the bay there is necessarily a poor run in the river, and this is the time when it is essential that the few fish which do escape the bay nets be allowed unobstructed passage up the river. With the possible exception of one firm, it is believed that the canneries on the Nushagak would welcome the closing of Wood River to all commercial fishing. But three, moreover, of the eight firms in the region, have traps in the river at present, all of them doing by far the greater part of their fishing in the bay. Thus the closing of the river for a term of years would be but temporary inconvenience, at most, to any of the firms, and such inconvenience would be more than counterbalanced by the results of allowing the red salmon access to

their spawning beds. Without some such measure as this, it is probable that the other canneries, for self-preservation, will place traps in the river, and thus completely obstruct the already impeded passage. The river has stood the drain thus far, but the past season's run points to the necessity for precautions.

The establishment of a hatchery on the Wood River chain of lakes is a matter of great interest to all the canneries in this region. There are several excellent sites along the shores of the first lake (Aleknagik), and the cost of a hatchery here would be much less than elsewhere in Alaska. Almost any of the cannery ships could be utilized in transporting the necessary building material and supplies from the coast to the Nushagak in the spring, with at most a very small charge for the service. The question of labor would be simple, as there is a small resident white population on the Nushagak throughout the year, while Indians are quite numerous. It is thought that if the Department were to submit the two propositions at the same time—the closing of Wood River to all fishing and the establishment of a hatchery on the chain of lakes—there would be practically no opposition to the prohibition.

5. That there be available in Alaskan waters a vessel belonging to the Department of Commerce and Labor for the use of the Bureau of Fisheries in the salmon inspection. This is considered necessary for the following reasons:

Navigation in these waters is difficult, and the changing personnel of revenue cutters permits no officer any great familiarity with the region. In consequence the cutters enter none of the Bristol Bay rivers except the Nushagak, anchoring usually 5 to 10 miles off the mouths. Canneries as much as 17 miles distant must thus be visited in the small boats of the ship, which encounter numerous dangers in the swift tides, frequent storms, and fogs prevalent in the region. The accommodation of the boat's crew, moreover, is a problem. It is impossible to carry food and shelter for a several days trip, and the necessary four or five oarsmen and officer, in addition to the agent, are a burden to the cannery men. In consequence very little general work can be done.

With a vessel belonging to the service, and the navigator having once become familiar with the region, the agent could be taken into the rivers for visits of such length as were necessary; he would no longer be compelled to depend upon the canneries for shelter and subsistence, and also he would not be directly under their observation while making his investigations, as is now the case.

OTHER FISHERIES.

COD.

The cod fishery of Alaska is growing steadily from year to year, the only apparent limit to its development being a market for the product. All of the firms operating in the district have their headquarters at San Francisco, Cal., or Seattle, Anacortes, or Tacoma, Wash., at which places or in their immediate vicinity the kench-cured fish are received and prepared for marketing. The greater part of the product is sold in the United States, a considerable quantity being marketed in New England. The rest is sent to Porto Rico and other West Indian islands, and to Central America, the Hawaiian Islands, Australia, China, Japan, and other countries in the East. The industry was badly demoralized during the greater part of 1906, owing to the bitter rate-cutting war between certain of the San Francisco dealers, which forced prices down to such a point that but little, if any, profit was left. The war did not extend to the export trade, however, and this was consequently the more active.

The fishery is conducted in two ways. One is the establishment, near the banks, of shore stations, where the catch is collected daily by means of small boats, and whence from time to time, as sufficient quantity has accumulated, it is shipped to market in vessels dispatched from the coast ports specially for the purpose. Under the other plan vessels sail from Puget Sound ports and San Francisco direct to the banks and return thence to the home port with the catch. This branch of the fishery can not be credited to Alaska, however, and therefore does not appear in the tables (p. 8–11) in this report.

FISHING STATIONS.

The most important fishery and the one which figures in the statistical data of this report is that prosecuted from the shore stations. Following the establishment of the first permanent station, in 1867, the business fluctuated from year to year with the varying profitableness of shore and vessel fishing. For several years past, however, the stations have evidently been the more remunerative, as their number has considerably increased. The following were in operation in 1906:

Alaska Codfish Company: Company Harbor and Moffat Cove, Sannak Island; Unga, Baranof (Squaw Harbor), and Kelley Rock (Winchester), Unga Island, and Dora Harbor, on Unimak Island.

Blom Codfish Company: Eagle Harbor, on Nagai Island.

Pacific-States Trading Company: Nagai, on Nagai Island, and Ikatik, on Unimak Island.

Seattle-Alaska Fish Company: Baranof (Squaw Harbor), on Unga Island.

Union Fish Company: Pirate Cove, Popof Island; Northeast Harbor, Big Koniuji Island; Sanborn Harbor, Wedge Cape, and Eagle Harbor, on Nagai Island; Unga, on Unga Island; Pavlof Harbor and Johnson Harbor, on Sannak Island, and Dora Harbor, on Unimak Island.

King & Winge, of Seattle, expect to establish a station at Doublin Bay this year.

Nearly all of the fishing stations (several are operated only during the summer) are open the year round, the fishermen going out in their dories each day the weather is favorable. Usually there is one man to a boat and hand lines are quite generally employed, although a few trawls are used. Trawls were found to be unprofitable because, owing to the frequent storms at certain seasons, the fishermen often could not reach them until after the fish on them had spoiled. Owing to long-continued stormy weather, which prevented trips to the banks, the winter fishing this year was very poor. After the middle of the spring, however, when the weather settled, good catches were made.

A small plant for the rendering of oil from the cod livers is located at the Kelley Rock (Winchester) station of the Alaska Codfish Company. A portion of the oil is prepared for medicinal purposes and sold to hospitals in San Francisco.

STATISTICS.

During the year 1906 there were operated 19 stations, valued at $64,805, and employing 38 shoresmen, 7 transporters, and 190 fishermen. The boats in use numbered 205, valued at $7,000, and the fishermen used $2,825 worth of hand and trawl lines. Four transporting vessels, with a total net tonnage of 179 and a value of $16,700, were used in the work. The catch by the station fishermen amounted to 3,126,434 pounds of salted cod (in preparing which 4,168,579 pounds of fresh cod were used), valued at $110,473. Some other products were prepared—7,000 pounds of cod tongues, valued at $350, and 240 gallons of cod-liver oil, valued at $84. A few cod were taken incidentally in Southeast Alaska.

VESSEL FISHING.

Nearly all of the vessels fish in Bering Sea, where there are but few safe harbors for the location of shore stations. Some of the fleet spent the winter of 1905–6 in the north, but for the greater part of the season stormy weather prevailed on the banks in both Bering Sea and the North Pacific Ocean, and as a consequence but few of the vessels secured full cargoes.

There was considerable complaint among the fishermen that the cod caught off Sannak were covered with scabs, which condition was ascribed by some to the dumping overboard on the banks of the gurry from the fishing vessels; but this hardly seems probable. Others claim that the practice referred to drives the cod from the banks.

The fishermen working east of Sannak Island are reported to have made catches of cod which averaged 8 pounds each. This ground is somewhat dangerous and has not been fished for some time.

The following new vessels were added to the fleet this year: Schooner *Fortuna*, of Tacoma; steamer *Newport* (transporter), of San Francisco; schooner *Ottilie Fjord*, of San Francisco; schooner *Rosie H.* (transporter), of San Francisco, and schooner *Dora Bluhm*, of San Francisco. The schooner *Arago*, of San Francisco, which has been engaged in the Alaska codfishery since 1880, and the schooner *Zampa*, of San Francisco, have been sold and are now engaged in other business.

Disasters to the fleet in 1906 were not so serious as in 1905. Early in the year the small schooner *Pirate*, belonging to the Union Fish Company, and engaged in plying between the company's different stations, was wrecked and became a total loss. The schooner *Glen*, of San Francisco, while on her way to the banks in March was driven ashore twice, but got off each time. The schooner *Marion*, while en route from San Francisco to one of the stations, was wrecked April 11 on one of the Shumagins, and became a total loss, with no casualties, however.

One member of the crew of the schooner *Fremont* was frozen to death in his dory, while another was washed overboard and drowned. A third fisherman was adrift in his dory for eight days, and when picked up was suffering from badly frozen legs.

The vessel owners make frequent and bitter complaint of the class of men available for the work of fishing. Usually there are a few good fishermen on each vessel, but the rest are riff-raff picked up along the water fronts of the Pacific coast cities. This year the Robinson Fisheries Company, of Anacortes, Wash., engaged 40 experienced cod fishermen in Gloucester, Mass., and brought them to the coast, shipping them as part of the crews of their schooners *Alice* and *Joseph Russ;* it was thought by the company that with

this expert help larger and quicker catches would be made and the schooners would be enabled to make two trips each year to the banks. The men did very well as fishermen, but they were unable to accomplish the two trips, and in order to incite them to harder work the company offered three prizes ($25 to the first, $15 to the second, and $10 to the third) for the three men on each vessel catching the greatest number of fish. On the *Alice* the winner of first prize caught 10,935 fish; the second, 10,534, and the third, 10,002 fish. On the *Joseph Russ* the first prize winner caught 12,650 fish; the second, 12,445, and the third, 10,990 fish. Only three of the prizes were won by the eastern fishermen, however.

A serious evil, due primarily to the poor class of fishermen employed, is the frequent desertions from vessels while fishing. As the men necessarily take the dory and gear with them when deserting, the money loss in each case also is considerable.

The California and Washington vessels operating in Alaskan waters this year numbered about 18 fishing vessels and 4 transporters. As already stated, neither they nor their catch appear in the statistical tables of this report.

COD HATCHING.

The fishermen are very desirous that a hatchery be established on one of the Shumagin Islands, and several generous offers to assist the Bureau of Fisheries have been made by certain of the firms engaged in the industry. Nothing can be done in this matter, however, until a specific appropriation is obtained from Congress for the establishment of such a hatchery.

HALIBUT.

The halibut is rapidly becoming one of the most important commercial fishes of Alaska. At present the fishery is restricted to Southeast Alaska, but as the demand increases and means of communication between Central and Western Alaska and the Puget Sound ports improve, Central Alaska, at least, is certain to develop a large halibut industry. Little prospecting has so far been done in the latter region, but what data are available indicate that there are as good banks in that section as in Southeast Alaska. Very little is known in regard to the abundance of halibut in Western and Arctic Alaska, but as the fish has been reported from a number of points, it will probably be found there in considerable numbers.

Various conditions combined to the disadvantage of the halibut fishery this year, however. The greater part of the Alaska catch is shipped to eastern points, where it comes in competition with Atlantic halibut. The Atlantic fishermen made good catches in the spring and summer, and the eastern market thus became glutted, so that

prices dropped until many of the Pacific coast fishermen either ceased fishing for the time being or else restricted the amount taken. During part of the summer the New England Fisheries Company, which has its headquarters in Victoria, British Columbia, and is one of the largest shippers on the coast, limited its steamers to 100,000 pounds of halibut per trip; and at this very time halibut were unusually abundant on the southeast Alaska banks, so that the biggest catches ever made were possible then had the money return justified the effort. The coast dealers, recognizing the disadvantages of depending too much upon the eastern markets, are now putting forth strenuous efforts to build up a trade west of the Alleghanies and are succeeding admirably. The demand for halibut from the coast cities and towns also is increasing at a remarkably rapid rate as the fish becomes better known, and it is very probable that within a few years three-fourths of the Pacific halibut will be marketed west of the Mississippi River.

For about four or five months the big plant at Tee Harbor was closed on account of a strike of the fishermen. They had been receiving 27 cents per fish for all halibut over 15 pounds in weight, but demanded 30 cents. As most of the halibut taken in the summer months are fletched, the strike caused a great reduction in the year's product prepared in this manner.

The lack of bait sometimes hampers the fishermen. Herring, the bait used almost exclusively and at times very abundant, are often not to be found for periods of a week or two. During the late fall and winter the demand is very heavy, for the Puget Sound and Alaskan fleets, numbering 41 vessels, rendezvous at Petersburg, at the head of Wrangell Narrows. Fresh herring make the best bait, but frequently the fishermen have to fall back upon the salted. There is need of a small cold-storage plant at Petersburg, which could buy up the herring during the summer and fall, when they are most abundant, and retain them in cold storage for the winter demand, and it is probable that such a plant will be in operation during the latter part of 1907. A company has been organized, and the work has begun.

Advices were received late in the year to the effect that halibut were being found in large numbers on the banks, and there were indications that the winter catch would be the largest known for some time. That it would be profitable, also, was assured by the fact that in winter the Alaska banks are about the only available Pacific source of supply for American fishermen, and prices are consequently high.

The experiment of using steam trawlers in Atlantic waters the last year or two created considerable interest among the Pacific halibut fishermen, and in the early part of 1906 two steam trawlers were fitted out by a British Columbia company to work on the banks along

that coast. The attempt was abandoned after several months, however, having proved unprofitable. According to the reports of the masters of these vessels, the halibut was too cunning a fish for them, and would avoid the trawl without much apparent effort. This was especially noticeable when the trawl was being operated in the vicinity of the dory fishermen. While the latter would be making good catches, the trawls would make hauls containing but few halibut and a quantity of small fish of other kinds, for which there is no market on the Pacific coast. Both of the steam trawlers are now being fitted out for dory fishing.

No halibut was canned in 1906. Several firms on the Pacific coast are experimenting, and if a market can be built up there is almost no limit to the quantity which can be packed. A few cases packed in Alaska in 1904 and 1905 met with a very favorable reception, but sufficient capital has not yet materialized to push the industry. As halibut are especially abundant in Alaska during the winter months, when salmon are very scarce, it would be an easy matter to utilize one of the many salmon canneries then idle for the packing of this product.

One Seattle firm which secures a considerable part of its fresh halibut from Alaskan waters has just perfected a fish jelly which is made from the choicest cuts of halibut steaks. A form of smoked halibut put on the market is thin strips packed in half-pound paper cartons. These make very neat and convenient packages for lunches or picnics, and in this shape the product has met with a ready sale.

STATISTICS.

During 1906 there were 304 persons employed in all branches of the fishery. In 1905 there were 276. In 1906 there were 246 fishermen, 39 shoresmen, and 19 transporters, while the total investment that year was $106,702, against $95,980 in 1905. The halibut marketed fresh in 1906 amounted to 3,347,578 pounds, valued at $125,607. The quantity marketed fresh in 1905 was 3,144,614 pounds, valued at $85,326, over which 1906 showed a gain of 202,964 pounds and $40,281. The quantity of frozen halibut prepared in 1906 was 529,550 pounds, valued at $21,047, against 316,341 pounds, valued at $12,641, in 1905, a gain of 213,209 pounds and $8,406 for 1906. In 1906 the quantity of halibut salted, or fletched, was 321,803 pounds, valued at $11,554, against 1,213,845 pounds, valued at $48,554, in 1905. This large decrease—892,042 pounds and $37,000—was due, as already stated, to the strike at one of the large plants during the summer months, the season of the year when halibut are salted. There was also a large decrease in 1906 in the quantity of halibut smoked, 46,713 pounds, valued at $2,382, being prepared in 1905, and only 1,100 pounds, valued at $110, being the output in 1906. No halibut were canned in 1906.

The following tables show in detail the condition of the industry in 1906:

EMPLOYEES IN THE HALIBUT FISHERIES IN 1906.

How employed.	Number.	How employed.	Number.
Fishermen:		Transporters:	
Vessel fisheries—		Whites	13
Whites	68	Indians	6
Shore fisheries—		Total	19
Whites	34		
Indians	144	Grand total	304
Total	246		
Shoresmen:			
Whites	29		
Indians	10		
Total	39		

INVESTMENT IN AND PRODUCTS OF THE HALIBUT FISHERIES IN 1906.

Items.	Number.	Value.	Items.	Number.	Value.
Fishing vessels:			Shore and accessory property.		$36,450
Steamers and launches	4	$6,300	Total		106,702
Tonnage	40				
Outfit		2,000		Pounds.	Value.
Sailing	14	8,950			
Tonnage	135		Catch:		
Outfit		4,185	Vessel fisheries—		
Transporting vessels:			Halibut, fresh	833,269	$31,321
Steamers and launches	6	24,000	Shore fisheries—		
Tonnage	79		Halibut, fresh	2,514,309	94,286
Outfit		3,495	Halibut, frozen	529,550	21,047
Sailing	1	1,000	Halibut, salted	321,803	11,554
Tonnage	16		Halibut, smoked	1,100	110
Outfit		120			
Boats	171	10,015	Total	4,200,031	158,318
Apparatus:					
Vessel fisheries, lines		3,167			
Shore fisheries, lines		6,930			

VESSEL FISHING.

As previously noted, a fleet of Puget Sound power and sail vessels visits Southeast Alaska during the months from November to March, when, owing to stormy weather and a scarcity of fish, it is not safe or profitable to visit the fishing banks near their home ports. This fleet makes its headquarters at Petersburg, at the head of Wrangell Narrows, shipping the catch home via the regular steamship lines. During 1906 there were 23 vessels, valued, with outfits, at $47,145, and manned by 128 men, who used $8,500 worth of trawl lines. The catch amounted to 2,002,670 pounds of fresh halibut, valued at $80,881. As these vessels all hail from the state of Washington, however, none of these data are included in the statistical tables of this report. In addition to the above, some six or eight American steamers, hailing from Puget Sound ports, also visited Alaskan waters on certain trips, but it was found an impossibility to gather data showing just what proportion of their catch came from Alaskan waters.

HERRING.

The herring fishery is of considerable importance in Southeast Alaska, although much neglected in other parts of the district. According to the best information obtainable, the herring in Southeast Alaska begin to spawn during May and continue in some localities as late as July 1. The grounds are widely distributed, extending from Howkan on the south to Skagway and out through Icy Straits to Cross Sound on the north. Immediately after spawning the fish school in great abundance out in the deep water, especially in Frederick Sound and the southern end of Stephens' passage, and then reenter the bays for the purpose of feeding. During July and August they are filled with a red feed which makes them very difficult to cure. In September and October apparently they change their food, for the red substance is not then noticeable in their stomachs, and at this time they are in their prime. The runs are usually composed of mixed sizes, although in early summer there are said to be numerous bays where all the herring will be of small size.

In the early part of 1906 some good catches of herring were made in Gastineau channel. There was also a fair run during the summer, but the numbers seemed to drop off very seriously in the fall months, and the fishermen found it impossible to get enough to supply the demands of the halibut fleet for bait. They charge this condition to the fertilizer plant at Killisnoo, which consumes chiefly herring, and whose fishing operations they claim also break up the schools and drive the fish out into the deeper water, where they are difficult to catch. This matter will be treated more fully in the discussion of fertilizer and oils.

There is no question but that the herring fisheries of Alaska will be quite important in the near future. At the present time the only uses made of the fish are in salting for food, selling fresh and salted for bait in the other fisheries, and as fertilizer and oil. The province of British Columbia, which has a run of the same species, is making every effort possible to improve the industry and develop it along varied lines, and in pursuance of this object the Dominion government sent a Scotch fishery expert out to the Pacific coast the latter part of 1904 to report wherein the methods of packing could be so improved that the product could compete with the foreign and eastern herring. The substance of his report is as follows:

(1) Pacific herring, in the main, are smaller and contain far more oil than the Atlantic herring.

(2) Pacific herring are adapted for kippers, suitable for use within a limited time, but not so suitable for pickling in barrels to compete with the best Scottish or Norwegian herring.

(3) When pickled they will not keep so long in good condition as the Atlantic herring, and could not therefore compete with properly pickled Atlantic herring.

As the eastern fishermen find it difficult to supply their own markets, there is no reason why, when proper methods of packing are followed, a large trade in Pacific coast herring should not be built up, and in this Alaska ought to be the chief participator. There is a steady demand in Australia and China, the Straits Settlements, and elsewhere in Asia for pickled herring. If a determined effort were made, the Pacific coast dealers could undoubtedly supply a good part of this market.

During the winter of 1905–6 one of the canneries at New Westminster, British Columbia, as an experiment put up a considerable quantity of herring in hermetically sealed cans. Should this product meet with favor it would be more profitable than salt herring, and salmon canneries could be utilized in canning herring at times when they would otherwise be idle.

The Juneau Packing Company, of Juneau, has a well-equipped smokehouse, where it smokes a considerable quantity of herring each year. The same company has also a plant for the canning of sardines, but, owing to the lack of sufficient cheap labor and the low prices of this product during the last two years, has not operated the plant since 1904.

STATISTICS.

During the year 1906 there were 8 firms and individuals regularly engaged in the packing of herring in Southeast Alaska, while a new firm engaged in some experimental work in Chignik Bay, Central Alaska. These plants employed 13 shoresmen and 48 fishermen; used 14 seines, valued at $2,150, 9 gill nets, valued at $900, 1 trap, valued at $1,500, and 31 boats, valued at $1,345. The prepared products were as follows: 785 half barrels, valued at $1,963, and 1,055 barrels, valued at $7,130, salted for food; 2,200 barrels of fresh herring, valued at $2,200, and 4,450 barrels of salted herring, valued at $9,075, for bait; and 67,249 pounds of smoked herring, valued at $2,219.

The herring salted for food will run from 500 to 700 fish to the barrel, while those salted for bait are much smaller, running from 900 to 1,200 to the barrel. The salted bait is generally put up during the summer months, and the fish are usually dumped whole into a barrel, about 50 pounds of salt being sprinkled upon them. While the halibut fishery is at its height during the winter months, the herring are generally furnished fresh, just as they come from the water. The barrel is not included in the purchase price with either fresh or salted bait.

FERTILIZER AND OIL.

The question whether fertilizer plants in Alaska should be permitted to utilize food-fishes in their work is a subject of considerable interest to the people of the district. A heavily signed protest, asking for the enactment of a prohibitory law, has been presented to Congress by citizens of Southeast Alaska.

At the present time there is but one fertilizer plant—that of the Alaska Oil and Guano Company, at Killisnoo—engaged in the industry to any extent. This plant was built originally to handle herring, and since it began to operate, in 1882, has produced 4,281,420 gallons of oil, valued at $1,055,368, and 29,319,800 pounds of fertilizer, valued at $349,349, with the addition of four years' output of fertilizer for which records are wanting. In the early years of the industry the vast majority of the fish taken were herring, but of late years this species has become so scarce in the vicinity of the plant that large quantities of salmon have been utilized to fill out. In 1906 the proportion was 33,500 barrels of herring and 18,000 barrels of salmon, of which latter it is probable that a small portion was dogfish and sharks, although the company's official report does not so state. The salmon used are said to be humpbacks and dogs, both excellent food fishes, and the former furnishing the major part of the salmon canned in Southeast Alaska. Dog salmon were formerly much neglected and considered really a refuse fish, but when in 1900 they were dry-salted for the Japanese trade which had sprung up, the demand became so great that in 1905, 7,280,234 pounds, valued at $115,643, were dry-salted, while 41,972 cases, valued at $113,056, were canned. In 1906 the output of dry-salted dog salmon dropped (for reasons explained elsewhere in this report) to 1,081,680 pounds, valued at $16,449, but the pack of canned salmon increased to 254,812 cases, valued at $730,235. In addition, several hundred barrels were pickled. In view of its great importance as food, the use of salmon (except offal) in the preparation of fertilizer should be absolutely prohibited.

For the use of herring the plea of the company has been that these fish were not being used for food, and could not be so prepared profitably. This was true for some years subsequent to the establishment of the Killisnoo plant; but it is not true now. Since 1891, the earliest year for which data are available, 9,255 half-barrels and 41,840 barrels of salted herring, valued at $217,726, have been prepared for food or as bait for use in the other fisheries, while 107,134 pounds of smoked herring, valued at $4,553, and 3,173 cases of sardines, valued at $12,059, were prepared and marketed. A small part of the salted pack was put up by the fertilizer company from a few of the best fish brought in.

At the present time the halibut fishermen are dependent upon herring for bait. In the summer and early fall fishing for halibut is carried on in a desultory manner, but in the late fall and winter a large fleet of local and Puget Sound vessels frequents the Southeast Alaska banks, creating a very heavy demand for herring bait, which, for the past two seasons, the captains complain, has been very difficult to obtain in regular and sufficient supply to operate the vessels without vexatious and costly delays. This lack of bait may be due, however, as much to the erratic habits of the herring (they may appear in countless numbers in a certain bay one year, while the next year there may be not one) as to a general decrease in its abundance. Heretofore the business of supplying bait to the halibut fleet has been conducted in a very slipshod manner, and if there are found improved methods of catching the herring when abundant and preserving them until needed, it is probable that the difficulties of the halibut fishermen will be overcome.

There is, moreover, another phase of the question to consider. When the company established its plant at Killisnoo in 1882 practically no use had been made of the immense numbers of herring in these waters, and everybody welcomed the advent of the new industry. At present the establishment gives employment to 60 persons, half of them Indians, the little settlement of Killisnoo being quite largely dependent upon the work and wages derived from the company. The plant, which is worth $50,000, is generally operated from June to October, and in this time disburses in wages alone about $50,000. As the local objections to the use of herring for fertilizer have developed only within the last three years, it would seem unfair to forbid the the plant to use herring now unless a substitute can be found. A substitute, however, is possibly at hand.

In 1906 Alaska furnished 107,643,061 pounds of prepared salmon, and this output, owing to the loss in dressing, which was about 30 per cent, represented a gross quantity of 153,775,802 pounds of fish. Of the 30 per cent waste, which amounted to 46,132,741 pounds, every pound was dumped overboard to pollute the waters and air in the vicinity of the cannery or saltery.

The Pacific Coast and Norway Packing Company has installed a small plant in its Tonka cannery, and as soon as this is put in working order expects to handle all of the waste from the canning operations. A fertilizer plant at Ladner, British Columbia, on the Fraser River, handles all of the salmon offal and refuse it can secure. The oil extracted is said to meet with a good demand from tanners, while there is an unlimited demand for the fertilizer. The offal is collected in specially constructed scows.

There does not appear to be any valid reason why each cannery should not turn this waste into fertilizer and oil. While the money

returns to anyone would not be large, they would aggregate a considerable sum, and in addition would aid the fisheries by making the waters sweeter and purer. It is possible, also, that the question of the Killisnoo plant might be thus solved. If the machinery could be adapted for salmon offal—and as whole salmon are utilized at present there can hardly be a doubt of this—the plant might be run wholly with offal. There are two large canneries within a comparatively short distance of Killisnoo, while three or four more are situated not much farther away than the company's steamers go at present in pursuit of herring.

There is a small fertilizer plant at Pleasant Bay, built in 1905, but the products prepared by it have not yet amounted to much. In 1904 a fertilizer plant was constructed on Dall Island, but, owing to the unsuitability of the machinery installed, it has never been operated. It is now being remodeled, however, and will probably be operated in 1907.

The plant of the Ketchikan Ka-ko Oil Company, at Loring, where oil was extracted from the livers of dogfish, did not operate this year. This is to be regretted, for dogfish are a most unmitigated nuisance, and anything that tends to reduce their numbers in Alaskan waters will very much aid in preserving the other fisheries.

AQUATIC FURS.

BEAVER.

The catch of this most valuable of the interior fur-bearing aquatic animals is decreasing from year to year. In 1905 it was 1,935 skins, valued at $8,271, while in 1906 it was 1,536 skins, valued at $8,620, a decrease of 399 skins, but an increase in value of $349 for 1906.

MUSKRAT.

But few of the muskrat skins are shipped out of Alaska, being generally used by the traders to barter with the natives for more valuable furs. The natives use the muskrat furs for clothing and blankets or robes. In 1905, 12,599 skins, valued at $1,192, were sent out of the district, but in 1906 there was a large falling off, only 3,611 skins, valued at $302, being shipped.

LAND OTTER.

This is one of the most widely distributed of the coastal fur-bearing animals of Alaska, but, like the other aquatic animals, was taken in fewer numbers in 1906. In 1905 the output was 1,889 skins, valued at $14,458, while in 1906 it was 1,709 skins, valued at $16,618, a decrease of 180 in number, but an increase in value of $2,160.

SEA OTTER.

During 1906 the schooner parties hunted from May to August, the most frequented regions being the Fairweather Grounds, off Yakutat Bay, and the reefs off the Sannak Islands. The schooner *Challenge* also worked this year in the neighborhood of Amchiatka, one of the Rat Islands. As the sea otter can be hunted only in calm weather, the favorable hours are few. The schooner captains estimate that there were only about 70 hours of good hunting weather during the whole of last season. In May and June it was the best. The general arrangement in schooner hunting is for the vessel to take one-fourth of the gross proceeds and furnish everything but the canoes and rifles, though including the ammunition. The native hunters will sometimes make a pro rata division of their share, but the favorite method is for each hunter to take what he kills. The hunters usually go out in two-hole bidarkas, two men to the craft, and will go 20 to 30 miles from the schooner and remain away all day in these flimsy-looking boats. The number of schooners engaged in hunting dropped off this year, owing to the requirement of law which compels them to clear foreign from the customs-house and hunt not less than 9 miles from shore. These requirements make it unprofitable to outfit. The fleet and catch in 1906 is shown in the following table:

THE SEA OTTER FLEET IN 1906.

Name of vessel.	Port.	Tonnage.	Value.	Outfit.	Crew.	Indian hunters.	Canoes.		Sea otters.	
							No.	Value.	No.	Value.
Schooner Everett Hays	Unalaska	37	$2,000	$300	3	20	10	$150	2	$300
Schooner Emma	Marzovia	24	1,500	250	3	20	10	150	[a]14	2,100
Schooner Challenge	Atka	37	1,900	300	3	31	21	315	4	650
Total		98	$5,400	850	9	71	41	$615	20	$3,050

[a] Had 14 on July 20; a few more were secured after this date, but the number is unknown.

In addition to the catch shown above, 7 sea otters, valued at $1,754, and one pup, valued at $25, were killed in various ways (4 of them by Indian hunters at the southern end of Kodiak Island), making a total catch by Alaskans of 28 sea otters, valued at $4,829, as compared with 61, valued at $13,867, in 1905.

For several seasons past, cod-fishing vessels have been reporting herds of sea otter in Bering Sea about 75 miles offshore, but no effort has been made as yet on the part of the hunters to verify the truth of these reports.

In various parts of Western and Central Alaska this past summer were heard reports of Japanese vessels engaged in hunting seal and sea otter. The master of the schooner *Challenge* reported that a Japanese schooner was hunting for sea otter off the Rat Islands at the same time his party was there, but he did not know whether the

vessel had met with any success. The Japanese schooner had 4 boats engaged in hunting. Reports of the presence of Japanese schooners in the vicinity of the Sannak Islands were quite circumstantial, especially after the dispersal of the pelagic fleet by the capture of part of the crews of two Japanese schooners which raided the Pribilof group in July. The British Columbia pelagic sealing fleet also killed 13 sea otters (the schooner *Casco* securing 12 and the schooner *City of San Diego* 1), a most unusual catch for this fleet, which gets few sea otters as a rule.

FUR SEAL.

The shipment of fur seals by the lessees of the Pribilof Islands was 12,536 from St. Paul Island, 1,940 from St. George Island, a total of 14,476 skins for the group. These sold in the London market for $445,137. The number of seals killed on the islands this year, however, was only 12,886 (11,186 on St. Paul Island and 1,700 on St. George Island), the remainder of the shipment noted above being composed of skins secured in previous seasons and not marketed. In addition there were 373 fur-seal skins, valued at $8,094 (this represents the price paid to the hunters for these skins and not the London price), taken in Southeast Alaska; 224, valued at $1,344, taken in Central Alaska, and one, valued at $10, taken in Western Alaska; making a total of 598 skins, valued at $9,448, taken by Alaskan natives, in addition to skins taken on the Pribilof Islands, a grand total of 15,074 skins shipped from Alaska. The catch off Baranof Island by the Sitka Indians was unusually heavy in May, the greater part of the Southeast Alaska catch being credited to them. The competition among the buyers for these skins was unusually keen, as high as $24 being paid for very good ones.

The pelagic fleet hailing from British Columbia and working on the Alaskan herd was composed this year of 17 schooners, and the catch of the fleet amounted to 7,983 skins from Bering Sea and 1,403 skins from along the British Columbia-Alaskan coast, a total of 9,386, which brought an average price of $21.56 each in the London market, a decrease of $3 per skin from the price received last year (1905). In 1905 this fleet took in Bering Sea 10,832 skins, 2,849 more than were taken in 1906. The coast catch also decreased in 1906 as compared with 1905.

A Japanese pelagic fleet, variously estimated at from 25 to 31 vessels, also hunted seals in Bering Sea and is reported to have secured about 7,000 skins. Several of these vessels participated in the raids upon the rookeries of St. Paul Island on July 16 and 17 with rather disastrous consequences to themselves, as 5 of their men were killed and 12 captured, 2 of the latter being wounded. The prisoners were later tried at Valdez and each sentenced to three months imprisonment.

MISCELLANEOUS AQUATIC MAMMALS.

Hair seals.—To the natives of Alaska the hair seal is probably the most useful aquatic animal they hunt, for from the flesh and oil is secured a considerable part of their winter food, while the skins are put to many useful purposes. The skin, flesh, and oil are also used by the coast Indians in barter with the interior tribes. Only a small portion of the skins are shipped from Alaska, the number this year being 17,684, valued at $12,332. This, however, is a large increase over 1905, when the shipments totaled only 9,098 skins, valued at $5,554.

Walrus.—This animal is sought mainly for its tusks of ivory. In 1906 there were shipped from Alaska 11,323 pounds of ivory, valued at $7,125; 20 walrus hides, valued at $40; 1 walrus head and tusk, $10; 1 walrus skull and tusk, $40, and 1 head curio, $15. The last three were natural history specimens.

This enormous animal is becoming very scarce in Alaskan waters, owing to indiscriminate slaughter by the whalers. The scarcity in recent years has caused frightful suffering and death among the tribes, for to many of the Eskimo the walrus is almost a necessity of life.

Whales.—Many species of whales occur in Alaskan waters, but the great majority of them are finbacks, sulphur bottoms, and humpbacks. An occasional sperm whale is seen. The region of especial abundance is around the lower end of Prince of Wales Island and in Frederick Sound in Southeast Alaska. In Murder Cove, at the southern end of Admiralty Island, Southeast Alaska, there is in course of construction a large whaling plant, to be operated on the plan of those on the British Columbia coast, which will probably be ready to begin operation in March, 1907. Every part of the animal will be utilized. These whales do not yield as much whalebone as the bowhead, or "right," whale, but it is hoped that several hundred pounds will be secured from each. The average amount of oil obtained, according to British Columbia reports, is about 75 barrels from each whale. Part of the flesh will be canned or otherwise prepared, and shipped to Japan and other countries for food, while the refuse will be turned into fertilizer.

MISCELLANEOUS FISHERY RESOURCES OF ALASKA.

Owing to the immense coast line, and the fact that the populated districts are for the most part on the coast or along the many rivers which wind back into the interior, aquatic products form a large proportion of the food of the natives of Alaska, and, in many instances, of the white residents also. The catching and curing of fishery foods, principally the different species of salmon, occupies the attention of

the natives during the summer and early fall, when the fish enters the streams and bays for the purpose of spawning; the catch is stowed away in storehouses until needed during the winter months. Not only must the native prepare winter food for himself and family, but also for his dogs, of which each family usually has three or four, and which are the sole dependence of the native for drawing his sled in winter when the ground is covered with snow. At one place on the Ugaguk River last summer (in July) two natives had on their curing racks over 8,000 salmon, the greater part of which were intended as dog food, and these men expected to put up from 4,000 to 6,000 more before the salmon season ended. They had a large kennel of dogs, part of which were for hire in the season, hence the large number of fish cured, but very few families put up less than 4,000 to 5,000 salmon each season for their own household use and for their dogs. In 1880 Mr. Ivan Petroff, special agent of the Tenth Census, estimated that the natives of Southeast and Central Alaska, the Aleutian chain, and the Bristol Bay region, alone consumed yearly 44,891,000 pounds of fish. This takes no account of the enormous quantities of fish consumed each year in the Kuskokwim River, Yukon River, and Arctic districts.

In all sections of Alaska other aquatic products besides fish are used—hair and fur seals, walrus, grampus, beluga, whales, porpoises, land and sea otters, beaver, various crustaceans and mollusks, and algæ. It is impossible, however, to secure even approximate figures for these products, owing to the fact that most of them are consumed by the fishermen or hunters, and the remainder are used for barter with the interior tribes. None of these items, therefore, appear in the statistical tables in this report.

Last April there was, according to the Indians and a few white men who stay there the year around, a large run of a certain species of fish in the Ugashik River, but to get a definite description of the fish was found impossible. All statements agreed, however, that it was neither the eulachon nor the smelt, both of which frequent the river. It is only an occasional visitor, the Indians claim, and has not been here for some years. Its presence is considered by them an indication of a big run of salmon later on, but in this instance, at least, the prophecy proved false.

Following is a summary of the present knowledge of the leading fishery products which go to form a considerable part of the food of the natives, but do not enter, or, at the most, enter very slightly, into the commercial fisheries of Alaska:

Atka mackerel (*Pleurogrammus monopterygius*).—This species, which is also known locally as kelp-fish and yellow or striped fish, is found about the whole of the Aleutian chain and among the Shumagin Islands. When salted in brine it has a flavor very similar to mack-

eel, whence its name. It occurs in great abundance, and is usually found in kelp beds in 3 to 40 fathoms in the spring and early summer, returning to deeper water later. It is generally near the bottom, but can easily be tolled to the surface. In weight the fish averages about 2¼ pounds, while its average length is about 18 inches. The Attu natives generally use a gig to catch it, or rather a long pole, along the length of which are fastened several hooks. This they push down in the water, then give it a quick, upward jerk, and often catch more than one fish at a time. Purse seines would undoubtedly prove a very effective means of capture. During the early days of the gold excitement most of the steamers engaged in the carrying trade to St. Michael and Nome stopped at Dutch Harbor for coal going and coming, and the Attu natives would put up and sell to these steamers a small quantity of the fish each year. As but few vessels call at Dutch Harbor now, however, this trade has ceased, and the fish is practically unused except for local consumption, but there is no doubt that some day it will occupy an important position in the fish exports of Alaska.

Blackfish (Dallia pectoralis).—This species, which is peculiar to the Kuskokwim and Yukon deltas, does not exceed 5 or 6 inches in length, and is one of the most nutritious and toothsome fishes found in Alaskan waters. According to Petroff, it is found in all the shallow channels and lagoons of this region and constitutes the chief subsistence of the natives during the winter months. It is so abundant that only old men, boys, and women engage in the catching of it. It is exceedingly fat, and a good quantity of pellucid oil is obtained from it by a very primitive process. Huge drift logs are fashioned into troughs, which are then filled with water and a quantity of the fish. "A large number of smooth cobblestones are thrown into a fire until they are thoroughly heated, when they are picked up with sticks fashioned for the purpose and deposited in the water, which boils up at once. After a few minutes these stones must be removed and replaced by fresh ones, this laborious process being continued until the oil has been boiled out * * * and floats on the surface, when it is removed with flat pieces of bone or roughly fashioned ladles and decanted into bladders or whole sealskins."

Boreogadus saida.—This, according to the Report of the International Polar Expedition to Point Barrow, Alaska (1885), is quite a plentiful fish in the neighborhood of Point Barrow at most seasons of the year, and forms an important item in the food supply of the natives. During the latter part of October and early in November, after the sea has closed and when tide cracks form along the shore, the natives generally catch a good many at the very edge of the beach in about a foot of water. They use a short line of whalebone, to which is attached a small lure made of blackened ivory, roughly

representing an amphipod crustacean, and armed with a barbless hook. Later in the season the fish have retired to the deeper water and are not seen again until early in February, when they become exceedingly abundant in about 15 fathoms of water. The natives flock to the ice in great numbers then, and, selecting the level portions of the ice fields, dig holes and fish through these with jigs that are kept close to the bottom. Bushels of fish are said to be taken in this way each day when fishing is practicable.

Eulachon (*Thaleichthys pacificus*).—This species, a near relative of the smelt, is the well-known candlefish. It is highly prized by the natives for its excellent food qualities, and as it is exceedingly oily, by simply inserting a piece of pith through the axis of the fish when dried, it may be used as a candle or torch, the pith burning like the wick of a well-filled lamp. The oil and a grease extracted from the fish are favorite condiments with the natives.

The eulachon is not abundant in Alaska, only occasional runs appearing in the Stikine, Unuk, and Chilkat rivers in the Southeast Alaska region. Large schools frequent the larger rivers of Cook Inlet, in Central Alaska, but their stay is exceedingly brief. The great runs occur in the British Columbia rivers, especially the Nass, in March and April.

Lampreys (*Lampetra aurea*) are abundant in the Yukon River in the spring, especially at Anvik, it is said, where they are used for food. The Indians catch them chiefly for food for their dogs, but eat them themselves when other food is scarce.

Smelt (*Hypomesus olidus*).—There is an annual run of this species in most of the streams of Western Alaska, especially the Yukon, where it is of considerable importance, but it is taken only for local consumption. On Puget Sound the drying of smelt for export to Japan is becoming an important industry, and there is no doubt that the Alaska smelt would serve this purpose as well were it properly prepared.

Tomcod or Wachna (*Microgadus proximus*).—This is an important species locally. It is reported abundant in Yes Bay, Southeast Alaska, in the spring, and is also said to appear in other sections of Alaska, but its chief center of abundance is Bering Sea, particularly Norton Sound. It is said to be a permanent inhabitant of the shores of this sea, but is most abundant in the fall of the year when the ice begins to form in the rivers and along the shores. According to Dall, "the wachna fishery commences about the middle of October. At first the fish are caught from boats anchored close inshore, but later the natives cut holes in the new ice, set up two or three stakes with a mat hung upon them to keep off the wind and sit there all day, hauling them in as fast as the line is dropped into the water. The hook is made of white walrus ivory, furnished with a sharp pin set

in obliquely, but without a barb. The whiteness of the ivory, which is kept constantly in motion, attracts the fish and no bait whatever is required. In November, when the ice becomes very thick and the cold increases, the fish retire to deeper water and the fishing is over until the following spring. * * * They are preserved by removing the intestines and drying in large bunches strung on seal line, or by throwing them into long cylindrical baskets made of twisted grass and keeping them entire in a frozen state. * * * They are among the most palatable of the many fish found in these seas, and the number preserved is so great as to be almost incalculable. They serve the natives for food either boiled or in the frozen state. They also form an important article of dog feed in the northern portions of Alaska near the coast."

Trout.—There are five species of trout known from Alaska—namely, steelhead, Dolly Varden, cutthroat, rainbow, and lake. The steelhead is the most important commercially, a small quantity being frozen and exported from Alaska each year. While all of the species are fairly abundant, some occur in extraordinary numbers—for instance, the Dolly Varden, or salmon trout, as it is known locally—and all form a most important item in the food supply of the natives and resident whites. But few are sold, and these in Southeast Alaska and at a few places on the Yukon River. There is probably no place in the world where the angler can have better and surer sport than in angling for the different species of trout in Alaska. Plenty of cutthroat trouts were taken in the traps on Nushagak Bay this season. About three years ago one of the canneries put up some with the intention of calling them pink salmon, but they turned out a dirty yellow, making them unsalable. Some were salted, also, but in that condition they proved too dry. A few were packed in bay leaves, but with poor success, for they were practically tasteless.

Whitefish (*Coregonus*).—Seven species of these excellent food fishes are reported from Alaska. They are especially abundant in the rivers emptying into Bering Sea, and are also found in lesser numbers in those streams tributary to the Arctic Ocean. In the Bering Sea rivers the Indians catch them by means of ingenious wickerwork traps, made somewhat after the general style of a fyke net. They are composed of a series of cylindrical and conical baskets, fitting into each other, with a small opening in the end connecting one with the other, and the series terminating in a tube with a removable bottom, through which the captive fish are extracted. Some of these baskets are from 15 to 25 feet in length. They are secured with stakes driven into the river bottom, and the leader, composed of square sections of wickerwork, is held in place by stakes. The traps are generally set over shoals and eddies, where the whitefish congregate, and, as the river freezes over soon after the traps are set, they must be

entirely submerged. Throughout the winter, when the snow lies deep through forest and tundra, and hunting is impossible, the natives of this region depend almost entirely upon whitefish for sustenance. Early in the morning the men visit the traps, armed with ice picks fashioned from walrus tusks or reindeer antlers, for on each succeeding night a new, solid ice covering forms over the trap and must be removed to get at the fish.

The same style of trap, only larger, is used in catching the various species of salmon. In the Arctic streams the natives fish with gill nets through the ice in October and early November, and again in February, March, and April; whitefish are caught also in the streams during the summer.

Other fishes.—Among other species of fishes used locally for food the following more important ones may be mentioned:

In fresh waters: The common pike (*Esox lucius*); the Arctic grayling (*Thymallus signifer*); the inconnu (*Stenodus mackenzii*), which attains a length of 5 feet and a weight of 50 pounds; burbot, or losh (*Lota maculatus*), and sucker (*Catostomus catostomus*).

In salt waters: The redfish or "black bass" of Sitka (*Sebastodes melanops*), an excellent food fish and quite abundant; sculpins (Cottidæ) are quite abundant, and at Atka, in the Aleutian chain, are salted for food; flounders are abundant everywhere, while capelin and lance, or lant, are abundant and make excellent bait for the better species.

Crabs.—Crabs are exceedingly abundant in Southeast and Central Alaska, where they attain a very large size, and are much relished as food by both whites and natives. At several places in southeast Alaska they can be purchased in the local markets, but usually must be caught by the consumer.

Shrimp.—The investigations of the *Albatross* show that shrimp are abundant in the waters of Central Alaska, south of the Alaska Peninsula, and it is probable that they would be found in equal numbers if sought for in other parts of the district. But slight use is made of them at present.

Shellfish.—Clams, especially *Machæra patula*, or the razor clam, are found in abundance throughout Southeast and Central Alaska. Small quantities have been canned in Southeast Alaska in various years, but lack of cheap labor and capital has prevented development in this line. Many clams are gathered and consumed locally. Mussels are said to be plentiful and large along the Aleutian chain.

Octopus.—Although abundant in Alaskan waters, but little use is made of this animal, even by the natives. One of the reported methods of capture is unique. When an octopus is found, the native, instead of attempting to tear it loose from its lair, to which it is firmly attached by its sucker-like arms, removes the stem from his

pipe and smears some of the nicotine into the cleft of a long stick. This stick he then pokes downward until near the animal's head, then suddenly into its mouth, when, it is said, the nicotine paralyzes the octopus so that it allows itself to be lifted out of the water.

Holothurians.—Bêche-de-mer, trepang, or sea cucumber, as they are known to the trade, are found in great quantities in southeast Alaska, but absolutely no use is made of them at the present time. They are said to be especially abundant in shallow water in May and June.

The collection and preparation of this animal for market is a large and profitable business in the South Sea Islands. Nearly all the prepared product is sold in China, and the market price quoted at Shanghai early in 1906 was about 34 cents American gold per pound. The manner of curing is simple and well known.

Sea urchin.—The natives of the Aleutian chain consume large quantities of this animal, which seems to be abundant in that section.

Algæ.—In April and May the Thlingits of Southeast Alaska gather an alga, or seaweed, which they dry, press in boxes, and put away to be eaten. There is no record that other tribes follow this custom, however. Many species of algæ are found on the coasts of Alaska, and while the country is at present too little developed to hope for much from this source, the time will probably come when the gathering of seaweed and the extraction of by-products will be quite important commercially. Hundreds of tons of the giant kelp (*Nereocystis lutkeana*) are to be found everywhere along the Alaska coast. The Indians formerly used the upper or hollow portions of the great stems as receptacles for dogfish and other oils, while the thin stem, which anchors the floating mass and is of great strength and flexibility, has long been prepared and used by them for fishing lines. A number of chemical products can be produced from kelp, as well as from other algæ.

NEW LAWS IN FORCE IN 1907.

The year 1906 witnessed the adoption of three laws which, it is hoped and believed, will have a most beneficial effect upon the fisheries of the district.

The act under which the salmon fisheries of Alaska have been governed since 1889 was ineffective, and radical changes were found necessary. The new act did not become law, however, until June 26, when the fishing was at its height, and the news of its passage could not reach the more inaccessible regions until after the close of the fishing season, consequently the provisions of the old law continued to rule in a considerable part of the district. The first season in which the new law will have a thorough trial will be that of 1907. The provisions are as follows:

AN ACT For the protection and regulation of the fisheries of Alaska.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That every person, company, or corporation carrying on the business of canning, curing, or preserving fish or manufacturing fish products within the territory known as Alaska, ceded to the United States by Russia by the treaty of March thirtieth, eighteen hundred and sixty-seven, or in any of the waters of Alaska over which the United States has jurisdiction, shall, in lieu of all other license fees and taxes therefor and thereon, pay license taxes on their said business and output as follows: Canned salmon, four cents per case; pickled salmon, ten cents per barrel; salt salmon in bulk, five cents per one hundred pounds; fish oil, ten cents per barrel; fertilizer, twenty cents per ton. The payment and collection of such license taxes shall be under and in accordance with the provisions of the act of March third, eighteen hundred and ninety-nine, entitled "An act to define and punish crimes in the district of Alaska, and to provide a code of criminal procedure for the district," and amendments thereto.

SEC. 2. That the catch and pack of salmon made in Alaska by the owners of private salmon hatcheries operated in Alaska shall be exempt from all license fees and taxation of every nature at the rate of ten cases of canned salmon to every one thousand red or king salmon fry liberated, upon the following conditions:

That the Secretary of Commerce and Labor may from time to time, and on the application of the hatchery owner shall, within a reasonable time thereafter, cause such private hatcheries to be inspected for the purpose of determining the character of their operations, efficiency, and productiveness, and if he approves the same shall cause notice of such approval to be filed in the office of the clerk or deputy clerk of the United States district court of the division of the district of Alaska wherein any such hatchery is located, and shall also notify the owners of such hatchery of the action taken by him. The owner, agent, officer, or superintendent of any hatchery the effectiveness and productiveness of which has been approved as above provided shall, between the thirtieth day of June and the thirty-first day of December of each year, make proof of the number of salmon fry liberated during the twelve months immediately preceding the thirtieth day of June, by a written statement under oath.

Such proof shall be filed in the office of the clerk or deputy clerk of the United States district court of the division of the district of Alaska wherein such hatchery is located, and when so filed shall entitle the respective hatchery owners to the exemption as herein provided; and a false oath as to the number of salmon fry liberated shall be deemed perjury and subject the offender to all the pains and penalties thereof. Duplicates of such statements shall also be filed with the Secretary of Commerce and Labor. It shall be the duty of such clerk or deputy clerk in whose office the approval and proof heretofore provided for are filed to forthwith issue to the hatchery owner, causing such proofs to be filed, certificates which shall not be transferable and of such denominations as said owner may request (no certificate to cover fewer than one thousand fry), covering in the aggregate the number of fry so proved to have been liberated; and such certificates may be used at any time by the person, company, corporation, or association to whom issued for the payment pro tanto of any license fees or taxes upon or against or on account of any catch or pack of salmon made by them in Alaska; and it shall be the duty of all public officials charged with the duty of collecting or receiving such license fees or taxes to accept such certificates in lieu of money in payment of all license fees or taxes upon or against the pack of canned salmon at the ratio of one thousand fry for each ten cases of salmon. No hatchery owner shall obtain the rebates from the output of any hatchery to which he might otherwise be entitled under this act unless the efficiency of said hatchery has first been approved by the Secretary of Commerce and Labor in the manner herein provided for.

SEC. 3. That it shall be unlawful to erect or maintain any dam, barricade, fence, trap, fish wheel, or other fixed or stationary obstruction, except for purposes of fish culture, in any of the waters of Alaska at any point where the distance from shore to shore is less than five hundred feet, or within five hundred yards of the mouth of any red-salmon stream where the same is less than five hundred feet in width, with the purpose or result of capturing salmon or preventing or impeding their ascent to their spawning grounds, and the Secretary of Commerce and Labor is hereby authorized and directed to have any and all such unlawful obstructions removed or destroyed.

SEC. 4. That it shall be unlawful to lay or set any drift net, seine, set net, pound net, trap, or any other fishing appliance for any purpose except for purposes of fish culture, across or above the tide waters of any creek, stream, river, estuary, or lagoon, for a distance greater than one-third the width of such creek, stream, river, estuary, or lagoon, or within one hundred yards outside of the mouth of any red-salmon stream where the same is less than five hundred feet in width. It shall be unlawful to lay or set any seine or net of any kind within one hundred yards of any other seine, net, or other fishing appliance which is being or which has been laid or set in any of the waters of Alaska, or to drive or construct any trap or any other fixed fishing appliance within six hundred yards laterally or within one hundred yards endwise of any other trap or fixed fishing appliance.

SEC. 5. That it shall be unlawful to fish for, take, or kill any salmon of any species in any manner or by any means except by rod, spear, or gaff, in any of the waters of Alaska over which the United States has jurisdiction, except Cook Inlet, the Delta of Copper River, Bering Sea, and the waters tributary thereto, from six o'clock post meridian of Saturday of each week until six o'clock antemeridian of the Monday following, or to fish for, or catch, or kill in any manner or by any appliances except by rod, spear, or gaff, any salmon in any stream of less than one hundred yards in width in Alaska between the hours of six o'clock in the evening and six o'clock in the morning of the following day of each and every day of the week. Throughout the weekly close season herein prescribed the gate, mouth, or tunnel of all stationary and floating traps shall be closed, and twenty-five feet of the webbing or net of the "heart" of such traps on each side next to the "pot" shall be lifted or lowered in such manner as to permit the free passage of salmon and other fishes.

SEC. 6. That the Secretary of Commerce and Labor may, in his discretion, set aside any streams or lakes as preserves for spawning grounds, in which fishing may be limited or entirely prohibited; and when, in his judgment, the results of fishing operations in any stream, or off the mouth thereof, indicate that the number of salmon taken is larger than the natural production of salmon in such stream, he is authorized to establish close seasons or to limit or prohibit fishing entirely for one year or more within such stream or within five hundred yards of the mouth thereof, so as to permit salmon to increase: *Provided, however*, That such power shall be exercised only after all persons interested shall be given a hearing, of which due notice must be given by publication; and where the interested parties are known to the Department they shall be personally notified by a notice mailed not less than thirty days previous to such hearing. No order made under this section shall be effective before the next calendar year after same is made: *And provided further*, That such limitations and prohibitions shall not apply to those engaged in catching salmon who keep such streams fully stocked with salmon by artificial propagation.

SEC. 7. That it shall be unlawful to can or salt for sale for food any salmon more than forty-eight hours after it has been killed.

SEC. 8. That it shall be unlawful for any person, company, or corporation wantonly to waste or destroy salmon or other food fishes taken or caught in any of the waters of Alaska.

SEC. 9. That it shall be unlawful for any person, company, or corporation canning, salting, or curing fish of any species in Alaska to use any label, brand, or trade-mark which shall tend to misrepresent the contents of any package of fish offered for sale: *Provided*, That the use of the terms "red," "medium red," "pink," "chum," and so forth, as applied to the various species of Pacific salmon under present trade usages shall not be deemed in conflict with the provisions of this act when used to designate salmon of those known species.

SEC. 10. That every person, company, and corporation engaged in catching, curing, or in any manner utilizing fishery products, or in operating fish hatcheries in Alaska, shall make detailed annual reports thereof to the Secretary of Commerce and Labor, on blanks furnished by him, covering all such facts as may be required with respect thereto for the information of the Department. Such reports shall be sworn to by the superintendent, manager, or other person having knowledge of the facts, a separate blank form being used for each establishment in cases where more than one cannery, saltery, or other establishment is conducted by a person, company, or corporation, and the same shall be forwarded to the Department at the close of the fishing season and not later than December fifteenth of each year.

SEC. 11. That the catching or killing, except with rod, spear, or gaff, of any fish of any kind or species whatsoever in any of the waters of Alaska over which the United States has jurisdiction shall be subject to the provisions of this act, and the Secretary of Commerce and Labor is hereby authorized to make and establish such rules and regulations not inconsistent with law as may be necessary to carry into effect the provisions of this act.

SEC. 12. That to enforce the provisions of this act and such regulations as he may establish in pursuance thereof, the Secretary of Commerce and Labor is authorized and directed to depute, in addition to the agent and assistant agent of salmon fisheries now provided by law, from the officers and employees of the Department of Commerce and Labor, a force adequate to the performance of all work required for the proper investigation, inspection, and regulation of the Alaskan fisheries and hatcheries, and he shall annually submit to Congress estimates to cover the cost of the establishment and maintenance of fish hatcheries in Alaska, the salaries and actual traveling expenses of such officials, and for such other expenditures as may be necessary to carry out the provisions of this act.

SEC. 13. That any person, company, corporation, or association violating any provision of this act or any regulation established in pursuance thereof shall, upon conviction thereof, be punished by a fine not exceeding one thousand dollars or imprisonment at hard labor for a term of not more than ninety days, or by both such fine and imprisonment, at the discretion of the court; and in case of the violation of any of the provisions of section four of this act and conviction thereof a further fine of not more than two hundred and fifty dollars per diem may, at the discretion of the court, be imposed for each day such obstruction is maintained. And every vessel or other apparatus or equipment used or employed in violation of any provision of this act, or of any regulation made thereunder, may be seized by order of the Secretary of Commerce and Labor, and shall be held subject to the payment of such fine or fines as may be imposed.

SEC. 14. That the violation of any provision of this act may be prosecuted in any district court of Alaska or any district court of the United States in the States of California, Oregon, or Washington. And it shall be the duty of the Secretary of Commerce and Labor to enforce the provisions of this act and the rules and regulations made thereunder. And it shall be the duty of the district attorney to whom any violation is reported by any agent or representative of the Department of Commerce and Labor to institute proceedings necessary to carry out the provisions of this act.

SEC. 15. That all acts or parts of acts inconsistent with the provisions of this act are, so far as inconsistent, hereby repealed.

SEC. 16. That this act shall take effect and be in force from and after its passage.

Approved, June 26, 1906.

AN ACT To prohibit aliens from fishing in the waters of Alaska.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it shall be unlawful for any person not a citizen of the United States, or who has declared his intention to become a citizen of the United States, and is not a bona fide resident therein, or for any company, corporation, or association not organized or authorized to transact business under the laws of the United States or under the laws of any State, Territory, or district thereof, or for any person not a native of Alaska, to catch or kill, or attempt to catch or kill, except with rod, spear, or gaff, any fish of any kind or species whatsoever in any of the waters of Alaska under the jurisdiction of the United States: *Provided, however*, That nothing contained in this act shall prevent those lawfully taking fish in the said waters from selling the same, fresh or cured, in Alaska or in Alaskan waters, to any alien person, company, or vessel then being lawfully in said waters: *And provided further*, That nothing contained in this act shall prevent any person, firm, corporation, or association lawfully entitled to fish in the waters of Alaska from employing as laborers any aliens who can now be lawfully employed under the existing laws of the United States, either at stated wages or by piecework, or both, in connection with Alaskan fisheries, or with the canning, salting, or otherwise preserving of fish.

SEC. 2. That every person, company, corporation, or association found guilty of a violation of any provision of this act or of any regulation made thereunder shall, for each offense, be fined not less than one hundred dollars nor more than five hundred dollars, which fine shall be a lien against any vessel or other property of the offending party or which was used in the commission of such unlawful act. Every vessel used or employed in violation of any provision of this act or of any regulation made thereunder shall be liable to a fine of not less than one hundred dollars nor more than five hundred dollars, and may be seized and proceeded against by way of libel in any court having jurisdiction of the offense.

SEC. 3. That the violation of any provision of this act or of any regulation made thereunder may be prosecuted in any United States district court of Alaska, California, Oregon, or Washington.

SEC. 4. That the collector of customs of the district of Alaska is hereby authorized to search and seize every foreign vessel and arrest every person violating any provision of this act or any regulation made thereunder, and the Secretary of Commerce and Labor shall have power to authorize officers of the Navy and of the Revenue-Cutter Service and agents of the Department of Commerce and Labor to likewise make such searches, seizures, and arrests. If any foreign vessel shall be found within the waters to which this act applies, having on board fresh or cured fish and apparatus or implements suitable for killing or taking fish, it shall be presumed that the vessel and apparatus were used in violation of this act until it is otherwise sufficiently proved. And every vessel, its tackle, apparatus, or implements so seized shall be given into the custody of the United States marshal of either of the districts mentioned in section three of this act, and shall be held by him subject to the proceedings provided for in section two of this act. The facts in connection with such seizure shall be at once reported to the United States district attorney for the district to which the vessel so seized shall be taken, whose duty it shall be to institute the proper proceedings.

SEC. 5. That the Secretary of Commerce and Labor shall have power to make rules and regulations not inconsistent with law to carry into effect the provisions of this act. And it shall be the duty of the Secretary of Commerce and Labor to enforce the provisions of this act and the rules and regulations made thereunder, and for that purpose he may employ, through the Secretary of the Treasury and the Secretary of the Navy, the vessels of the United States Revenue-Cutter Service and of the Navy: *Provided, however,* That nothing contained in this act shall be construed as affecting any existing treaty or convention between the United States and any foreign power.

Approved, June 14, 1906.

PURE-FOOD LAW.

Another important act, to prevent "the manufacture, sale, or transportation of adulterated or misbranded or poisonous or deleterious foods, drugs, medicines, and liquors, and for regulating traffic therein, and for other purposes," more commonly known as the "Pure food and drug law," which became a law June 30, 1906, affects the Alaska canned products chiefly in its bearing upon misbranding, a subject which is also covered by the new fishery law. The use of deleterious substances and the packing of light-weight goods have never been practiced by the canneries. The pure-food law, with the regulations adopted thereunder, is too long to be quoted here. It will be found in Circular No. 21, Office of the Secretary, United States Department of Agriculture.

O

STATISTICS OF THE FISHERIES OF THE NEW ENGLAND STATES FOR 1905

Bureau of Fisheries Document No. 620

Blank page retained for pagination

CONTENTS.

	Page.
Introduction	7
General and comparative statistics.	8
Persons engaged	8
Investment	8
Products	9
Comparison with previous statistics	13
Maine fisheries	14
General statistics	14
Fisheries by counties	16
Products by apparatus	22
Miscellaneous notes	30
Canning industry	33
Smoked-fish industry	37
Wholesale trade	39
New Hampshire fisheries	39
General statistics	39
Products by apparatus	40
Wholesale trade	41
Massachusetts fisheries	41
General statistics	41
Massachusetts fisheries—Continued.	Page.
Fisheries by counties	44
Products by apparatus	54
Miscellaneous notes	68
Wholesale trade	71
Boston	71
Gloucester	72
Rhode Island fisheries	73
General statistics	73
Fisheries by counties	75
Products by apparatus	78
Oyster industry	82
Connecticut fisheries	83
General statistics	83
Fisheries by counties	84
Products by apparatus	87
Oyster industry	91
Menhaden industry	92
Miscellaneous notes	93
Wholesale trade	93

Blank page retained for pagination

STATISTICS OF THE FISHERIES OF THE NEW ENGLAND STATES FOR 1905.

INTRODUCTION.

This report relates to the coast fisheries of the New England States in the calendar year 1905, and is based upon inquiries made by the statistical agents of the Bureau in 1906. The statistics have already been published in condensed form in Statistical Bulletin No. 198.

Earlier publications of the Bureau on the fisheries of the New England States are as follows:

The Fishery Industries of the United States. Section II, Geographical Review of the Fisheries for 1880, parts I to V.

The Fishery Industries of the United States. Section V, History and Methods of the Fisheries.

Report on the Conditions of the Sea Fisheries of the South Coast of New England in 1871 and 1872. By Spencer F. Baird. Report U. S. Fish Commission 1871–72, p. i–xli.

The Sea Fisheries of Eastern North America. By Spencer F. Baird. Report U. S. Fish Commission 1886, p. 3–224.

Statistical Review of the Coast Fisheries of the United States. By J. W. Collins. Report U. S. Fish Commission 1888, p. 271–378.

Notes on the Oyster Fishery of Connecticut. By J. W. Collins. Bulletin U. S. Fish Commission, vol. IX, 1889, p. 461–497.

The Herring Industry of the Passamaquoddy Region, Maine. By Ansley Hall. Report U. S. Fish Commission 1896, p. 443–489.

Report on the Fisheries of the New England States. By J. W. Collins and Hugh M. Smith. Bulletin U. S. Fish Commission, vol. X, 1890, p. 73–176.

The Lobster Fishery of Maine. By John N. Cobb. Bulletin U. S. Fish Commission, vol. XIX, 1899, p. 241–265.

Statistics of the Fisheries of the New England States. Report U. S. Fish Commission 1900, p. 311–386.

Statistics of the Fisheries of the New England States, 1902. Report Bureau of Fisheries 1904, p. 245–325.

GENERAL AND COMPARATIVE STATISTICS.

PERSONS ENGAGED.

The number of persons employed in the fisheries of the New England States in 1905 was 37,339, of whom 10,649 were on fishing vessels, 441 on transporting vessels, 13,114 in the shore or boat fisheries, and 13,135 were shoresmen in the wholesale fishery trade, sardine canneries, smokehouses, skinning lofts, oyster houses, and other shore industries connected with the fisheries. Maine employed in its fisheries and related industries 15,881 persons; New Hampshire, 145; Massachusetts, 15,694; Rhode Island, 2,212; and Connecticut, 3,407. Compared with the returns for 1902, the year for which the last previous canvass was made, there was a decrease of 3,951 persons in Maine and of 16 in New Hampshire, but an increase of 1,394 in Massachusetts, 95 in Rhode Island, and 567 in Connecticut; a decrease of 1,911 in the total number employed.

PERSONS ENGAGED IN THE FISHERIES OF THE NEW ENGLAND STATES IN 1905.

States.	Fishermen.	Shoresmen.	Total.
Maine	7,442	8,439	15,881
New Hampshire	132	13	145
Massachusetts	12,618	3,076	15,694
Rhode Island	1,708	504	2,212
Connecticut	2,304	1,103	3,407
Total	24,204	13,135	37,339

INVESTMENT.

The total amount of capital invested in the fisheries and fishery industries of these states was $22,530,720. The investment in Maine was $8,972,049; in New Hampshire, $47,050; in Massachusetts, $10,810,442; in Rhode Island, $1,065,426, and in Connecticut, $1,635,753. Compared with 1902, the investment shows an increase of $2,522,286. There has been an increase in all the states except Massachusetts, where there was a decrease of $1,152. The largest increases were $2,032,546 in Maine and $434,698 in Connecticut. The investment in the region as a whole included 1,447 fishing and transporting vessels, valued at $4,385,896, and having a net tonnage of 45,668 net tons and outfits valued at $1,727,709; 11,913 row, sail, and power boats in the shore fisheries, valued at $1,048,506; fishing apparatus used by vessels and boats to the value of $1,469,779; shore and accessory property valued at $8,777,354, and cash capital amounting to $5,121,476. The forms of apparatus having the largest aggregate value were seines, $161,477; gill nets, $162,381; pound nets, trap nets, and weirs, $561,708; hand and trawl lines, $309,446, and lobster pots, $210,293.

INVESTMENT IN THE FISHERIES OF THE NEW ENGLAND STATES IN 1905.

Items.	Maine.		New Hampshire.		Massachusetts.	
	Number.	Value.	Number.	Value.	Number.	Value.
Vessels fishing	269	$325,651	1	$250	649	$2,745,360
Tonnage	3,561		6		32,961	
Outfit		128,409		190		1,300,096
Vessels transporting	143	257,600			14	16,300
Tonnage	1,889				429	
Outfit		47,015				2,495
Boats	5,569	420,100	115	7,755	3,592	389,103
Seines	133	15,845			275	128,985
Gill nets	2,521	23,149	35	470	12,472	123,338
Pound nets, trap nets, and weirs	669	198,873	9	4,410	220	180,790
Fyke nets	29	667			80	500
Bag nets	120	3,948				
Dip nets	168	646			240	569
Beam trawls					66	1,696
Lines, hand and trawl		31,897		432		274,057
Eel pots	608	590	5	5	1,787	2,305
Lobster pots	143,427	147,022	4,070	4,230	25,282	35,099
Harpoons		1,338				2,144
Spears	74	119			126	232
Tongs, rakes, hoes, etc	1,368	1,047	29	46	2,282	7,656
Dredges	88	2,126			1,714	4,534
Other apparatus		317		12		313
Shore and accessory property		4,404,140		17,750		3,603,384
Cash capital		2,961,550		11,500		1,991,426
Total		8,972,049		47,050		10,810,442

Items.	Rhode Island.		Connecticut.		Total.	
	Number.	Value.	Number.	Value.	Number.	Value.
Vessels fishing	95	$285,250	240	$689,880	1,254	$4,046,391
Tonnage	1,486		4,814		42,828	
Outfit		74,535		167,424		1,670,654
Vessels transporting	16	20,950	20	44,655	193	339,505
Tonnage	124		398		2,840	
Outfit		3,040		4,595		57,055
Boats	1,269	123,969	1,368	107,579	11,913	1,048,506
Seines	68	8,075	93	8,572	569	161,477
Gill nets	473	7,028	338	8,396	15,839	162,381
Pound nets, trap nets, and weirs	230	161,535	68	16,100	1,202	561,708
Fyke nets	776	4,647	190	1,911	1,075	7,725
Bag nets					120	3,948
Dip nets	7	7	4	8	419	1,230
Beam trawls					66	1,696
Lines, hand and trawl		2,153		907		309,446
Eel pots	3,521	2,619	1,576	1,469	7,497	7,048
Lobster pots	10,923	13,255	6,662	10,687	190,364	210,293
Harpoons		343		735		4,560
Spears	61	48	47	41	308	440
Tongs, rakes, hoes, etc	1,015	3,018	581	1,987	5,275	13,754
Dredges	228	4,354	1,307	12,417	3,337	23,431
Other apparatus						642
Shore and accessory property		325,100		426,980		8,777,354
Cash capital		25,500		131,500		5,121,476
Total		1,065,426		1,635,753		22,530,720

PRODUCTS.

The products of the fisheries aggregated 480,283,604 pounds, having a value to the fishermen of $14,184,205. Maine produced 124,723,786 pounds, valued at $2,386,406; New Hampshire, 1,036,452 pounds, valued at $51,944; Massachusetts, 255,654,475 pounds, valued at $7,025,249; Rhode Island, 23,896,243 pounds, valued at $1,546,658; Connecticut, 74,972,648 pounds, valued at $3,173,948. Some of the more important species taken in the New England fisheries, and the quantity and value, including the fresh, salted, and

smoked product, were: Cod, cusk, haddock, hake, and pollock, 225,182,272 pounds, $4,086,342; halibut, 3,715,776 pounds, $237,876; mackerel, 15,981,034 pounds, $1,084,781; herring, 83,390,554 pounds, $692,854; alewives, 8,743,284 pounds, $92,957; eels, 1,266,287 pounds, $77,151; flounders, 5,761,473 pounds, $151,756; menhaden, 31,775,378 pounds, $81,971; scup, 6,587,351 pounds, $166,082; shad, 1,260,904 pounds, $87,670; squeteague, 8,609,180 pounds, $200,890; swordfish, 3,296,369 pounds, $204,637; whiting or silver hake, 4,812,840 pounds, $25,563; lobsters, 11,524,499 pounds, $1,319,107; hard clams or quahogs, 1,568,264 pounds or 196,033 bushels, $336,709; soft clams, 6,375,850 pounds or 637,585 bushels, $406,252; and oysters, 33,220,194 pounds or 4,745,742 bushels, $3,961,785. The products of the whale fisheries, consisting of whale and sperm oil, whalebone, ambergris, and sea-elephant oil and skins, were valued at $482,102.

QUANTITY AND VALUE OF PRODUCTS TAKEN IN THE FISHERIES OF THE NEW ENGLAND STATES IN 1905.

Products.	Maine.		New Hampshire.		Massachusetts.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Albacore or horse mackerel					201,709	$4,433
Alewives, fresh	2,340,286	$12,517	20,000	$200	2,560,930	24,841
Alewives, salted	175,700	2,393	68,000	1,020	1,433,500	22,761
Alewives, smoked	239,250	4,714			75,000	1,500
Amberfish					400	15
Bluefish					100,930	9,469
Bonito					65,050	3,042
Butterfish	5,950	301			82,890	3,513
Catfish	37,500	187			62,675	1,044
Cod, fresh	9,366,880	181,284	332,200	8,166	44,987,710	991,679
Cod, salted	1,447,131	57,998	4,700	141	17,274,913	696,938
Cunner	281,500	4,060	2,500	75	115,900	6,020
Cusk, fresh	1,572,368	24,603			6,978,395	103,312
Cusk, salted	51,300	1,405			477,803	10,644
Eels	255,150	15,537	800	24	541,945	31,041
Flounders, fresh	97,100	1,776			4,041,683	97,783
Flounders, salted					2,000	40
Haddock, fresh	8,595,210	145,431	63,000	1,048	66,132,919	1,051,910
Haddock, salted	95,050	1,966			921,042	17,194
Hake, fresh	14,183,450	140,210	20,950	314	20,310,158	252,764
Hake, salted	562,800	8,295			390,809	5,674
Halibut, fresh	118,075	10,884			3,047,092	199,602
Halibut, salted					465,909	18,630
Herring, fresh	63,819,600	286,020	40,000	400	15,252,829	266,699
Herring, salted	452,800	5,875			3,111,625	114,997
Herring, smoked	713,700	18,863				
Hickory shad					4,100	76
Mackerel, fresh	755,250	50,148	16,650	833	8,790,755	603,515
Mackerel, salted	120,000	10,400			5,313,216	362,928
Menhaden, fresh					1,010,190	6,263
Menhaden, salted					8,600	252
Perch, white					19,650	1,420
Perch, yellow					10,000	800
Pollock, fresh	2,820,993	23,489	42,400	606	25,181,838	263,595
Pollock, salted	270,960	5,429	31,500	747	304,033	4,332
Salmon	86,298	20,137				
Sand eel					573,100	9,502
Sculpins	15,000	75				
Scup					1,019,200	26,751
Sea bass					122,300	5,924
Shad, fresh	541,156	38,312			79,128	5,035
Shad, salted	126,100	4,234			12,000	311
Sharks, dogfish	190,000	340				
Sharks, other					400	8
Skates	25,000	50			1,335	15
Smelt	587,985	64,004			7,375	806
Squeteague					5,224,816	108,200
Striped bass	4,200	1,040			21,050	1,587

QUANTITY AND VALUE OF PRODUCTS TAKEN IN THE FISHERIES OF THE NEW ENGLAND STATES IN 1905—Continued.

Products.	Maine.		New Hampshire.		Massachusetts.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Sturgeon	6,400	$590			12,185	$967
Sturgeon caviar	400	300			307	167
Suckers	7,000	140				
Swordfish	779,980	49,888			1,703,554	116,692
Tautog					240,123	7,701
Tomcod	119,200	1,918			63,400	1,105
Whiting, fresh	124,500	1,085	50,000	$625	4,298,090	19,077
Whiting, salted					1,600	20
Other fish					1,826	38
Squid					785,750	9,205
Clam, hard (quahog)					1,332,208	288,987
Clam (soft), fresh	2,727,100	109,840	27,700	2,770	2,175,190	209,545
Clam (soft), salted	1,001,400	25,320				
Clam, razor					40,500	1,620
Oyster, market					788,060	207,475
Oyster, seed					207,550	14,515
Scallops	415,600	51,900			263,237	98,712
Cockles and winkles	48,000	1,400			37,000	11,100
Crab, hard					60,000	500
Lobster	9,018,759	989,799	256,052	32,575	1,283,071	176,234
Shrimp					2,000	500
Sounds	212,985	8,673			59,118	3,990
Fish roe	10,000	300			13,240	285
Halibut fins					9,990	710
Livers	298,720	3,276			561,026	5,621
Oil, fish					26,325	856
Oil, whale					3,933,554	246,565
Oil, sea-elephant					590,625	25,000
Whalebone					55,950	193,037
Ambergris					94	16,900
Sea-elephant skins					5,000	600
Irish moss			60,000	2,400	765,000	30,600
Total	124,723,786	2,386,406	1,036,452	51,944	255,654,475	7,025,249

Products.	Rhode Island.		Connecticut.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Albacore or horse mackerel	4,680	$118			206,389	$4,551
Alewives, fresh	598,590	7,031	1,232,028	$15,080	6,751,834	60,569
Alewives, salted					1,677,200	26,174
Alewives, smoked					314,250	6,214
Amberfish					400	15
Bluefish	94,660	6,397	128,002	7,801	323,592	23,667
Bonito	8,420	415			73,470	3,457
Butterfish	341,155	18,714	21,327	995	451,322	23,523
Catfish			4,090	228	104,265	1,459
Cod, fresh	1,096,820	33,983	554,870	24,383	56,338,480	1,239,495
Cod, salted					18,726,744	755,077
Cunner					399,900	10,155
Cusk, fresh					8,550,763	127,915
Cusk, salted					529,103	12,049
Eels	290,195	17,545	178,197	13,004	1,266,287	77,151
Flounders, fresh	1,143,465	35,428	477,225	16,729	5,759,473	151,716
Flounders, salted					2,000	40
German carp			1,267	96	1,267	96
Haddock, fresh	515,735	14,788	294,260	8,475	75,601,064	1,221,652
Haddock, salted					1,016,092	19,160
Hake, fresh			2,500	50	34,517,058	393,338
Hake, salted					953,609	13,969
Halibut, fresh			84,700	8,760	3,249,867	219,246
Halibut, salted					465,909	18,630
Herring, fresh					79,112,429	553,119
Herring, salted					3,564,425	120,872
Herring, smoked					713,700	18,863
Hickory shad	21,065	494			25,165	570
Kingfish	2,925	446			2,925	446
Mackerel, fresh	837,930	48,054	147,233	8,903	10,547,818	711,453
Mackerel, salted					5,433,216	373,328
Menhaden, fresh	1,026,200	3,022	29,730,388	72,434	31,766,778	81,719
Menhaden, salted					8,600	252
Perch, white	37,700	2,285	13,518	788	70,868	4,493
Perch, yellow					10,000	800
Pickerel			3,002	248	3,002	248
Pollock, fresh	291,435	5,339	6,200	150	28,342,866	293,179
Pollock, salted					606,493	10,508

QUANTITY AND VALUE OF PRODUCTS TAKEN IN THE FISHERIES OF THE NEW ENGLAND STATES IN 1905—Continued.

Products.	Rhode Island.		Connecticut.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Salmon	10	$2	24	$4	86,332	$20,143
Sand eel					573,100	9,502
Sculpins	1,600	12			16,600	87
Scup	5,540,040	138,030	28,111	1,301	6,587,351	166,082
Sea bass	219,745	12,029	96,716	6,286	438,761	24,239
Shad, fresh	17,026	1,509	485,494	38,269	1,122,804	83,125
Shad, salted					138,100	4,545
Sharks, dogfish					190,000	340
Sharks, other					400	8
Skates					26,335	65
Smelt	6,450	651	16,895	2,330	618,705	67,851
Spanish mackerel	98	17	16	3	114	20
Squeteague	3,222,785	86,478	161,579	6,212	8,609,180	200,890
Striped bass	31,775	3,890	18,548	2,692	75,573	9,209
Sturgeon			1,969	88	20,554	1,645
Sturgeon caviar					707	467
Suckers			58,833	2,269	65,833	2,509
Sunfish			2,593	140	2,593	140
Swordfish	362,120	17,864	450,715	20,193	3,296,369	204,637
Tautog	309,430	10,668	85,208	3,549	634,761	21,918
Tomcod	2,500	92	8,932	462	194,032	3,577
Whiting, fresh	270,070	3,766	68,580	990	4,811,240	25,543
Whiting, salted					1,600	20
Other fish					1,826	38
Squid	133,300	2,666	26,350	614	945,400	12,485
Clam, hard (quahog)	181,936	37,701	54,120	10,021	1,568,264	336,709
Clam (soft), fresh	306,600	39,543	137,860	19,234	5,374,450	380,932
Clam (soft), salted					1,001,400	25,320
Clam, razor					40,500	1,620
Oyster, market	5,287,366	874,232	7,949,893	1,206,217	14,025,319	2,287,924
Oyster, seed	1,125,250	55,731	17,802,075	1,603,615	19,194,875	1,673,861
Scallops	1,500	420			680,337	151,032
Cockles and winkles					85,000	12,500
Shells			14,142,600	14,194	14,142,600	14,194
Crab, hard	13,280	580			73,280	1,080
Crab, soft	6,560	1,240			6,560	1,240
Lobster	529,827	64,358	436,790	56,141	11,524,499	1,319,107
Shrimp					2,000	500
Sounds					272,103	12,663
Fish roe					23,240	585
Halibut fins					9,990	710
Livers					859,746	8,897
Oil, fish					26,325	856
Oil, whale					3,933,554	240,565
Oil, sea-elephant					590,625	25,000
Whalebone					55,950	193,037
Ambergris					94	16,900
Sea-elephant skins					5,000	600
Irish moss	16,000	1,120			841,000	34,120
Total	23,896,243	1,546,658	74,972,648	3,173,948	480,283,604	14,184,205

SUPPLEMENTARY STATEMENT OF CERTAIN OF THE FOREGOING PRODUCTS, IN BUSHELS AND GALLONS.

Products.	Maine.		New Hampshire.		Massachusetts.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Clam, hard (quahog).....bushels..					166,526	$288,987
Clam (soft), fresh.....do....	272,710	$109,840	2,770	$2,770	217,519	209,545
Clam (soft), salted.....do....	100,140	25,320				
Clam, razor.....do....					4,050	1,620
Oyster, market.....do....					112,580	207,475
Oyster, seed.....do....					29,650	14,515
Scallops.....do....	69,267	51,900			43,872	98,712
Cockles and winkles.....do....	4,800	1,400			3,700	11,100
Oil, fish.....gallons..					3,510	856
Oil, whale.....do....					524,474	246,505
Oil, sea-elephant.....do....					78,750	25,000

Products.	Rhode Island.		Connecticut.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Clam, hard (quahog).....bushels..	22,742	$37,701	6,765	$10,021	196,033	$336,709
Clam (soft), fresh.....do....	30,660	39,543	13,786	19,234	537,445	380,932
Clam (soft), salted.....do....					100,140	25,320
Clam, razor.....do....					4,050	1,620
Oyster, market.....do....	755,338	874,232	1,135,699	1,206,217	2,003,617	2,287,924
Oyster, seed.....do....	160,750	55,731	2,551,725	1,603,615	2,742,125	1,673,861
Scallops.....do....	250	420			113,389	151,032
Cockles and winkles.....do....					8,500	12,500
Shells.....do....			235,710	14,194	235,710	14,194
Oil, fish.....gallons..					3,510	856
Oil, whale.....do....					524,474	246,505
Oil, sea-elephant.....do....					78,750	25,000

COMPARISON WITH PREVIOUS STATISTICS.

Compared with the returns for 1902 there has been a decrease in the fishery products of these states amounting to 53,791,843 pounds, or 10.07 per cent, in quantity, but an increase of $1,777,921, or 14.33 per cent, in value. There was a large decrease in both quantity and value in Maine and in quantity in New Hampshire, but an increase in both respects in all the other states. It may be interesting to note that the total catch of cod decreased 13,189,725 pounds in quantity and $194,735 in value, but cusk increased 3,674,042 pounds and $60,546; haddock, 29,539,841 pounds and $290,592; hake, 2,288,108 pounds and $70,377; and pollock, 11,205,232 pounds, and $134,898. The mackerel catch decreased 4,377,948 pounds in quantity and $51,973 in value. The halibut catch decreased 8,649,929 pounds and $425,962; declining from 12,365,705 pounds, valued at $662,838 in 1902 to 3,715,776 pounds, valued at $237,876 in 1905. The catch of this species was, however, exceptionally small.

COMPARATIVE STATEMENT OF THE EXTENT OF THE FISHERIES OF THE NEW ENGLAND STATES IN 1902 AND 1905.

States.	Persons engaged.				Capital invested.			
	1902.	1905.	Increase (+) or decrease (−) in 1905.		1902.	1905.	Increase (+) or decrease (−) in 1905.	
			Number.	Percentage.			Amount.	Percentage.
Maine	19,832	15,881	−3,951	−19.92	$6,939,503	$8,972,049	+$2,032,546	+29.28
New Hampshire	161	145	− 16	− 9.93	42,002	47,050	+ 5,048	+12.01
Massachusetts	14,300	15,694	+1,394	+ 9.74	10,811,594	10,810,442	− 1,152	− .01
Rhode Island	2,117	2,212	+ 95	+ 4.48	1,014,280	1,065,426	+ 51,146	+ 5.04
Connecticut	2,840	3,407	+ 567	+19.96	1,201,055	1,635,753	+ 434,698	+36.19
Total	39,250	37,339	−1,911	− 4.86	20,008,434	22,530,720	+ 2,522,286	+12.60

States.	Products.							
	Pounds.				Value.			
	1902.	1905.	Increase (+) or decrease (−) in 1905.		1902.	1905.	Increase (+) or decrease (−) in 1905.	
			Amount.	Percentage.			Amount.	Percentage.
Maine	242,390,371	124,723,786	−117,666,585	−48.54	$2,918,772	$2,386,406	− $532,366	−18.23
New Hampshire	1,593,013	1,036,452	− 556,561	−34.93	50,003	51,944	+ 1,941	+ 3.88
Massachusetts	230,645,950	255,654,475	+ 5,008,525	+ 2.17	6,482,427	7,025,249	+ 542,822	+ 8.37
Rhode Island	21,613,964	23,896,243	+ 2,282,279	+10.56	1,155,701	1,546,658	+ 390,957	+33.82
Connecticut	37,832,149	74,972,648	+ 37,140,499	+98.17	1,799,381	3,173,948	+1,374,567	+76.39
Total	534,075,447	480,283,604	− 53,791,843	−10.07	12,406,284	14,184,205	+1,777,921	+14.33

FISHERIES OF MAINE.

The coast of Maine, owing to its many indentations and islands, has especial advantages for the fisherman. Its rocky character also makes it suitable for the breeding and growth of lobsters, and the lobster fishery is by far the most important of the state.

GENERAL STATISTICS.

Persons engaged.—In 1905, 15,881 persons were engaged in the coast fisheries and allied industries of Maine. Of this number, 1,126 were engaged on fishing vessels; 330 on transporting vessels; 5,986 in the shore fisheries, and 8,439 were shoresmen employed chiefly in sardine canneries, smoke houses, and other wholesale fishery establishments. Compared with 1902 there has been a decrease of 3,951, or nearly 20 per cent, in the total number of persons engaged.

PERSONS ENGAGED IN THE FISHERIES OF MAINE IN 1905.

How engaged.	Number.
On vessels, fishing	1,126
On vessels, transporting	330
In shore or boat fisheries	5,986
Shoresmen	8,439
Total	15,881

Investment.—The amount of capital invested in 1905 in vessels, boats, apparatus, shore property, and cash capital was $8,972,049. This is an increase of $2,032,546, or more than 22 per cent, since 1902. Of the total investment, $758,675 represents the value of 412 vessels with their outfits; $420,100, the value of 5,569 boats under 5 tons; $427,584, the value of apparatus used in the shore and vessel fisheries; $4,404,140 the value of shore and accessory property, and $2,961,550 the amount of cash capital employed.

INVESTMENT IN THE FISHERIES OF MAINE IN 1905.

Items.	Number.	Value.	Items.	Number.	Value.
Vessels fishing	269	$325,651	Apparatus—shore fisheries:		
Tonnage	3,561		Pound nets, trap nets, and weirs	669	$198,873
Outfit		128,409	Gill nets	[d] 1,335	12,835
Vessels transporting	143	257,600	Fyke nets	29	667
Tonnage	1,889		Dip nets	164	626
Outfit		47,015	Bag nets	120	3,948
Boats, sail and row	4,771	187,165	Seines	[e] 95	6,630
Boats, gasoline	[a] 798	232,935	Lines, hand and trawl		15,126
Apparatus—vessel fisheries:			Eel pots and traps	579	625
Gill nets	[b] 1,186	10,314	Lobster pots	132,962	136,532
Seines	[c] 38	9,215	Cunner traps	217	261
Lines, hand and trawl		16,771	Dredges	71	1,685
Eel pots	30	15	Spears	74	119
Lobster pots	10,465	10,490	Hoes	1,348	1,034
Cunner traps	4	6	Shore and accessory property		4,404,140
Dip nets	4	20	Cash capital		2,961,550
Dredges	17	441			
Hoes	20	13	Total		8,972,049
Harpoons		1,338			

[a] Includes one steamer worth $500.
[b] 90,730 yards in length.
[c] 7,655 yards in length.
[d] 80,672 yards in length
[e] 10,415 yards in length.

Products.—The aggregate catch in 1905 by all forms of apparatus was 124,723,786 pounds, valued at $2,386,406. This is a decrease since 1902 of 117,666,585 pounds and $532,366 in value, or 48 per cent and 18 per cent, respectively. The leading products, with their weights and values, are as follows: Lobsters, 9,018,759 pounds, valued at $989,799; herring, 64,986,100 pounds, valued at $310,758; cod, 10,814,011 pounds, valued at $239,282; hake, 14,746,250 pounds, valued at $148,505; haddock, 8,690,260 pounds, valued at $147,397; clams, 372,850 bushels, valued at $135,160; smelt, 587,985 pounds, valued at $64,004; mackerel, 875,250 pounds, valued at $60,548.

PRODUCTS OF THE FISHERIES OF MAINE IN 1905.

Products.	Vessel fisheries.		Shore fisheries.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives, fresh	89,000	$475	2,251,286	$12,042	2,340,286	$12,517
Alewives, salted			175,700	2,393	175,700	2,393
Alewives, smoked			239,250	4,714	239,250	4,714
Butterfish			5,950	301	5,950	301
Catfish	3,800	20	33,700	167	37,500	187
Cod, fresh	4,335,300	88,582	5,031,580	92,702	9,366,880	181,284
Cod, salted	1,045,281	42,797	401,850	15,201	1,447,131	57,998
Cunners			281,500	4,060	281,500	4,060
Cusk, fresh	1,250,300	19,155	322,068	5,448	1,572,368	24,603
Cusk, salted	10,800	288	40,500	1,117	51,300	1,405
Dogfish			190,000	340	190,000	340
Eels	11,500	632	243,650	14,905	255,150	15,537
Flounders	1,000	10	96,100	1,766	97,100	1,776
Haddock, fresh	5,173,600	95,082	3,421,610	50,349	8,595,210	145,431
Haddock, salted	21,650	515	73,400	1,451	95,050	1,966
Hake, fresh	9,389,300	96,499	4,794,150	43,711	14,183,450	140,210
Hake, salted	267,000	3,185	295,800	5,110	562,800	8,295
Halibut	70,000	6,642	48,075	4,242	118,075	10,884
Herring, fresh	7,501,600	46,607	56,318,000	239,413	63,819,600	286,020
Herring, salted	100,000	2,000	352,800	3,875	452,800	5,875
Herring, smoked			713,700	18,863	713,700	18,863
Mackerel, fresh	408,000	27,690	347,250	22,458	755,250	50,148
Mackerel, salted	120,000	10,400			120,000	10,400
Pollock, fresh	814,300	7,089	2,006,693	16,400	2,820,993	23,489
Pollock, salted	72,000	707	198,960	4,722	270,960	5,429
Salmon			86,298	20,137	86,298	20,137
Sculpin			15,000	75	15,000	75
Shad, fresh			541,156	38,312	541,156	38,312
Shad, salted	103,900	3,469	22,200	765	126,100	4,234
Skates			25,000	50	25,000	50
Smelt	23,000	1,890	564,985	62,114	587,985	64,004
Striped bass			4,200	1,040	4,200	1,040
Sturgeon			6,400	590	6,400	590
Caviar			400	300	400	300
Suckers			7,000	140	7,000	140
Swordfish	779,980	49,888			779,980	49,888
Tomcod			119,200	1,918	119,200	1,918
Whiting			124,500	1,085	124,500	1,085
Lobsters	742,075	88,233	8,276,684	901,566	9,018,759	989,799
Clams, fresh	33,000	990	2,694,100	108,850	[a] 2,727,100	109,840
Clams, salted	54,000	1,350	947,400	23,970	[b] 1,001,400	25,320
Scallops	48,800	6,100	366,800	45,800	[c] 415,600	51,900
Winkles			48,000	1,400	[d] 48,000	1,400
Fish roe	10,000	300			10,000	300
Livers	204,470	2,173	94,250	1,103	298,720	3,276
Sounds, fresh	147,825	6,019	62,660	2,554	210,485	8,573
Sounds, salted	2,500	100			2,500	100
Total	32,833,981	608,887	91,889,805	1,777,519	124,723,786	2,386,406

[a] 272,710 bushels. [b] 100,140 bushels. [c] 69,267 bushels. [d] 4,800 bushels.

THE FISHERIES BY COUNTIES.

Ten counties of Maine were interested in the coast fisheries during 1905. These were Cumberland, Hancock, Kennebec, Knox, Lincoln, Penobscot, Sagadahoc, Waldo, Washington, and York. The fishing in Kennebec County was mainly for shad in the Kennebec River. In Penobscot County most of the fishing was in the Penobscot River.

Hancock County leads all others in the value of its fisheries, which, in 1905, amounted to $629,067. The lobster was by far the most important product. The herring, cod, clam, scallop, and hake fisheries were also valuable.

The fisheries and related industries of Washington County employed 8,740 persons in 1905. Most of those not engaged in fishing were employed in sardine canneries or smokehouses. This county leads

all others in the number of persons engaged and capital invested, and ranks third in the value of its fisheries.

Knox County ranks second in the value of its fisheries and first in the value of its lobster catch. Its fisheries for herring, hake, and cod also furnished a considerable revenue to the fishermen. Rockland is an important market.

Cumberland County ranks fourth in the value of its fisheries, and leads all others in the catch of swordfish and mackerel. Its haddock fishery is also very important. Portland is the principal market for the fishermen of this and adjoining counties.

Lincoln County ranks third in the number of persons engaged and fifth in the value of its fisheries. The lobster supports the most important fishery.

Of the five remaining counties the most important are York and Sagadahoc. The former leads all others in the value of its haddock and the latter in its shad catch. Practically all of the shad of the state are taken in the Kennebec River.

The following tables show the extent of the fisheries in each county of Maine in 1905:

STATEMENT, BY COUNTIES, OF THE NUMBER OF PERSONS ENGAGED IN THE FISHERIES OF MAINE IN 1905.

Counties.	On vessels fishing.	On vessels transporting.	In shore or boat fisheries.	Shoresmen.	Total.
Cumberland	238	57	623	267	1,185
Hancock	364	24	1,502	682	2,572
Kennebec	.....	.....	19	.....	19
Knox	143	38	597	352	1,130
Lincoln	132	20	768	397	1,317
Penobscot	.....	.....	97	19	116
Sagadahoc	10	.....	383	6	399
Waldo	.....	.....	42	.....	42
Washington	95	101	1,741	6,713	8,740
York	144	.....	214	3	361
Total	1,126	330	5,986	8,439	15,881

STATEMENT SHOWING, BY COUNTIES, THE INVESTMENT IN THE FISHERIES OF MAINE IN 1902.

Items.	Cumberland.		Hancock.		Kennebec.		Knox.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	40	$72,550	98	$97,701			48	$32,050
Tonnage	750		1,294				418	
Outfit		39,200		24,440				10,090
Vessels transporting	22	49,700	13	23,500			18	30,300
Tonnage	362		151				177	
Outfit		11,650		1,685				7,130
Boats, sail and row	436	10,829	1,128	44,685	19	$275	517	26,750
Boats, gasoline	151	29,525	229	72,750			148	39,475
Apparatus—vessel fisheries:								
Gill nets	396	3,794	160	1,000			44	240
Seines	12	2,425					6	675
Lines, hand and trawl		5,917		2,915				1,967
Eel pots			30	15				
Lobster pots	75	75	4,950	4,950			3,450	3,450
Dip nets			4	20				
Dredges			17	441				
Hoes			20	13				
Harpoons		823						30
Apparatus—shore fisheries:								
Pound nets, trap nets, and weirs	15	5,525	157	21,498	2	350	44	15,900
Gill nets	148	1,210	8	48	19	285	94	1,160
Fyke nets	12	84					3	15
Dip nets			14	70			7	14
Bag nets			33	1,545				
Seines	39	3,045	15	520			9	1,060
Lines, hand and trawl		3,930		2,772				787
Eel pots and traps			72	36				
Lobster pots	10,613	10,613	30,410	30,410			27,410	27,410
Cunner traps	54	124						
Dredges			64	1,650				
Spears	35	58	9	16			3	5
Hoes	229	146	526	425			93	75
Shore and accessory property		244,772		205,254		85		210,096
Cash capital		404,000		320,500				305,000
Total		899,995		858,859		995		713,679

Items.	Lincoln.		Penobscot.		Sagadahoc.		Waldo.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	39	$43,600			4	$2,350		
Tonnage	342				37			
Outfit		12,570				655		
Vessels transporting	8	19,300						
Tonnage	132							
Outfit		4,385						
Boats, sail and row	602	18,613	56	$979	299	6,811	49	$844
Boats, gasoline	68	15,825			73	18,445		
Apparatus—vessel fisheries:								
Gill nets	100	940			5	50		
Seines	19	5,990			1	125		
Lines, hand and trawl		1,666				194		
Lobster pots	1,150	1,150						
Apparatus—shore fisheries:								
Pound nets, trap nets, and weirs	72	29,890	2	110	102	34,515	48	3,810
Gill nets	125	963	44	557	126	1,939		
Fyke nets	8	328			6	240		
Bag nets			11	700	10	335		
Seines	28	1,725						
Lines, hand and trawl		1,391		66		2,511		
Eel pots and traps	26	75	15	15	413	472		
Lobster pots	20,274	20,274			3,445	3,445	175	175
Cunner traps	108	54						
Spears	25	37						
Hoes	156	133			53	43	2	2
Shore and accessory property		113,986		19,240		11,840		1,225
Cash capital		114,500		15,000		5,800		
Total		407,395		36,667		89,779		6,056

STATEMENT SHOWING, BY COUNTIES, THE INVESTMENT IN THE FISHERIES OF MAINE IN 1902—Continued.

Items.	Washington.		York.		Total.	
	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	25	$14,600	15	$62,800	269	$325,651
Tonnage	257		463		3,561	
Outfit		4,150		37,304		128,409
Vessels transporting	82	134,800			143	257,600
Tonnage	1,067				1,889	
Outfit		22,165				47,015
Boats, sail and row	1,513	72,670	152	4,709	4,771	187,105
Boats, gasoline	88	46,065	[a] 41	10,850	798	232,035
Apparatus—vessel fisheries:						
Gill nets	71	515	410	3,775	1,186	10,314
Seines					38	9,215
Lines, hand and trawl		876		3,236		16,771
Eel pots					30	15
Lobster pots	790	790	50	75	10,465	10,490
Cunner traps			4	6	4	6
Dip nets					4	20
Dredges					17	441
Hoes					20	13
Harpoons				485		1,338
Apparatus—shore fisheries:						
Pound nets, trap nets, and weirs	223	85,965	4	1,310	669	198,873
Gill nets	247	2,590	524	4,083	1,335	12,835
Fyke nets					29	667
Dip nets	143	542			164	626
Bag nets	66	1,368			120	3,948
Seines			4	280	95	6,630
Lines, hand and trawl		2,356		1,313		15,126
Eel pots and traps	53	27			579	625
Lobster pots	34,033	34,033	6,602	10,172	132,962	136,532
Cunner traps			55	83	217	261
Dredges	7	35			71	1,685
Spears			2	3	74	119
Hoes	273	199	16	11	1,348	1,034
Shore and accessory property		3,591,883		5,750		4,404,140
Cash capital		1,795,250		1,500		2,961,550
Total		5,810,870		147,745		8,972,049

[a] Includes one steamer worth $500.

STATEMENT, BY COUNTIES, OF THE PRODUCTS OF THE FISHERIES OF MAINE IN 1905.

Products.	Cumberland.		Hancock.		Kennebec.		Knox.	
	Pounds.	Value.	Pounds.	Value.	Lbs.	Value.	Pounds.	Value.
Alewives, fresh	40,000	$200	260,500	$2,094			961,250	$1,303
Alewives, salted			49,200	615				
Alewives, smoked			65,750	1,192			46,000	920
Butterfish	5,450	271						
Catfish	21,000	104						
Cod, fresh	2,755,500	53,030	1,444,100	30,656			946,080	18,914
Cod, salted			1,076,781	43,413			25,600	1,250
Cunners	118,000	1,630						
Cusk, fresh	499,000	7,034	439,800	7,659			175,568	2,605
Cusk, salted			5,000	120			500	15
Eels	41,500	2,590	20,900	1,114			5,000	250
Flounders	29,000	720	40,700	510			27,000	540
Haddock, fresh	2,680,500	49,412	638,550	7,861			672,760	9,110
Haddock, salted			7,500	93				
Hake, fresh	3,172,000	29,177	3,079,550	30,464			1,959,400	18,929
Hake, salted			162,000	2,385			3,800	175
Halibut	36,000	3,570	43,400	3,783			2,400	180
Herring, fresh	1,695,000	9,217	15,632,000	83,740			5,747,400	25,965
Herring, salted			100,000	2,000			23,000	802
Mackerel, fresh	294,450	19,538	20,000	2,000			18,600	1,066
Mackerel, salted	40,000	4,000						
Pollock, fresh	691,000	5,055	224,000	1,786			229,118	1,661
Pollock, salted			75,000	1,067			12,700	510
Salmon	110	19	32,964	7,875			346	76
Sculpin	15,000	75						
Shad, fresh	51,496	841	1,200	80	26,400	$1,766		
Shad, salted	62,500	2,000	3,000	120			12,000	390
Smelt	95,135	9,008	220,100	18,875			52,500	6,150
Sturgeon					1,500	110		
Caviar					200	150		
Swordfish	508,380	34,988					30,000	900
Tomcod	1,000	50	7,500	150			6,500	195
Whiting	120,000	1,050						
Lobsters	665,374	82,856	2,378,600	271,197			2,362,781	273,812
Clams, fresh	721,800	34,355	766,700	30,013			150,000	5,500
Clams, salted	20,000	675	946,400	23,770				
Scallops			401,200	50,150				
Livers	65,700	672	84,345	1,026			34,525	435
Sounds, fresh	33,450	1,323	81,850	3,259			30,960	1,317
Total	14,478,345	353,460	28,308,590	629,067	28,100	2,026	13,535,788	372,970

Products.	Lincoln.		Penobscot.		Sagadahoc.		Waldo.	
	Pounds.	Value.	Lbs.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives, fresh	679,036	$5,638	5,000	$40	339,000	$2,737	31,500	$280
Alewives, salted	9,500	190						
Alewives, smoked	25,000	375			58,000	997		
Cod, fresh	717,200	14,214			1,354,500	21,548		
Cod, salted	43,350	2,439						
Cunners	110,000	705						
Cusk, fresh	43,500	653			21,000	315		
Cusk, salted	12,800	447						
Eels	18,500	940	6,000	240	154,250	9,893		
Haddock, fresh	120,200	1,040			478,000	4,855		
Haddock, salted	17,850	390						
Hake, fresh	1,877,500	17,544			1,133,000	10,048		
Hake, salted	129,000	2,550						
Herring, fresh	10,905,600	58,250			5,007,200	32,215		
Mackerel, fresh	105,500	8,380			58,700	3,074		
Mackerel, salted	80,000	6,400						
Pollock, fresh	172,800	2,376			29,000	211	5,000	200
Pollock, salted	34,500	827						
Salmon			9,464	2,454	2,246	535	31,383	7,098
Shad, fresh	113,010	8,682			256,800	24,936	300	19
Shad, salted	48,400	1,719						
Smelt	54,700	7,283	8,000	640	34,500	3,325		
Striped bass	4,000	1,000			200	40		
Sturgeon	400	30			4,500	450		
Caviar					200	150		
Suckers					7,000	140		
Tomcod	40,000	400	25,000	750				
Lobsters	1,248,506	107,176			265,200	31,954	5,425	702
Clams, fresh	527,350	20,420			60,500	3,280	2,000	100
Clams, salted					35,000	875		
Winkles	18,000	500						
Sounds, fresh	6,000	240						
Total	17,162,202	270,808	53,464	4,124	9,298,796	151,578	75,608	8,399

STATISTICS, BY COUNTIES, OF THE PRODUCTS OF THE FISHERIES OF MAINE IN 1905—Continued.

Products.	Washington.		York.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives, fresh	24,000	$225			2,340,286	$12,517
Alewives, salted	109,000	1,468	8,000	$120	175,700	2,393
Alewives, smoked	44,500	1,230			239,250	4,714
Butterfish			500	30	5,950	301
Catfish			16,500	83	37,500	187
Cod, fresh	654,900	10,120	1,494,600	32,802	9,366,880	181,284
Cod, salted	273,700	9,592	27,700	1,304	1,447,131	57,998
Cunners			53,500	1,725	281,500	4,060
Cusk, fresh	10,500	262	383,000	6,075	1,572,368	24,603
Cusk, salted	33,000	823			51,300	1,405
Dogfish			190,000	340	190,000	340
Eels	8,500	460	500	50	255,150	15,537
Flounders			400	6	97,100	1,776
Haddock, fresh	1,501,200	20,243	2,504,000	52,910	8,595,210	145,431
Haddock, salted	69,700	1,483			95,050	1,966
Hake, fresh	567,000	4,603	2,395,000	29,445	14,183,450	140,210
Hake, salted	267,000	3,135	1,000	50	562,800	8,295
Halibut	21,375	1,921	14,900	1,430	118,075	10,884
Herring, fresh	24,741,200	76,113	91,200	520	63,819,600	286,020
Herring, salted	45,000	822	284,800	2,251	452,800	5,875
Herring, smoked	713,700	18,863			713,700	18,863
Mackerel, fresh	17,000	1,000	241,000	15,000	755,250	50,148
Mackerel, salted					120,000	10,400
Pollock, fresh	1,144,900	9,198	325,175	3,002	2,820,993	23,489
Pollock, salted	132,760	1,935	16,000	1,000	270,960	5,429
Salmon	9,710	2,065	75	15	86,298	20,137
Sculpin					15,000	75
Shad, fresh	91,950	1,988			541,156	38,312
Shad, salted			200	5	126,100	4,234
Skates			25,000	50	25,000	50
Smelt	121,900	18,516	1,150	207	587,985	64,004
Striped bass					4,200	1,040
Sturgeon					6,400	590
Caviar					400	300
Suckers					7,000	140
Swordfish			241,600	14,000	779,980	49,888
Tomcod	38,400	361	800	12	119,200	1,918
Whiting			4,500	35	124,500	1,085
Lobsters	1,665,781	163,890	427,092	58,212	9,018,759	989,799
Clams, fresh	474,000	13,947	24,750	2,225	[a] 2,727,100	109,840
Clams, salted					[b] 1,001,400	25,320
Scallops	14,400	1,750			[c] 415,600	51,900
Winkles			30,000	900	[d] 48,000	1,400
Fish roe			10,000	300	10,000	300
Livers	20,750	209	93,400	934	298,720	3,276
Sounds, fresh	11,425	439	46,800	1,995	210,485	8,573
Sounds, salted	2,500	100			2,500	100
Total	32,829,751	366,761	8,953,142	227,213	124,723,786	2,386,406

[a] 272,710 bushels. [b] 100,140 bushels. [c] 69,267 bushels. [d] 4,800 bushels.

THE PRODUCTS BY APPARATUS.

Lobster and eel pots and traps.—The lobster being the most important product of the fisheries of Maine, the apparatus used in its capture shows, therefore, the largest and most valuable yield—9,018,759 pounds, worth $989,799. Lobsters are taken in the vessel fisheries, but the greater part of the catch is obtained by small boats.

STATEMENT, BY COUNTIES, OF THE CATCH WITH EEL POTS, EEL TRAPS, AND LOBSTER POTS IN MAINE IN 1905.

Products.	Cumberland.		Hancock.		Knox.		Lincoln.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Vessel fisheries:								
Eels			11,500	$632				
Lobsters	7,800	$1,300	332,725	39,774	300,100	$35,459	55,500	$6,840
Total	7,800	1,300	344,225	40,406	300,100	35,459	55,500	6,840
Shore fisheries:								
Eels			5,000	250			6,000	360
Lobsters	657,574	81,556	2,045,875	231,423	2,062,681	238,353	1,193,006	100,336
Total	657,574	81,556	2,050,875	231,673	2,062,681	238,353	1,199,006	100,696
Grand total	665,374	82,856	2,395,100	272,079	2,362,781	273,812	1,254,506	107,536

Products.	Penobscot.		Sagadahoc.		Waldo.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Shore fisheries:						
Eels	6,000	$240	154,250	$9,893		
Lobsters			265,200	31,954	5,425	$702
Total	6,000	240	419,450	41,847	5,425	702
Grand total	6,000	240	419,450	41,847	5,425	702

Products.	Washington.		York.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Vessel fisheries:						
Eels					11,500	$632
Lobsters	41,450	$4,260	4,500	$600	742,075	88,233
Total	41,450	4,260	4,500	600	753,575	88,865
Shore fisheries:						
Eels	8,500	460			179,750	11,203
Lobsters	1,624,331	159,630	422,592	57,612	8,276,684	901,566
Total	1,632,831	160,090	422,592	57,612	8,456,434	912,769
Grand total	1,674,281	164,350	427,092	58,212	9,210,009	1,001,634

Lines.—Trawl and hand lines are very generally used along the Maine coast, and yielded, in 1905, 39,346,015 pounds, valued at $621,301. Of this quantity 22,425,126 pounds were taken in the vessel fisheries and the remainder in the shore fisheries.

STATEMENT, BY COUNTIES, OF THE YIELD OF THE HAND AND TRAWL LINE FISHERIES OF MAINE IN 1905.

Products.	Cumberland.		Hancock.		Knox.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Vessel fisheries:						
Catfish	3,300	$17				
Cod, fresh	1,137,000	22,240	830,600	$17,394	704,000	$14,080
Cod, salted			905,281	37,923		
Cusk, fresh	374,000	5,185	350,300	5,562	110,000	1,696
Haddock, fresh	1,763,000	37,300	414,900	4,076	593,000	7,955
Haddock, salted			2,500	38		
Hake, fresh	2,312,000	21,852	2,153,300	21,236	1,280,000	12,495
Hake, salted			45,000	490		
Halibut	35,500	3,535	19,400	1,663	200	14
Pollock, fresh	170,500	1,462	144,000	1,081	77,000	580
Pollock, salted			57,000	557		
Livers	59,200	607	29,295	362	10,125	144
Sounds, fresh	31,650	1,251	41,050	1,642	21,100	860
Total	5,886,150	93,449	4,992,626	92,024	2,795,425	37,824
Shore fisheries:						
Catfish	17,700	87				
Cod, fresh	1,507,500	28,350	613,500	13,262	242,080	4,834
Cod, salted			171,500	5,490	25,600	1,250
Cusk, fresh	125,000	1,849	89,500	2,097	65,568	909
Cusk, salted			5,000	120	500	15
Haddock, fresh	917,500	12,112	223,050	3,785	79,760	1,155
Haddock, salted			5,000	55		
Hake, fresh	860,000	7,325	926,250	9,228	679,400	6,434
Hake, salted			117,000	1,895	3,800	175
Halibut	500	35	24,000	2,120	2,200	166
Pollock, fresh	381,500	2,873	80,000	705	57,918	421
Pollock, salted			18,000	510	12,700	510
Salmon					59	13
Smelt			156,500	12,520		
Livers	6,500	65	55,050	664	24,400	291
Sounds	1,800	72	40,800	1,617	9,860	457
Total	3,818,000	52,768	2,525,750	54,068	1,203,845	16,630
Grand total	9,704,150	146,217	7,518,376	146,092	3,999,270	54,454

Products.	Lincoln.		Penobscot.		Sagadahoc.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Vessel fisheries:						
Cod, fresh	133,200	$2,779			100,000	$1,975
Cod, salted	8,500	460				
Cusk, fresh	20,500	308			12,000	180
Cusk, salted	1,300	52				
Haddock, fresh	71,700	551			30,000	375
Haddock, salted	1,150	32				
Hake, fresh	756,000	7,485			93,000	831
Hake, salted	10,000	200				
Pollock, fresh	14,300	101				
Total	1,016,650	11,968			235,000	3,361
Shore fisheries:						
Cod, fresh	419,000	7,985			1,254,500	19,573
Cod, salted	34,850	1,979				
Cusk, fresh	23,000	345			9,000	135
Cusk, salted	11,500	395				
Haddock, fresh	48,500	480			448,000	4,480
Haddock, salted	16,700	358				
Hake, fresh	1,121,500	10,059			1,040,000	9,217
Hake, salted	119,000	2,350				
Pollock, fresh	66,000	465			17,000	115
Pollock, salted	34,500	827				
Salmon			1,344	$338		
Smelt	25,600	4,293			15,500	1,550
Sounds	6,000	240				
Total	1,926,150	29,785	1,344	338	2,784,000	35,070
Grand total	2,942,800	41,753	1,344	338	3,019,000	38,431

STATEMENT, BY COUNTIES, OF THE YIELD OF THE HAND AND TRAWL LINE FISHERIES OF MAINE IN 1905—Continued.

Products.	Washington.		York.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Vessel fisheries:						
Catfish			500	$3	3,800	$20
Cod, fresh	237,000	$3,709	933,500	20,805	4,075,300	82,982
Cod, salted	131,500	4,414			1,045,281	42,797
Cusk, fresh	10,500	262	373,000	5,962	1,250,300	19,155
Cusk, salted	9,500	236			10,800	288
Haddock, fresh	205,000	1,300	2,096,000	43,525	5,173,600	95,082
Haddock, salted	18,000	445			21,650	515
Hake, fresh	453,000	3,685	2,342,000	28,915	9,389,300	96,499
Hake, salted	212,000	2,495			267,000	3,185
Halibut	2,000	160	12,900	1,270	70,000	6,642
Pollock, fresh	7,500	68	268,000	2,346	681,300	5,638
Pollock, salted	15,000	150			72,000	707
Livers	13,250	134	92,600	926	204,470	2,173
Sounds, fresh	7,425	279	46,600	1,987	147,825	6,019
Sounds, salted	2,500	100			2,500	100
Fish roe			10,000	300	10,000	300
Total	1,324,175	17,437	6,175,100	106,039	22,425,126	362,102
Shore fisheries:						
Catfish			16,000	80	33,700	167
Cod, fresh	412,400	6,341	510,100	10,967	4,959,080	91,312
Cod, salted	142,200	5,178	27,200	1,284	401,350	15,181
Cusk, fresh			10,000	113	322,068	5,448
Cusk, salted	23,500	587			40,500	1,117
Dogfish			190,000	340	190,000	340
Haddock, fresh	1,296,200	18,943	408,000	9,385	3,421,610	50,349
Haddock, salted	51,700	1,038			73,400	1,451
Hake, fresh	114,000	918	53,000	530	4,794,150	43,711
Hake, salted	55,000	640	1,000	50	295,800	5,110
Halibut	19,375	1,761	2,000	160	48,075	4,242
Pollock, fresh	1,113,200	8,560	57,175	656	1,772,793	13,795
Pollock, salted	105,700	1,481	16,000	1,090	186,900	4,418
Salmon	550	137			1,953	488
Skates			25,000	50	25,000	50
Smelt					197,600	18,363
Livers	7,500	75	800	8	94,250	1,103
Sounds	4,000	160	200	8	62,600	2,554
Total	3,345,325	45,819	1,316,475	24,721	16,920,889	259,199
Grand total	4,669,500	63,256	7,491,575	130,760	39,346,015	621,301

Pound nets, trap nets, and weirs.—Pound nets, trap nets, and weirs follow lines in importance. Their catch in 1905 was 55,332,159 pounds, valued at $319,471, all of it taken in the shore fisheries. Herring constitute more than two-thirds of the value of the catch.

STATEMENT, BY COUNTIES, OF THE YIELD OF THE POUND-NET, TRAP-NET, AND WEIR FISHERIES OF MAINE IN 1905.

Products (shore fisheries).	Cumberland.		Hancock.		Kennebec.		Knox.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives, fresh	.....	.....	260,500	$2,094	.....	.....	.....	.....
Alewives, salted	.....	.....	49,200	615	.....	.....	.....	.....
Alewives, smoked	.....	.....	62,000	1,117	.....	.....	46,000	$920
Butterfish	5,450	$271	.....	.....	.....	.....	.....	.....
Cod	6,000	90	.....	.....	.....	.....	.....	.....
Herring, fresh	417,600	2,729	15,012,000	67,100	.....	.....	4,428,000	20,580
Mackerel, fresh	88,750	5,462	.....	.....	.....	.....	2,500	100
Pollock, fresh	138,000	690	.....	.....	.....	.....	.....	.....
Salmon	110	19	32,964	7,875	.....	.....	287	63
Shad, fresh	49,096	721	1,200	80	2,100	$146	.....	.....
Smelt	2,500	300	14,300	1,585	.....	.....	.....	.....
Tomcod	1,000	50	.....	.....	.....	.....	.....	.....
Whiting	120,000	1,050	.....	.....	.....	.....	.....	.....
Total	828,506	11,382	15,432,164	80,466	2,100	146	4,476,787	21,663

Products (shore fisheries).	Lincoln.		Penobscot.		Sagadahoc.		Waldo.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives, fresh	79,000	$1,550	5,000	$40	339,000	$2,737	31,500	$280
Alewives, smoked	25,000	375	.....	.....	58,000	997	.....	.....
Herring, fresh	4,299,600	29,900	.....	.....	4,982,000	32,060	.....	.....
Mackerel, fresh	.....	.....	.....	.....	51,200	2,624	.....	.....
Pollock, fresh	2,500	10	.....	.....	12,000	96	5,000	200
Salmon	.....	.....	440	106	2,246	535	31,383	7,098
Shad, fresh	92,400	7,115	.....	.....	187,575	18,853	300	19
Shad, salted	2,000	75	.....	.....	.....	.....	.....	.....
Smelt	.....	.....	.....	.....	4,500	325	.....	.....
Striped bass	.....	.....	.....	.....	200	40	.....	.....
Sturgeon	400	30	.....	.....	.....	.....	.....	.....
Suckers	.....	.....	.....	.....	7,000	140	.....	.....
Total	4,500,900	39,055	5,440	146	5,643,721	58,407	68,183	7,597

Products (shore fisheries).	Washington.		York.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives, fresh	12,000	$135	.....	.....	727,000	$6,836
Alewives, salted	21,000	268	8,000	$120	78,200	1,003
Alewives, smoked	19,500	645	.....	.....	210,500	4,054
Butterfish	.....	.....	500	30	5,950	301
Cod	5,500	70	.....	.....	11,500	160
Flounders	.....	.....	400	6	400	6
Herring, fresh	23,473,200	69,473	.....	.....	52,612,400	221,842
Herring, smoked	713,700	18,863	.....	.....	713,700	18,863
Mackerel, fresh	.....	.....	19,000	1,350	161,450	9,536
Pollock, fresh	17,200	500	.....	.....	174,700	1,496
Pollock, salted	12,060	304	.....	.....	12,060	304
Salmon	2,623	516	75	15	70,128	16,227
Shad, fresh	6,050	180	.....	.....	338,721	27,114
Shad, salted	.....	.....	.....	.....	2,000	75
Smelt	51,900	7,851	1,150	207	74,350	10,268
Striped bass	.....	.....	.....	.....	200	40
Sturgeon	.....	.....	.....	.....	400	30
Suckers	.....	.....	.....	.....	7,000	140
Tomcod	5,200	29	800	12	7,000	91
Whiting	.....	.....	4,500	35	124,500	1,085
Total	24,339,933	98,834	34,425	1,775	55,332,159	319,471

Hoes and dredges.—These are used both in the vessel and shore fisheries, but mainly in the latter. Their total yield in 1905 was 372,850 bushels of clams, valued at $135,160, and 69,267 bushels of scallops, valued at $51,900. Since the last canvass of this state scallops have increased 262 per cent in quantity and 270 per cent in value.

STATEMENT, BY COUNTIES, OF THE CATCH OF SHELLFISH, WITH HOES AND DREDGES, IN MAINE IN 1905.

Products.	Cumberland.		Hancock.		Knox.		Lincoln.		Sagadahoc.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Vessel fisheries:										
Clams, fresh			33,000	$990						
Clams, salted			54,000	1,350						
Scallops			48,800	6,100						
Total			135,800	8,440						
Shore fisheries:										
Clams, fresh	721,800	$34,355	733,700	29,023	150,000	$5,500	527,350	$20,420	60,500	$3,280
Clams, salted	20,000	675	892,400	22,420					35,000	875
Scallops			352,400	44,050						
Winkles							18,000	500		
Total	741,800	35,030	1,978,500	95,493	150,000	5,500	545,350	20,920	95,500	4,155
Grand total	741,800	35,030	2,114,300	103,933	150,000	5,500	545,350	20,920	95,500	4,155

Products.	Waldo.		Washington.		York.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Vessel fisheries:								
Clams, fresh							33,000	$990
Clams, salted							54,000	1,350
Scallops							48,800	6,100
Total							135,800	8,440
Shore fisheries:								
Clams, fresh	2,000	$100	474,000	$13,947	24,750	$2,225	2,694,100	108,850
Clams, salted							947,400	23,970
Scallops			14,400	1,750			366,800	45,800
Winkles					30,000	900	[a] 48,000	1,400
Total	2,000	100	488,400	15,697	54,750	3,125	4,056,300	180,020
Grand total	2,000	100	488,400	15,697	54,750	3,125	4,102,100	188,460

[a] Taken by hand.

Seines.—The total catch by seines was 10,609,135 pounds, valued at $88,183. The most valuable species taken were herring, mackerel, and smelt. More than two-thirds of the catch was taken in the vessel fisheries and the rest in the shore fisheries.

STATEMENT, BY COUNTIES, OF THE YIELD OF THE SEINE FISHERIES OF MAINE IN 1905.

Products.	Cumberland.		Hancock.		Knox.		Lincoln.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Vessel fisheries:								
Alewives					35,000	$200	54,000	$275
Flounders	1,000	$10						
Herring	384,000	1,612			498,000	2,010	5,784,000	24,850
Mackerel, fresh	25,000	1,500					100,000	8,000
Mackerel, salted	40,000	4,000					80,000	6,400
Pollock					93,000	651	40,000	800
Shad, salted	62,500	2,000					41,400	1,469
Smelt	21,500	1,740					1,500	150
Total	534,000	10,862			626,000	2,861	6,100,900	41,944
Shore fisheries:								
Alewives	40,000	200			785,000	600	8,000	40
Flounders	8,000	160	40,700	$510	9,000	360		
Herring, fresh	807,000	4,487			440,000	1,781	822,000	3,500
Herring, salted								
Mackerel	6,000	480			100	6	2,500	200
Pollock	1,000	30			1,200	9	50,000	1,000
Shad, salted					12,000	390	5,000	175
Smelt	71,135	6,968	16,000	1,600	52,500	6,150	23,600	2,440
Tomcod					6,500	195		
Total	933,135	12,325	56,700	2,110	1,306,300	9,491	911,100	7,355
Grand total	1,467,135	23,187	56,700	2,110	1,932,300	12,352	7,012,000	49,299

Products.	Sagadahoc.		York.		Total.	
	Lbs.	Value.	Lbs.	Value	Lbs.	Value.
Vessel fisheries:						
Alewives					89,000	$475
Flounders					1,000	10
Herring	6,000	$35			6,672,000	28,507
Mackerel, fresh					125,000	9,500
Mackerel, salted					120,000	10,400
Pollock					133,000	1,451
Shad, salted					103,900	3,469
Smelt					23,000	1,890
Total	6,000	35			7,266,900	55,702
Shore fisheries:						
Alewives					833,000	840
Flounders					57,700	1,030
Herring, fresh					2,069,000	9,768
Herring, salted			120,000	$300	120,000	300
Mackerel			15,000	900	23,600	1,586
Pollock					52,200	1,039
Shad, salted					17,000	565
Smelt					163,235	17,158
Tomcod					6,500	195
Total			135,000	1,200	3,342,235	32,481
Grand total	6,000	35	135,000	1,200	10,609,135	88,183

Gill nets.—Gill nets are used both in the shore and vessel fisheries, the total catch by them in 1905 being 3,216,802 pounds, valued at $84,032. The most important species taken were herring, mackerel, cod, and shad.

STATEMENT, BY COUNTIES, OF THE YIELD OF THE GILL-NET FISHERIES OF MAINE IN 1905.

Products.	Cumberland.		Hancock.		Kennebec.		Knox.		Lincoln.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Vessel fisheries:										
Cod, fresh	105,000	$2,350							105,000	$2,250
Herring, fresh	84,000	380	500,000	$16,240			14,400	$60		
Herring, salted			100,000	2,000						
Mackerel	59,000	3,940	20,000	2,000			16,000	960		
Total	248,000	6,670	620,000	20,240			30,400	1,020	105,000	2,250
Shore fisheries:										
Cod, fresh									60,000	1,200
Cod, salted										
Herring, fresh	2,400	9					367,000	1,534		
Herring, salted							23,000	802		
Mackerel	115,700	8,156							3,000	180
Pollock										
Salmon										
Shad, fresh	2,400	120			24,300	$1,620			20,610	1,567
Shad, salted			3,000	120						
Smelt										
Striped bass									4,000	1,000
Sturgeon					1,500	110				
Caviar					200	150				
Total	120,500	8,285	3,000	120	26,000	1,880	390,000	2,336	87,610	3,947
Grand total	368,500	14,955	623,000	20,360	26,000	1,880	420,400	3,356	192,610	6,197

Products.	Penobscot.		Sagadahoc.		Washington.		York.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Vessel fisheries:										
Cod, fresh							50,000	$1,000	260,000	$5,600
Herring, fresh			19,200	$120	182,000	$1,200			799,600	18,000
Herring, salted									100,000	2,000
Mackerel					17,000	1,000	171,000	10,290	283,000	18,190
Total			19,200	120	199,000	2,200	221,000	11,290	1,442,600	43,790
Shore fisheries:										
Cod, fresh							1,000	30	61,000	1,230
Cod, salted							500	20	500	20
Herring, fresh					606,000	4,040	91,200	520	1,066,600	6,103
Herring, salted					45,000	822	164,800	1,951	232,800	3,575
Mackerel			7,500	450			36,000	2,550	162,200	11,336
Pollock					7,000	70			7,000	70
Salmon	7,680	$2,010			2,887	680			10,567	2,690
Shad, fresh			69,225	6,083	85,900	1,808			202,435	11,198
Shad, salted							200	5	3,200	125
Smelt					17,500	2,035			17,500	2,035
Striped bass									4,000	1,000
Sturgeon			4,500	450					6,000	560
Caviar			200	150					400	300
Total	7,680	2,010	81,425	7,133	764,287	9,455	293,700	5,076	1,774,202	40,242
Grand total	7,680	2,010	100,625	7,253	963,287	11,655	514,700	16,366	3,216,802	84,032

Harpoons and spears.—Harpoons are used exclusively in taking swordfish, the catch having increased 21 per cent in quantity and 11 per cent in value since 1902. All of it is taken in the vessel fisheries.

STATEMENT, BY COUNTIES, OF THE CATCH OF SWORDFISH WITH HARPOONS IN THE VESSEL FISHERIES OF MAINE IN 1905.

Counties.	Pounds.	Value.
Cumberland	508,380	$34,988
Knox	30,000	900
York	241,600	14,000
Total	779,980	49,888

STATEMENT, BY COUNTIES, OF THE CATCH OF EELS WITH SPEARS, IN THE SHORE FISHERIES OF MAINE IN 1905.

Counties.	Pounds.	Value.
Cumberland	41,500	$2,590
Hancock	4,400	232
Knox	5,000	250
Lincoln	12,500	580
York	500	50
Total	63,900	3,702

Dip nets, bag nets, fyke nets, spears, and cunner traps.—These apparatus in 1905 yielded 1,973,686 pounds, valued at $29,735, the catch consisting of herring, tomcod, flounders, sculpin, smelt, alewives, and cunners.

STATEMENT, BY COUNTIES, OF THE CATCH WITH DIP NETS AND BAG NETS IN MAINE IN 1905.

Products.	Hancock.		Knox.		Lincoln.		Penobscot.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Vessel fisheries:								
Herring	30,000	$100	.....	.....	.....	.....	.....	.....
Shore fisheries:								
Alewives, fresh	.....	.....	141,250	$503	538,036	$3,773	.....	.....
Alewives, salted	.....	.....	.....	.....	9,500	190	.....	.....
Alewives, smoked	3,750	75	.....	.....	.....	.....	.....	.....
Herring	90,000	300	.....	.....	.....	.....	.....	.....
Salmon	.....	.....	.....	.....	.....	.....	.....	.....
Smelt	33,300	3,170	.....	.....	.....	.....	8,000	$640
Tomcod	7,500	150	.....	.....	.....	.....	25,000	750
Total	134,550	3,695	141,250	503	547,536	3,963	33,000	1,390
Grand total	164,550	3,795	141,250	503	547,536	3,963	33,000	1,390

STATEMENT, BY COUNTIES, OF THE CATCH WITH DIP NETS AND BAG NETS IN MAINE IN 1905--Continued.

Products.	Sagadahoc.		Washington.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Vessel fisheries:						
Herring					30,000	$100
Shore fisheries:						
Alewives, fresh			12,000	$90	691,286	4,366
Alewives, salted			88,000	1,200	97,500	1,390
Alewives, smoked			25,000	585	28,750	660
Herring			480,000	1,400	570,000	1,700
Salmon			3,650	732	3,650	732
Smelt	13,000	$1,300	52,500	8,630	106,800	13,740
Tomcod			33,200	332	65,700	1,232
Total	13,000	1,300	694,350	12,969	1,563,686	23,820
Grand total	13,000	1,300	694,350	12,969	1,593,686	23,920

STATEMENT, BY COUNTIES, OF THE YIELD OF THE FYKE-NET FISHERIES OF MAINE IN 1905.

Products (shore fisheries).	Cumberland.		Knox.		Lincoln.		Sagadahoc.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Flounders	20,000	$550	18,000	$180					38,000	$730
Sculpin	15,000	75							15,000	75
Smelt					4,000	$400	1,500	$150	5,500	550
Tomcod					40,000	400			40,000	400
Total	35,000	625	18,000	180	44,000	800	1,500	150	98,500	1,755

STATEMENT, BY COUNTIES, OF THE CATCH OF CUNNERS IN CUNNER TRAPS IN THE SHORE FISHERIES OF MAINE IN 1905.

Counties.	Pounds.	Value.
Cumberland	118,000	$1,630
Lincoln	110,000	705
York	53,500	1,725
Total	281,500	4,060

MISCELLANEOUS NOTES.

Lobsters.—The value of the lobster catch is more than two-fifths the value of all the products combined, the fishery being carried on at practically every locality along the coast. There has been a decrease since 1902, however, of 3,144,630 pounds and $76,608 in value, or 25 per cent and 7 per cent, respectively, owing to the diminishing supply. The entire catch was made in pots, of which there has been a slight decrease in number since 1902.

Herring.—In the catch of herring since 1902 there has been a decrease of 97,418,166 pounds and $199,431, mainly in Washington County. In 1902, 80 per cent of the state's entire catch of herring was taken in this county, but in 1905 only 39 per cent. The herring are utilized mainly in sardine canneries and smokehouses, and for salting

purposes, and some for bait in the trawl and hand-line fishery. The greater part of the catch was taken in pound nets, trap nets, and weirs.

Cod.—Since 1902 the quantity of cod taken has decreased 6,576,453 pounds, with a decrease of $137,394 in value, or 37 per cent and 36 per cent, respectively. Practically the entire catch was taken with lines. Many men leave their regular occupations on shore to engage in catching cod during the winter. Nearly 87 per cent of the output was sold fresh by the fishermen, the remainder salted. The catch was divided almost equally between the vessel and shore fisheries.

Hake.—This species ranks second in quantity and fourth in value of the catch, the average price received by the fishermen being about 1 cent a pound. The most prolific hake fishing grounds in the United States are off the shores of Maine, and many vessels engage exclusively in "haking" during certain times of the year. The fishermen always sell the hake dressed, this custom having begun, it is said, about the time of the civil war, when the sounds were very valuable in the manufacture of glue, and has been continued ever since, even though the sounds are now much less valuable. There has been a decrease of 21 per cent in the quantity of hake and 2 per cent increase in value since 1902.

Haddock.—This fish ranks next to cod in the quantity and next to hake in the value of the catch. There has been an increase since 1902 of 24 per cent in quantity and 17 per cent in value.

Smelt.—Since 1902 there has been a decrease of 47 per cent in the catch of smelt and 34 per cent in its value. There is always a demand during the fall and winter, however, and the fishermen seldom realize less than 10 cents a pound, the average being considerably more.

Mackerel.—There has been a decline in this fishery since 1902 of 49 per cent in quantity and 40 per cent in value. Gill nets, seines, and pound nets were the apparatus used.

Shad.—As in other sections of the country, the catch of shad shows a considerable falling off in quantity. Compared with 1902 there has been a decrease of 21 per cent, with an increase, however, of 47 per cent in value.

Menhaden.—This fish did not appear in large numbers along the coast of Maine during 1905, and the menhaden factories therefore did not operate during that year.

Clams.—Clams are sold fresh for food and to canneries, and salted for bait. There has been a steady decline in the product for several years, since 1902 amounting to 32 per cent in quantity and 30 per cent in value.

Salmon.—The catch of salmon in the whole state amounted to 86,298 pounds, valued at $20,137. By far the largest part of this,

as usual, was taken in Penobscot River and Bay, statistics for which waters are given in the following tables:

STATEMENT, BY LOCALITIES, OF THE EXTENT OF THE SALMON FISHERY OF PENOBSCOT RIVER AND BAY IN 1903, 1904, AND 1905.

Towns.[a]	Persons engaged.			Weirs and traps.					
				1903.		1904.		1905.	
	1903.	1904.	1905.	No.	Value.	No.	Value.	No.	Value.
Brooksville (Cape Rosier)	2	2	2	5	$375	5	$375	5	$375
Bucksport	7	6	5	10	600	8	480	6	360
Castine	2	2	1	2	160	2	160	1	75
Hampden	3	3	3						
Islesboro	4	4	4	6	535	6	535	6	535
Lincolnville	7	8	7	14	700	16	800	15	750
Ragged Island				1	500				
Rockland	1	1		1	40	1	40		
Northport	4	4	4	10	525	10	525	10	525
Orland	14	14	13	22	1,185	22	1,185	20	1,125
Orrington	5	6	6	2	100	1	50	1	50
Penobscot	15	14	14	20	1,520	18	1,425	17	1,360
Searsport	2	2	2	3	700	3	700	3	700
South Brewer	3	2	2						
Stockton	13	10	9	15	1,680	12	1,280	11	1,180
Verona	23	22	22	40	2,840	39	2,760	37	2,580
Winterport	4	3	3	4	155	3	120	3	120
Bangor	32	35	43						
Bradley	20	24	28						
Montague	4	4	6						
Total	165	167	174	155	11,615	146	10,435	135	9,735

Towns.[a]	Gill nets.						Lines.					
	1903.		1904.		1905.		1903.		1904.		1905.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Hampden	4	$30	4	$31	4	$30						
Orrington	8	303	10	325	10	327						
South Brewer	5	43	3	25	3	24						
Bangor	9	80	7	52	10	75	15	$45	18	$54	22	$66
Bradley	10	60	12	72	14	84						
Montague	2	12	2	12	3	17						
Total	38	528	38	517	44	557	15	45	18	54	22	66

Towns.[a]	Boats, scows, and rafts.						Shore and accessory property.			Total investment.		
	1903.		1904.		1905.							
	No.	Value.	No.	Value.	No.	Value.	1903.	1904.	1905.	1903.	1904.	1905.
Brooksville (Cape Rosier)	2	$25	2	$25	2	$25	$100	$100	$100	$500	$500	$500
Bucksport	10	190	9	175	7	145	250	225	200	1,040	880	705
Castine	3	35	3	35	2	25	25	25	10	220	220	110
Hampden	3	21	3	22	3	24	25	25	25	76	78	79
Islesboro	5	74	5	74	5	74	85	85	85	769	619	694
Lincolnville	8	110	9	130	8	115	275	300	300	1,085	1,230	1,165
Ragged Island										500		
Rockland	1	12	1	12						52	52	
Northport	4	75	4	75	4	75	225	225	225	825	825	825
Orland	18	230	18	230	17	215	175	175	175	1,590	1,590	1,515
Orrington	5	68	6	83	6	85	70	70	75	541	528	537
Penobscot	28	540	27	515	26	505	380	375	375	2,440	2,315	2,440
Searsport	2	75	2	75	2	75	100	100	100	875	875	875
South Brewer	3	30	2	20	2	20	15	10	10	88	55	54
Stockton	18	375	13	265	12	245	450	425	400	2,505	1,970	1,825
Verona	35	650	35	650	33	610	725	725	700	4,215	4,135	3,890
Winterport	7	110	5	90	5	90	75	75	75	340	285	285
Bangor	18	340	19	385	24	475	25	25	30	490	516	646
Bradley	10	150	12	180	14	210				210	252	294
Montague	2	24	2	24	3	35				36	36	52
Total	182	3,134	177	3,065	175	3,048	3,000	2,965	2,885	18,397	16,961	16,291

STATEMENT, BY LOCALITIES, OF THE EXTENT OF THE SALMON FISHERY OF PENOBSCOT RIVER AND BAY IN 1903, 1904, AND 1905—Continued.

Towns.[a]	Catch of salmon.								
	1903.			1904.			1905.		
	No.	Lbs.	Value.	No.	Lbs.	Value.	No.	Lbs.	Value.
Brooksville (Cape Rosier)	74	1,036	$228	70	945	$208	88	1,056	$242
Bucksport	140	1,960	422	120	1,672	368	167	1,837	434
Castine	91	1,274	293	79	1,066	254	48	552	140
Hampden	45	630	138	41	567	126	62	744	248
Islesboro	258	3,612	748	306	4,104	862	408	4,826	999
Lincolnville	352	4,752	1,030	384	4,780	1,046	495	5,693	1,254
Ragged Island	47	658	144						
Vinal Haven	2	22	5	2	22	5	2	22	5
North Haven	6	84	18	5	70	16	23	287	63
Rockland	4	56	12	3	37	8	3	37	8
Northport	446	6,244	1,424	420	5,302	1,231	459	5,279	1,246
Orland	115	1,610	368	150	2,030	467	240	2,880	691
Orrington	250	3,498	738	90	1,288	283	235	2,618	616
Penobscot	715	10,010	2,280	710	9,458	2,245	876	10,506	2,488
Searsport	322	4,186	920	297	3,713	817	503	5,785	1,297
South Brewer	32	448	96	20	270	62	30	354	82
Stockton	590	8,260	1,736	546	7,361	1,548	712	7,892	1,860
Verona	1,014	14,196	3,210	1,158	15,613	3,663	1,386	16,133	3,880
Winterport	150	2,100	441	120	1,654	353	159	1,908	442
Bangor	89	1,196	270	81	1,114	275	185	2,185	562
Bradley	105	1,470	367	160	2,190	565	273	3,276	872
Montague	12	168	38	14	189	49	24	288	74
Total	4,859	67,470	14,935	4,776	63,395	14,451	6,378	74,158	17,503

[a] The salmon credited to Vinal Haven and North Haven in 1903, 1904, and 1905, and to Rockland in 1905, were taken incidentally by apparatus fished for other species.

The following table gives the number, pounds, and value of salmon taken in the Penobscot River and Bay each year from 1895 to 1905, inclusive:

STATEMENT, FOR VARIOUS YEARS, OF THE CATCH OF SALMON IN PENOBSCOT RIVER AND BAY.

Years.	Number.	Pounds.	Value.	Years.	Number.	Pounds.	Value.
1895	4,395	65,011	$11,356	1901	6,821	86,055	$12,263
1896	6,403	80,225	12,716	1902	3,269	45,782	9,950
1897	3,985	51,522	7,911	1903	4,859	67,470	14,935
1898	3,225	42,560	8,342	1904	4,776	63,395	14,451
1899	3,515	45,688	10,424	1905	6,378	74,158	17,503
1900	3,541	44,060	7,832				

THE CANNING INDUSTRY.

The canning industry of Maine still is very important, though the number of canneries in operation in 1905 was only 46, against 75 in 1902. Of these establishments 33 were engaged in canning sardines, 18 in canning clams, and 1 each in canning herring, mackerel, and cod, some canneries handling two or more products. Most of the sardine canneries are in Washington County. Of the remainder 5 are in Hancock County, 3 in Lincoln County, and 1 in Knox County.

Notwithstanding the reduction from 52 to 33 sardine canneries in operation the output was considerably larger than in 1902. The number of clam canneries has decreased from 24 to 18 and the output has also decreased somewhat. The number of establishments canning plain herring has decreased from 9 to 1 and the output is correspondingly reduced. In 1905 one establishment canned cod and one canned mackerel. The products prepared in 1905 were 2,159,797 cases of sardines, valued at $5,078,587; 3,000 cases of plain herring, $7,200; 85 cases of mackerel, $340; 3,226 cases of cod, $8,931; 500 barrels of Russian sardines, $1,750; 716 barrels of salted herring, $2,428; 200,000 pounds of skinned and boned herring, $16,000; 184,638 boxes and 28,000 pounds in bulk of smoked herring, $15,857; 46,018 cases of clams, $135,990; 4,168 cases of clam juice, $6,269; 500 cases of clam extract, $750; 14,750 cases of clam chowder, $49,470; and secondary products, such as oil, pomace, scrap, and fertilizer, valued at $18,490; the total value being $5,342,062.

STATEMENT, BY COUNTIES, OF THE ESTABLISHMENTS, CASH CAPITAL, COST OF MATERIALS, NUMBER OF PERSONS ENGAGED, AND WAGES PAID IN THE CANNING INDUSTRY OF MAINE IN 1905.

Counties.	Canneries.		Cash capital.	Cost of materials.	Persons engaged.	Wages paid.
	No.	Value.				
Cumberland	6	$9,150	$25,000	$9,015	106	$12,380
Hancock	7	112,350	152,500	166,321	560	68,050
Knox	4	28,200	44,500	47,205	164	29,000
Lincoln	4	61,500	69,000	79,560	315	39,780
Washington	25	1,068,325	1,611,800	2,276,712	5,872	1,011,224
Total	46	1,279,525	1,902,800	2,578,813	7,017	1,160,434

STATEMENT, BY COUNTIES, OF THE PRODUCTS OF THE CANNING INDUSTRY OF MAINE IN 1905.

Products.	Cumberland.		Hancock.		Knox.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Raw products:						
Cod.....pounds..	225,000	$2,250				
Herring.....do....	240,000	900	6,780,000	$25,400	2,160,000	$9,000
Mackerel.....do....	10,000	100				
Clams.....bushels..	39,900	16,367	39,000	13,957	22,500	7,050
Total.....		19,617		39,357		16,050
Manufactured products:						
Sardines in oil—						
Quarters.....cases..			85,800	247,250	8,000	18,000
Sardines in mustard—						
Quarters.....do....			2,700	6,640	3,000	7,500
Three-quarters.....do....			47,600	149,760	28,000	60,200
Plain herring—						
One-pound.....do....	3,000	7,200				
Mackerel—						
One-pound.....do....	85	340				
Cod—						
Number one.....do....	1,163	2,326				
Number three-fourths...do....	2,063	6,605				
Clams—						
Four-ounce.....do....	1,464	1,976				
Five-ounce.....do....					1,500	4,500
Six-ounce.....do....	2,160	3,828	5,750	17,250	2,500	7,500
Seven-ounce.....do....			1,700	5,100		
Eight-ounce.....do....	2,665	5,843	8,450	25,940	4,000	13,100
Ten-ounce.....do....	1,730	4,834				
One-pound.....do....	1,700	5,440	1,200	2,880		
Two-pound.....do....					500	1,050
Clam juice—						
Number two.....do....	4,158	6,237				
One-gallon.....do....	10	32				
Clam chowder—						
Ten-ounce.....do....	7,300	21,260				
Number three.....do....	5,450	20,710				
Total.....		86,631		454,820		111,850
Secondary products:						
Oil.....gallons..			1,000	150		
Pomace.....tons..			50	400		
Total.....				550		
Total manufactured and secondary products.....		86,631		455,370		111,850

STATEMENT, BY COUNTIES, OF THE PRODUCTS OF THE CANNING INDUSTRY OF MAINE IN 1905—Continued.

Products.	Lincoln.		Washington.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Raw products:						
Cod.....pounds					225,000	$2,250
Herring.....do	3,888,000	$16,880	97,028,400	$393,661	110,096,400	445,841
Mackerel.....do					10,000	100
Clams.....bushels	1,000	300	33,000	9,700	135,400	47,374
Total		17,180		403,361		495,565
Manufactured products:						
Sardines in oil—						
Quarters.....cases	30,500	76,275	1,485,197	3,401,307	1,609,497	3,742,832
Halves.....do			1,500	4,500	1,500	4,500
Sardines in mustard—						
Quarters.....do			68,345	166,568	74,045	180,708
Three-quarters.....do	45,500	103,950	351,465	827,915	472,565	1,141,825
Sardines in spices—						
Quarters.....do			190	722	190	722
Three-quarters.....do			2,000	8,000	2,000	8,000
Plain herring—						
One-pound.....do					3,000	7,200
Mackerel—						
One-pound.....do					85	340
Cod—						
Number one.....do					1,163	2,326
Number three-fourths...do					2,063	6,605
Russian sardines.....barrels			500	1,750	500	1,750
Herring salted—						
Dry.....do			50	180	50	180
Pickled.....do			666	2,248	666	2,248
Smoked herring—						
Medium.....boxes			176,638	14,517	176,638	14,517
Lengthwise.....do			8,000	640	8,000	640
In bulk.....pounds			28,000	700	28,000	700
Skinned and boneless....do			200,000	16,000	200,000	16,000
Clams—						
Four-ounce.....cases					1,464	1,976
Five-ounce.....do					1,500	4,500
Six-ounce.....do	266	798			10,676	29,376
Seven-ounce.....do					1,700	5,100
Eight-ounce.....do	133	426			15,248	45,309
Ten-ounce.....do					1,730	4,834
One-pound.....do			9,100	33,125	12,000	41,445
Two-pound.....do			1,200	2,400	1,700	3,450
Clam juice—						
Number two.....do					4,158	6,237
One-gallon.....do					10	32
Clam chowder—						
Ten-ounce.....do					7,300	21,260
Number three.....do			2,000	7,500	7,450	28,210
Clam extract—						
Assorted sizes.....do			500	750	500	750
Total		181,449		4,488,822		5,323,572
Secondary products:						
Oil.....gallons			10,000	1,760	11,000	1,910
Pomace.....tons			190	1,980	240	2,380
Scrap.....do			270	2,200	270	2,200
Fertilizer.....do			600	12,000	600	12,000
Total				17,940		18,490
Total manufactured and secondary products		181,449		4,506,762		5,342,062

STATEMENT, BY PRODUCTS AND COUNTIES, OF THE CANNING ESTABLISHMENTS IN MAINE IN 1905.

Counties.	Sardine.	Herring.	Mackerel.	Cod.	Clams.	Total.[a]
Cumberland		1	1	1	5	6
Hancock	5				6	7
Knox	1				3	4
Lincoln	3				1	4
Washington	24				3	25
Total	33	1	1	1	18	46

[a] Number of canneries in each county without duplication.

THE SMOKED-FISH INDUSTRY.

The number of firms engaged in the smoked-fish industry in Maine in 1905, exclusive of canners and fishermen, was 86. Of these, 79 were in Washington County, 3 in Cumberland County, 3 in Lincoln County, and 1 in Penobscot County. The species smoked were herring, haddock, pollock, and alewives. Some of the smokers also prepared salted and pickled fish, Russian sardines, and cod sounds. The number of persons engaged was 994, the value of smokehouses and other shore and accessory property utilized was $190,380, the cash capital amounted to $195,450, the cost of materials was $62,376, the amount of wages paid was $77,440, and the total value of the products was $317,482.

STATEMENT, BY COUNTIES, OF THE NUMBER OF FIRMS, CAPITAL INVESTED, PERSONS ENGAGED, AND WAGES PAID IN THE SMOKED-FISH INDUSTRY OF MAINE IN 1905.

Counties.	Number of firms.	Value of shore property.	Cost of materials.	Cash capital.	Persons engaged.	Wages.
Cumberland	3	$8,350	$2,450	$27,000	24	$6,000
Lincoln	3	12,000	1,380	5,000	33	600
Washington and Penobscot	80	170,030	58,546	163,450	937	70,840
Total	86	190,380	62,376	195,450	994	77,440

STATEMENT, BY COUNTIES, OF THE PRODUCTS OF THE SMOKED-FISH INDUSTRY OF MAINE IN 1905.

Products.	Cumberland.		Lincoln.		Washington and Penobscot.		Total.	
	Quantity	Value.	Quantity	Value.	Quantity	Value.	Quantity	Value.
Raw products:								
Alewives.....pounds..			1,041,000	$3,643			1,041,000	$3,643
Cod.....do....					203,000	$1 915	203,000	1,915
Haddock.....do....	1,700,000	$34,000			154,000	1,580	1,854,000	35,580
Herring.....do....			168,000	1,400	18,818,400	67,980	18,986,400	69,380
Herring, salted.....do....					100,000	2,250	100,000	2,250
Pollock.....do....					132,200	1,135	132,200	1,135
Total.....	1,700,000	34,000	1,209,000	5,043	19,407,600	74,860	22,316,600	113,903
Manufactured products:								
Smoked alewives.....			979,000	12,237			979,000	12,237
Smoked haddock—Finnan haddies.....pounds..	965,000	51,830			100,000	6,500	1,065,000	58,330
Kippered herring.....cases..					350	1,400	350	1,400
Smoked herring—								
Bloaters.....boxes..					30,894	7,436	30,894	7,436
Lengthwise.....do....			20,000	1,800	187,700	15,784	207,700	17,584
Medium.....do....					1,848,355	157,792	1,848,355	157,792
Boneless.....do....					27,450	11,428	27,450	11,428
Gross.....pounds..					599,500	16,576	599,500	16,576
Smoked pollock.....do....					4,000	160	4,000	160
Russian sardines...barrels..					673	1,582	673	1,582
Cod, salted.....pounds..					94,568	4,195	94,568	4,195
Cod, pickled.....barrels..					4	16	4	16
Haddock, pickled.....do....					15	60	15	60
Herring, salted.....do....					6,735	25,569	6,735	25,569
Pollock, salted.....pounds..					69,120	2,289	69,120	2,289
Pollock, pickled....barrels..					10	45	10	45
Cod sounds, dried..pounds..					163	41	163	41
Total.....		51,830		14,037		250,873		316,740
Secondary products:								
Pomace.....tons..					50	550	50	550
Oil.....gallons..					1,000	192	1,000	192
Total.....						742		742
Total manufactured and secondary products.....		51,830		14,037		251,615		317,482

Smoked herring.—The herring smoked by fishermen are shown as smoked herring in the preceding tables, but the American-caught herring smoked by canners and regular smokers are shown as fresh herring, as that was the condition in which they were sold by the fishermen. The following tables give the total quantity and value of herring smoked, by fishermen, canners, and regular smokers, in Maine in 1905, and also the total quantity and value for each year from 1880 to 1905 for which statistics are available:

QUANTITY AND VALUE OF SMOKED HERRING PREPARED IN MAINE IN 1905.

Preparers.	Pounds.	Value.
Fishermen.....	713,700	$18,863
Canners.....	1,335,828	31,857
Regular smokers.....	14,446,090	210,816
Total.....	16,495,618	261,536

QUANTITY AND VALUE OF SMOKED HERRING PREPARED IN MAINE IN VARIOUS YEARS FROM 1880 TO 1905.

Years.	Pounds.	Value.	Years.	Pounds.	Value.
1880	4,434,111	$99,973	1892	10,151,695	$232,036
1887	3,419,485	100,488	1898	10,671,170	185,836
1888	4,360,435	140,154	1902	14,910,560	314,152
1889	5,090,425	159,330	1905	16,495,618	261,536

WHOLESALE FISHERY TRADE.

Besides the canning and smoked-fish industries there is also an extensive wholesale trade in fresh and salted fishery products.

STATEMENT, BY COUNTIES, OF THE NUMBER OF FIRMS, CAPITAL INVESTED, PERSONS ENGAGED, AND WAGES PAID IN THE WHOLESALE FISHERY TRADE OF MAINE IN 1905, NOT INCLUDED IN THE CANNED AND SMOKED-FISH INDUSTRIES.

Counties.	Number of firms.	Value of shore and accessory property.	Cash capital.	Persons engaged.	Wages paid.
Cumberland	28	$200,720	$334,800	153	$76,900
Hancock	14	58,075	133,500	87	24,950
Knox	12	147,600	253,500	156	54,800
Lincoln	11	21,150	40,000	49	7,200
Sagadahoc and York	3	9,440	7,300	9	1,950
Washington	5	9,700	35,000	21	6,636
Total	73	446,685	804,100	475	172,436

FISHERIES OF NEW HAMPSHIRE.

GENERAL STATISTICS.

The commercial fisheries of New Hampshire are of small extent, and confined to Rockingham County, which is the only county in the state bordering the seacoast. The number of persons employed in the fisheries in 1905 was 145; the amount of capital invested, $47,050; and the weight and value of the products, 1,036,452 pounds, $51,944. The products in 1905 compared with 1902 have decreased 556,561 pounds in quantity, but increased $1,941 in value.

The following tables present in a condensed form the number of persons employed, the amount of capital invested, and the quantity and value of the products of the fisheries of New Hampshire in 1905:

PERSONS ENGAGED IN THE FISHERIES OF NEW HAMPSHIRE IN 1905.

How engaged.	Number.
On vessels, fishing	5
In shore or boat fisheries	127
Shoresmen	13
Total	145

INVESTMENT IN THE FISHERIES OF NEW HAMPSHIRE IN 1905.

Items.	Number.	Value.	Items.	Number.	Value.
Vessels fishing	1	$250	Apparatus—shore fisheries—Continued.		
Tonnage	6		Lobster pots	4,070	$4,230
Outfit		190	Eel pots	5	5
Boats, sail and row	97	3,155	Clam rakes and forks	20	13
Boats, gasoline	18	4,600	Rakes—Irish moss	9	33
Apparatus—vessel fisheries:			Cunner nets	6	12
Lines, trawl		50	Shore property		17,750
Apparatus—shore fisheries:			Cash capital		11,500
Pound nets and weirs	9	4,410			
Gill nets	35	470	Total		47,050
Lines, hand and trawl		382			

PRODUCTS OF THE FISHERIES OF NEW HAMPSHIRE IN 1905.

Products.	Vessel fisheries.		Shore fisheries.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives, fresh			20,000	$200	20,000	$200
Alewives, salted			68,000	1,020	68,000	1,020
Cod, fresh	18,000	$360	314,200	7,806	332,200	8,166
Cod, salted			4,700	141	4,700	141
Cunners			2,500	75	2,500	75
Eels			800	24	800	24
Haddock	9,000	135	54,000	913	63,000	1,048
Hake	3,800	57	17,150	257	20,950	314
Herring			40,000	400	40,000	400
Mackerel			16,650	833	16,650	833
Pollock, fresh	5,200	52	37,200	554	42,400	606
Pollock, salted			31,500	747	31,500	747
Whiting			50,000	625	50,000	625
Lobsters			256,052	32,575	256,052	32,575
Clams, soft			27,700	2,770	[a] 27,700	2,770
Irish moss			60,000	2,400	60,000	2,400
Total	36,000	604	1,000,452	51,340	1,036,452	51,944

[a] 2,770 bushels.

THE PRODUCTS BY APPARATUS.

The catch with hand lines and trawls aggregated 388,750 pounds, valued at $9,068. Of the remaining forms of apparatus, pound nets and weirs took 256,000 pounds, valued at $3,995; gill nets, 8,650 pounds, valued at $433; cunner traps, 2,500 pounds, valued at $75; rakes and hoes, 87,700 pounds, valued at $5,170. The lobster catch, taken in lobster pots, amounted to 256,052 pounds, valued at $32,575, or more than half of the total value of the fishery products of the state.

YIELD FROM TRAWL LINES IN THE VESSEL FISHERIES OF NEW HAMPSHIRE IN 1905.

Products.	Pounds.	Value.	Products.	Pounds.	Value.
Cod	18,000	$360	Pollock	5,200	$52
Haddock	9,000	135			
Hake	3,800	57	Total	36,000	604

YIELD OF THE SHORE FISHERIES OF NEW HAMPSHIRE IN 1905.

Apparatus and species.	Pounds.	Value.	Apparatus and species.	Pounds.	Value.
Pound nets and weirs:			Rakes and hoes:		
Alewives, fresh	20,000	$200	Clams, soft	27,700	$2,770
Alewives, salted	68,000	1,020	Irish moss	60,000	2,400
Cod	65,000	1,300	Total	87,700	5,170
Herring	40,000	400			
Mackerel	8,000	400	Pots:		
Pollock	5,000	50	Lobsters	256,052	32,575
Whiting	50,000	625	Eels	800	24
Total	256,000	3,995	Total	256,852	32,599
Lines, trawl and hand:					
Cod, fresh	249,200	6,506	Gill nets: Mackerel	8,650	433
Cod, salted	4,700	141	Cunner traps: Cunners	2,500	75
Haddock	54,000	913	Grand total	1,000,452	51,340
Hake	17,150	257			
Pollock, fresh	32,200	504			
Pollock, salted	31,500	747			
Total	388,750	9,068			

INVESTMENT AND NUMBER OF PERSONS ENGAGED IN THE WHOLESALE FISHERY TRADE OF NEW HAMPSHIRE IN 1905.

Items.	Number.	Value.
Establishments	3	$8,450
Cash capital		11,500
Wages paid		7,500
Persons engaged	13	

FISHERIES OF MASSACHUSETTS.

GENERAL STATISTICS.

Massachusetts takes first rank among the New England States for quantity and value of its fishery products, and for the amount of capital invested.

Persons engaged.—The number of persons engaged in 1905 was 15,694. Of these, 7,999 were on fishing vessels, 38 on transporting vessels, 4,581 in the shore or boat fisheries, and 3,076 were shoresmen employed chiefly in wholesale fish establishments. Compared with the statistics for 1902, there has been an increase of 1,394 in the number of persons employed.

PERSONS ENGAGED IN THE FISHERIES OF MASSACHUSETTS IN 1905.

How engaged.	Number.
On vessels fishing	7,999
On vessels transporting	38
In shore or boat fisheries	4,581
Shoresmen	3,076
Total	15,694

Investment.—The total investment in the fisheries, including vessels, boats, apparatus of capture, value of buildings and cash capital, was $10,810,442; a decrease of $1,152 since the last canvass.

INVESTMENT IN THE FISHERIES OF MASSACHUSETTS IN 1905.

Items.	Number.	Value.	Items.	Number.	Value.
Vessels fishing	649	$2,745,360	Apparatus—shore fisheries Continued.		
Tonnage	32,961		Pound nets and trap nets	216	$178,290
Outfit [a]		1,300,096	Lines, hand and trawl		12,360
Vessels transporting	14	16,300	Cunner nets and traps	111	224
Tonnage	429		Lobster pots	24,432	33,759
Outfit		2,495	Eel pots	1,787	2,365
Boats, sail and row	2,879	153,468	Fyke nets	80	500
Boats, gasoline [b]	713	235,635	Beam trawls	27	226
Apparatus—vessel fisheries:			Spears and gaffs	126	232
Seines	187	121,155	Harpoons, swordfish		46
Gill nets	10,959	112,471	Tongs, rakes, forks, and hoes	2,159	7,000
Pound nets	4	2,500	Dredges	1,589	4,128
Beam trawls	39	1,470	Dip nets	240	569
Lines, hand and trawl		261,697	Rakes—Irish moss	101	505
Dredges	125	406	Minor apparatus		89
Tongs and rakes	22	151	Shore and accessory property		3,603,384
Lobster pots	850	1,340	Cash capital		1,991,426
Harpoons—swordfish		2,098			
Apparatus—shore fisheries:			Total		10,810,442
Seines	88	7,830			
Gill nets	1,513	10,867			

[a] The harpoons, guns, etc., used on whaling vessels are included in the "outfit" of vessels fishing.
[b] Includes 5 steamers, valued at $4,300.

Products.—The products of the fisheries aggregated 255,654,475 pounds, valued at $7,025,249; an increase over 1902 of 25,008,525 pounds and $542,822. The catch by vessels was 205,162,761 pounds, valued at $5,251,561, and by boats in the shore fisheries 50,491,714 pounds, valued at $1,773,688.

The yield comprised a large number of species, the more important of which, including fresh, salted, and smoked fish, were as follows: Cod, 62,262,623 pounds, $1,688,617; cusk, 7,456,198 pounds, $113,956; haddock, 67,053,961 pounds, $1,069,104; hake, 20,700,967 pounds, $258,438; halibut, 3,513,001 pounds, $218,232; herring, 18,364,454 pounds, $381,696; mackerel, 14,103,971 pounds, $966,443; pollock, 25,485,871 pounds, $267,927; alewives, 4,069,430 pounds, $49,102; flounders, 4,043,683 pounds, $97,823; swordfish, 1,703,554 pounds, $116,692; squeteague, 5,224,816 pounds, $108,200, and whiting, 4,299,690 pounds, $19,097.

PRODUCTS OF THE FISHERIES OF MASSACHUSETTS IN 1905.

Products.	Vessel fisheries.		Shore fisheries.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives, fresh	366,000	$3,630	2,194,930	$21,211	2,560,930	$24,841
Alewives, salted			1,433,500	22,761	1,433,500	22,761
Alewives, smoked			75,000	1,500	75,000	1,500
Amberfish	400	15			400	15
Bluefish	64,560	6,026	36,370	3,443	100,930	9,469
Bonito	38,200	1,720	26,850	1,322	65,050	3,042
Butterfish	4,200	204	78,690	3,309	82,890	3,513
Catfish	22,500	394	40,175	650	62,675	1,044
Cod, fresh	40,586,762	889,300	4,400,948	102,379	44,987,710	991,679
Cod, salted	16,431,513	654,868	843,400	42,070	17,274,913	696,938
Cusk, fresh	6,959,595	103,037	18,800	275	6,978,395	103,312
Cusk, salted	477,803	10,644			477,803	10,644
Cunners			115,900	6,020	115,900	6,020
Eels			541,945	31,041	541,945	31,041
Flounders, fresh	1,692,926	42,791	2,348,757	54,992	4,041,683	97,783
Flounders, salted			2,000	40	2,000	40
Haddock, fresh	63,566,942	995,714	2,565,977	56,196	66,132,919	1,051,910
Haddock, salted	921,042	17,194			921,042	17,194
Hake, fresh	18,139,083	224,179	2,171,075	28,585	20,310,158	252,764
Hake, salted	390,809	5,674			390,809	5,674
Halibut, fresh	3,036,294	198,625	10,798	977	3,047,092	199,602
Halibut, salted	465,909	18,630			465,909	18,630
Herring, fresh	8,628,139	192,366	6,624,690	74,333	15,252,829	266,699
Herring, salted	3,111,625	114,997			3,111,625	114,997
Hickory shad			4,100	76	4,100	76
Horse mackerel	1,500	60	200,209	4,373	201,709	4,433
Mackerel, fresh	7,899,346	555,931	891,409	47,584	8,790,755	603,515
Mackerel, salted	5,313,216	362,928			5,313,216	362,928
Menhaden, fresh	792,600	4,617	217,590	1,646	1,010,190	6,263
Menhaden, salted	8,600	252			8,600	252
Perch, white			19,650	1,420	19,650	1,420
Perch, yellow			10,000	800	10,000	800
Pollock, fresh	18,579,194	186,738	6,602,644	76,857	25,181,838	263,595
Pollock, salted	304,033	4,332			304,033	4,332
Sand eels	65,800	1,645	507,300	7,857	573,100	9,502
Scup	61,200	2,208	958,000	24,543	1,019,200	26,751
Sea bass	26,500	1,165	95,800	4,759	122,300	5,924
Shad, fresh	2,160	206	76,968	4,829	79,128	5,035
Shad, salted	12,000	311			12,000	311
Sharks	200	5	200	3	400	8
Skates	335	5	1,000	10	1,335	15
Smelt			7,375	866	7,375	866
Squeteague	131,127	3,360	5,093,689	104,840	5,224,816	108,200
Striped bass	1,000	100	20,050	1,487	21,050	1,587
Sturgeon	300	30	11,885	937	12,185	967
Caviar	40	28	267	139	307	167
Swordfish	1,642,564	113,462	60,990	3,230	1,703,554	116,692
Tautog	9,100	263	231,023	7,438	240,123	7,701
Tom cod	12,000	180	51,400	925	63,400	1,105
Whiting, fresh			4,298,090	19,077	4,298,090	19,077
Whiting, salted			1,600	20	1,600	20
Refuse fish	1,826	38			1,826	38
Crabs, hard			60,000	500	60,000	500
Lobsters	55,050	7,434	1,228,021	168,800	1,283,071	176,234
Shrimp			2,000	500	2,000	500
Squid			785,750	9,205	785,750	9,205
Clams, hard	40,080	8,515	1,292,128	280,472	[a] 1,332,208	288,987
Clams, soft	2,000	300	2,173,190	209,245	[b] 2,175,190	209,545
Clams, razor			40,500	1,620	[c] 40,500	1,620
Oysters, market	63,350	15,070	724,710	192,405	[d] 788,060	207,475
Oysters, seed			207,550	14,515	[e] 207,550	14,515
Scallops	24,720	9,270	238,517	89,442	[f] 263,237	98,712
Cockles			37,000	11,100	[g] 37,000	11,100
Irish moss			765,000	30,600	765,000	30,600
Oil, whale	3,933,554	246,565			[h] 3,933,554	246,565
Oil, cod	26,325	856			[i] 26,325	856
Oil, sea-elephant	590,625	25,000			[j] 590,625	25,000
Whalebone	55,950	193,037			55,950	193,037
Ambergris	94	16,900			94	16,900
Sea-elephant skins	5,000	600			5,000	600
Livers	521,580	5,226	39,446	395	561,026	5,621
Sounds	58,000	3,979	1,118	11	59,118	3,990
Halibut fins	9,990	710			9,990	710
Cod roe	7,500	227	5,740	58	13,240	285
Total	205,162,761	5,251,561	50,491,714	1,773,688	255,654,475	7,025,249

[a] 166,526 bushels.
[b] 217,519 bushels.
[c] 4,050 bushels.
[d] 112,580 bushels.
[e] 29,650 bushels.
[f] 43,872 bushels.
[g] 3,700 bushels.
[h] 524,474 gallons.
[i] 3,510 gallons.
[j] 78,750 gallons.

THE FISHERIES BY COUNTIES.

Essex County leads all the others in the importance of its fisheries. The number of persons employed was 7,193. Of these, 4,278 were on vessels, 1,362 in the shore fisheries, and 1,553 were shoresmen employed in the wholesale trade and in the preparation of fishery products. The capital invested was $4,986,997. The products taken in the vessel and shore fisheries amounted to 125,170,485 pounds, valued at $3,404,866.

Gloucester is the principal port in Essex County. In 1905 the fishery interests of Gloucester gave employment to 5,784 persons, of whom 3,926 were on vessels fishing and transporting, 306 in the boat or shore fisheries, and 1,552 were shoresmen, engaged chiefly in preparing fish for market. Compared with the canvass of 1902, the total shows a decrease of 176 persons. The number of vessels, exclusive of those in Rockport, was 275 fishing and 7 transporting, with a combined tonnage of 16,348 net tons, and a total value of $1,319,400, with outfits valued at $575,619. The apparatus used on vessels consisted of 145 seines, valued at $97,470; 5,583 gill nets, valued at $63,281; hand lines and trawls valued at $123,786, and swordfish harpoons valued at $220. In the shore fisheries there were 241 boats employed, valued at $48,460, including 62 gasoline boats, valued at $31,550. The apparatus employed in the shore fisheries consisted principally of lines, seines, and gill nets. The number of vessels using purse seines in the mackerel fishery was 84, and the catch of mackerel, fresh and salt, by seines, amounted to 8,883,962 pounds, valued at $632,507. The product of the vessel fisheries of Gloucester, including fresh and salted fish, amounted to 99,281,193 pounds, valued at $2,790,031, and that of the shore fisheries, 7,242,558 pounds, valued at $106,259. The total products amounted to 106,523,751 pounds, valued at $2,896,290. A comparison with the returns of 1902 shows a decrease of 7,900,706 pounds and $119,862 in the value of products, which may be accounted for by a decrease of 18 in the number of vessels fishing from Gloucester.

The next county in importance is Suffolk, the fishery industries of which gave employment to 2,997 persons, of whom 1,767 were on vessels, 304 in the boat fisheries, and 926 were shoresmen employed in the wholesale fish trade. The total investment amounted to $3,630,081, and the products aggregated 64,663,139 pounds, valued at $1,184,412, an increase over the 1902 returns of 22,196,855 pounds and $28,932 in value. The increase in products is largely in the cheaper grades of fish, hence the small increase in value noted.

The vessel fishery in this county shows a steady increase in the number, tonnage, and value of vessels fishing, and a corresponding increase in the catch. In 1905 there were 113 vessels engaged, with

a net tonnage of 6,582 tons, valued at $742,460, an increase over 1902 of 35 vessels and $168,010. Nearly the entire product of the fisheries of this county was taken in vessels, the catch amounting to 59,504,783 pounds, valued at $1,048,030. The apparatus in use on vessels consisted of lines, seines, gill nets, and harpoons for swordfish. The catch by lines was greater than that of any other form of apparatus in use, amounting to 57,878,395 pounds, valued at $903,770. The principal products of the vessel fisheries were 12,611,290 pounds of cod, 33,671,519 pounds of haddock, 7,605,820 pounds of hake, 1,876,490 pounds of pollock, 2,041,026 pounds of cusk, 756,488 pounds of fresh mackerel, 317,000 pounds of salt mackerel, and 411,500 pounds of swordfish.

The shore fisheries of Suffolk County in 1905 gave employment to 304 persons, using a variety of apparatus, the principal form being lines. The line fishermen are nearly all Italians, who are increasing in numbers yearly. They fish from camps located on the islands in Boston Harbor, bringing their catch each morning to Boston, and selling it from the place assigned to them at the head of T wharf. The catch consists of eels, flounders, cod, haddock, pollock, whiting, and hake, the total amounting to 4,293,200 pounds, valued at $105,456.

The lobster fishery from the near-by beaches and islands in the harbor shows a large decline in recent years, the catch in 1905 amounting to 100,356 pounds, valued at $14,724. This is less than one-third of the catch shown by the returns for 1902.

Clams are still taken from the mud flats in the harbor, but are diminishing in quantity. The catch in 1905, by 15 boats, amounted to 17,280 bushels.

The cunner fishery has shown a steady decline year by year, decreasing from 57,600 pounds in 1902 to 5,000 pounds in 1905.

Sixty men, using 45 gasoline boats, equipped with gill nets, engaged in catching herring for bait, the products amounting to 525,000 pounds, valued at $6,562.

In Barnstable County, which is third in importance, the capital invested was $1,038,636, the number of persons employed was 2,529, and the products amounted to 45,134,489 pounds valued at $1,221,205. Compared with the returns for 1902, an increase of $319,810 appears in the investment, an increase of 278 in the number of persons employed, and an increase of 8,978,471 pounds in quantity, and $288,377 in value of the products. The number of vessels engaged in fishing and transporting was 143, valued at $330,375, an increase over previous returns of 18 vessels fishing and 1 transporting. The apparatus of capture on vessels consisted of seines, gill nets, beam trawls, dredges, tongs, rakes, lobster pots, harpoons for swordfish, and gear used in the whale fisheries.

The number of boats in the shore fisheries was 989, valued at $117,625, including 190 gasoline boats, valued at $70,255. The apparatus used in the shore fisheries consisted principally of seines, gill nets, pound nets, lines, lobster pots, eel pots, fyke nets, beam trawls, tongs, rakes, dredges, and various forms of minor apparatus.

Provincetown, owing to its favorable location, is the principal port in this county, having a fleet of 76 vessels engaged in the fisheries. Of these 72 were in the general food fisheries, 3 in the whale fishery, and one engaged in transporting fish. The vessels engaged in the food fisheries vary in tonnage from 5 to 129 tons, the larger vessels fishing on the Grand Banks, and those of less tonnage on Georges, Browns, and the off-shore banks along the New England coast. The mackerel vessels numbered 40, 38 using gill nets and 2 steamers using purse nets. The products of the vessel fisheries, marketed at Provincetown and other ports, aggregated 22,898,908 pounds, valued at $446,967; 8,582,870 pounds, valued at $137,668, were taken by boats in the shore fisheries. These products do not include those taken in the whale fishery, the latter amounting to 56,070 gallons of sperm oil, with a value of $25,720, and 14 pounds of ambergris, valued at $2,900, taken incidentally.

The number of persons employed in the fisheries of Provincetown was 1,223, of which 824 were on vessels, 279 in the shore fisheries, and 120 in the wholesale trade. The number of boats in the shore fisheries was 193, valued at $45,755, including 103 gasoline boats and 3 small steamers. The principal apparatus in the shore fisheries were 30 pound nets, $42,750; 180 gill nets, $1,540; lines, $2,474; 368 lobster pots, $552; 2 seines, $155; and 11 beam trawls, $132.

Bristol County had 1,331 persons employed in the fisheries, the total investment was $753,997, and the products amounted to 6,660,837 pounds, valued at $607,174. The importance of the fisheries of this county depends in a large measure on the whale fishery, with its allied industries of refining oil, preparing whalebone for market, etc. Of the 43 vessels engaged in the fisheries, 19 were whalers, having a combined tonnage of 4,317 tons, a value of $138,500, and outfits valued at $214,960, including apparatus, such as guns, lances, harpoons, etc., used in the capture of whales. The crews of the whalers numbered 615 men, or an average of about 32 men to the vessel. The products in the whale fisheries consisted of 468,404 gallons of whale oil, valued at $220,845; 55,950 pounds of whalebone, valued at $193,037; and 80 pounds of ambergris, valued at $14,000; a total of $427,882, or more than two-thirds of the value of the entire products taken in the fisheries of this county. In addition to the whalers, one vessel engaged in the hunting of sea elephants in the southern Indian Ocean, the value of the products amounting to $25,600. The remain-

ing vessels, except one transporter, were engaged in the general food fisheries, their apparatus consisting principally of gill nets, seines, lines, and harpoons for swordfish.

The catch of the vessels and boats aggregated 6,660,837 pounds, valued at $607,174. Of the more valuable species in the food fisheries, fresh and salted, may be noted: Cod, 385,600 pounds, $8,366; alewives, 416,250 pounds, $5,855; mackerel, 263,700 pounds, $11,768; swordfish, 231,100 pounds, $12,667; hard clams, 36,215 bushels, $71,525; soft clams, 3,655 bushels, $4,606; oysters, market and seed, 10,100 bushels, $9,345; and scallops, 2,500 bushels, $5,625. Compared with 1902 there appears an increase of 371,283 pounds and $160,845.

In Plymouth County the fisheries gave employment to 774 persons, the capital invested was $211,566, and the products aggregated 6,759,288 pounds, valued at $278,868. Compared with returns for the previous canvass the fisheries of this county show a decline, the decrease amounting to 1,038,670 pounds and $3,430. The most notable falling off is in the cod and halibut fisheries. The cod fisheries declined from 1,736,475 pounds, $42,000, in 1902, to 925,148 pounds, $19,050, in 1905, and the catch of halibut from 669,000 pounds, $49,250, to 189,700 pounds, $18,970.

The fisheries of Dukes County are carried on from the island of Marthas Vineyard, which practically constitutes the county. In 1905 337 persons were engaged in the fisheries, utilizing a capital of $125,702, and the products amounted to 5,039,587 pounds, valued at $188,786. The principal forms of apparatus were pound nets, gill nets, seines, lobster pots, dredges, tongs, rakes, and hoes. Pound nets were the most important, their catch amounting to 3,232,737 pounds, valued at $71,564, or more than half of the weight of all the products. The leading species taken were squeteague, 2,147,700 pounds, $43,627; scup, 832,400 pounds, $21,513; mackerel, 313,130 pounds, $15,226; swordfish, 155,720 pounds, $8,441; flounders, 337,600 pounds, $6,867; hard clams, 18,000 bushels, $31,500; scallops, 11,226 bushels, $25,260; and lobsters, 59,670 pounds, $7,373.

The vessels fishing numbered 18, and are of small type, varying from 5 to 17 tons net. Two vessels engaged in transporting. The most valuable species taken by vessels was mackerel, 192,300 pounds, $9,215; swordfish, 104,230 pounds, $5,734, and cod, 216,800 pounds, $4,336.

The fisheries of Norfolk County are of minor importance compared with those previously mentioned. The number of persons engaged was 45; the capital invested, $13,616, and the products amounted to 341,414 pounds, valued at $21,114. The principal form of apparatus used was lobster pots, the catch amounting to 113,214

pounds, valued at $15,850. Near Cohasset, in this county, a few men engaged in the Irish moss industry, the product amounting to 65,000 pounds, valued at $2,600.

Nantucket County has fisheries of considerable importance, engaging the attention of 488 persons. Of these, nearly two-thirds are in the shore fisheries. Ten vessels were engaged in fishing, one in transporting, and 209 boats were used in the shore fisheries. The apparatus utilized by vessels and boats consisted principally of seines, gill nets, pound nets, lines, lobster pots, dredges, tongs, and rakes.

The total weight and value of the products was 1,885,236 pounds, valued at $118,824. The principal species, fresh and salted, were as follows: Cod, 828,700 pounds, $33,018; bluefish, 41,960 pounds, $4,005; mackerel, 81,690 pounds, $4,577; pollock, 322,616 pounds, $7,919; clams, hard, 6,200 bushels, $10,850, and scallops, 19,600 bushels, $44,100. Compared with the returns for 1902 this county shows an increase of 1,115,906 pounds and $51,701 in value of its fishery products.

The following tables give the extent of the fisheries in each county of Massachusetts in 1905:

STATEMENT, BY COUNTIES, OF THE NUMBER OF PERSONS ENGAGED IN THE FISHERIES OF MASSACHUSETTS IN 1905.

Counties.	On vessels fishing.	On vessels transporting.	In shore or boat fisheries.	Shoresmen.	Total.
Barnstable	988	6	1,311	224	2,529
Bristol	746	2	390	203	1,331
Dukes	49	6	272	10	337
Essex	4,257	21	1,362	1,553	7,193
Nantucket	27	3	302	156	488
Norfolk	.....	.....	45	.....	45
Plymouth	165	.....	605	4	774
Suffolk	1,767	.....	304	926	2,997
Total	7,999	38	4,581	3,076	15,694

STATEMENT, BY COUNTIES, OF THE INVESTMENT IN THE FISHERIES OF MASSACHUSETTS IN 1905.

Items.	Barnstable.		Bristol.		Dukes.		Essex.		Nantucket.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	140	$328,275	42	$165,950	18	$18,300	315	$1,401,125	10	$11,000
Tonnage	3,481		4,990		160		17,015		82	
Outfit		121,496		236,035		4,116		628,554		1,235
Vessels transporting	3	2,100	1	2,000	2	2,000	7	9,700	1	500
Tonnage	66		16		12		330		5	
Outfit		230		360		385		1,490		30
Boats, sail and row	709	47,370	313	11,483	226	11,625	573	33,085	201	20,920
Boats, gasoline	190	70,255	35	13,950	57	26,700	280	72,475	8	4,000
Apparatus—vessel fisheries:										
Seines	14	5,460	1	150	2	90	147	97,720	5	760
Gill nets	2,393	19,833	385	3,610	398	3,702	6,738	74,286	310	3,360
Pound nets									4	2,500
Beam trawls	39	1,470								
Lines, hand and trawl		16,375		961		494		131,489		293
Dredges	76	262	2	36	19	47			28	61
Tongs and rakes	12	80	8	61					2	10
Lobster pots	340	420	100	100			410	820		
Harpoons, swordfish		59		114		56		1,110		9
Apparatus—shore fisheries:										
Seines	15	700	27	1,965	11	640	33	4,440		
Gill nets	628	5,316	47	180	60	360	554	2,192	60	1,200
Pound nets and trap nets	128	111,685	1	50	58	41,275	26	21,280		
Lines, hand and trawl		2,664		155		101		7,267		110
Cunner nets and traps							50	127		
Lobster pots	1,814	2,652	615	615	1,124	1,301	7,435	9,219	210	315
Eel pots	945	1,098			620	1,037	152	165		
Fyke nets	60	297	14	178						
Beam trawls	27	226								
Spears and gaffs	63	91	45	123	6	6	1	2	8	8
Harpoons, swordfish				18		28				
Tongs, rakes, forks, and hoes	696	3,376	203	1,311	115	524	613	310	30	150
Dredges	464	1,048	170	702	175	525			668	1,336
Dip nets	108	196			2	10	94	265		
Minor apparatus		39								50
Shore and accessory property		191,763		120,990		7,580		1,709,150		1,000
Cash capital		103,800		192,900		4,800		780,726		1,000
Total		1,038,636		753,997		125,702		4,986,997		49,847

STATEMENT, BY COUNTIES, OF THE INVESTMENT IN THE FISHERIES OF MASSACHUSETTS IN 1905—Continued.

Items.	Norfolk.		Plymouth.		Suffolk.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing			11	$78,250	113	$742,460	649	$2,745,360
Tonnage			651		6,582		32,961	
Outfit				29,080		279,580		1,300,096
Vessels transporting							14	16,300
Tonnage							429	
Outfit								2,495
Boats, sail and row	35	$705	587	21,970	145	6,310	2,879	153,468
Boats, gasoline	22	6,885	62	20,620	59	20,750	713	235,635
Apparatus—vessel fisheries:								
Seines			3	3,075	15	13,900	187	121,155
Gill nets			275	2,200	460	5,480	10,959	112,471
Pound nets							4	2,500
Beam trawls							39	1,470
Lines, hand and trawl				16,546		95,539		261,697
Dredges							125	406
Tongs and rakes							22	151
Lobster pots							850	1,340
Harpoons, swordfish				75		675		2,098
Apparatus—shore fisheries:								
Seines			2	85			88	7,830
Gill nets			10	84	154	1,535	1,513	10,867
Pound nets and trap nets			3	4,000			216	178,290
Lines, hand and trawl		1		47		2,015		12,360
Cunner nets and traps	37	58	6	12	9	27	111	224
Lobster pots	2,775	4,162	8,949	13,223	1,510	2,272	24,432	33,759
Eel pots			70	65			1,787	2,365
Fyke nets			6	25			80	500
Beam trawls							27	226
Spears and gaffs			3	2			126	232
Harpoons, swordfish								46
Tongs, rakes, forks, and hoes	9	54	473	1,230	20	45	2,159	7,000
Dredges			112	517			1,589	4,128
Dip nets	12	26	24	72			240	569
Rakes, Irish moss			101	505			101	505
Minor apparatus								89
Shore and accessory property		1,725		11,383		1,559,703		3,603,384
Cash capital				8,500		899,700		1,991,426
Total		13,616		211,566		3,630,081		10,810,442

STATEMENT, BY COUNTIES, OF THE PRODUCTS OF THE FISHERIES OF MASSACHUSETTS IN 1905.

Products.	Barnstable.		Bristol.		Dukes.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives, fresh	345,100	$3,400	86,750	$900	210,780	$2,547
Alewives, salted	710,800	13,552	329,500	4,955	5,000	125
Alewives, smoked	75,000	1,500				
Bluefish	34,690	3,455	2,600	260	19,580	1,589
Bonito	10,600	516			16,250	806
Butterfish	38,890	1,656			30,000	1,350
Catfish	2,475	50				
Cod, fresh	10,085,725	201,798	240,600	5,157	263,600	5,280
Cod, salted	1,055,637	50,507	145,000	3,209	62,000	3,100
Cusk, fresh	120,100	1,869				
Eels	323,620	17,424	53,000	3,054	70,200	3,921
Flounders, fresh	2,335,533	57,326	75,700	1,520	337,600	6,867
Flounders, salted	2,000	40				
Haddock, fresh	8,080,211	121,304	119,000	1,885	76,500	1,245
Haddock, salted	5,570	120	7,500	150		
Hake, fresh	1,964,575	29,268	2,000	30	2,000	40
Hake, salted	4,700	59	7,500	150		
Halibut, fresh	222,248	15,188	9,300	837		
Halibut, salted	480	20				
Herring, fresh	2,210,490	22,880				
Hickory shad	4,100	76				
Horse mackerel	190,809	4,193				
Mackerel, fresh	1,720,912	92,718	246,700	11,088	311,130	15,086
Mackerel, salted	54,000	2,900	17,000	680	2,000	140
Menhaden, fresh	416,690	2,018	200,000	650	16,000	100
Menhaden, salted	600	12				
Perch, white			4,350	355	15,300	1,065
Perch, yellow			10,000	800		
Pollock, fresh	6,073,309	83,558	10,300	207	20,550	412
Pollock, salted	7,145	125	7,500	150		
Sand eels	573,100	9,502				
Scup	91,800	2,341	36,000	752	832,400	21,513
Sea bass	26,400	1,235	5,200	204	90,400	4,470
Shad, fresh	34,390	2,047	24,928	2,296	1,650	86
Sharks	200	3				
Skates	1,000	10				
Smelt	325	65	3,150	361	2,000	180
Squeteague	2,823,566	57,545	11,200	224	2,147,700	43,627
Striped bass	6,850	866	14,000	700	200	21
Sturgeon	10,385	824			1,500	113
Caviar	120	60			147	79
Swordfish	92,250	4,990	231,100	12,667	155,720	8,441
Tautog	49,773	1,280	143,050	4,792	26,900	833
Tom cod	4,400	110	7,000	215		
Whiting, fresh	2,394,090	12,712				
Lobsters	88,198	11,567	34,250	4,343	59,670	7,373
Shrimp	2,000	500				
Squid	700,500	8,192			39,450	417
Clams, hard	702,528	138,522	289,720	71,525	144,000	31,500
Clams, soft	49,940	4,904	36,550	4,606	12,000	1,200
Clams, razor	40,500	1,620				
Oysters, market	661,850	181,190	37,100	6,945		
Oysters, seed	5,600	90	33,600	2,400		
Scallops	60,672	22,752	15,005	5,625	67,360	25,260
Oil, whale	420,525	25,720	3,513,029	220,845		
Oil, sea-elephant			590,625	25,000		
Whalebone			55,950	193,037		
Ambergris	14	2,900	80	14,000		
Sea-elephant skins			5,000	600		
Livers	190,646	1,907				
Sounds	1,118	11				
Cod roe	5,740	58				
Total	45,134,489	1,221,205	6,660,837	607,174	5,039,587	188,786

STATEMENT, BY COUNTIES, OF THE PRODUCTS OF THE FISHERIES OF MASSACHUSETTS IN 1905—Continued.

Products.	Essex.		Nantucket.		Norfolk.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives, fresh	1,808,400	$17,095			27,400	$274
Alewives, salted			25,000	$500	1,600	24
Amberfish			400	15		
Bluefish	1,000	50	41,960	4,005		
Bonito			38,200	1,720		
Butterfish	13,400	483	600	24		
Catfish	60,200	994				
Cod, fresh	19,817,347	485,977	301,700	6,668	4,800	96
Cod, salted	15,472,776	613,167	527,000	26,350		
Cusk, fresh	4,609,869	68,254				
Cusk, salted	477,803	10,644				
Cunners	92,750	4,785			15,400	770
Eels	32,225	2,124	8,000	480		
Flounders, fresh	61,850	1,140	31,000	930		
Haddock, fresh	20,526,553	355,119	169,570	2,614		
Haddock, salted	907,972	16,924				
Hake, fresh	9,345,563	107,222				
Hake, salted	378,609	5,465				
Halibut, fresh	2,532,194	155,616				
Halibut, salted	465,429	18,610				
Herring, fresh	12,070,939	232,433			114,000	1,500
Herring, salted	2,991,625	112,597				
Horse mackerel	7,900	135	1,500	60		
Mackerel, fresh	5,523,371	394,732	81,690	4,577		
Mackerel, salted	4,874,616	326,244				
Menhaden, fresh	377,500	3,495				
Menhaden, salted			8,000	240		
Pollock, fresh	16,780,473	151,145	322,116	7,904		
Pollock, salted	288,888	4,042	500	15		
Scup			50,300	1,809		
Shad, fresh	16,300	420	1,860	186		
Shad, salted	12,000	311				
Sharks	200	5				
Skates	335	5				
Smelt	1,900	260				
Squeteague	120,800	3,813	59,900	1,797		
Sturgeon			300	30		
Caviar			40	28		
Swordfish	711,584	41,072	30,400	1,672		
Tautog	700	18				
Whiting, fresh	1,854,000	5,865				
Whiting, salted	1,600	20				
Refuse fish	1,826	38				
Lobsters	478,093	67,360	18,000	2,250	113,214	15,850
Squid	45,800	506				
Clams, hard			49,600	10,850		
Clams, soft	1,873,900	187,105				
Scallops			117,600	44,100		
Irish moss					65,000	2,600
Oil, cod	26,325	856				
Livers	370,380	3,714				
Sounds	58,000	3,979				
Halibut fins	9,990	710				
Cod roe	7,500	227				
Total	125,170,485	3,404,866	1,885,236	118,824	341,414	21,114

STATEMENT, BY COUNTIES, OF THE PRODUCTS OF THE FISHERIES OF MASSACHUSETTS IN 1905.

Products.	Plymouth.		Suffolk.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives, fresh	82,500	$625			2,560,930	$24,841
Alewives, salted	361,600	3,605			1,433,500	22,761
Alewives, smoked					75,000	1,500
Amberfish					400	15
Bluefish	1,100	110			100,930	9,469
Bonito					65,050	3,042
Butterfish					82,890	3,513
Catfish					62,675	1,044
Cod, fresh	912,648	18,445	13,361,290	$268,258	44,987,710	991,679
Cod, salted	12,500	605			17,274,913	696,938
Cusk, fresh	147,400	2,211	2,041,026	30,978	6,978,395	103,312
Cusk, salted					477,803	10,644
Cunners	2,750	115	5,000	350	115,900	6,020
Eels	11,700	582	43,200	3,456	541,945	31,041
Flounders, fresh			1,200,000	30,000	4,041,683	97,783
Flounders, salted					2,000	40
Haddock, fresh	1,989,566	29,822	35,171,519	539,921	66,132,919	1,051,910
Haddock, salted					921,042	17,194
Hake, fresh	690,200	8,600	8,305,820	107,604	20,310,158	252,764
Hake, salted					390,809	5,674
Halibut, fresh	189,700	18,970	93,650	8,991	3,047,092	199,602
Halibut, salted					465,909	18,630
Herring, fresh	332,400	3,324	525,000	6,562	15,252,829	266,099
Herring, salted			120,000	2,400	3,111,625	114,997
Hickory shad					4,100	76
Horse mackerel	1,500	45			201,709	4,433
Mackerel, fresh	148,464	12,944	758,488	72,370	8,790,755	603 515
Mackerel, salted	48,600	4,374	317,000	28,530	5,313,216	362,928
Menhaden, fresh					1,010,190	6,263
Menhaden, salted					8,600	252
Perch, white					19,650	1,420
Perch, yellow					10,000	800
Pollock, fresh	48,600	491	1,926,490	19,878	25,181,838	263,595
Pollock, salted					304,033	4,332
Sand eels					573,100	9,502
Scup	8,700	336			1,010,200	26,751
Sea bass	300	15			122,300	5,924
Shad, fresh					79,128	5,035
Shad, salted					12,000	311
Sharks					400	8
Skates					1,335	15
Smelt					7,375	866
Squeteague	61,650	1,194			5,224,816	108,200
Striped bass					21,050	1,587
Sturgeon					12,185	967
Caviar					307	167
Swordfish	71,000	7,100	411,500	40,750	1,703,554	116,692
Tautog	19,700	778			240,123	7,701
Tom cod	52,000	780			63,400	1,105
Whiting, fresh			50,000	500	4,298,090	19,077
Whiting, salted					1,600	20
Refuse fish					1,826	38
Crabs, hard			60,000	500	60,000	500
Lobsters	391,290	52,767	100,356	14,724	1,283,071	176,234
Shrimp					2,000	500
Squid					785,750	9,205
Clams, hard	146,360	36,590			1,332,208	288,987
Clams, soft	30,000	3,000	172,800	8,640	2,175,190	209,545
Clams, razor					40,500	1,620
Oysters, market	89,110	19,340			788,660	207,475
Oysters, seed	168,350	12,025			207,550	14,515
Scallops	2,600	975			263,237	98,712
Cockles	37,000	11,100			37,000	11,100
Irish moss	700,000	28,000			765,000	30,600
Oil, whale					3,933,554	246,565
Oil, cod					26,325	856
Oil, sea-elephant					590,625	25,000
Whalebone					55,950	193,037
Ambergris					94	16,900
Sea-elephant skins					5,000	600
Livers					561,026	5,621
Sounds					59,118	3,990
Halibut fins					9,990	710
Cod roe					13,240	285
Total	6,759,288	278,868	64,663,139	1,184,412	255,654,475	7,025,249

THE PRODUCTS BY APPARATUS.

The following table shows in condensed form the pounds and value of products taken by each form of apparatus:

APPARATUS USED IN THE VESSEL AND SHORE FISHERIES OF MASSACHUSETTS IN 1905.

Apparatus.	Vessel fisheries.		Shore fisheries.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines	16,502,859	$859,933	3,993,858	$48,410	20,496,717	$908,343
Gill nets	12,310,449	419,151	940,374	20,057	13,250,823	439,208
Pound nets and trap nets	464,516	13,331	19,396,822	300,536	19,861,338	313,867
Beam trawls	1,546,386	39,575	164,700	4,564	1,711,086	44,139
Lines	167,925,564	3,283,418	14,864,949	324,145	182,790,513	3,607,563
Cunner nets and traps			113,650	5,930	113,650	5,930
Pots, lobster and eel	55,050	7,434	1,634,866	191,565	1,689,916	198,999
Fyke nets			68,700	3,328	68,700	3,328
Dip nets			3,686,600	41,412	3,686,600	41,412
Harpoons	1,642,564	113,462	60,900	3,225	1,703,464	116,687
Spears and gaffs			2,700	117	2,700	117
Dredges, tongs, rakes, etc	130,150	33,155	5,425,915	814,719	5,556,065	847,874
Whaling apparatus	4,585,223	482,102			4,585,223	482,102
Minor apparatus			137,680	15,680	137,680	15,680
Total	205,162,761	5,251,561	50,491,714	1,773,688	255,654,475	7,025,249

Lines.—Considering the value of the catch, lines are the most important apparatus used in the fisheries of the state, the value of the output being more than one-half of the entire catch. Both hand and trawl lines were used, but the latter are by far the more important. The leading species taken on lines are haddock, cod, hake, pollock, halibut, cusk, mackerel, and flounders. Other species, such as tautog, scup, sea bass, eels, bluefish, squeteague, catfish, etc., were also taken in considerable quantities, but their capture was confined to comparatively few localities. The value of the secondary products, as livers, sounds, roe, and oil, amounted to $10,752. Of the total line catch, 167,925,564 pounds, valued at $3,283,418, were taken in the vessel fisheries, and 14,864,949 pounds, valued at $324,145, were taken in the shore fisheries. The most important centers in the state from which this fishery is prosecuted are Gloucester, Boston, and Provincetown.

STATEMENT, BY COUNTIES, OF THE YIELD OF THE HAND AND TRAWL LINE FISHERIES OF MASSACHUSETTS IN 1905.

Products.	Barnstable.		Bristol.		Dukes.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Vessel fisheries:						
Bluefish	2,650	$225			9,450	$766
Cod, fresh	8,289,350	165,857	175,000	$3,500	216,800	4,336
Cod, salted	688,737	32,162	140,000	3,059		
Cusk, fresh	120,100	1,869				
Flounders	50,400	1,173	7,400	148	80,900	1,638
Haddock, fresh	7,593,900	114,010	118,000	1,865	69,000	1,095
Haddock, salted	5,570	120	7,500	150		
Hake, fresh	1,491,000	22,165	2,000	30		
Hake, salted	4,700	59	7,500	150		
Halibut, fresh	211,550	14,219	9,300	837		
Halibut, salted	480	20				
Mackerel, fresh	223,200	11,040	122,500	5,190	101,900	4,655
Mackerel, salted	4,000	310	17,000	680	2,000	140
Pollock, fresh	1,710,300	27,685	3,300	66		
Pollock, salted	7,145	125	7,500	150		
Scup	4,500	115	5,900	179	20,800	714
Sea bass	4,700	155	3,000	120	18,800	890
Squeteague	16,000	320			4,000	80
Tautog	7,100	183	2,000	80		
Livers	151,200	1,512				
Total	20,586,582	393,324	627,900	16,204	523,650	14,314
Shore fisheries:						
Bluefish	1,200	120	2,600	260	9,480	758
Catfish	2,475	50				
Cod, fresh	1,617,897	32,356	65,600	1,657	46,400	928
Cod, salted	366,900	18,345	5,000	150	62,000	3,100
Eels	1,000	60	1,000	80	2,400	144
Flounders	182,747	3,973	68,000	1,360	171,800	3,436
Haddock	406,311	6,094	1,000	20	7,500	150
Hake	461,575	6,923			2,000	40
Halibut	10,698	969				
Mackerel	47,200	2,360	31,200	1,248	46,130	2,276
Pollock	953,328	14,301	7,000	141	1,800	36
Scup	22,800	656	30,100	573	52,000	2,077
Sea bass	21,500	1,075	2,200	84	50,800	2,540
Squeteague	13,700	336	11,200	224	15,900	341
Striped bass	1,800	180	14,000	700		
Tautog	13,700	498	140,550	4,692	16,000	540
Livers	39,446	395				
Sounds	1,118	11				
Cod roe	5,740	58				
Total	4,171,135	88,760	379,450	11,189	484,210	16,366
Grand total	24,757,717	482,084	1,007,350	27,393	1,007,860	30,680

STATEMENT, BY COUNTIES, OF THE YIELD OF THE HAND AND TRAWL LINE FISHERIES OF MASSACHUSETTS IN 1905—Continued.

Products.	Essex.		Nantucket.		Norfolk.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Vessel fisheries:						
Bluefish			11,000	$1,100		
Catfish	22,500	$394				
Cod, fresh	16,378,122	404,163	134,800	3,096		
Cod, salted	15,472,776	613,167	127,000	6,350		
Cusk, fresh	4,651,069	67,979				
Cusk, salted	477,803	10,644				
Flounders	1,500	20				
Haddock, fresh	20,127,353	346,455	14,170	283		
Haddock, salted	907,972	16,924				
Hake, fresh	8,350,063	96,280				
Hake, salted	378,609	5,465				
Halibut, fresh	2,532,094	155,608				
Halibut, salted	465,429	18,610				
Mackerel, fresh	1,800	110				
Mackerel, salted	3,000	200				
Pollock, fresh	13,649,533	119,663				
Pollock, salted	288,888	4,042	500	15		
Sharks	200	5				
Skates	335	5				
Refuse fish	1,826	38				
Halibut fins	9,990	710				
Livers	370,380	3,714				
Sounds	58,000	3,979				
Cod roe	7,500	227				
Cod oil	26,325	856				
Total	84,183,067	1,869,258	287,470	10,844		
Shore fisheries:						
Catfish	37,700	600				
Cod, fresh	1,280,400	30,968	120,000	2,400	4,800	$96
Cod, salted			400,000	20,000		
Cunners	250	10				
Cusk	18,800	275				
Flounders	52,350	920	30,000	900		
Haddock	399,200	8,664	155,400	2,331		
Hake	995,500	10,942				
Halibut	100	8				
Mackerel	1,000	50	4,590	230		
Pollock	1,802,450	17,553	30,000	600		
Scup			20,300	609		
Smelt	1,900	260				
Total	4,589,650	70,250	760,290	27,070	4,800	96
Grand total	88,772,717	1,939,508	1,047,760	37,914	4,800	96

STATEMENT, BY COUNTIES, OF THE YIELD OF THE HAND AND TRAWL LINE FISHERIES OF MASSACHUSETTS IN 1905—Continued.

Products.	Plymouth.		Suffolk.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Vessel fisheries:						
Bluefish					23,100	$2,091
Catfish					22,500	304
Cod, fresh	786,600	$15,732	12,590,290	$245,338	38,570,962	842,022
Cod, salted	3,000	130			16,431,513	654,868
Cusk, fresh	147,400	2,211	2,041,026	30,978	6,959,595	103,037
Cusk, salted					477,803	10,644
Flounders					140,200	2,979
Haddock, fresh	1,973,000	29,585	33,671,519	502,421	63,566,942	995,714
Haddock, salted					921,042	17,194
Hake, fresh	690,200	8,600	7,605,820	97,104	18,139,083	224,179
Hake, salted					390,809	5,674
Halibut, fresh	189,700	18,970	93,650	8,991	3,036,294	198,625
Halibut, salted					465,909	18,630
Mackerel fresh			600	60	450,000	21,055
Mackerel, salted					26,000	1,330
Pollock, fresh	47,600	476	1,876,490	18,878	17,287,223	166,768
Pollock, salted					304,033	4,332
Scup					31,200	1,008
Sea bass					26,500	1,165
Sharks					200	5
Skates					335	5
Squeteague					20,000	400
Tautog					9,100	263
Refuse fish					1,826	38
Halibut fins					9,990	710
Livers					521,580	5,226
Sounds					58,000	3,979
Cod roe					7,500	227
Cod oil					26,325	856
Total	3,837,500	75,704	57,879,395	903,770	167,925,564	3,283,418
Shore fisheries:						
Bluefish	1,100	110			14,380	1,248
Catfish					40,175	650
Cod, fresh	106,048	2,313	750,000	22,500	3,991,145	93,218
Cod, salted	9,500	475			843,400	42,070
Cunners					250	10
Cusk					18,800	275
Eels			43,200	3,456	47,600	3,740
Flounders			1,200,000	30,000	1,704,897	40,589
Haddock	16,566	237	1,500,000	37,500	2,485,977	54,996
Hake			700,000	10,500	2,159,075	28,405
Halibut					10,798	977
Mackerel	4,000	200			134,120	6,364
Pollock			50,000	1,000	2,844,578	33,631
Scup	8,700	336			133,900	4,251
Sea bass	300	15			74,800	3,714
Smelt					1,900	260
Squeteague	16,800	504			57,600	1,405
Striped bass					15,800	880
Tautog	19,200	768			189,450	6,498
Whiting			50,000	500	50,000	500
Livers					39,446	395
Sounds					1,118	11
Cod roe					5,740	58
Total	182,214	4,958	4,293,200	105,456	14,864,949	324,145
Grand total	4,019,714	80,662	62,172,595	1,009,226	182,790,513	3,607,563

Seines.—Next to lines in importance are seines, the catch with which was 20,496,717 pounds, valued at $908,343. Of this amount 16,502,859 pounds, valued at $859,933, were taken in the vessel fisheries, and 3,993,858 pounds, valued at $48,410, were taken in the shore fisheries. Purse seines are used in the vessel and haul seines in the shore fisheries. The leading species taken in seines were mackerel, herring, and alewives, these three constituting more than four-fifths of the catch. Pollock, menhaden, cod, shad, whiting, etc., were also taken in considerable quantities. The mackerel were taken along the coast from Cape Hatteras to the Gulf of St. Lawrence, from March until late in the fall, while most of the herring were taken off Newfoundland during the winter.

STATEMENT, BY COUNTIES, OF THE YIELD OF THE SEINE FISHERIES OF MASSACHUSETTS IN 1905.

Products.	Barnstable.		Bristol.		Dukes.		Essex.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Vessel fisheries:								
Alewives, fresh							360,000	$3,600
Bluefish	11,200	$1,120						
Cod							190,000	3,600
Flounders	3,340	167			2,000	$40		
Herring, fresh	608,800	6,238					2,006,250	58,317
Herring, salted							1,285,800	25,238
Mackerel, fresh	365,725	21,065					4,038,746	307,863
Mackerel, salted	50,000	2,650					4,845,216	324,644
Menhaden	239,000	657	200,000	$650	4,000	40	343,600	3,240
Pollock	31,000	1,550					864,855	10,231
Sand eels	65,800	1,645						
Shad, salted							12,000	311
Squeteague	43,227	933						
Total	1,418,092	36,025	200,000	650	6,000	80	13,946,467	737,044
Shore fisheries:								
Alewives, fresh	100,000	1,000	84,000	855	149,180	2,095	1,300,000	12,300
Alewives, salted	416,800	8,643	329,500	4,955	5,000	125		
Bluefish					450	45		
Cod							40,000	750
Eels	4,000	200			5,900	236		
Flounders	10,700	214			6,500	235		
Herring							421,300	5,415
Mackerel							9,100	475
Perch, white			3,000	240	15,300	1,065		
Perch, yellow			10,000	800				
Pollock							176,000	1,548
Sand eels	14,000	350						
Shad			24,928	2,296				
Smelt			3,100	356	2,000	180		
Shrimp	2,000	500						
Squeteague					2,600	52		
Striped bass	3,500	525						
Tomcod			5,000	175				
Whiting							800,000	2,000
Total	551,000	11,432	459,528	9,677	186,930	4,033	2,746,400	22,488
Grand total	1,969,092	47,457	659,528	10,327	192,930	4,113	16,692,867	759,532

STATEMENT, BY COUNTIES, OF THE YIELD OF THE SEINE FISHERIES OF MASSACHUSETTS IN 1905—Continued.

Products.	Nantucket.		Plymouth.		Suffolk.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Vessel fisheries:								
Alewives, fresh							360,000	$3,600
Bluefish	13,400	$1,180					24,600	2,300
Cod							190,000	3,600
Flounders							5,340	207
Herring, fresh			20,000	$200			2,635,050	64,755
Herring, salted							1,285,800	25,238
Mackerel, fresh			44,000	4,400	497,300	$49,070	4,945,771	382,398
Mackerel, salted			48,600	4,374	297,000	26,730	5,240,816	358,398
Menhaden							786,600	4,587
Pollock							895,855	11,781
Sand eels							65,800	1,645
Shad, salted							12,000	311
Squeteague							43,227	933
Tomcod			12,000	180			12,000	180
Total	13,400	1,180	124,600	9,154	794,300	75,800	16,502,859	859,933
Shore fisheries:								
Alewives, fresh							1,633,180	16,250
Alewives, salted			10,000	180			761,300	13,903
Bluefish							450	45
Cod							40,000	750
Eels							9,900	436
Flounders							17,200	449
Herring							421,300	5,415
Mackerel							9,100	475
Perch, white							18,300	1,305
Perch, yellow							10,000	800
Pollock							176,000	1,548
Sand eels							14,000	350
Shad							24,928	2,296
Smelt							5,100	536
Shrimp							2,000	500
Squeteague							2,600	52
Striped bass							3,500	525
Tomcod			40,000	600			45,000	775
Whiting							800,000	2,000
Total			50,000	780			3,993,858	48,410
Grand total	13,400	1,180	174,600	9,934	794,300	75,800	20,496,717	908,343

Dredges, tongs, rakes, forks, and hoes.—The total catch by these apparatus was 5,556,065 pounds, valued at $847,874. Of this 130,150 pounds, valued at $33,155, was taken in the vessel fisheries, and 5,425,915 pounds, valued at $814,719, in the shore fisheries, showing a great preponderance for the latter. The products consisted of hard, soft, and razor clams, oysters, and Irish moss. Clams contributed more than one-half of the total value. They are taken mainly with rakes and hoes, and the oysters with tongs. A special rake is used for collecting Irish moss from the rocks.

STATEMENT, BY COUNTIES, OF THE CATCH BY DREDGES, TONGS, RAKES, HOES, AND FORKS IN MASSACHUSETTS IN 1905.

Products.	Barnstable.		Bristol.		Dukes.		Essex.		Nantucket.	
	Pounds.	Value.	Lbs.	Value.	Lbs.	Value.	Pounds.	Value.	Lbs.	Value.
Vessel fisheries:										
Clams, soft			2,000	$300						
Clams, hard	23,280	$4,365	15,200	3,800					1,600	$350
Oysters, market	35,350	9,750	28,000	5,320						
Scallops	12,040	4,515			7,360	$2,760			5,320	1,995
Total	70,670	18,630	45,200	9,420	7,360	2,760			6,920	2,345
Shore fisheries:										
Clams, soft	49,940	4,994	34,550	4,306	12,000	1,200	1,873,900	$187,105		
Clams, hard	675,248	133,407	267,320	66,575	144,000	31,500			48,000	10,500
Clams, razor	40,500	1,620								
Oysters, seed	5,600	90	33,600	2,400						
Oysters, market	626,500	171,440	9,100	1,625						
Scallops	44,152	16,557	15,005	5,625	60,000	22,500			112,280	42,105
Irish moss										
Total	1,441,940	328,108	359,575	80,531	216,000	55,200	1,873,900	187,105	160,280	52,605
Grand total	1,512,610	346,738	404,775	89,951	223,360	57,960	1,873,900	187,105	167,200	54,950

Products.	Norfolk.		Plymouth.		Suffolk.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Vessel fisheries:								
Clams, soft							2,000	$300
Clams, hard							40,080	8,515
Oysters, market							63,350	15,070
Scallops							24,720	9,270
Total							130,150	33,155
Shore fisheries:								
Clams, soft			30,000	$3,000	172,800	$8,640	2,173,190	200,245
Clams, hard			146,360	36,590			1,280,928	278,572
Clams, razor							40,500	1,620
Oysters, seed			168,350	12,025			207,550	14,515
Oysters, market			89,110	19,340			724,710	192,405
Scallops			2,600	975			234,037	87,762
Irish moss	65,000	$2,600	700,000	28,000			765,000	30,600
Total	65,000	2,600	1,136,420	99,930	172,800	8,640	5,425,915	814,719
Grand total	65,000	2,600	1,136,420	99,930	172,800	8,640	5,556,065	847,874

Whaling apparatus.—The catch by these apparatus consisted of secondary products from whales and sea elephants, such as oil, whalebone, ambergris, and sea-elephant skins. The value of the catch was $482,102, all of which is credited to the vessel fisheries.

STATEMENT, BY COUNTIES, OF THE PRODUCTS OF THE WHALE FISHERIES OF MASSACHUSETTS IN 1905.

Products (vessel fisheries).	Barnstable.		Bristol.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Oil, whale	420,525	$25,720	3,513,029	$220,845	3,933,554	$246,565
Whalebone			55,950	193,037	55,950	193,037
Ambergris	14	2,900	80	14,000	94	16,900
Sea elephant oil			590,625	25,000	590,625	25,000
Sea elephant skins			5,000	600	5,000	600
						482,102
Total	420,539	28,620	4,164,684	453,482	4,585,223	

Gill nets.—Gill nets yielded 13,250,823 pounds of products, valued at $439,208. Of this 12,310,449 pounds, valued at $419,151, was taken in the vessel fisheries, and the remainder, less than 5 per cent, in the shore fisheries. Herring and mackerel constituted nearly 90 per cent of the value of the entire yield. Important catches of cod and bluefish were made also. The herring were taken mostly off Newfoundland, and the mackerel along the Atlantic coast. The herring were sold principally in Boston and Gloucester, either frozen or salted, and the mackerel in New York, Boston, Newport, Gloucester, and other cities. Gill nets for cod were used mainly in Essex County.

STATEMENT, BY COUNTIES, OF THE YIELD OF THE GILL NET FISHERIES OF MASSACHUSETTS IN 1905.

Products.	Barnstable.		Bristol.		Dukes.		Essex.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Vessel fisheries:								
Alewives							6,000	$30
Bluefish	10,100	$990						
Bonito								
Butterfish	3,600	180						
Cod							1,757,900	42,086
Herring, fresh	7,000	175					5,986,089	127,436
Herring, salted							1,705,825	87,359
Mackerel, fresh	594,387	31,499	88,500	$4,425	88,400	$4,420	1,327,300	78,217
Mackerel, salted							26,400	1,400
Menhaden, fresh							6,000	30
Menhaden, salted	600	12						
Pollock							104,000	885
Shad							300	20
Squeteague	14,000	410						
Striped bass	1,000	100						
Total	630,687	33,366	88,500	4,425	88,400	4,420	10,919,814	337,463
Shore fisheries:								
Alewives							80,000	500
Bluefish	3,600	420						
Cod, fresh							132,700	3,570
Flounders							8,000	200
Herring	8,000	80					25,500	275
Mackerel	65,510	3,284	4,500	225	13,500	675	48,000	2,650
Squeteague	6,100	142						
Total	83,210	3,926	4,500	225	13,500	675	294,200	7,195
Grand total	713,897	37,292	93,000	4,650	101,900	5,095	11,214,014	344,658

STATEMENT, BY COUNTIES, OF THE YIELD OF THE GILL NET FISHERIES OF MASSACHUSETTS IN 1905—Continued.

Products.	Nantucket.		Plymouth.		Suffolk.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Vessel fisheries:								
Alewives							6,000	$30
Bluefish	6,160	$585					16,260	1,575
Bonito	21,000	860					21,000	860
Butterfish							3,600	180
Cod					21,000	$420	1,778,900	42,506
Herring, fresh							5,993,089	127,611
Herring, salted					120,000	2,400	1,825,825	89,759
Mackerel, fresh	67,000	3,842	69,300	$6,480	258,588	23,090	2,493,475	151,973
Mackerel, salted					20,000	1,800	46,400	3,200
Menhaden, fresh							6,000	30
Menhaden, salted							600	12
Pollock							104,000	885
Shad							300	20
Squeteague							14,000	410
Striped bass							1,000	100
Total	94,160	5,287	69,300	6,480	419,588	27,710	12,310,449	419,151
Shore fisheries:								
Alewives							80,000	500
Bluefish	10,800	1,080					14,400	1,500
Cod, fresh							132,700	3,570
Flounders							8,000	200
Herring					525,000	6,562	558,500	6,917
Mackerel			1,164	64	2,000	150	134,674	7,048
Squeteague	6,000	180					12,100	322
Total	16,800	1,260	1,164	64	527,000	6,712	940,374	20,057
Grand total	110,960	6,547	70,464	6,544	946,588	34,422	13,250,823	439,208

Pound nets and trap nets.—The catch by these apparatus was 19,861,338 pounds, valued at $313,867, of which 97 per cent of the quantity and 95 per cent of the value are credited to the shore fisheries. Squeteague constituted nearly one-third of the value of the entire catch, an increase of nearly 25 per cent since 1902, and nearly 300 per cent since 1898. Other important species taken in these apparatus were pollock, mackerel, herring, scup, whiting, squid, flounders, cod, horse mackerel, alewives, and butterfish. Several species of minor importance are also taken. Pound nets are used mainly in Barnstable, Dukes, Essex, and Nantucket counties, Barnstable exceeding all other counties in the quantity and value of products taken by this form of apparatus. Suffolk County does not show any pound nets for the reason that the nets of one firm previously credited to that county are now shown under Essex County.

STATEMENT, BY COUNTIES, OF THE YIELD OF THE POUND-NET AND TRAP-NET FISHERIES OF MASSACHUSETTS IN 1905.

Products.	Barnstable.		Bristol.		Dukes.		Essex.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Shore fisheries:								
Alewives, fresh	114,100	$1,283	1,500	$30	56,600	$352	62,400	$665
Alewives, salted	52,000	1,062						
Bluefish	5,940	580			200	20	1,000	50
Bonito	10,600	516			16,250	806		
Butterfish	35,290	1,476			30,000	1,350	13,400	483
Cod	178,478	3,585			400	16	38,225	840
Eels	18,300	989	400	32	1,400	76		
Flounders	372,760	7,540			76,400	1,518		
Haddock	80,000	1,200						
Hake	12,000	180						
Herring	1,586,690	16,387					1,155,300	13,790
Hickory shad	4,100	76						
Horse mackerel	190,809	4,193					7,900	135
Mackerel	424,890	23,470			61,200	3,060	97,425	5,367
Menhaden	177,690	1,361			12,000	60	27,900	225
Pollock	3,378,681	40,022			18,750	376	183,635	1,265
Sand eels	493,300	7,507						
Scup	64,500	1,570			759,600	18,722		
Sea bass	200	5			20,800	1,040		
Shad	34,390	2,047			1,650	86	16,000	400
Sharks	200	3						
Skates	1,000	10						
Smelt	325	65	50	5				
Squeteague	2,730,539	55,404			2,125,200	43,154	120,800	3,813
Squid	700,500	8,192			39,450	417	45,800	596
Striped bass	550	61			200	21		
Sturgeon	10,385	824			1,500	113		
Caviar	120	60			147	79		
Swordfish					90	5		
Tautog	28,973	599			10,900	203	700	18
Tomcod	4,400	110						
Whiting, fresh	2,394,090	12,712					1,054,000	3,865
Whiting, salted							1,600	20
Total	13,105,800	193,089	1,950	67	3,232,737	71,564	2,826,085	31,532
Grand total	13,105,800	193,089	1,950	67	3,232,737	71,564	2,826,085	31,532

Products.	Nantucket.		Plymouth.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Shore fisheries:						
Alewives, fresh					234,600	$2,330
Alewives, salted					52,000	1,062
Bluefish					7,140	650
Bonito					26,850	1,322
Butterfish					78,690	3,309
Cod			20,000	$400	237,103	4,841
Eels					20,100	1,097
Flounders					449,160	9,058
Haddock					80,000	1,200
Hake					12,000	180
Herring			132,400	1,324	2,874,390	31,501
Hickory shad					4,100	76
Horse mackerel			1,500	45	200,209	4,373
Mackerel			30,000	1,800	613,515	33,697
Menhaden					217,590	1,646
Pollock			1,000	15	3,582,066	41,678
Sand eels					493,300	7,507
Scup					824,100	20,292
Sea bass					21,000	1,045
Shad					52,040	2,533
Sharks					200	3
Skates					1,000	10
Smelt					375	70
Squeteague			44,850	690	5,021,389	103,061
Squid					785,750	9,205
Striped bass					750	82
Sturgeon					11,885	937
Caviar					267	139
Swordfish					90	5
Tautog			500	10	41,073	920
Tomcod					4,400	110
Whiting, fresh					3,448,090	16,577
Whiting, salted					1,600	20
Total			230,250	4,284	19,396,822	300,536

STATEMENT, BY COUNTIES, OF THE YIELD OF THE POUND-NET AND TRAP-NET FISHERIES OF MASSACHUSETTS IN 1905—Continued.

Products.	Nantucket.		Plymouth.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Vessel fisheries:						
Amberfish	400	$15			400	$15
Bluefish	600	60			600	60
Bonito	17,200	860			17,200	860
Butterfish	600	24			600	24
Cod	46,900	1,172			46,900	1,172
Flounders	1,000	30			1,000	30
Horse mackerel	1,500	60			1,500	60
Mackerel	10,100	505			10,100	505
Pollock	292,116	7,304			292,116	7,304
Menhaden, salted	8,000	240			8,000	240
Scup	30,000	1,200			30,000	1,200
Shad	1,860	186			1,860	186
Squeteague	53,900	1,617			53,900	1,617
Sturgeon	300	30			300	30
Caviar	40	28			40	28
Total	464,516	13,331			464,516	13,331
Grand total	464,516	13,331	230,250	$4,284	19,861,338	313,867

Lobster and eel pots.—The catch by pots consisted of 1,283,071 pounds of lobsters, valued at $176,234, and 406,845 pounds of eels, valued at $22,765. All of the eels and 96 per cent of the lobsters were taken in the shore fisheries. Lobsters are taken in every county of the state where commercial fisheries are carried on, but Essex and Plymouth lead all others in the quantity and value of the catch. The use of eel pots is not so general. Hard crabs are taken in pots similar to lobster pots except that the laths are placed closer together. This catch is shown in the tables under the yield of minor apparatus.

STATEMENT, BY COUNTIES, OF THE CATCH OF LOBSTER POTS IN MASSACHUSETTS IN 1905.

Counties.	Vessel fisheries.		Shore fisheries.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Barnstable	17,150	$2,234	71,048	$9,333	88,198	$11,567
Bristol	10,000	1,200	24,250	3,143	34,250	4,343
Dukes			59,670	7,373	59,670	7,373
Essex	27,900	4,000	450,193	63,360	478,093	67,360
Nantucket			18,000	2,250	18,000	2,250
Norfolk			113,214	15,850	113,214	15,850
Plymouth			391,290	52,767	391,290	52,767
Suffolk			100,356	14,724	100,356	14,724
Total	55,050	7,434	1,228,021	168,800	1,283,071	176,234

Harpoons.—Besides their use in the whale fishery, harpoons are used in capturing swordfish, the catch of which in 1905 amounted to 1,703,464 pounds, valued at $116,687, 96 per cent of which were taken in the vessel fisheries. The catch in 1905 was considerably more than twice as large as in 1902, and was taken in all the fishery counties except Norfolk.

STATEMENT, BY COUNTIES, OF THE CATCH OF SWORDFISH BY HARPOONS IN THE VESSEL AND SHORE FISHERIES OF MASSACHUSETTS IN 1905.

Counties.	Vessel fisheries.		Shore fisheries.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Barnstable	92,250	$4,990			92,250	$4,990
Bristol	221,600	12,144	9,500	$523	231,100	12,667
Dukes	104,230	5,734	51,400	2,702	155,630	8,436
Essex	711,584	41,072			711,584	41,072
Nantucket	30,400	1,672			30,400	1,672
Plymouth	71,000	7,100			71,000	7,100
Suffolk	411,500	40,750			411,500	40,750
Total	1,642,564	113,462	60,900	3,225	1,703,464	116,687

Beam trawls.—Beam trawls, or dragnets, as they are sometimes called, are used only in Barnstable County, for taking flounders, the catch of which was 1,711,086 pounds, with a value of $44,139, 90 per cent being taken in the vessel fisheries. There has been an increase of 20 per cent in the catch since 1902, but an increase of only 2 per cent in value.

CATCH OF FLOUNDERS, BY BEAM TRAWLS, IN BARNSTABLE COUNTY IN 1905.

Fisheries.	Pounds.	Value.
Vessel	1,546,386	$39,575
Shore	164,700	4,564
Total	1,711,086	44,139

Dip nets and fyke nets.—Dip nets are used only in the shore fisheries, the catch by this apparatus in 1905 consisting of 2,770,500 pounds of herring, worth $30,500, and 916,100 pounds of alewives, worth $10,912. The nets are used in Barnstable, Dukes, Essex, Norfolk, and Plymouth counties.

The catch by fyke nets was 68,700 pounds, worth $3,328, of which eels constituted over 80 per cent, the remainder being flounders, cunners, tomcod, white perch, alewives, and tautog.

STATEMENT, BY COUNTIES, OF THE CATCH BY DIP NETS AND FYKE NETS IN THE SHORE FISHERIES OF MASSACHUSETTS IN 1905.

Products.	Barnstable.		Bristol.		Dukes.		Essex.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Dip nets:								
Alewives, fresh	131,000	$1,117			5,000	$100		
Alewives, salted	242,000	3,847						
Alewives, smoked	75,000	1,500						
Herring							2,476,500	$27,200
Total	448,000	6,464			5,000	100	2,476,500	27,200
Fyke nets:								
Alewives			1,250	$15				
Eels	53,500	2,727	1,800	144				
Flounders, fresh	3,000	75	300	12				
Flounders, salted	2,000	40						
Perch, white			1,350	115				
Tautog			500	20				
Tomcod			2,000	40				
Total	58,500	2,842	7,200	346				
Grand total	506,500	9,306	7,200	346	5,000	100	2,476,500	27,200

Products.	Norfolk.		Plymouth.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Dip nets:						
Alewives, fresh	27,400	$274	82,500	$625	245,900	$2,116
Alewives, salted	1,600	24	351,600	3,425	595,200	7,296
Alewives, smoked					75,000	1,500
Herring	114,000	1,500	180,000	1,800	2,770,500	30,500
Total	143,000	1,798	614,100	5,850	3,686,600	41,412
Fyke nets:						
Alewives					1,250	15
Cunners			2,000	80	2,000	80
Eels			1,000	60	56,300	2,931
Flounders, fresh					3,300	87
Flounders, salted					2,000	40
Perch, white					1,350	115
Tautog					500	20
Tomcod					2,000	40
Total			3,000	140	68,700	3,328
Grand total	143,000	1,798	617,100	5,990	3,755,300	44,740

Cunner nets and traps.—These apparatus were used in the shore fisheries of Essex, Norfolk, Plymouth, and Suffolk counties, and caught 113,650 pounds of cunners, worth $5,930.

STATEMENT, BY COUNTIES, OF THE CATCH BY CUNNER NETS AND TRAPS, AND EEL POTS, SPEARS, AND GAFFS IN THE SHORE FISHERIES OF MASSACHUSETTS IN 1905.

Products.	Barnstable.		Bristol.		Dukes.		Essex.		Nantucket.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Cunners							92,500	$4,775		
Eels	246,820	$13,448	49,800	$2,798	60,500	$3,465	32,225	2,124	8,000	$480
Flounders	1,500	45								
Total	248,320	13,493	49,800	2,798	60,500	3,465	124,725	6,899	8,000	480

Products.	Norfolk.		Plymouth.		Suffolk.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Cunners	15,400	$770	750	$35	5,000	$350	113,650	$5,930
Eels			10,700	522			408,045	22,837
Flounders							1,500	45
Total	15,400	770	11,450	557	5,000	350	523,195	28,812

Spears, gaffs, and other minor apparatus.—The catch by these apparatus was 140,380 pounds, valued at $15,797. Spears and gaffs were used in taking eels and flounders, and the minor apparatus in taking cockles, hard clams, scallops, alewives, and hard crabs.

STATEMENT, BY COUNTIES, OF THE CATCH BY MINOR APPARATUS IN THE SHORE FISHERIES OF MASSACHUSETTS IN 1905.

Products.	Barnstable.		Bristol.		Nantucket.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives, salted					25,000	$500
Clams, hard	4,000	$750	7,200	$1,150		
Cockles						
Scallops	4,480	1,680				
Crabs, hard						
Total	8,480	2,430	7,200	1,150	25,000	500

Products.	Plymouth.		Suffolk.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives, salted					25,000	$500
Clams, hard					11,200	1,900
Cockles	37,000	$11,100			37,000	11,100
Scallops					4,480	1,680
Crabs, hard			60,000	$500	60,000	500
Total	37,000	11,100	60,000	500	137,680	15,680

MISCELLANEOUS NOTES.

Alewives.—These fish, taken in ponds, brooks, and in and near the mouths of rivers having an outlet to the sea, are caught in varying quantities from year to year. Under favorable circumstances they enter the streams in large numbers, while at other times they are exceedingly scarce. The catch in 1905, including the fresh, salted, and smoked product, amounted to 4,069,430 pounds, valued at $49,102. The smoking of alewives engaged the attention of a few individuals in Barnstable County, the quantity smoked being 75,000 pounds.

Bluefish.—The catch of bluefish on the Massachusetts coast shows a steady decline. In years past this species appeared regularly in the spring in large quantities, but of late only sporadic schools are seen. The quantity taken in 1905 was 100,930 pounds, valued at $9,469.

Cod.—The fishery for cod in Massachusetts shows a decrease in yield when compared with the catch of 1902. The total quantity taken was 62,262,623 pounds, valued at $1,688,617. Of this 57,018,275 pounds was taken in the vessel fisheries, and 5,244,348 pounds in the shore fisheries.

Cusk.—This is chiefly a vessel fishery, and the larger portion of the catch is taken on Georges and Cashes banks, though at nearly all the other banks visited some cusk are taken. In 1905 the catch amounted to 7,456,198 pounds, valued at $113,956, an increase over 1902 of 4,562,891 pounds.

Eels.—The catch of eels shows an increase over the returns for the previous canvass. The catch in 1905 was 541,945 pounds, valued at $31,041.

Flounders.—The flounder catch is greater than it was in 1902. The vessel catch increased 776,577 pounds, and a large increase is also noted in the shore fisheries. The total catch was 4,043,683 pounds, valued at $97,823, a net increase of 1,448,016 pounds. More than half of this was taken in Barnstable County by beam trawls.

Haddock.—The catch of haddock was greater than that of any other species taken in the fisheries of this state, amounting in 1905 to 67,053,961 pounds, valued at $1,069,104, of which 2,565,977 pounds were taken in the shore fisheries.

Hake.—The hake catch shows an increase of 6,343,013 pounds over the catch of 1902, the total in 1905 being 20,700,967 pounds, valued at $258,438.

Halibut.—The most conspicuous decrease was in the catch of halibut. There has been a gradual decline, extending over a series of years, until it became necessary to ship halibut from the Pacific coast to supply the demand. In 1905 the catch was 3,513,001 pounds, valued at $218,232.

Herring.—The catch of herring in 1905 amounted to 18,364,454 pounds, valued at $381,696; of this amount 6,624,690 pounds was taken in the shore fisheries and 11,739,764 pounds in the vessel fisheries. The larger portion of the catch was taken on the west coast of Newfoundland by vessels from Gloucester. During the season of 1904–5, 37 vessels sailed from Gloucester to engage in the winter herring fishery, and brought in fares aggregating 10,248,264 pounds, valued at $237,610.

Mackerel.—The mackerel catch shows a decrease in comparison with the figures for 1902. The decline is wholly in the vessel fishery, the shore catch showing an increase. The total catch in 1905 was 14,103,971 pounds, valued at $966,443.

Pollock.—An increase of more than 100 per cent appears in the pollock catch as compared with 1902, the returns for 1905 amounting to 25,485,871 pounds, valued at $267,927. The demand for this fish is growing, and the range of shipments is now very wide. In former years small sales of pollock were the rule, but there is now a better market.

Scup.—The catch of scup is made almost wholly in the shore fisheries. Out of a total of 1,019,200 pounds, valued at $26,751, only 61,200 pounds were taken in the vessel fishery. The total catch shows an increase of 430,300 pounds since 1902.

Squeteague.—The catch of squeteague along the Massachusetts coast shows a steady increase from year to year. The catch in 1905 was 5,224,816 pounds, valued at $108,200, an increase of 1,454,599 pounds since 1902.

Swordfish.—With the greater demand for swordfish a large increase is shown in the catch. Vessels of various sizes are employed in the fishery, many of them being equipped with swordfish gear in addition to their other apparatus. The catch in 1905 was 1,703,554 pounds, valued at $116,692.

Whiting.—The catch of whiting in 1905 was 4,299,690 pounds, valued at $19,097. The greater portion is disposed of by the fishermen to wholesale dealers, who salt the fish and pack them in barrels for shipment.

Lobsters.—The catch of lobsters in Massachusetts shows a constant decrease from year to year; in 1905 it was 1,283,071 pounds, valued at $176,234, a decrease of 412,617 pounds since 1902. The value, however, was $1,139 more than in 1902, and this increase is constant as the supply diminishes.

Crabs.—The utilization of crabs in this state is a comparatively new industry, and the preparation and shipment of crab meat has not yet gone far beyond the experimental stage. At Winthrop Beach one dealer has engaged in the business. There is a plentiful supply of crabs.

Clams.—The quantity of hard clams taken has increased from 106,818 bushels, valued at $131,139, in 1902, to 166,526 bushels, valued at $288,987, in 1905. The larger portion of the catch was taken at Wellfleet and Orleans, in Barnstable County, and from that portion of Plymouth County bordering Buzzards Bay. The increased production and advance in price has made the fishery very profitable.

The yield of soft clams has decreased in quantity but increased in value, the catch for 1905 being 217,519 bushels, valued at $209,545.

Oysters.—The oyster industry shows a gratifying increase, the total catch in 1905 amounting to 142,230 bushels, valued at $221,990, an increase of 38,844 bushels since 1902. Very few seed oysters are taken, the catch amounting to 29,650 bushels. Barnstable County ranks first in the production of oysters, Osterville, Wellfleet, and Cotuit being the principal towns from which they are shipped. Plymouth County is next in importance, the oyster beds being located near the head of Buzzards Bay, in the waters of Wareham township.

Scallops.—The scallop fishery is carried on in five counties of this state, Nantucket leading in the quantity and value of the catch. In 1905 the products amounted to 43,872 bushels, valued at $98,712.

Irish moss.—Irish moss (*Chrondrus crispus*) is an edible seaweed found at various places along the New England coast, but more particularly in the vicinity of Scituate and Plymouth. Nearly the entire crop is disposed of to brewers and to firms handling brewers' supplies, a very small percentage going to wholesale druggists and grocers. The product in 1905 was 765,000 pounds, valued at $30,600.

The season for gathering the moss begins in May and ends in September. The height of the season is reached during the months of June and July. The moss, having fully ripened at this time, is yellow in color and easily distinguished from the mass of vegetation surrounding it.

A long-handled rake, operated from a boat, is the only apparatus used in gathering moss. In fair weather a good day's work is about 150 pounds of moss to the man.

Whales.—The whaling fleet of Massachusetts numbered 22 vessels, 19 hailing from New Bedford and 3 from Provincetown. The products consisted of 524,474 gallons of oil, valued at $246,565; 55,950 pounds of whalebone, valued at $193,037, and 94 pounds of ambergris, valued at $16,900.

Sea elephants.—One vessel from New Bedford engaged in the capture of sea elephants, the products of the venture amounting to $25,600. This fishery is not prosecuted regularly, only an occasional vessel engaging in it. The location of the fishery is Kerguelen or Desolation Island, in the Southern Indian Ocean. The season begins about October 1 and closes in February following. The animals are taken for their hides and oil. They are killed on the shore with

rifles, lances, and harpoons. The crew of the vessel mentioned captured between 2,500 and 3,000; the weight of the hides saved was 5,000 pounds, and the oil produced was 78,750 gallons.

Cod eggs.—The shipping of cod eggs to France for use as bait in the sardine fisheries continues, two firms in Gloucester being engaged in this business. The eggs are packed in barrels holding 250 pounds. A greater demand and better prices could be obtained if the eggs were picked over by the fishermen and sorted into different sizes, as is done in Norway, the eggs from that country always having the preference among the sardine fishermen of France.

WHOLESALE FISHERY TRADE.

There are wholesale fishery establishments in Barnstable, Bristol, Dukes, Essex, Nantucket, Plymouth, and Suffolk counties, but Boston, in Suffolk County, and Gloucester, in Essex County, are by far the most important wholesale centers in the state. There were in 1905 36 wholesale firms in the state exclusive of those in Suffolk and Essex counties; the number of persons engaged was 319, the value of buildings and accessory property was $267,417, and the cash capital invested was $311,000. Included in the above 36 firms were 4 cold-storage plants and 2 canneries, having a value of $100,800. The cold-storage plants are located as follows: 1 at East Dennis, 1 at North Truro, and 2 at Provincetown. The two canneries are located at North Truro and Provincetown, the former canning mackerel and the latter herring. Three firms at New Bedford are engaged in the manufacture of oil from fish and whales. One of these firms supplies all of the oil used by one of the leading typewriter companies in the country, and also a very fine grade of watch and clock oil.

Boston.—The number of firms in the various branches of the wholesale fishery trade in Boston in 1905 was 77; the number of persons engaged, 887; the amount of wages paid, $498,129, and the investment in shore property and the cash capital were $2,431,243. Boston leads all other cities in the extent and value of its fresh fish trade, many vessels from Gloucester, Provincetown, Portland, Me., and other ports in New England landing their fares at T wharf. The total quantity of fish landed in Boston in 1905 by American vessels was 101,306,695 pounds, valued at $2,484,595. In addition, large quantities of fishery products were landed by rail from localities along the coast and by vessels from the British provinces.

Five firms in Chelsea were engaged in the wholesale business, their employees numbering 39, to whom $14,600 were paid in wages, and their cash capital and shore property amounting to $27,100. Of the 5 firms mentioned, 4 were engaged in the smoking of fish and 1 in the manufacture of oil.

WHOLESALE FISHERY TRADE OF BOSTON AND CHELSEA IN 1905.

Cities.	Number of firms.	Persons engaged.	Shore property.	Cash capital.	Wages paid.
Boston	[a] 77	887	$1,543,243	$888,000	$498,129
Chelsea	[a] 5	39	15,400	11,700	14,000

[a] The number of firms in Boston engaged in the various branches of the trade was as follows: Fresh fish, 39; salted, smoked, and canned fish, 13; lobsters, 12; oysters, clams, etc., 10; glue, 1; miscellaneous fishery products, 2. In Chelsea 4 firms engaged in the smoking of fish and 1 in the manufacture of oil.

Gloucester.—This city is a most important fishery center, its industries consisting principally of the preparation and distribution of salted and smoked fish, and the manufacture of a variety of secondary fishery products, such as oil, glue, isinglass, and fertilizer.

Thirteen firms either prepared smoked fish or handled the output of other smokers, some having contracts with Boston dealers to furnish the latter's supply. The total quantity of fish smoked by these firms in 1905 was 7,468,180 pounds, valued at $517,813. Herring and halibut constituted the greater part of the output, though large quantities of haddock and some pollock and swordfish were included.

Six firms handled glue, isinglass, or scrap, fish skins, heads, etc., being used in making the glue and scrap and sounds in making the isinglass. The largest glue manufacturing plant in the United States is located here.

The manufacture of oil from cod livers is an important industry in Gloucester, several thousand barrels being prepared in 1905. One firm is engaged in refining oil. Competition is very brisk among the oil manufacturers to secure the livers brought in by the fishing vessels.

The fresh fish business of Gloucester has never been very extensive when compared with the salt fish handled, but the enlargement in 1906 of one of the important establishments will probably lead to further extension in this line of the trade.

Two firms in Gloucester are engaged in buying fish eggs, which are salted and exported to France, where they are used as bait in the sardine fishery.

The total quantity of fish landed at Gloucester in 1905 by American vessels was 103,581,155 pounds, valued at $2,467,529. Of this, 68,450,526 pounds, valued at $1,166,632, was landed fresh and the remainder salted. More than three-fifths of the catch of cod, which is the most important fish, is salted on the fishing grounds. This becomes necessary on account of the length of the trips, which sometimes extend through several months. The same is true of the Newfoundland herring, the fares being landed either salted or frozen. The greater proportion of other species, except mackerel, is salted by the dealers. Pollock leads in the quantity landed fresh, followed by hake, haddock, cod, cusk, mackerel, halibut, and other species.

WHOLESALE FISHERY TRADE OF GLOUCESTER IN 1905.

Number of firms	a 53
Persons engaged	1,552
Shore property	$1,674,140
Cash capital	$780,226
Wages paid	$726,908

a Includes 7 firms in Rockport, Mass. Of the above firms 8 handled fresh fish; 30 salted, smoked, or boneless; 10 oil, glue, and isinglass; 2 cold storage; 2 sounds and fish roe, and 1 lobsters.

WHOLESALE TRADE OF BARNSTABLE, BRISTOL, DUKES, NANTUCKET, AND PLYMOUTH COUNTIES.

Counties.	Number of firms.	Persons engaged.	Wages paid.	Shore and accessory property.	Cash capital.
Barnstable	18	179	$43,768	$139,542	$103,800
Bristol	10	120	52,400	117,975	192,900
Dukes and Nantucket	5	16	1,550	5,050	5,800
Plymouth	3	4	500	4,850	8,500
Total	36	319	98,218	267,417	311,000

FISHERIES OF RHODE ISLAND.

GENERAL STATISTICS.

The returns for the fisheries of Rhode Island in 1905 exhibit an increase over the showing for 1902, slight in the items of persons engaged and amount of investment, but very considerable in value of the products.

Persons engaged.—The number of persons increased from 2,117 to 2,212, and the amount of the investment in vessels, apparatus, and other property employed from $1,014,280 to $1,065,426.

PERSONS ENGAGED IN THE FISHERIES OF RHODE ISLAND IN 1905.

How engaged.	Number.
On vessels fishing	531
On vessels transporting	24
Boat or shore fishermen	1,153
Shoresmen	504
Total	2,212

INVESTMENT IN THE FISHERIES OF RHODE ISLAND IN 1905.

Items.	Number.	Value.	Items.	Number.	Value.
Vessels fishing	95	$285,250	Apparatus, shore fisheries—Continued.		
Tonnage	1,486		Seines	65	$5,725
Outfit		74,535	Gill nets	70	3,188
Vessels transporting	16	20,950	Fyke nets	776	4,647
Tonnage	124		Lines, hand and trawl		500
Outfit		3,040	Pots, lobster	10,673	12,955
Boats	1,269	123,969	Pots, eel	3,421	2,544
Apparatus, vessel fisheries:			Spears	61	48
Pound nets and trap nets	40	82,950	Dip nets	7	7
Purse seines	3	2,350	Dredges	76	514
Gill nets	394	3,840	Rakes	54	195
Lines, hand and trawl		1,653	Tongs	452	1,981
Pots, lobster	250	300	Hoes	322	267
Pots, eel	100	75	Shovels	72	52
Harpoons		343	Shore and accessory property		325,100
Dredges	152	3,840	Cash capital		25,500
Rakes	2	8			
Tongs	106	508	Total		1,065,426
Hoes	7	7			
Apparatus, shore fisheries: Pound nets and trap nets	196	78,585			

Products.—The value of the fishery products in the two years under consideration has increased from $1,155,701 to $1,546,658, or 33 per cent. The principal item in this increase has been oysters, the value of which in 1902 amounted to $588,052, while in 1905 it was $929,963, or 58 per cent greater. Aside from this the products show a slight increase, from $567,649 in 1902 to $616,695 in 1905. Principal among the other products showing an increase are butterfish, $10,407 to $18,714; cod, from $20,652 to $33,983; flatfish and flounders, from $27,839 to $35,428; mackerel, from $32,950 to $48,054; pollock, from $300 to $5,339; squeteague, $75,853 to $86,478; swordfish, from $6,743 to $17,864; lobsters, from $39,488, to $64,358, and clams, from $32,514 to $39,543. The principal decreases in the value of the products from 1902 to 1905 have been scallops, from $25,208 to $420; bluefish, from $9,416 to $6,397; bonito, from $3,860 to $415; eels, from $22,290 to $17,545, and shad, from $2,465 to $1,509.

PRODUCTS OF THE FISHERIES OF RHODE ISLAND IN 1905.

Products.	Vessel fisheries.		Shore fisheries.		Total.	
	Pounds.	Value	Pounds.	Value.	Pounds	Value.
Albacore or horse mackerel			4,680	$118	4,680	$118
Alewives	92,010	$1,033	506,580	5,998	598,590	7,031
Bluefish	31,910	2,019	62,750	4,378	94,660	6,397
Bonito	860	77	7,560	338	8,420	415
Butterfish	104,240	5,907	236,915	12,807	341,155	18,714
Cod	585,200	18,911	511,620	15,072	1,096,820	33,983
Eels	14,585	948	275,610	16,597	290,195	17,545
Flatfish and flounders	387,015	13,028	756,450	22,400	1,143,465	35,428
Haddock	472,385	13,499	43,350	1,289	515,735	14,788
Hickory shad	5,140	133	15,925	361	21,065	494
Kingfish	300	52	2,625	394	2,925	446
Mackerel	423,440	23,939	414,490	24,115	837,930	48,054

PRODUCTS OF THE FISHERIES OF RHODE ISLAND IN 1905—Continued.

Products.	Vessel fisheries.		Shore fisheries.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Menhaden	457,000	$1,123	569,200	$1,899	1,026,200	$3,022
Perch			37,700	2,285	37,700	2,285
Pollock	116,465	1,848	174,970	3,491	291,435	5,339
Salmon	10	2			10	2
Sculpin	1,600	12			1,600	12
Scup	3,839,905	92,839	1,700,135	45,191	5,540,040	138,030
Sea bass	91,820	5,520	127,925	6,509	219,745	12,029
Shad	2,392	218	14,634	1,291	17,026	1,509
Smelt			6,450	651	6,450	651
Spanish mackerel	73	14	25	3	98	17
Squeteague	693,135	19,823	2,529,650	66,655	3,222,785	86,478
Squid	38,100	715	95,200	1,951	133,300	2,666
Striped bass	5,030	673	26,745	3,217	31,775	3,890
Swordfish	360,770	17,799	1,350	65	362,120	17,864
Tautog	47,800	1,704	261,630	8,964	309,430	10,668
Tomcod			2,500	92	2,500	92
Whiting	26,300	446	243,770	3,320	270,070	3,766
Lobsters	10,350	1,300	519,477	63,058	529,827	64,358
Crabs, hard			13,280	580	13,280	580
Crabs, soft			6,560	1,240	6,560	1,240
Clams	4,500	580	302,100	38,963	[a] 306,600	39,543
Quahogs	14,320	3,260	167,616	34,441	[b] 181,936	37,701
Scallops			1,500	420	[c] 1,500	420
Oysters, market	4,811,611	799,386	475,755	74,846	[d] 5,287,366	874,232
Oysters, seed	109,970	8,555	1,015,280	47,176	[e] 1,125,250	55,731
Irish moss			16,000	1,120	16,000	1,120
Total	12,748,236	1,035,363	11,148,007	511,295	23,896,243	1,546,658

[a] 30,660 bushels. [b] 22,742 bushels. [c] 250 bushels. [d] 755,338 bushels. [e] 160,750 bushels.

THE FISHERIES BY COUNTIES.

The extent of the fisheries in each county of Rhode Island is shown in the following series of tables:

STATEMENT, BY COUNTIES, OF THE NUMBER OF PERSONS ENGAGED IN THE FISHERIES OF RHODE ISLAND IN 1905.

Counties.	On vessels fishing.	On vessels transporting.	Boat or shore fishermen.	Shoresmen.	Total.
Bristol	66		101	157	324
Kent	12	1	188	19	220
Newport	319	14	422	46	801
Providence	117	7	144	279	547
Washington	17	2	298	3	320
Total	531	24	1,153	504	2,212

STATEMENT, BY COUNTIES, OF THE INVESTMENT IN THE FISHERIES OF RHODE ISLAND IN 1905.

Items.	Bristol.		Kent.		Newport.	
	Number.	Value.	Number.	Value.	Number.	Value.
Vessels fishing	16	$54,150	4	$8,300	50	$126,350
Tonnage	181		49		721	
Outfit		11,825		1,930		35,755
Vessels transporting			1	1,500	9	12,000
Tonnage			10		67	
Outfit				335		1,525
Boats	135	11,140	232	18,449	396	61,550
Apparatus—vessel fisheries:						
Pound nets and trap nets					29	70,050
Purse seines					2	1,600
Gill nets					394	3,840
Lines, hand and trawl						1,651
Pots, lobster					250	300
Pots, eel	100	75				
Harpoons						343
Dredges	62	1,460	12	220	8	195
Tongs	62	302	8	40	4	20
Hoes	3	3				
Apparatus—shore fisheries:						
Pound nets and trap nets	11	2,250	15	2,825	121	58,300
Seines			4	340	27	3,340
Gill nets	3	85	11	398	54	2,300
Fyke nets	65	325	298	1,602	220	980
Lines, hand and trawl		4		14		404
Pots, lobster	130	136	71	74	8,472	9,944
Pots, eel	430	360	829	574	252	252
Spears, eel	8	6	7	6	9	5
Dredges	18	240	14	70	22	86
Rakes	8	40	11	50	20	60
Tongs	76	347	108	518	10	48
Hoes	42	40	116	98	37	34
Shovels	10	10	15	12		
Shore and accessory property		55,650		11,100		143,200
Cash capital						13,000
Total		138,448		48,455		547,132

Items.	Providence.		Washington.		Total.	
	Number.	Value.	Number.	Value.	Number.	Value.
Vessels fishing	21	$88,300	4	$8,150	95	$285,250
Tonnage	505		30		1,486	
Outfit		23,295		1,730		74,535
Vessels transporting	3	5,725	3	1,725	16	20,950
Tonnage	32		15		124	
Outfit		1,000		180		3,040
Boats	169	11,190	337	21,640	1,269	123,969
Apparatus—vessel fisheries:						
Pound nets and trap nets			11	12,000	40	82,950
Purse seines	1	750			3	2,350
Gill nets					394	3,840
Lines, hand and trawl				2		1,653
Pots, lobster					250	300
Pots, eel					100	75
Harpoons						343
Dredges	70	1,965			152	3,840
Rakes			2	8	2	8
Tongs	32	146			106	508
Hoes	2	2	2	2	7	7
Apparatus—shore fisheries:						
Pound nets and trap nets			49	15,210	196	78,585
Seines	2	115	32	1,930	65	5,725
Gill nets			11	405	79	3,188
Fyke nets			193	1,740	776	4,647
Lines, hand and trawl		1		77		500
Pots, lobster			2,000	2,801	10,673	12,955
Pots, eel	1,060	626	850	732	3,421	2,544
Spears, eel	17	15	20	16	61	48
Dip nets			7	7	7	7
Dredges	8	60	14	58	76	514
Rakes	15	45			54	195
Tongs	91	402	167	666	452	1,981
Hoes	84	62	43	33	322	267
Shovels	47	30			72	52
Shore and accessory property		108,200		6,950		325,100
Cash capital		12,500				25,500
Total		254,429		76,962		1,065,426

STATEMENT, BY COUNTIES, OF THE PRODUCTS OF THE FISHERIES OF RHODE ISLAND IN 1905.

Products.	Bristol.		Kent.		Newport.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Albacore or horse mackerel					4,680	$118
Alewives	24,670	$454	150	$2	264,270	2,786
Bluefish			5,900	424	81,720	5,498
Bonito			200	16	6,550	252
Butterfish	9,000	518	28,300	1,512	250,565	13,611
Cod					939,080	28,999
Eels	35,300	2,799	50,300	2,816	39,805	1,906
Flatfish and flounders	29,050	857	59,050	1,860	777,740	23,547
Haddock					494,135	14,143
Hickory shad					13,515	269
Kingfish					1,650	318
Mackerel					692,250	37,940
Menhaden	24,500	114	136,000	585	659,100	1,686
Pollock					274,435	5,054
Salmon					10	2
Sculpin					1,600	12
Scup	800	40	2,000	60	5,007,770	123,846
Sea bass					197,520	10,680
Shad	10,920	970	90	8	1,886	169
Spanish mackerel					73	14
Squeteague	58,300	2,124	224,850	6,957	2,154,055	54,316
Squid					79,600	1,446
Striped bass					12,125	1,589
Swordfish					362,120	17,864
Tautog	38,500	1,495	28,350	925	183,965	5,671
Tomcod	1,300	56				
Whiting	1,200	48			257,370	3,535
Lobsters	3,670	510	5,120	640	423,850	50,923
Clams	41,100	5,126	96,700	12,086	20,000	3,690
Quahogs	24,000	4,520	83,136	17,410	15,360	2,860
Scallops			240	60	780	240
Oysters, market	1,780,527	298,585	265,895	47,213	205,520	32,159
Oysters, seed	82,880	4,135	95,690	7,280		
Irish moss					16,000	1,120
Total	2,166,617	322,351	1,082,571	99,854	13,448,099	446,263

Products	Providence.		Washington.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Albacore or horse mackerel					4,680	$118
Alewives			309,500	$3,789	598,590	7,031
Bluefish			7,040	475	94,660	6,397
Bonito			1,670	147	8,420	415
Butterfish			52,390	3,073	341,155	18,714
Cod			157,740	4,984	1,096,820	33,983
Eels	91,680	$5,802	73,110	4,222	290,195	17,545
Flatfish and flounders			277,025	9,164	1,143,465	35,428
Haddock			21,600	645	515,735	14,788
Hickory shad			7,550	225	21,065	494
Kingfish			1,275	128	2,925	446
Mackerel	46,500	3,120	99,180	6,994	837,930	48,054
Menhaden			206,600	637	1,026,200	3,022
Perch			37,700	2,285	37,700	2,285
Pollock			17,000	285	291,435	5,339
Salmon					10	2
Sculpin					1,600	12
Scup			529,470	14,084	5,540,040	138,030
Sea bass			22,225	1,349	219,745	12,029
Shad			4,130	362	17,026	1,509
Smelt			6,450	651	6,450	651
Spanish mackerel			25	3	98	17
Squeteague			785,580	23,081	3,222,785	86,478
Squid			53,700	1,220	133,300	2,666
Striped bass			19,650	2,301	31,775	3,890
Swordfish					362,120	17,864
Tautog			58,615	2,577	309,430	10,668
Tomcod			1,200	36	2,500	92
Whiting			11,500	183	270,070	3,766
Lobsters			97,187	12,285	529,827	64,358
Crabs, hard			13,280	580	13,280	580
Crabs, soft			6,560	1,240	6,560	1,240
Clams	95,800	13,715	44,000	4,926	306,600	39,543
Quahogs	56,040	12,236	2,800	675	181,936	37,701
Scallops			480	120	1,500	420
Oysters, market	2,962,064	486,855	73,360	9,420	5,287,366	874,232
Oysters, seed	292,530	15,754	654,150	28,562	1,125,250	55,731
Irish moss					16,000	1,120
Total	3,545,214	537,482	3,653,742	140,708	23,896,243	1,546,658

THE PRODUCTS BY APPARATUS.

The catch with purse seines and haul seines in the vessel and shore fisheries of Rhode Island in 1905 amounted to 1,310,160 pounds, valued at $28,106; gill nets took 329,640 pounds of various species, for which the fishermen received $12,425; pound nets, 11,904,879 pounds, $316,757; fyke nets, 195,470 pounds, $6,032; trawls and hand lines, 2,072,275 pounds, $75,094; pots, 744,257 pounds, $77,293; spears and harpoons, 401,070 pounds, $20,384; dip nets, 35,840 pounds, $2,940, and dredges, tongs, etc., 6,902,652 pounds, $1,007,627. The following tables show, by counties and species, the quantity and value of products taken with each form of apparatus in the vessel and shore fisheries of Rhode Island in 1905:

STATEMENT, BY COUNTIES, OF THE YIELD OF THE SEINE FISHERIES OF RHODE ISLAND IN 1905.

Products.	Kent.		Newport.		Providence.		Washington.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Vessel fisheries:										
Bluefish			3,200	$192					3,200	$192
Mackerel					46,500	$3,120			46,500	3,120
Menhaden			310,000	725					310,000	725
Scup			2,000	60					2,000	60
Squeteague			72,800	2,176					72,800	2,176
Total			388,000	3,153	46,500	3,120			434,500	6,273
Shore fisheries:										
Alewives							221,840	$2,288	221,840	2,288
Bluefish	2,600	$192							2,600	192
Butterfish	1,100	64							1,100	64
Cod							42,750	1,570	42,750	1,570
Eels	400	20			3,680	222	4,200	244	8,280	486
Flatfish and flounders	3,850	145	52,170	1,264			14,000	467	70,020	1,876
Mackerel			49,400	2,470			31,000	2,170	80,400	4,640
Menhaden	90,000	375							90,000	375
Perch							36,000	2,175	36,000	2,175
Shad							160	16	160	16
Shad, hickory							2,000	60	2,000	60
Smelt							3,950	401	3,950	401
Squeteague	27,760	1,066	267,150	5,348			12,500	375	307,410	6,789
Striped bass							5,900	784	5,900	784
Tautog	2,850	105					400	12	3,250	117
Total	128,560	1,967	368,720	9,082	3,680	222	374,700	10,562	875,660	21,833
Grand total	128,560	1,967	756,720	12,235	50,180	3,342	374,700	10,562	1,310,160	28,106

STATEMENT, BY COUNTIES, OF THE YIELD OF THE GILL-NET FISHERIES OF RHODE ISLAND IN 1905.

Products.	Bristol.		Kent.		Newport.		Washington.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Vessel fisheries: Mackerel					72,500	$4,060			72,500	$4,060
Shore fisheries:										
Bluefish			3,300	$232	40,590	2,891	3,200	$224	47,090	3,347
Bonito			200	16					200	16
Butterfish			8,200	498	1,000	60			9,200	558
Mackerel					7,170	531	2,000	140	9,170	671
Menhaden					65,000	325			65,000	325
Squeteague	2,950	$118	3,000	120	114,050	2,974	6,000	210	126,000	3,422
Striped bass					80	10			80	10
Tomcod	400	16							400	16
Total	3,350	134	14,700	866	227,890	6,791	11,200	574	257,140	8,365
Grand total	3,350	134	14,700	866	300,390	10,851	11,200	574	329,640	12,425

STATEMENT, BY COUNTIES, OF THE CATCH BY POUND NETS AND TRAP NETS IN RHODE ISLAND IN 1905.

Products.	Bristol.		Kent.		Newport.		Washington.		Total.	
	Lbs.	Value	Lbs.	Value	Lbs.	Value.	Lbs.	Value	Lbs.	Value.
Vessel fisheries:										
Alewives					61,500	$562	30,510	$471	92,010	$1,033
Bluefish					12,275	756	1,060	70	13,335	826
Bonito					260	21	600	56	860	77
Butterfish					91,600	5,132	12,640	775	104,240	5,907
Cod					134,060	3,406	7,340	235	141,400	3,641
Eels					3,730	143	2,855	165	6,585	308
Flatfish and flounders					249,000	8,552	53,215	1,722	302,215	10,274
Haddock					1,750	47			1,750	47
Hickory shad					4,790	124	350	9	5,140	133
Kingfish					300	52			300	52
Mackerel					17,100	1,059	8,330	516	25,430	1,575
Menhaden					2,000	13	145,000	385	147,000	398
Pollock					113,265	1,773	3,200	75	116,465	1,848
Salmon					10	2			10	2
Sculpin					1,600	12			1,600	12
Scup					3,578,135	85,598	259,770	7,181	3,837,905	92,779
Sea bass					81,730	4,929	8,740	528	90,470	5,457
Shad					642	59	1,750	159	2,392	218
Spanish mackerel					73	14			73	14
Squeteague					351,820	9,700	250,030	7,351	601,850	17,051
Squid					13,900	135	24,200	580	38,100	715
Striped bass					2,630	419	2,400	254	5,030	673
Tautog					15,000	504	7,450	269	22,450	773
Whiting					26,300	446			26,300	446
Total					4,763,470	123,458	819,440	20,801	5,582,910	144,259
Shore fisheries:										
Alewives	24,670	$454	150	$2	202,770	2,224	57,150	1,030	284,740	3,710
Bluefish					3,780	252	1,980	125	5,760	377
Bonito					6,290	231	1,070	91	7,360	322
Butterfish	9,000	518	19,000	950	157,965	8,419	39,750	2,298	226,615	12,185
Cod					106,000	2,970	7,350	200	113,350	3,170
Eels	800	64			7,095	373	4,685	310	12,580	747
Flatfish and flounders	5,350	167	15,300	500	331,370	9,055	88,760	2,995	440,780	12,717
Haddock					750	22	600	15	1,350	37
Hickory shad					8,725	145	5,200	156	13,925	301
Horse mackerel					4,680	118			4,680	118
Kingfish					1,350	266	1,275	128	2,625	394
Mackerel					237,220	12,776	50,350	3,638	287,570	16,414
Menhaden	24,500	114	46,000	210	282,100	623	61,600	252	414,200	1,199
Perch							1,200	70	1,200	70
Pollock					124,370	2,421	13,800	210	138,170	2,631
Scup	800	40	2,000	60	1,427,635	38,188	268,700	6,863	1,699,135	45,151
Sea bass					112,640	5,580	12,685	770	125,325	6,350
Shad	10,920	970	90	8	1,244	110	2,220	187	14,474	1,275
Smelt							2,500	250	2,500	250
Spanish mackerel							25	3	25	3
Squeteague	55,350	2,006	161,090	4,461	1,321,900	33,305	508,050	13,660	2,046,390	53,432
Squid					65,700	1,311	29,500	640	95,200	1,951
Striped bass					9,415	1,160	11,350	1,263	20,765	2,423
Swordfish					1,350	65			1,350	65
Tautog	35,000	1,355	14,500	460	47,365	1,427	21,265	644	118,130	3,886
Whiting	1,200	48			231,070	3,089	41,500	183	213,770	3,320
Total	168,490	5,736	258,130	6,651	4,692,784	124,130	1,202,565	35,981	6,321,969	172,498
Grand total	168,490	5,736	258,130	6,651	9,456,254	247,588	2,022,005	56,782	11,904,879	316,757

STATEMENT, BY COUNTIES, OF THE YIELD OF THE FYKE-NET FISHERIES OF RHODE ISLAND IN 1905.

Products (shore fisheries).	Bristol.		Kent.		Newport.		Washington.		Total.	
	Lbs.	Value	Lbs.	Value	Lbs.	Value.	Lbs.	Value	Lbs.	Value.
Eels							120	$9	120	$9
Flatfish and flounders	23,700	$690	40,500	$1,215	50,000	$1,560	78,550	2,442	192,750	5,907
Perch							500	40	500	40
Tomcod	900	40					1,200	36	2,100	76
Total	24,600	730	40,500	1,215	50,000	1,560	80,370	2,527	195,470	6,032

STATEMENT, BY COUNTIES, OF THE YIELD OF THE LINE-FISHERIES OF RHODE ISLAND IN 1905.

Products.	Bristol.		Kent.		Newport.		Providence.		Washington.		Total.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Vessel fisheries:												
Bluefish					15,375	$1,001					15,375	$1,001
Cod					438,800	15,120			5,000	$150	443,800	15,270
Flounders					84,800	2,754					84,800	2,754
Haddock					470,635	13,452					470,635	13,452
Mackerel					279,010	15,184					279,010	15,184
Sea bass					1,350	63					1,350	63
Squeteague					18,485	596					18,485	596
Tautog					19,100	649			6,250	282	25,350	931
Total					1,327,555	48,819			11,250	432	1,338,805	49,251
Shore fisheries:												
Bluefish					6,500	406			800	56	7,300	462
Cod					260,220	7,503			95,300	2,829	355,520	10,332
Eels							6,000	$360	1,900	115	7,900	475
Flounders					10,400	362			42,500	1,538	52,900	1,900
Haddock					21,000	622			21,000	630	42,000	1,252
Mackerel					29,850	1,860			7,500	530	37,350	2,390
Pollock					36,800	860					36,800	860
Scup									1,000	40	1,000	40
Sea bass					1,800	108			800	51	2,600	159
Squeteague			33,000	$1,310	7,850	217			9,000	1,485	49,850	3,012
Tautog	3,500	$140	11,000	360	102,500	3,091			23,250	1,370	140,250	4,961
Total	3,500	140	44,000	1,670	476,920	15,029	6,000	360	203,050	8,644	733,470	25,843
Grand total	3,500	140	44,000	1,670	1,804,475	63,848	6,000	360	214,300	9,076	2,072,275	75,094

STATEMENT, BY COUNTIES, OF THE CATCH OF EELS AND LOBSTERS BY POTS IN RHODE ISLAND IN 1905.

Products.	Bristol.		Kent.		Newport.		Providence.		Washington.		Total.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Vessel fisheries:												
Eels	8,000	$640									8,000	$640
Lobsters					10,350	$1,300					10,350	1,300
Total	8,000	640			10,350	1,300					18,350	1,940
Shore fisheries:												
Eels	21,500	1,695	45,700	$2,581	23,380	1,090	71,500	$4,450	44,350	$2,479	206,430	12,295
Lobsters	3,670	510	5,120	640	413,500	49,623			97,187	12,285	519,477	63,058
Total	25,170	2,205	50,820	3,221	436,880	50,713	71,500	4,450	141,537	14,764	725,907	75,353
Grand total	33,170	2,845	50,820	3,221	447,230	52,013	71,500	4,450	141,537	14,764	744,257	77,293

STATEMENT, BY COUNTIES, OF THE CATCH BY SPEARS AND HARPOONS IN THE FISHERIES OF RHODE ISLAND IN 1905.

Products.	Bristol.		Kent.		Newport.		Providence.		Washington.		Total.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Vessel fisheries: Sword-fish					360,770	$17,799					360,770	$17,799
Shore fisheries: Eels	5,000	$400	4,200	$215	5,600	300	10,500	$770	15,000	$900	40,300	2,585
Total	5,000	400	4,200	215	366,370	18,099	10,500	770	15,000	900	401,070	20,384

STATEMENT, BY COUNTIES, OF THE CATCH BY DIP NETS, ETC., IN THE SHORE FISHERIES OF RHODE ISLAND IN 1905.

Products.	Newport.		Washington.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Crabs, hard			13,280	$580	13,280	$580
Crabs, soft			6,560	1,240	6,560	1,240
Irish moss	16,000	$1,120			16,000	1,120
Total	16,000	1,120	19,840	1,820	35,840	2,940

STATEMENT, BY COUNTIES, OF THE CATCH BY DREDGES, TONGS, ETC., IN RHODE ISLAND IN 1905.

Products.	Bristol.		Kent.		Newport.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Vessel fisheries:						
Clams	2,000	$270				
Quahogs	1,120	210				
Oysters, market, private	1,530,557	257,692	175,700	$32,050	178,500	$28,445
Oysters, seed, private			70,420	5,300		
Total	1,533,677	258,172	246,120	37,350	178,500	28,445
Shore fisheries:						
Clams	39,100	4,856	96,700	12,086	29,000	3,690
Quahogs	22,880	4,310	83,136	17,410	15,360	2,860
Scallops			240	60	780	240
Oysters, market, private	249,070	40,893	89,635	15,123	27,020	3,714
Oysters, market, public			560	40		
Oysters, seed, private			23,870	1,920		
Oysters, seed, public	82,880	4,135	1,400	60		
Total	394,830	54,194	295,541	46,699	72,160	10,504
Grand total	1,928,507	312,366	541,661	84,049	250,660	38,949

Products.	Providence.		Washington.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Vessel fisheries:						
Clams	1,500	$210	1,000	$100	4,500	$580
Quahogs	12,800	2,950	400	100	14,320	3,260
Oysters, market, private	2,926,854	481,199			4,811,611	799,386
Oysters, seed, private	31,500	2,830			101,920	8,130
Oysters, seed, public	8,050	425			8,050	425
Total	2,980,704	517,614	1,400	200	4,940,401	811,781
Shore fisheries:						
Clams	94,300	13,505	43,000	4,826	302,100	38,963
Quahogs	43,840	9,286	2,400	575	167,616	34,441
Scallops			480	120	1,500	420
Oysters, market, private	35,210	5,656	35,000	5,300	436,835	70,686
Oysters, market, public			38,360	4,120	38,920	4,160
Oysters, seed, private	11,200	860			35,070	2,780
Oysters, seed, public	241,780	11,630	654,150	28,562	980,210	44,396
Total	426,330	40,946	773,390	43,503	1,962,251	195,846
Grand total	3,407,034	528,560	774,790	43,703	6,902,652	1,007,627

THE OYSTER INDUSTRY.

The oyster fishery of Rhode Island, in 1905, gave employment to 926 persons. The investment in vessels, boats, fishing apparatus, and shore and accessory property amounted to $374,588, and the yield from private and public areas aggregated 916,088 bushels of market and seed oysters, valued at $929,963.

STATEMENT, BY COUNTIES, OF THE EXTENT OF THE OYSTER INDUSTRY OF RHODE ISLAND IN 1905.

Items.	Bristol.		Kent.		Newport.	
	Number.	Value.	Number.	Value.	Number.	Value.
Persons engaged:						
On vessels and boats	118	.....	23	.....	12	.....
Shoresmen	157	.....	19	.....	15	.....
Total	275	.....	42	.....	27	.....
Steamers	14	$53,250	3	$7,500	2	$6,800
Tonnage	168	.....	43	.....	39	.....
Outfit	.....	10,980	.....	1,685	.....	1,700
Sail vessels	1	500	1	800	.....	.....
Tonnage	7	.....	6	.....	.....	.....
Outfit	.....	120	.....	245	.....	.....
Boats (under 5 tons)	76	7,990	14	3,115	3	870
Dredges	80	1,700	16	260	12	235
Tongs and rakes	104	503	18	83	4	20
Shore property	.....	54,400	.....	3,500	.....	2,850
Total investment	.....	129,443	.....	17,188	.....	12,475
Oysters sold:						
Private, market.....bushels	47,391	73,329	20,305	28,253	5,360	5,924
Private, market.....gallons	206,970	225,256	17,600	18,920	24,000	26,235
Private, seed.....bushels	.....	.....	13,470	7,220	.....	.....
Public, market.....do	.....	.....	80	40	.....	.....
Public, seed.....do	11,840	4,135	200	60	.....	.....
Total	.....	302,720	.....	54,493	.....	32,159

Items.	Providence.		Washington.		Total.	
	Number.	Value.	Number.	Value.	Number.	Value.
Persons engaged:						
On vessels and boats	165	.....	159	.....	477	.....
Shoresmen	255	.....	3	.....	449	.....
Total	420	.....	162	.....	926	.....
Steamers	19	$87,250	.....	.....	38	$154,800
Tonnage	434	.....	.....	.....	684	.....
Outfit	.....	21,880	.....	.....	.....	36,245
Sail vessels	3	775	.....	.....	5	2,075
Tonnage	20	.....	.....	.....	33	.....
Outfit	.....	340	.....	.....	.....	705
Boats (under 5 tons)	77	6,905	181	$10,685	351	20,565
Dredges	78	2,025	4	28	190	4,248
Tongs and rakes	90	398	159	636	375	1,640
Shore property	.....	82,800	.....	1,760	.....	145,310
Total investment	.....	202,373	.....	13,109	.....	374,588
Oysters sold:						
Private, market.....bushels	46,070	65,764	800	980	119,926	174,250
Private, market.....gallons	377,082	421,091	4,200	4,320	629,852	695,822
Private, seed.....bushels	6,100	3,690	.....	.....	19,570	10,910
Public, market.....do	.....	.....	5,480	4,120	5,560	4,160
Public, seed.....do	35,690	12,064	93,450	28,562	141,180	44,821
Total	.....	502,609	.....	37,982	.....	929,963

INVESTMENT AND NUMBER OF PERSONS EMPLOYED IN THE WHOLESALE FISHERY TRADE OF RHODE ISLAND IN 1905.

Items.	No.	Value.	Items.	No.	Value.
Establishments	6	$41,600	Wages paid		$26,500
Cash capital		25,500	Persons engaged	48	

FISHERIES OF CONNECTICUT.

GENERAL STATISTICS.

The returns for the fisheries of Connecticut in 1905 show a decided improvement since 1902. In the earlier year there were 2,840 persons engaged; the investment in vessels, apparatus, etc., amounted to $1,201,055, and the products aggregated 37,832,149 pounds, for which the fishermen received $1,799,381. In 1905 the number of persons employed had increased to 3,407; the investment was $1,635,753, and the products were nearly doubled in quantity and value, amounting to 74,972,648 pounds, worth $3,173,948. These figures exceed those of any year for which statistics are available.

PERSONS ENGAGED IN THE FISHERIES OF CONNECTICUT IN 1905.

How engaged.	Number.
On vessels fishing	988
On vessels transporting	49
In shore or boat fisheries	1,267
Shoresmen	1,103
Total	3,407

INVESTMENT IN THE FISHERIES OF CONNECTICUT IN 1905.

Items.	No.	Value.	Items.	No.	Value.
Vessels fishing	240	$689,880	Apparatus—shore fisheries—Continued.		
Tonnage	4,814		Pound nets	68	$16,100
Outfit		167,424	Fyke nets	190	1,911
Vessels transporting	20	44,655	Eel pots	1,576	1,469
Tonnage	398		Lobster pots	5,449	8,272
Outfit		4,505	Spears	47	41
Boats	1,368	107,579	Lines		132
Apparatus—vessel fisheries:			Harpoons		10
Seines	9	3,725	Dredges	475	2,217
Gill nets	175	1,740	Rakes	106	554
Lobster pots	1,213	2,415	Tongs	174	1,084
Lines		775	Hoes	276	222
Harpoons		725	Dip nets	4	8
Dredges	832	10,200	Shore and assessory property		426,980
Rakes	19	95	Cash capital		131,500
Tongs	6	30	Total		1,635,753
Apparatus—shore fisheries:					
Seines	84	4,847			
Gill nets	163	6,656			

PRODUCTS OF THE FISHERIES OF CONNECTICUT IN 1905.

Products.	Vessel fisheries.		Shore fisheries.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives			1,232,028	$15,980	1,232,028	$15,980
Bluefish	90,250	$5,420	37,752	2,381	128,002	7,801
Bullheads			4,090	228	4,090	228
Butterfish			21,327	995	21,327	995
Carp, German			1,267	96	1,267	96
Cod	541,200	23,800	13,670	583	554,870	24,383
Eels			178,197	13,004	178,197	13,004
Flatfish			253,988	8,071	253,988	8,071
Flounders	117,905	5,102	105,332	3,556	223,237	8,658
Haddock	293,700	8,460	500	15	294,200	8,475
Hake	2,500	50			2,500	50
Halibut	84,700	8,760			84,700	8,760
Mackerel	101,800	5,973	45,433	2,930	147,233	8,903
Menhaden	26,214,200	65,541	3,516,188	6,893	29,730,388	72,434
Perch			13,518	788	13,518	788
Pickerel			3,002	248	3,002	248
Pollock	6,200	150			6,200	150
Salmon			24	4	24	4
Scup	2,500	120	25,611	1,181	28,111	1,301
Sea bass	73,750	4,645	22,966	1,641	96,716	6,286
Shad			485,494	38,269	485,494	38,269
Smelt			16,895	2,330	16,895	2,330
Spanish mackerel			16	3	16	3
Squeteague			161,579	6,212	161,579	6,212
Striped bass			18,548	2,692	18,548	2,692
Sturgeon			1,969	88	1,969	88
Suckers			58,833	2,369	58,833	2,369
Sunfish			2,593	140	2,593	140
Swordfish	438,715	19,648	12,000	545	450,715	20,193
Tautog	13,900	603	71,308	2,946	85,208	3,549
Tomcod or frostfish			8,932	462	8,932	462
Whiting			68,580	990	68,580	990
Squid			26,350	614	26,350	614
Lobsters	94,380	12,160	342,410	43,981	436,790	56,141
Oysters, market	7,575,463	1,152,996	374,430	53,221	[a] 7,949,893	1,206,217
Oysters, seed	16,977,520	1,537,546	884,555	66,069	[b] 17,862,075	1,603,615
Clams			137,860	19,234	[c] 137,860	19,234
Quahogs	8,320	1,474	45,800	8,547	[d] 54,120	10,021
Shells			14,142,600	14,194	[e] 14,142,600	14,194
Total	52,637,003	2,852,448	22,335,645	321,500	74,972,648	3,173,948

[a] 1,135,699 bushels. [b] 2,551,725 bushels. [c] 13,786 bushels. [d] 6,765 bushels. [e] 235,710 bushels.

THE FISHERIES BY COUNTIES.

The following series of tables shows the extent of the commercial fisheries in 1905 in each of the five counties of Connecticut in which they are carried on:

STATEMENT, BY COUNTIES, OF THE NUMBER OF PERSONS ENGAGED IN THE FISHERIES OF CONNECTICUT IN 1905.

Counties.	On vessels fishing.	On vessels transporting.	In shore or boat fisheries.	Shoresmen.	Total.
Fairfield	518	37	408	268	1,231
Hartford			116	3	119
Middlesex			287	1	288
New Haven	240	7	195	752	1,194
New London	230	5	261	79	575
Total	988	49	1,267	1,103	3,407

STATEMENT, BY COUNTIES, OF THE INVESTMENT IN THE FISHERIES OF CONNECTICUT IN 1905.

Items.	Fairfield.		Hartford.		Middlesex.		New Haven.		New London.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	152	$909,280					49	$204,000	39	$176,600	240	$689,880
Tonnage	2,252						1,453		1,109		4,814	
Outfit		67,256						66,823		33,345		167,424
Vessels transporting	14	35,400					3	3,175	3	6,080	20	44,655
Tonnage	296						80		22		398	
Outfit		3,530						305		670		4,505
Boats	481	38,558	77	$2,811	254	$16,364	258	14,426	298	35,420	1,368	107,579
Apparatus—vessel fisheries:												
Seines									9	3,725	9	3,725
Gill nets									175	1,740	175	1,740
Lobster pots	68	120							1,145	2,295	1,213	2,415
Lines		13								762		775
Harpoons		195								530		725
Dredges	624	6,671					208	3,529			832	10,200
Rakes	17	87							2	10	19	97
Tongs							6	30			6	30
Apparatus—shore fisheries:												
Seines	7	540	29	2,213	30	1,592	4	100	14	402	84	4,847
Gill nets	1	18	23	382	103	3,925	1	35	35	2,296	163	6,656
Pound nets					10	3,350	8	3,450	50	9,300	68	16,100
Tyke nets	15	475	21	100	22	278	13	210	119	848	190	1,911
Eel pots	294	408	40	40	278	249	435	385	529	387	1,576	1,469
Lobster pots	270	409			830	1,245	1,075	1,470	3,274	5,148	5,449	8,272
Spears	21	21			6	4	7	5	13	11	47	41
Lines		2				16		2		112		132
Harpoons										10		10
Dredges	391	1,863					84	354			475	2,217
Rakes	91	487					10	51	5	16	106	554
Tongs	64	560			29	145	69	326	12	53	174	1,084
Hoes	108	95			35	27	117	88	16	12	276	222
Dip nets									4	8	4	8
Shore and accessory property		100,700		1,680		3,070		249,300		72,230		426,980
Cash capital		39,000						47,500		45,000		131,500
Total		605,688		7,226		30,265		595,564		397,010		1,635,753

STATEMENT, BY COUNTIES, OF THE PRODUCTS OF THE FISHERIES OF CONNECTICUT IN 1905.

Products.	Fairfield.		Hartford.		Middlesex.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives			896,980	$11,426	255,387	$3,410
Bluefish	2,250	$200			30,493	1,837
Bullheads			1,040	70	1,500	83
Butterfish					188	10
Carp, German			892	68	375	28
Cod					20	1
Eels	47,830	4,166	1,505	173	27,270	1,693
Flatfish	6,250	308			32,708	936
Flounders	5,425	310			16,695	732
Mackerel	7,500	450			7,050	531
Menhaden					247,800	506
Perch			4,392	281	7,326	391
Pickerel			240	23	1,327	113
Salmon					15	2
Sea bass					5,800	314
Shad	4	1	52,056	4,197	302,756	24,145
Smelt	12,800	1,920				
Squeteague	600	34			11,952	553
Striped bass	5,960	1,058			2,224	276
Sturgeon					1,002	37
Suckers			20,520	870	19,753	783
Sunfish			300	12	908	60
Swordfish	124,875	4,924				
Tautog	300	21			8,241	402
Tomcod, or frostfish	5,250	293				
Lobsters	27,720	4,770			35,615	4,655
Oysters, market	3,674,559	511,373			13,370	1,680
Oysters, seed	9,537,745	960,616			12,950	530
Clams	40,460	4,420			12,500	1,912
Quahogs	40,840	7,656			80	15
Shells	12,246,600	12,614				
Total	25,786,968	1,515,134	977,925	17,120	1,055,305	45,633

Products.	New Haven.		New London.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	7,886	$155	71,775	$989	1,232,028	$15,980
Bluefish	1,209	105	93,990	5,659	128,002	7,801
Bullheads			1,550	75	4,090	228
Butterfish	675	32	20,464	953	21,327	995
Carp, German					1,267	96
Cod			554,850	24,382	554,870	24,383
Eels	24,680	2,071	76,912	4,901	178,197	13,004
Flatfish	21,330	802	193,700	6,025	253,988	8,071
Flounders	682	34	200,435	7,582	223,237	8,658
Haddock			294,200	8,475	294,200	8,475
Hake			2,500	50	2,500	50
Halibut			84,700	8,760	84,700	8,760
Mackerel			132,683	7,922	147,233	8,903
Menhaden	3,211,548	6,081	26,271,040	65,847	29,730,388	72,434
Perch			1,800	116	13,518	788
Pickerel			1,435	112	3,002	248
Pollock			6,200	150	6,200	150
Salmon			9	2	24	4
Scup			28,111	1,301	28,111	1,301
Sea bass	400	24	90,516	5,948	96,716	6,286
Shad	10,404	809	120,274	9,117	485,494	38,269
Smelt			4,095	410	16,895	2,330
Spanish mackerel			16	3	16	3
Squeteague	10,301	424	138,726	5,201	161,579	6,212
Striped bass	340	53	10,024	1,307	18,548	2,692
Sturgeon	647	36	320	15	1,969	88
Suckers			18,560	716	58,833	2,369
Sunfish			1,385	68	2,593	140
Swordfish			325,840	15,269	450,715	20,193
Tautog	5,652	272	71,015	2,854	85,208	3,549
Tomcod, or frostfish	3,242	152	440	17	8,932	462
Whiting			68,580	990	68,580	990
Squid			26,350	614	26,350	614
Lobsters	43,045	6,116	330,410	40,600	436,790	56,141
Oysters, market	4,247,264	691,186	14,700	1,978	7,949,893	1,206,217
Oysters, seed	8,311,380	642,469			17,862,075	1,603,615
Clams	77,300	11,903	7,600	999	137,860	19,234
Quahogs	9,200	1,685	4,000	665	54,120	10,021
Shells	1,896,000	1,580			14,142,600	14,194
Total	17,883,245	1,365,989	29,269,205	230,072	74,972,648	3,173,948

THE PRODUCTS BY APPARATUS.

Through the importance of the oyster industry, the principal forms of apparatus used in the fisheries of Connecticut are dredges, rakes, and tongs, which yielded $2,853,528, or 90 per cent of the total value of the products. Next in rank among the forms of apparatus are seines, which yielded products to the value of $95,706; lines, which yielded $67,694 worth; eel and lobster pots, $66,140; pound nets, $32,347; gill nets, $31,048; harpoons and spears, $22,524; fyke nets, $4,501, and dip nets, which yielded only $460 worth of fishery products. The following series of tables show, by counties and species, the quantity and value of products taken with each form of apparatus in the vessel and shore fisheries of Connecticut in 1905:

STATEMENT BY COUNTIES OF THE CATCH BY DREDGES, TONGS, RAKES, ETC., IN CONNECTICUT IN 1905.

Products.	Fairfield.		Middlesex.		New Haven.		New London.		Total.	
	Pounds.	Value.	Lbs.	Val.	Pounds.	Value.	Lbs.	Val.	Pounds.	Value.
Vessel fisheries:										
Oysters, market, private	3,570,469	$499,339	.....	.....	3,994,144	$652,857	.....	.....	7,564,613	$1,152,196
Oysters, market, public	5,250	400	.....	.....	5,600	400	.....	.....	10,850	800
Oysters, seed, private	8,082,550	849,306	.....	.....	8,025,850	623,120	.....	.....	16,108,400	1,472,426
Oysters, seed, public	744,100	56,575	.....	.....	125,020	8,545	.....	.....	869,120	65,120
Quahogs	5,520	1,034	.....	.....	.....	.....	2,800	$440	8,320	1,474
Flounders	4,325	247	.....	.....	.....	.....	.....	.....	4,325	247
Total	12,412,214	1,406,901	.....	.....	12,150,614	1,284,922	2,800	440	24,565,628	2,692,263
Shore fisheries:										
Oysters, market, private	98,840	11,634	6,020	$825	234,360	36,519	14,700	1,978	353,920	50,956
Oysters, market, public	.....	.....	7,350	855	13,160	1,410	.....	.....	20,510	2,265
Oysters, seed, private	60,620	5,093	.....	.....	9,800	760	.....	.....	70,420	5,853
Oysters, seed, public	650,475	49,642	12,950	530	150,710	10,044	.....	.....	814,135	60,216
Clams	40,460	4,420	12,500	1,912	77,300	11,903	7,600	999	137,860	19,234
Quahogs	35,320	6,622	80	15	9,200	1,685	1,200	225	45,800	8,547
Shells	12,246,600	12,614	.....	.....	1,896,000	1,580	.....	.....	14,142,600	14,194
Total	13,132,315	90,025	38,900	4,137	2,390,530	63,901	23,500	3,202	15,585,245	161,265
Grand total	25,544,529	1,496,926	38,900	4,137	14,541,144	1,348,823	26,300	3,642	40,150,873	2,853,528

STATEMENT, BY COUNTIES, OF THE YIELD OF THE SEINE FISHERIES OF CONNECTICUT IN 1905.

Products.	Fairfield.		Hartford.		Middlesex.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Shore fisheries:						
Alewives			896,860	$11,423	217,127	$2,886
Bullheads			915	58	1,500	83
Carp, German			867	66	375	28
Eels			800	109	100	8
Flatfish					270	12
Perch			4,132	265	6,526	343
Pickerel			240	23	927	85
Shad			43,116	3,478	31,468	2,454
Smelt	12,800	$1,920				
Squeteague	250	13				
Striped bass	2,960	518			1,121	144
Sturgeon					820	26
Suckers			18,070	770	17,753	718
Sunfish			300	12	708	50
Tomcod, or frostfish	2,750	143				
Total	18,760	2,594	965,300	16,204	278,695	6,837
Grand total	18,760	2,594	965,300	16,204	278,695	6,837

Products.	New Haven.		New London.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Vessel fisheries:						
Bluefish			8,000	$420	8,000	$420
Flounders			7,250	240	7,250	240
Mackerel			8,000	400	8,000	400
Menhaden			26,213,400	65,536	26,213,400	65,536
Squeteague			45,000	1,800	45,000	1,800
Total			26,281,650	68,396	26,281,650	68,396
Shore fisheries:						
Alewives	2,100	$54	7,795	138	1,123,882	14,501
Bullheads			1,300	65	3,715	206
Carp, German					1,242	94
Eels	820	82			1,720	199
Flatfish			200	8	470	20
Perch			1,000	60	11,658	668
Pickerel			1,200	84	2,367	192
Shad	80	8			74,664	5,940
Smelt					12,800	1,920
Squeteague	2,600	78	250	12	3,100	103
Striped bass	100	15	3,571	521	7,752	1,198
Sturgeon					820	26
Suckers			14,460	520	50,283	2,008
Sunfish			360	30	1,368	92
Tomcod, or frostfish					2,750	143
Total	5,700	237	30,136	1,438	1,298,591	27,310
Grand total	5,700	237	26,311,786	69,834	27,580,241	95,706

STATEMENT, BY COUNTIES, OF THE YIELD OF THE LINE FISHERIES OF CONNECTICUT IN 1905.

Products.	Fairfield.		Middlesex.		New Haven.		New London.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Vessel fisheries:										
Bluefish	2,250	$200					80,000	$4,800	82,250	$5,000
Cod							541,200	23,800	541,200	23,800
Flounders							106,330	4,615	106,330	4,615
Haddock							293,700	8,460	293,700	8,460
Hake							2,500	50	2,500	50
Halibut							84,700	8,760	84,700	8,760
Mackerel	7,500	450					20,000	1,235	27,500	1,685
Pollock							6,200	150	6,200	150
Scup							2,500	120	2,500	120
Sea bass							73,250	4,615	73,250	4,615
Squeteague							5,200	208	5,200	208
Tautog							13,900	603	13,900	603
Total	9,750	650					1,229,480	57,416	1,239,230	58,066
Shore fisheries:										
Bluefish			28,750	$1,700			2,800	209	31,550	1,909
Cod							13,500	576	13,500	576
Eels	1,200	120							1,200	120
Flounders			8,500	355			9,950	410	18,450	765
Haddock							500	15	500	15
Mackerel			7,050	531			26,450	1,757	33,500	2,288
Sea bass			5,800	314	400	$24	15,800	1,247	22,000	1,585
Squeteague			4,300	215			6,600	318	10,900	533
Tautog			7,200	360	4,000	200	30,900	1,277	42,100	1,837
Total	1,200	120	61,600	3,475	4,400	224	106,500	5,809	173,700	9,628
Grand total	10,950	770	61,600	3,475	4,400	224	1,335,980	63,225	1,412,930	67,694

STATEMENT, BY COUNTIES, OF THE CATCH BY POTS IN THE FISHERIES OF CONNECTICUT IN 1905.

Products.	Fairfield.		Hartford.		Middlesex.		New Haven.		New London.		Total.	
	Lbs.	Value.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Value.	Lbs.	Value.
Vessel fisheries:												
Sea bass									500	$30	500	$30
Lobsters	9,850	$1,650							84,530	10,510	94,380	12,160
Total	9,850	1,650							85,030	10,540	94,880	12,190
Shore fisheries:												
Eels	32,880	2,786	685	$62	20,640	$1,291	21,260	$1,746	63,942	4,056	139,407	9,941
Sea bass									400	28	400	28
Lobsters	17,870	3,120			35,615	4,655	43,045	6,116	245,880	30,090	342,410	43,981
Total	50,750	5,906	685	62	56,255	5,946	64,305	7,862	310,222	34,174	482,217	53,950
Grand total	60,600	7,556	685	62	56,255	5,946	64,305	7,862	395,252	44,714	577,097	66,140

STATEMENT, BY COUNTIES, OF THE YIELD OF THE POUND-NET FISHERIES OF CONNECTICUT IN 1905.

Products (shore fisheries).	Middlesex.		New Haven.		New London.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	24,800	$248	5,786	$101	25,980	$383	56,566	$732
Bluefish	85	7	169	17	3,190	230	3,444	254
Butterfish	160	8	675	32	20,464	953	21,299	993
Cod	20	1			150	6	170	7
Eels					4,910	286	4,910	286
Flatfish	27,720	764	7,177	290	156,630	4,733	191,527	5,787
Flounders	7,275	342	682	34	75,705	2,269	83,662	2,645
Mackerel					11,933	642	11,933	642
Menhaden	243,000	487	3,211,548	6,081	56,840	306	3,511,388	6,874
Salmon	15	2			9	2	24	4
Scup					25,611	1,181	25,611	1,181
Sea bass					566	28	566	28
Shad	57,020	5,081	10,324	801	250	24	67,594	5,906
Smelt					4,075	408	4,075	408
Spanish mackerel					16	3	16	3
Squeteague	2,621	82	5,456	232	81,176	2,838	89,253	3,152
Striped bass	133	15	80	13	5,963	707	6,176	735
Sturgeon	170	10	647	36	320	15	1,137	61
Tautog	850	34	1,132	51	25,715	950	27,697	1,035
Tomcod, or frostfish					240	10	240	10
Whiting					68,580	990	68,580	990
Squid					26,350	614	26,350	614
Total	363,869	7,081	3,243,676	7,688	594,673	17,578	4,202,218	32,347

STATEMENT, BY COUNTIES, OF THE YIELD OF THE GILL-NET AND DIP-NET[a] FISHERIES OF CONNECTICUT IN 1905.

Products.	Fairfield.		Hartford.		Middlesex.		New Haven.		New London.		Total.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Value.	Lbs.	Val.	Lbs.	Value.	Lbs.	Value.
Vessel fisheries:												
Mackerel									66,300	$3,888	66,300	$3,888
Menhaden									800	5	800	5
Total									67,100	3,893	67,100	3,893
Shore fisheries:												
Alewives					11,560	$248			37,500	460	49,060	708
Bluefish					1,600	124	1,100	$88			2,700	212
Shad	4	$1	8,940	$719	214,172	16,602			120,024	9,093	343,140	26,415
Squeteague					3,200	160	400	20			3,600	180
Striped bass					850	100					850	100
Total	4	1	8,940	719	231,382	17,234	1,500	108	157,524	9,553	399,350	27,615
Grand total	4	1	8,940	719	231,382	17,234	1,500	108	224,124	13,446	466,450	31,508

[a] The dip-net catch is represented by one item, 37,500 pounds of alewives, valued at $460, taken in New London County.

STATEMENT, BY COUNTIES, OF THE YIELD OF THE FYKE-NET FISHERIES OF CONNECTICUT IN 1905.

Products (shore fisheries.)	Fairfield.		Hartford.		Middlesex.		New Haven.		New London.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives			120	$3	1,900	$28			500	$8	2,520	$39
Bluefish					58	6					58	6
Bullheads			125	12					250	10	375	22
Butterfish					28	2					28	2
Carp, German			25	2							25	2
Eels	1,200	$90	20	2	260	18	350	$26	700	54	2,530	190
Flatfish	6,250	308			4,718	160	14,153	512	36,870	1,284	61,991	2,264
Flounders					920	35			1,200	48	2,120	83
Menhaden					4,800	19					4,800	19
Perch			260	16	800	48			800	56	1,860	120
Pickerel					400	28			235	28	635	56
Shad					96	8					96	8
Smelt									20	2	20	2
Squeteague	350	21			1,831	96	1,845	94	500	25	4,526	236
Striped bass	3,000	540			120	15	160	25	490	79	3,770	659
Sturgeon					12	1					12	1
Suckers			2,450	100	2,000	65			4,100	196	8,550	361
Sunfish					200	10			1,025	38	1,225	48
Tautog	300	21			191	8	520	21	500	24	1,511	74
Tomcod, or frostfish	2,500	150					3,242	152	200	7	5,942	309
Total	13,600	1,130	3,000	135	18,334	547	20,270	830	47,390	1,859	102,594	4,501

STATEMENT, BY COUNTIES, OF THE CATCH BY SPEARS AND HARPOONS IN THE FISHERIES OF CONNECTICUT IN 1905.

Products.	Fairfield.		Middlesex.		New Haven.		New London.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Vessel fisheries:										
Swordfish	124,875	$4,924					313,840	$14,724	438,715	$19,648
Shore fisheries:										
Eels	12,550	1,170	6,270	$376	2,250	$217	7,360	505	28,430	2,268
Flounders	1,100	63							1,100	63
Swordfish							12,000	545	12,000	545
Total	13,650	1,233	6,270	376	2,250	217	19,360	1,050	41,530	2,876
Grand total	138,525	6,157	6,270	376	2,250	217	333,200	15,774	480,245	22,524

THE OYSTER INDUSTRY.

The increase in the value of the Connecticut fisheries has been due almost entirely to the expansion of the oyster industry of the state. The number of persons engaged in this industry increased in the two years under consideration from 1,678 to 2,127; the capital invested grew from $848,051 to $1,063,908, and the value of the oysters rose from $1,471,582 to $2,809,832, or nearly 100 per cent. The increase in the yield of seed oysters was from 1,233,469 bushels, worth $598,948, to 2,551,725 bushels, worth $1,603,615; while the market oysters have increased from 848,065 bushels, valued at $872,634, to 1,135,699 bushels, for which the fishermen received $1,206,217. Exclusive of the oyster industry, the number of persons

employed in the fisheries increased from 1,162 in 1902 to 1,280 in 1905; the capital invested increased from $353,004 to $571,845, and the value of the product increased from $327,799 to $364,116.

STATEMENT, BY COUNTIES, OF THE EXTENT OF THE OYSTER INDUSTRY OF CONNECTICUT IN 1905.

Items.	Fairfield.		Middlesex.		New Haven.		New London.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Persons engaged:										
On vessels and boats	802	.....	29	.....	312	.....	8	.....	1,151	.....
Shoresmen	268	.....	.....	.....	708	.....	.....	.....	976	.....
Total	1,070	.....	29	.....	1,020	.....	8	.....	2,127	.....
Steamers	51	$277,500	.....	.....	34	$195,950	.....	.....	85	$473,450
Tonnage	1,435	.....	.....	.....	1,307	.....	.....	.....	2,742	.....
Outfit	.....	57,910	.....	.....	.....	65,510	.....	.....	.....	123,420
Sail vessels	114	62,430	.....	.....	18	11,225	.....	.....	132	73,655
Tonnage	1,089	.....	.....	.....	226	.....	.....	.....	1,315	.....
Outfit	.....	12,155	.....	.....	.....	1,618	.....	.....	.....	13,773
Boats (under 5 tons)	257	30,448	29	$395	87	6,177	10	$639	383	37,659
Dredges	1,015	8,534	.....	.....	292	3,883	.....	.....	1,307	12,417
Tongs, rakes, etc	16	80	29	145	69	308	10	41	124	574
Shore property	.....	100,250	.....	260	.....	228,250	.....	200	.....	328,960
Total investment	.....	549,307	.....	800	.....	512,921	.....	880	.....	1,063,908
Oysters sold:										
Private, market, bush	360,587	309,863	860	825	18,500	23,082	2,100	1,978	382,047	335,748
Private, market, gal	163,600	201,110	.....	.....	585,572	666,294	.....	.....	749,172	867,404
Private, seed, bush	1,163,310	854,399	.....	.....	1,147,950	623,880	.....	.....	2,311,260	1,478,279
Public, market..do	750	400	1,050	855	2,680	1,810	.....	.....	4,480	3,065
Public, seed.....do	199,225	106,217	1,850	530	39,390	18,589	.....	.....	240,465	125,336
Total	.....	1,471,989	.....	2,210	.....	1,333,655	.....	1,978	.....	2,809,832

THE MENHADEN INDUSTRY.

Next to the oyster industry, the most important fishery in Connecticut is the menhaden, which also shows a considerable growth during the two years considered, the product increasing from 16,876,690 pounds, worth $47,964, in 1902, to 29,730,388 pounds, valued at $72,434, in 1905.

EXTENT OF THE MENHADEN INDUSTRY OF CONNECTICUT IN 1905.

Items.	No.	Value.	Items.	No.	Value.
Factories in operation	3	$59,600	Products prepared:		
Cash capital	7	40,000	Oil.....gal..	293,670	$55,866
Factory employees	76	.....	Dry scrap..... tons..	2,485	56,140
Men on vessels	92	.....	Acidulated scrap .do...	502	7,020
Steam vessels fishing	4	111,000	Green scrap .....do...	468	6,786
Tonnage	391	.....			
Outfit	.....	12,800	Value of products	.....	125,812
Seines used on vessels	4	3,000			
Menhaden utilized	46,336,600	71,875			

MISCELLANEOUS NOTES.

Owing largely to the greater efficiency of the lobster equipment by the introduction of motor boats, there has been an increase in the quantity of lobsters taken from 371,650 pounds in 1902 to 436,790 pounds in 1905. As the average value of the lobsters increased from 10.9 cents to 12.8 cents in the same period, the fishermen have been fairly prosperous. The yield of shad has increased from 119,945 in number to 121,373, and the average value has increased from 21.7 cents in 1902 to 31.5 cents in 1905. Among the other products which show an increase the most noticeable are cod, from 211,340 pounds to 554,870 pounds; haddock, from 189,150 to 294,200 pounds; swordfish, from 165,930 pounds to 450,715 pounds, and shells from the Housatonic River, which in 1905 amounted to 235,710 bushels. The principal items which show a decrease are bluefish, from 348,575 pounds to 128,002 pounds; mackerel, from 300,690 pounds to 147,233 pounds; scup, from 396,340 pounds to 28,111 pounds; squeteague, from 407,720 pounds to 161,579 pounds; clams, from 22,460 bushels to 13,786 bushels, and quahogs, from 18,927 bushels to 6,765 bushels. In 1902, 2,400 bushels of scallops were reported, but none are among the returns for 1905.

WHOLESALE FISHERY TRADE.

INVESTMENT AND NUMBER OF PERSONS ENGAGED IN THE WHOLESALE FISHERY TRADE OF CONNECTICUT IN 1905.

Items.	No.	Value.	Items.	No.	Value.
Establishments	6	$44,800	Wages paid		$38,920
Cash capital		91,500	Persons engaged	139	

DREDGING AND HYDROGRAPHIC RECORDS OF THE U. S. FISHERIES STEAMER ALBATROSS FOR 1906

Bureau of Fisheries Document No. 621.

Blank page retained for pagination

DREDGING AND HYDROGRAPHIC RECORDS OF THE U. S. FISHERIES STEAMER ALBATROSS FOR 1906.

This expedition of the *Albatross* covered the period from May 3 to December 10, 1906. The vessel sailed from San Francisco via Seattle to Dutch Harbor, Alaska; thence to the westward, among the Aleutian Islands, swinging northward and back again, to take in Bowers Bank in Bering Sea; from the end of the Aleutian chain northwestward to the Komandorski Islands, then to Petropaulovsk, Kamchatka; thence rounding the southern point of this peninsula and up its western coast to latitude 51° 40′; from this point southwestward in the Okhotsk Sea along the Kuril Islands to Hakodate, whence the course was taken along the western coast of Hondo, crossing the Sea of Japan to the Korean coast; thence zigzagging southward among the numerous islands at the lower end of the Japanese Archipelago, including the northern Linschotens; northward along the eastern Japanese coast, through the Inland Sea and along the outer coast of Hondo, again to Hakodate, thus completely circumnavigating Hondo and Kiushiu. From Hakodate the ship cruised northward west of Hokkaido, up the western coast of Saghalin Island to latitude 47° 40′, returning and rounding the lower end of the island to Cape Patience on the eastern side; from Cape Patience south again to the eastward of Hokkaido and back to Hakodate, returning thence to Yokohama, from which point, after a short cruise in Suruga and Sagami bays, the vessel sailed for San Francisco.

Three hundred and eighty-five stations were occupied during this expedition, the work including dredging and other collecting, and hydrographic and meteorological observations. Complete data for each of these stations are given in the following tables. Serial temperature records where taken are separately tabulated.

All stations where apparatus was employed to collect natural history material are given numbers in the "dredging" series, and are indicated by the prefixed letter D. The hydrographic stations, where soundings only were made, have another series of numbers and are designated by the letter H. At times specimens were taken with dip nets during the occupation of a hydrographic station, but, on account of the irregularity of such collecting, the station was not regarded as a collecting station. The last previous dredging station

was D. 4756, occupied during the Alaska cruise of 1905; the last hydrographic station was H. 4848, of the Eastern Pacific cruise of 1904–5. The present expedition extends the series, respectively, to D. 5095 and H. 4896.

The various kinds of apparatus used at each station are recorded in chronological order, each on a separate line, opposite the station number in the column "Apparatus."

The "Position" of a station is that point occupied by the vessel, as determined by the navigator at the time of beginning the first operation at that station. The position of the subsequent operations under the same station number correspond in a general way to the line as indicated under "Drift." The distance covered by all the operations of a station, however, is usually not greater than the negligible error of observation, except in stations near shore determined by bearings.

The degree of accuracy with which positions are located is, however, of greater importance in relation to the hydrographic information obtained, and a description of the methods is necessary to the proper use of this information. A great part of the region traversed is still unsurveyed; and even where surveyed, parts are incorrectly or incompletely charted. Owing to press of work and lack of time, no opportunity was afforded to correct such errors, and the best available charts were therefore used as the basis of all determinations of position when in sight of land; in the column "Chart" is noted the number and edition of the chart used at each station. When in sight of land position was fixed by the method that seemed best in each case—cross bearings, bearing and sextant angle, "three-point problem," vertical sextant angle and compass bearing—and from the position so obtained *on the chart in use* the latitude and longitude were pricked off and set down in the record as the position of the station. Since in unsurveyed regions different charts of the same locality vary greatly, it is evident that to replot a station accurately in relation to the shore features the position of the station as given by latitude and longitude must be set down *on the same chart from which it was determined*—that is, the chart specified in the column "Chart." If these charts should hereafter be corrected in latitude and longitude, the positions assigned to the stations must be changed accordingly.

In conformity with previous practice, an additional position, by true bearing and distance, of some prominent shore feature is given for each station when practicable. As viewed from the ship, the nearest and most prominent objects on shore from which the ship's position was determined were often topographical features, inconspicuous and unnamed on the chart, and impossible of identification by a brief written description. Therefore the bearings given in the

tables were laid off from the plotted position on the chart to some object prominent on the chart, whether the object could actually be seen from the ship or not. Positions may be plotted approximately by means of these bearings more conveniently than by their latitude and longitude, but where exactness is required the latter method should be used. In the case of stations from D. 4922 to H. 4883, inclusive, the chart used was found so far from accurate that no bearings observed could be made to plot. These positions are given, therefore, by the actual cross bearings observed, and when a correct chart of this locality is made these stations may be accurately plotted from the bearings given. In a few other cases, where there was no well-defined shore feature from which to measure, cross bearings are given instead of single bearings and distance, in addition to latitude and longitude. All bearings are true unless otherwise indicated.

The spelling of all geographic names in these tables is that found on the charts designated in the column "Chart." There is considerable variation in this respect in the different issues of charts.

"Time of day" in the case of soundings indicates the time the plummet struck bottom; in the case of dredgings, the time at which the apparatus began to tow on the bottom; in the case of intermediate nets, the time at which the nets started to tow at the depth indicated; in the case of surface hauls, the time at which they were lowered into the water and began to be towed or the current to pass through them.

"Depth" (in fathoms) is the depth obtained by the sounding when a sounding was made. In cases where no sounding was made the depth is estimated from the chart, unless the station immediately follows another, in which case the depth obtained at the preceding station is given. The least and greatest depths are given when the operation was of long duration.

"Temperatures." The air temperatures are taken from the ship's log for the hour nearest the hour entered in the time column; the same is true of the surface temperatures where the towing commenced near the hour mark, but in other cases the surface temperature was taken at the time given. The bottom temperature was taken at the time of sounding.

The "surface density" was in all cases reduced to 15° Centigrade.

In the double column "Trial" is indicated the depth at which apparatus was worked, as well as the duration of operation. In the case of bottom apparatus this latter is the time during which it is supposed to be dragging on the bottom, up to the beginning of reeling in; for intermediate nets the time occupied in towing at the depth shown in the depth column is indicated by the first quantity, the time occupied in hoisting by the second; for surface nets the time indicated is the time actually towed at the surface.

In the double column of "Drift" is shown approximately the general direction in which the gear was hauled as well as the distance. The state of the currents and of the wind, with the exigencies incident to the steering of the ship, make this more or less inaccurate.

The apparatus used consisted of the usual beam trawls and tangle swabs for all work on the bottom. All intermediate and surface work was done with a large tow net and three small plankton or Kofoid nets. The large net is known as "intermediate 3," and was usually rigged with two Kofoid nets, one at each side, when used for intermediate work, being lowered from the dredging boom on the starboard side. When used for surface work in the evening, it was lowered from the lower boom on the port side, the small plankton nets not being attached but towed astern from the taffrail, on two separate lines about 10 feet apart. The cod-lines were used several times on fishing banks.

ABBREVIATIONS AND SYMBOLS.

8′ Agassiz.....The 8-foot Agassiz beam trawl. The Agassiz type of beam trawl was used more and with better results than any other used during the cruise.

8′ Alb.-Blk.....8-foot Albatross-Blake beam trawl. The 8 and 9 foot Albatross-Blake beam trawls were used a few times during the cruise.

B. A.....British Admiralty.

botm.....bottom.

C. S.....Coast Survey.

Cod lines.....The usual codfishing handlines. These lines carried a 3½-pound sinker and two hooks and were used only on codfish banks.

D.....dredging, or collecting, station.

e. l.....electric light.

ext. cor.....extensive correction.

H.....hydrographic station.

H. O.....U. S. Hydrographic Office.

hbr.....harbor.

int. 3.....intermediate 3. This is a large ship's net on a 5½-foot ring; net about 11 feet long made of no. 0000 grit gauze, with about 3 feet of the bottom of no. 3 silk, and a brass bucket at the bottom. The outside netting is one-half inch webbing for the protection of the silk.

K. 1.....a small plankton or Kofoid net, made of no. 12 silk, on a 14-inch ring.

K. 2.....same as above, but made of no. 20 silk.

K. 4.....same as above, but made of no. 3 silk.

l. t.....left tangent.

Lt.....light.

Luc. sdr.....Lucas sounding machine.

mag.....magnetic.

m. b.....mud bag.

r. t.....right tangent.

spec.....specimen.

swabs.....tangle swabs.

12′ Tnr.....12-foot Tanner beam trawl; next to the 9-foot Agassiz, this was used more than any other during the cruise.

Tnr.-Blish sdr...Tanner-Blish sounding machine.

therm.....Negretti & Zambra thermometer, with Tanner case.
tr.....true.
wat. bot.....Sigsbee water bottle.
wng.....wing-nets, formerly called "butterflies."
* signifies depth as shown by chart when no sounding has been made.
** signifies depth and character of bottom as obtained by sounding at previous station.
‡ signifies nets towed astern, from taffrail, side by side, and about 10 feet apart.
§ signifies apparatus towed (horizontally) at depth indicated, during number of minutes given in the first period; then hoisted (vertically) to surface, net open, in time next shown.
△.....beacon.
?.....doubtful.

"Character of bottom," determined by the specimens from the sounding cup, is expressed by symbols, the key to which is appended:

bk...black.	dk...dark.	gy...gray.	S.....Sand.
bl....blue.	fne...fine.	hrd...hard.	Sh...Shells.
br...brown.	For...Foraminifera.	lav...lava.	sml...small.
br-gn.brownish-green.	G....Gravel.	M....Mud.	Sp..Specks.
brk..broken.	Glob..Globigerina.	Oz...Ooze.	St...Stones.
C....Clay	gn....green.	P.....Pebbles.	vol..volcanic.
Co...Coral.	gn-br.greenish-brown.	R.....Rock.	
crs..coarse.	gn-gy.greenish-gray.	rky....rocky.	

DREDGING RECORDS OF THE NORTHWESTERN

Station No.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	From San Francisco, Cal., to Union Bay, B. C.[a]				*fms.*	
D. 4757	39° 18′ N., 123° 58′ W. (about 20 miles off coast of California).	C. S. 5700; Mar.,1888.	May 4	10.02 a. m.	146	no spec.....
				10.13 a. m.	146	no spec.....
	From Union Bay, B. C., to Dutch Harbor, Alaska, via Goletas Channel and Unalga Pass.[b]					
D. 4758	Cape St. James, Queen Charlotte Ids., E. ¼ S., 70 miles (52° 02′ N., 132° 53′ W.).	H. O. 904; published Apr.,1883; ext. cor. Apr.1904.	May 19	10.21 a. m.	*1,600	.....
D. 4759	53° 05′ N., 138° 31′ W.....	C. S. "T;" published Apr.,1906.	May 20	10.15 a. m.	*2,000	.....
D. 4760	53° 53′ N., 144° 53′ W.....	....do.....	May 21	10.20 a. m.	*2,200	.....
D. 4761	Pt. Farewell, Shumagin Ids., north, 49 miles (53° 57′ 30″ N., 159° 31′ W.).	C. S. 8800; published June,1902.	May 23	1.24 p. m. 3.10 p. m.	1,973 1,973	bl. C..... bl. C.....
D. 4762	E. pt. Ugamak Id., N. 20° W., 29 miles (53° 46′ N., 164° 29′ W.).	C. S. 8860; published May,1902.	May 24	8.59 a. m. 9.04 a. m.	56 56	gn. S., brk. Sh.... gn. S., brk. Sh....
	From Dutch Harbor, Alaska, to Nazan Bay, Atka Id., Aleutian Ids.[c]					
D. 4763	Middle Peak, Bogoslof Ids., N. 79° E., 7 miles (53° 57′ N., 168° 06′ W.).	C. S. 8800	May 28	4.19 p. m.	*780	.....
D. 4764	NE. pt. Yunaska Id., S. 19° E., 41 miles (53° 20′ N., 171° W.).	....do.....	May 29	8.14 a. m. 9.16 a. m.	1,130 1,130	no spec..... br. M. (dredge)...
D. 4765	West pt. Yunaska Id., S. 37° E., 43.5 miles (53° 12′ N., 171° 37′ W.).	H. O. 8; published May,1868; ext. cor. June,1904.	....do...	1.20 p. m. 2.22 p. m. 4.02 p. m.	1,217 1,217 1,217	no spec..... fne. bk. S.(dredge) fne. bk. S.(dredge)
	From Nazan Bay, Atka Id., Aleutian Ids., to "Bowers Bank," Bering Sea.					
D. 4766	Koniuji Id., S. 22½° W., 27 miles (52° 38′ N., 174° 49′ W.).	....do.....	May 31	1.33 p. m.	1,766	no spec.....
				3.04 p. m.	1,766	no spec.....
				5.01 p. m.	1,766	no spec.....
H. 4849	53° 05′ N., 176° 11′ W.....	C. S. 9100; published Feb.,1906.	June 1	12.16 a. m.	2,050	br. M., bk. S.....
	On "Bowers Bank," Bering Sea.					
H. 4850	54° 05′ N., 179° 10′ E. (approx. position).	....do.....	June 3	6.21 a. m.	804	?.....
H. 4851	54° 07′ 30″ N., 179° 02′ 20″ E. (approx. position).	....do.....	....do...	7.59 a. m.	981	?.....

[a] Shore collections were made while ship was in dry dock at Quartermaster Harbor, near Tacoma, and at Union Bay while ship was coaling.

PACIFIC CRUISE OF THE ALBATROSS, 1906.

Temperatures.			Surface density.	Apparatus.	Trial.		Drift.		Remarks.
Air.	Surface.	Bottom.			Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.				h. m.		mi.	
56	53	.....	.....	Luc. sdr.....	.....	.....	.....	.....	Wire carried away after striking bottom. Lost 35-lb. lead and 146 fms. sounding wire.
56	53	.....	1.02387	Int.3; K.1, K.2§	100 fms.	0 20 8	NW. ½ N..	0.8	125 fms. dredge wire out.
52	50	.....	1.02310	Int.3; K.1, K.2§	300 fms.	20 16	NW. ½ N..	.8	400 fms. dredge wire out.
51	46	.....	1.02330	Int.3; K.1, K.2§	300 fms.	20 17	NW.byW.	.8	Westward of Queen Charlotte Ids.; 400 fms. dredge wire out.
44	44	.....	1.02333	Int.3; K.1, K.2§	300 fms.	20 16	E.....	.8	400 fms. dredge wire out.
46	44	35.0	.....	Luc. sdr.....	.....	.....	.....	.....	
47	44	35.0	.....	8′ Agassiz; m. b.; wng.	botm..	21	NE.....	.8	About 25 miles south of Chernabour Id.
51	40	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
51	40	.....	.....	Int.3; K.1, K.2§	50 fms..	20 4	NNW. ½ N.	.8	75 fms. dredge wire out.
41	42	.....	1.02330	Int.3; K.1, K.2§	300 fms.	20 14	SW. by W.	.8	In Bering Sea; 400 fms. dredge wire out.
40	41	35.2	.....	Luc. sdr.....	.....	.....	.....	.....	
40	41	35.2	.....	8′ Agassiz; m. b.; wng.	botm..	20	N. ½ E. to NE. ½ N..	.8	Lost one wing net.
41	42	35.2	.....	Luc. sdr.....	.....	.....	.....	.....	
45	42	35.2	1.02350	8′ Agassiz; m. b.	botm..	20	NNE. ½ N.	.8	Net came up foul of frame.
42	42	35.2	.....	Int.3; K.1, K.2§	300 fms.	20 13	NNE. ½ N.	.8	400 fms. dredge wire out.
40	41	?	.....	Luc. sdr.....	.....	.....	.....	.....	Lost five 60-lb. sounding shot; defective sounding cup attachment. Lost N. & Z. deep-sea therm.
46	41	?	.....	8′ Agassiz; m. b.	botm..	25	N. ½ E...	.9	
43	41	?	.....	Int.3; K.1, K.2§	300 fms.	20 13	NNE. ½ E.	.7	400 fms. dredge wire out.
42	41	35.0	.....	Luc. sdr.....	.....	.....	.....	.....	
39	40	36.1	.....	Luc. sdr.....	.....	.....	.....	.....	
39	40	.....	.....	Luc. sdr.....	.....	.....	.....	.....	First trial wire broke at 340 fms. Lost N. & Z. therm., sounding cup, stray lead, and 330 fms. sounding wire.

b Shore collections were made at Dutch Harbor, seining in Summer Bay.
c Shore collections were made in Nazan Bay.

Station No.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	On "Bowers Bank," Bering Sea—Continued.				*fms.*	
D. 4767	54° 12′ N., 179° 07′ 30″ E. (approx. position).	C. S. 9100; published Feb., 1906.	June 3	9.04 a. m.	771	gn. M.
				9.54 a. m.	771	gn. M.
				11.22 a. m.	771	gn. M.
D. 4768	54° 20′ 30″ N., 179° 09′ 30″ E. (approx. position).	....do....	....do...	1.12 p. m.	764	gn-br. M., fne. bk. S.
				1.58 p. m.	764	gn-br. M., fne. bk. S.
D. 4769	54° 30′ 40″ N., 179° 14′ E. (approx. position).	....do....	....do...	4.28 p. m.	244	gy. S., gn. M.
				4.53 p. m.	244–237	gy. S., gn. M.
				5.32 p. m.	237	.....
D. 4770	54° 31′ N., 179° 15′ E. (approx. position).	....do....	....do...	6.58 p. m.	247	.....
				7.08 p. m.	247	.....
D. 4771	54° 30′ N., 179° 17′ E.	....do....	June 4	7.02 a. m.	426	brk. Sh.
				7.39 a. m.	426	brk. Sh.
D. 4772	54° 30′ 30″ N., 179° 14′ E.	....do....	....do...	8.49 a. m.	344	gn-br. S.
				9.18 a. m.	344–372	gn-br. S.
				10.15 a. m.	372	gn-br. S.
D. 4773	54° 31′ N., 179° 04′ E.	....do....	....do...	11.05 a. m.	338	gn-br. S.
				11.30 a. m.	338	gn-br. S.
D. 4774	54° 33′ N., 178° 45′ E.	....do....	....do...	1.33 p. m.	557	gn. M., bk. Sp., For.
				2.13 p. m.	557–584	gn. M., bk. Sp., For.
D. 4775	54° 33′ 30″ N., 178° 44′ E.	....do....	....do...	3.14 p. m.	584	gn. M., bk. Sp., For.
				3.53 p. m.	584	gn. M., bk. Sp., For.
				5.06 p. m.	584	gn. M., bk. Sp., For.
	From "Bowers Bank" to "Petrel Bank," Bering Sea.					
H. 4852	54° 24′ N., 178° 44′ E.	....do....	June 4	7.05 p. m.	1,226	gn-br. M.
H. 4853	53° 37′ N., 179° 07′ E.	....do....	June 5	1.08 a. m.	1,718	br. M.
H. 4854	52° 50′ 30″ N., 179° 26′ E.	....do....	June 5	7.07 a. m.	702	crs. gn-br. S.
H. 4855	52° 41′ N., 179° 31′ E.	....do....	....do...	8.39 a. m.	842	no spec.
H. 4856	52° 35′ 30″ N., 179° 33′ E.	....do....	....do...	9.42 a. m.	808	gn. M., fne. bk. S., diatoms.
H. 4857	52° 29′ 30″ N., 179° 35′ E.	....do....	....do...	10.39 a. m.	324	fne. bk. S., diatoms.
	On "Petrel Bank," Bering Sea.					
H. 4858	52° 26′ 30″ N., 179° 36′ E.	....do....	June 5	11.06 a. m.	48	rky.?
H. 4859	52° 23′ 20″ N., 179° 37′ E.	....do....	....do...	11.26 a. m.	73	rky.?
H. 4860	52° 20′ N., 179° 39′ E.	....do....	....do...	11.45 a. m.	85	sml. G.
H. 4861	52° 16′ 30″ N., 179° 40′ 20″ E.	....do....	....do...	12.09 p. m.	56	bk. S., P.
H. 4862	52° 13′ 40″ N., 179° 42′ E.	....do....	....do...	12.30 p. m.	51	brk. Sh., rky.
D. 4776	Semisopochnoi Id., r. t. S. 41° W., l. t. S., about 12 miles (52° 11′ N., 179° 43′ E.).	H. O. 55; published Jan., 1875; ext. cor. Mar., 1904.	....do...	12.54 p. m.	50	bk. S., brk. Sh.
				1.04 p. m.	50–52	bk. S., brk. Sh.
D. 4777	Semisopochnoi Id., r. t. S. 44° W., l. t. S. 4° W., about 12 miles (52° 11′ N., 179° 49′ E.).	....do....	....do...	1.29 p. m.	52	fne. G.
				1.35 p. m.	52–43	fne. G.
D. 4778	Semisopochnoi Id., r. t. S. 45° W., l. t. S. 12° W., about 12 miles (52° 12′ N., 179° 52′ E.).	....do....	....do...	2.01 p. m.	43	fne. bk. G.
				2.00 p. m.	43	fne. bk. G.
				2.33 p. m.	43–33	fne. bk. G.
				2.57 p. m.	33	fne. bk. G., P., brk. Sh.

CRUISE OF THE ALBATROSS, 1906—Continued.

Temperatures.			Surface density.	Apparatus.	Trial.		Drift.		Remarks.
Air.	Surface.	Bottom.			Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.				h. m.		mi.	
39	40	36.5	.....	Luc. sdr.....	.....	.....	.....	.....	
45	40	36.5	1.02346	8′ Agassiz; m. b.	botm..	30	W. by N..	1.0	
45	40	36.5	.....	int.3; K.1,K.2§	300fms.	20 12	W. by N..	.8	400 fms. dredge wire out.
42	40	37.0	.....	Luc. sdr.....	.....	.....	.....	.....	
41	40	37.0	1.02361	8′ Agassiz....	botm..	30	N.....	1.0	
42	40	38.5	.....	Luc. sdr.....	.....	.....	.....	.....	
42	40	38.5	.....	8′ Agassiz....	botm..	20	N.....	.8	Stopped 2½ minutes while heaving in.
40	40	.....	.....	Luc. sdr.....	.....	.....	.....	.....	
40	40	.....	.....	Luc. sdr.....	.....	.....	.....	.....	
40	40	.....	1.02361	12′ Tnr.....	botm..	30	N. by W..	1.0	
39	40	.....	.....	Luc. sdr.....	.....	.....	.....	.....	
40	40	.....	.....	12′ Tnr.....	botm..	30	W. by N..	1.0	Stopped 2½ minutes while heaving in.
40	40	38.1	.....	Luc. sdr.....	.....	.....	.....	.....	
40	40	38.1	.....	12′ Tnr.....	botm..	30	W. by N..	1.0	
40	40	.....	.....	Luc. sdr.....	.....	.....	.....	.....	
40	40	38.1	.....	Luc. sdr.....	.....	.....	.....	.....	
41	40	38.1	.....	12′ Tnr.....	botm..	20	W. by N..	.7	
43	40	37.2	.....	Luc. sdr.....	.....	.....	.....	.....	
43	40	37.2	.....	12′ Tnr.....	botm..	20	W. by N..	.7	
43	40	.....	.....	Luc. sdr.....	.....	.....	.....	.....	
42	40	.....	1.02355	12′ Tnr.....	botm..	30	W. by N..	1.0	
42	40	.....	.....	int.3; K.1,K.2§	200fms.	15 10	W. by N..	.6	275 fms. dredge wire out.
40	40	739.0	.....	Luc. sdr.....	.....	.....	.....	.....	Thermometer fouled on stray line.
39	40	35.0	.....	Luc. sdr.....	.....	.....	.....	.....	
41	40	36.5	.....	Luc. sdr.....	.....	.....	.....	.....	
42	40	(?)	.....	Luc. sdr.....	.....	.....	.....	.....	Lost thermometer, sounding cup, stray lead, and 55 fms. sounding wire.
41	40	35.9	.....	Luc. sdr.....	.....	.....	.....	.....	
42	40	39.0	.....	Luc. sdr.....	.....	.....	.....	.....	
42	40	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	No botm. spec.; arming indented.
42	40	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	No botm. spec.; arming indented.
44	40	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
44	40	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
44	40	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
44	41	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
44	41	.....	1.02359	12′ Tnr.....	botm..	20	E. by S...	.8	
44	41	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
45	41	.....	1.02369	12′ Tnr.....	botm..	20	E. by S ...	.8	
45	41	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
45	41	.....	.....	11 cod lines ...	botm..	15	.....	.....	
45	41	.....	.....	12′ Tnr.....	botm..	20	E. by S ...	.8	Net badly torn.
45	41	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	

Station No.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	On "Petrel Bank," Bering Sea—Continued.				*fms.*	
D. 4779	Semisopochnoi Id., r. t. S. 59½° W., l. t. S. 37° W. (52° 11′ N., 179° 57′ W.).	H. O. 55; published Jan., 1875; ext. cor. Mar., 1904.	June 5	3.53 p. m. 3.52 p. m. 4.31 p. m. 4.56 p. m.	54 54–56 54–56 56	brk. Sh., P., S.... brk. Sh., P., S.... brk. Sh., P., S.... bk. S., Sh., P.....
H. 4863	52° 07′ 30″ N., 179° 54′ W.....	....do.....	....do...	5.24 p. m.	65	bk. S., P.....
	From "Petrel Bank," Bering Sea, to McDonald Bay, Agattu Id., Aleutians, via passage east of Semisopochnoi and Amchitka Ids.[a]					
H. 4864	52° 04′ 40″ N., 179° 51′ W.....	....do.....	June 5	5.51 p. m.	108	bk. S., P.....
H. 4865	51° 55′ 30″ N., 179° 43′ W., South pt. Semisopochnoi Id., S. 84° W.	....do.....	....do...	7.18 p. m.	1,248	bk. and gy. S.....
H. 4866	51° 26′ 40″ N., 179° 55′ W.....	....do.....	....do...	11.29 p. m.	329	gn-br. S., P.....
H. 4867	51° 05′ N., 179° 02′ E.....	....do.....	June 6	8.26 a. m.	1,284	gn. M., bk. S., fne. G.
H. 4868	51° 51′ N., 174° 39′ E.....	C. S. 9100	June 7	8.20 a. m.	1,471	dk. gy. M.....
D. 4780	52° 01′ N., 174° 30′ E.....	....do.....	....do...	10.06 a. m. 11.17 a. m.	1,046 1,046	gy. M., S., P..... gy. M., S., P.....
H. 4869	52° 08′ N., 174° 25′ E.....	....do.....	....do...	1.34 p. m.	818	fne. gy. S., G.....
D. 4781	52° 14′ 30″ N., 174° 13′ E.....	....do.....	....do...	3.02 p. m. 3.33 p. m. 4.47 p. m.	482 482 482	fne. gy. S., P..... fne. gy. S., P..... fne. gy. S., P.....
H. 4870	52° 24′ N., 173° 55′ E.....	....do.....	....do...	6.30 p. m.	70	gn. S., P.....
	From Agattu Id. to Chichagof Harbor, Attu Id., via Semichi Ids., Aleutians.[b]					
H. 4871	52° 45′ N., 173° 47′ 40″ E.....	....do.....	June 9	10.32 a. m.	30	bk. S.....
H. 4872	52° 47′ 30″ N., 173° 41′ E.....	....do.....	....do...	11.15 a. m.	65	brk. Sh., G., S....
H. 4873	52° 50′ N., 173° 34′ E.....	....do.....	....do...	12.08 p. m.	60	gy. S., brk. Sh....
D. 4782	East Cape, Attu Id., S. 22° W., 4 miles (52° 55′ N., 173° 27′ E.).	....do.....	....do...	1.01 p. m. 1.21 p. m.	57 57–59	R., G..... R., G.....
D. 4783	East Cape, Attu Id., S. 31° W., 4.5 miles (52° 55′ 30″ N., 173° 30′ E.).	....do.....	....do...	1.45 p. m. 1.57 p. m.	59 59	gn. S., brk. Sh., R gn. S., brk. Sh., R
	From Chichagof Harbor, Attu Id., around eastern end and south of Attu Id. to Preobrajeniya Bay, Medni (or Copper) Id., Komandorski Ids.[c]			2.23 p. m.	59	gn. S., brk. Sh., R
D. 4784	East Cape, Attu Id., S. 18° W., 4 miles (52° 55′ 40″ N., 173° 26′ E.).	....do.....	June 11	5.32 p. m. 5.47 p. m.	135 135	crs. P..... crs. P.....
H. 4874	52° 44′ N., 173° 35′ E.....	....do.....	....do...	8.06 p. m.	59	crs. bk. S.....
H. 4875	52° 30′ N., 173° 22′ E.....	....do.....	....do...	9.34 p. m.	63	bk. S.....
H. 4876	52° 34′ N., 173° 08′ E.....	....do.....	....do...	11.04 p. m.	60	gn. S., brk. Sh., For.

[a] Shore collections were made at Agattu Id.
[b] No landing was made at the Semichi Ids. Shore collections were made at Attu Id.

CRUISE OF THE ALBATROSS, 1906—Continued.

Temperatures.			Surface density.	Apparatus.	Trial.		Drift.		Remarks.
Air.	Surface.	Bottom.			Depth.	Duration.	Direction.	Distance.	
° F.	° F.	° F.				h. m.		mi.	
42	41	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
42	41	.....	.....	9 cod lines....	botm ..	28	.....	.....	
43	41	.....	1.02375	12′ Tnr.....	botm ..	20	W. by S...	0.8	
43	41	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
43	41	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
42	42	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
41	41	.....	.....	Luc. sdr.....	.....	.....	.....	.....	
42	41	37.9	.....	Luc. sdr.....	.....	.....	.....	.....	
42	40	35.1	.....	Luc. sdr.....	.....	.....	.....	.....	
43	41	35.8	.....	Luc. sdr.....	.....	.....	.....	.....	
43	41	35.9	.....	Luc. sdr.....	.....	.....	.....	.....	
45	42	35.9	1.02350	8′ Agassiz	botm ..	16	W	.7	Net slightly torn.
46	42	36.2	.....	Luc. sdr.....	.....	.....	.....	.....	
45	42	38.6	.....	Luc. sdr.....	.....	.....	.....	.....	
44	42	38.6	.....	12′ Tnr.....	botm ..	20	NW	.8	
42	42	38.6	.....	Int. 3; K.1, K.2 §	300 fms.	20 15	NW	.7	400 fms. dredge wire out. Water evidently shoaled, as nets touched bottom and were badly wrecked. K. 1 lost.
43	42	.....	.....	Luc. sdr.....	.....	.....	.....	.....	Numerous shallow soundings with Tnr.-Blish sdr. as vessel approached anchorage off Agattu Id.
42	41	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
43	41	.....	.....	Luc. sdr.....	.....	.....	.....	.....	Wire overran and kinked; cut off 125 fms.
43	41	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
42	41	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
42	41	.....	.....	8′ Agassiz	botm ..	10	ENE. ¾° E	.4	Net slightly torn.
42	41	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
42	41	.....	.....	8′ Agassiz	botm ..	5	ENE. ¾° E	.2	Lost trawl frame, etc. Only a small piece of net came up with bridle.
42	41	.....	.....	Int. 3; K. 2 §...	30 fms..	20 2	ENE. ¾° E	.7	50 fms. dredge wire out.
47	41	.....	.....	Luc. sdr.....	.....	.....	.....	.....	
47	41	.....	1.02354	9′ Alb.-Blk ...	botm ..	18	SE	.6	
43	42	.....	.....	Luc. sdr.....	.....	.....	.....	.....	
43	42	.....	.....	Luc. sdr.....	.....	.....	.....	.....	
43	42	.....	.....	Luc. sdr.....	.....	.....	.....	.....	

c Shore collections were made in Preobrajeniya Bay.

DREDGING RECORDS OF THE NORTHWESTERN PACIFIC

Station No.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	From Chichagof Harbor, Attu Id., around eastern end and south of Attu Id. to Preobrajeniya Bay, Medni (or Copper) Id., Komandorski Ids.—Continued.				*fms.*	
D. 4785	53° 20′ N., 170° 33′ E.....	H. O. 68; publication date not given; ext. cor. July, 1903.	June 12	4.18 p. m.	*1,850	.....
	From Preobrajeniya Bay, Medni Id., to Nikolski Bay, Bering Id., via passage between islands.[a]					
D. 4786	North point Copper Id., N. 84° E., 8.2 miles (54° 51′ 30″ N., 167° 14′ E.).	H. O. 1690; published Aug., 1898; ext. cor. Dec., 1899.	June 14	9.04 a. m. 9.10 a. m.	54 54	gn. S..... gn. S.....
D. 4787	North point Copper Id., N. 79° E., 8.5 miles (54° 50′ 50″ N., 167° 13′ 30″ E.).	....do.....	....do...	9.38 a. m. 9.44 a. m.	54 54–57	gn. S..... gn. S.....
D. 4788	North point Copper Id., N. 76° E., 8.8 miles (54° 50′ 24″ N., 167° 13′ E.).	....do.....	....do...	10.21 a. m. 10.28 a. m.	57 57–56	gn. S..... gn. S.....
D. 4789	North point Copper Id., N. 73° E., 9.1 miles (54° 49′ 45″ N., 167° 12′ 30″ E.).	....do.....	....do...	11.02 a. m. 11.12 a. m.	56 56	gn. S..... gn. S.....
D. 4790	Cape Monati, Bering Id., S. 84° E., 15 miles (54° 38′ 45″ N., 167° 11′ 45″ E.).	....do.....	....do...	1.03 p. m. 1.16 p. m.	64 64	P..... P.....
D. 4791	Cape Monati, Bering Id., N. 52° W., 8.75 miles (54° 36′ 15″ N., 166° 58′ 15″ E.).	....do.....	....do...	2.42 p. m. 2.52 p. m.	76 76–72	rky..... rky.....
D. 4792	Cape Monati, Bering Id., N. 50° W., 8.2 miles (54° 36′ 15″ N., 166° 57′ 15″ E.).	....do.....	....do...	3.24 p. m. 3.30 p. m.	72 72	P..... P.....
	From Nikolski Bay, Bering Id., Komandorski Ids., to Petropaulovsk, Avatcha Bay, Kamchatka.[b]					
D. 4793	Toperkoo Id., hbr. of Nikolski, Bering Id., N. 58° E., 44 miles (54° 48′ N., 164° 54′ E.).	H. O. 68..	June 16	10.14 a. m.	*2,700	.....
	From Petropaulovsk, Avatcha Bay, Kamchatka, to Codfish Banks, off mouth of Aangan River, west coast of Kamchatka, Sea of Okhotsk (via Kuril Strait).					
D. 4794	Staritschkof Id., S. 70° W., 5 miles (52° 47′ 20″ N., 158° 44′ 30″ E.).	H. O. 54; published Mar. 1, 1902.	June 20	9.55 a. m. 10.16 a. m.	58 58–69	S., P..... S., P.....
D. 4795	Staritschkof Id., S. 76° W., 4.8 miles (52° 46′ 50″ N., 158° 44′ 30″ E.).	....do.....	....do...	10.46 a. m. 10.51 a. m.	69 69–48	gn. S., P..... gn. S., P.....
D. 4796	Staritschkof Id., S. 71° W., 4 miles (52° 47′ N., 158° 43′ E.).	....do.....	....do...	11.18 a. m. 11.25 a. m.	48 48	S., P., Sh..... S., P., Sh.....
H. 4877	Dalni Point, N. 32° W., 13.5 miles (52° 41′ N., 158° 54′ 30″ E.).	....do.....	....do...	1.23 p. m.	804	gn. M., crs. bk. S., brk. Sh.
D. 4797	Staritschkof Id., N. 43° W., 11.5 miles (52° 37′ 30″ N., 158° 50′ E.).	....do.....	....do...	2.19 p. m. 2.57 p. m. 4.05 p. m.	682 682 682	gn. M., crs. bk. S., brk. Sh. gn. M., crs. bk. S., brk. Sh. gn. M., crs. bk. S., brk. Sh.

[a] Shore collections were made in Nikolski Bay.

CRUISE OF THE ALBATROSS, 1906—Continued.

Temperatures.			Surface density.	Apparatus.	Trial.		Drift.		Remarks.
Air.	Surface.	Bottom.			Depth.	Duration.	Direction.	Distance.	
° F.	° F.	° F.				h. m.		mi.	
44	42	.....	1.02354	Int. 3; K.2, K.4§	300 fms.	20 18	NE. by E. ½° E.	0.7	400 fms. dredge wire out.
49	41	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
49	41	.....	.....	9′ Alb.-Blk ...	botm ..	20	SW. by W.	.8	
46	41	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
46	41	.....	.....	12′ Tnr.....	botm ..	20	SW. by W.	.8	
46	41	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
46	41	.....	.....	12′ Tnr.....	botm ..	20	SW. by W.	.8	
43	41	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
43	41	.....	1.02340	12′ Tnr.....	botm ..	20	SW. by W.	.8	
50	41	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
50	41	.....	.....	9′ Alb.-Blk ...	botm ..	10	WSW.....	.4	Rough bottom; net badly torn.
44	42	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
44	42	.....	1.02354	9′ Alb.-Blk ...	botm ..	20	W	.8	
44	42	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
44	42	.....	1.02354	12′ Tnr.....	botm ..	20	W	.8	
45	41	.....	1.02364	Int. 3; K.2, K.4§	300 fms.	20 14	W	.7	
44	44	.....	.....	Tnr.-Blish sdr.	.....	.....	.....	.....	
44	44	.....	.....	12′ Tnr.....	botm ..	20	SE.....	.8	Off Avatcha Bay.
46	46	.....	.....	Tnr.-Blish sdr.	.....	.....	.....	.....	
46	46	.....	.....	12′ Tnr.....	botm ..	20	NW.....	.8	Off Avatcha Bay.
46	46	.....	.....	Tnr.-Blish sdr.	.....	.....	.....	.....	
46	46	.....	1.02303	12′ Tnr.....	botm ..	20	N	.8	Off Avatcha Bay.
47	45	36.0	.....	Luc. sdr.....	.....	.....	.....	.....	Off Avatcha Bay.
47	46	36.6	.....	Luc. sdr.....	.....	.....	.....	.....	
47	46	36.6	1.02293	9′ Alb.-Blk ...	botm ..	20	WNW....	.8	Off Avatcha Bay.
47	46	36.6	.....	Int. 3; K.2, K.4§	300 fms.	20 13	ESE.....	.8	400 fms. dredge wire out.

b Shore collections were made in Avatcha Bay; some work with small Tanner, 3½-foot dredge from steam launch.

DREDGING RECORDS OF THE NORTHWESTERN PACIFIC

Station No.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	On Codfish Banks, sea of Okhotsk (off mouth of Aangan River, Kamchatka).				*fms.*	
D. 4798	Mouth of Aangan River, N. 71° E., 8.5 miles (51° 37′ N., 156° 21′ E.).	B. A. 2405; published Dec., 1855; ext. cor. Mar., 1895.	June 21	3.32 p. m. 3.44 p. m.	25 25	gn. S. gn. S.
D. 4799	Mouth of Aangan River, N. 75° E., 8 miles (51° 38′ N., 156° 21′ E.).	....do.....	....do...	4.16 p. m. 5.00 p. m.	**25 **25	gn. S. ** gn. S. **
	From Codfish Banks, Sea of Okhotsk, to Milne Bay, Simushir Id., Kuril Ids.[a]					
D. 4800	Chirinkotan Id., S. 77° E., 13 miles (49° 06′ N., 153° 06′ E.).	....do.....	June 22	4.12 p. m.	*1,000	.....
	From Milne Bay, Simushir Id., Kuril Ids., to Hakodate, Hokkaido, Japan, via Boussole Strait.[b]					
D. 4801	Cape Rollin, Simushir Id., W. by N., 5 miles (46° 46′ 40″ N., 151° 41′ E.).	B. A. 2405 and H. O. 2184; published Oct., 1904.	June 24	10.22 a. m. 10.37 a. m.	107 107	crs. bk. S., P..... crs. bk. S., P.....
D. 4802	Cape Rollin, Simushir Id., N. 66° W., 8 miles (46° 44′ N., 151° 44′ E.).	....do.....	....do...	11.23 a. m. 11.31 a. m.	228 228	bk. S., crs. G..... bk. S., crs. G.....
D. 4803	Cape Rollin, Simushir Id., N. 59° W., 9 miles (46° 42′ N., 151° 45′ E.).	....do.....	....do...	12.48 p. m. 1.07 p. m.	229 229	crs. P., bk. S..... crs. P., bk. S.....
D. 4804	Cape Rollin, Simushir Id., N. 58° W., 9.7 miles (46° 42′ N., 151° 47′ E.).	....do.....	....do...	1.54 p. m. 2.09 p. m.	229 229	crs. P., bk. S..... crs. P., bk. S.....
D. 4805	44° 33′ N., 140° 04′ E.....	B. A. 2405.	June 25	10.12 a. m.	*1,000	.....
D. 4806	Erimo Saki, S. 71° W., 51.3 miles (42° 13′ N., 144° 21′ E.).	H. O. 2124; published July, 1903; ext. cor. May, 1905.	June 26	4.35 p. m.	Not charted.	.....
	From Hakodate, Japan, to Ebisu, Sado Id., Sea of Japan (via Tsugaru Strait).[c]					
D. 4807	Cape Tsiuka, S. 58° W., 10.3 miles (41° 36′ 12″ N., 140° 36′ E.).	H. O. 53; published 1855; ext. cor. Oct., 1898.	July 16	9.00 a. m. 9.09 a. m.	44 44–47	Sh., crs. G..... Sh., crs. G.....
D. 4808	Cape Tsiuka, S. 61° W., 10.6 miles (41° 35′ 50″ N., 140° 36′ 45″ E.).	....do.....	..do...	9.42 a. m. 9.55 a. m.	47 47	S., Sh., crs. G..... S., Sh., crs. G.....
D. 4809	C. Sirakami Lt., N. 22° E., 6.8 miles (41° 18′ N., 140° 08′ 40″ E.).	....do.....	....do...	2.23 p. m. 2.44 p. m. 3.27 p. m.	207 207–90 90	gy. S., P., brk. Sh. gy. S., P., brk. Sh. rky.....
D. 4810	C. Sirakami Lt., N. 28° E., 8 miles (41° 17′ 20″ N., 140° 07′ E.).	....do.....	....do...	4.07 p. m. 4.23 p. m. 5.03 p. m.	195 195 195	fne. gy. S..... fne. gy. S..... fne. gy. S.....

[a] Shore collections were made at Simushir Island.
[b] Shore collections were made at Hakodate.

CRUISE OF THE ALBATROSS, 1906—Continued.

Temperatures.			Surface density.	Apparatus.	Trial.		Drift.		Remarks.
Air.	Surface.	Bottom.			Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.				h. m.		mi.	
47	42	36.9	.....	Tnr.-Blish sdr.	.....	.....	.....	.....	
47	42	36.9	.....	12′ Tnr.....	botm ..	20	ENE.....	0.8	
47	42	.....	.....	12′ Tnr.....	botm ..	41	ENE.....	1.6	
45	40	.....	.....	9 cod lines....	botm ..	10	.....	.....	
39	37	.....	1.02354	Int.3; K.2,K.4§	300 fms.	20 27	NE.....	.8	Stopped 14 minutes while heaving in to navigate ship clear of dredge rope.
43	37	35.4	.....	Luc. sdr.....	.....	.....	.....	.....	
43	37	35.4	1.02382	12′ Tnr.....	botm ..	3	S. to SSW.	.1	Lost frame, net, etc.; only bridle came up.
42	37	36.1	.....	Luc. sdr.....	.....	.....	.....	.....	
44	37	36.1	.....	9′ Alb.-Blk ...	botm ..	20	SSW.....	.8	
43	37	35.9	.....	Luc. sdr.....	.....	.....	.....	.....	
43	37	35.9	1.02384	9′ Alb.-Blk ...	botm ..	20	SW.....	.8	Stopped 4 minutes while heaving in.
45	38	.....	.....	Luc. sdr.....	.....	.....	.....	.....	
45	38	.....	1.02374	9′ Alb.-Blk ...	botm ..	20	SW.....	.8	
45	40	.....	.....	Int.3; K.2,K.4§	200 fms.	20 9	SE.....	.8	275 fms. dredge wire out.
57	53	.....	.....	Int.3; K.2,K.4§	200 fms.	20 9	WSW	.8	275 fms. dredge wire out.
77	67	.....	.....	Tnr.-Blish sdr.	.....	.....	.....	.....	
77	67	.....	.....	12′ Tnr.....	botm ..	20	S.....	.8	
78	67	.....	.....	Tnr.-Blish sdr.	.....	.....	.....	.....	
78	67	.....	.....	12′ Tnr.....	botm ..	20	SSW	.8	
75	70	.....	.....	Luc. sdr.....	.....	.....	.....	.....	
76	70	.....	.....	12′ Tnr.....	botm ..	20	SW.....	.8	Stopped 1½ minutes while heaving in.
76	70	48.8	.....	Luc. sdr.....	.....	.....	.....	.....	
76	70	44.7	.....	Luc. sdr.....	.....	.....	.....	.....	
76	70	44.7	.....	12′ Tnr.....	botm ..	20	SW.....	.8	
74	70	44.7	.....	Int.3, K.2,K.4§	100 fms.	20 5	SW.....	.8	150 fms. dredge wire out.

[c] Shore collections were made at Ebisu.

DREDGING RECORDS OF THE NORTHWESTERN PACIFIC

Station No.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	From Hakodate, Japan, to Ebisu, Sado Id., Sea of Japan (via Tsugaru Strait)—Continued.				*fms.*	
D. 4811	39° 26′ N., 139° 20′ 30″ E.	H. O. 1300; published Aug., 1893; ext. cor. Feb., 1905.	July 17	8.00 p. m. 8.00 p. m.	*500 *500	....
D. 4812	North point Sado Id., S. 31° W., 15 miles (38° 33′ N., 138° 40′ E.).	....do.....	July 18	8.05 a. m. 8.26 a. m.	176 176–200	fne. br. M. (?) .... fne. br. M. (?) ....
D. 4813	North point Sado Id., S. 30° W., 17 miles (38° 35′ N., 138° 41′ E.).	....do.....	....do...	9.13 a. m. 9.29 a. m.	200 200	br. M., bk. S..... br. M., bk. S.....
D. 4814	North point Sado Id., S. 42° W., 15.7 miles (38° 32′ N., 138° 43′ E.).	....do.....	....do...	10.33 a. m. 11.07 a. m.	429 429	br. M..... br. M.....
D. 4815	Niigata Lt., S. 25° E., 21.5 miles (38° 16′ N., 138° 52′ E.).	....do.....	....do...	2.07 p. m. 2.18 p. m.	70 70	dk. gn. S..... dk. gn. S.....
D. 4816	Niigata Lt., S. 22° E., 19 miles (38° 14′ N., 138° 54′ E.).	....do.....	....do...	3.00 p. m. 3.08 p. m.	64 64	fne. gy. S ..... fne. gy. S .....
D. 4817	Niigata Lt., S. 29° E., 18 miles (38° 12′ N., 138° 52′ E.).	....do.....	....do....	3.51 p. m. 3.59 p. m.	61 61	fne. gy. S ..... fne. gy. S .....
	From Ebisu, Sado Id., to Nanao, Noto Peninsula, Hondo, Japan.[a]					
D. 4818	Hime Saki Lt., S. 24° E., 4 miles (38° 08′ 55″ N., 138° 31′ 30″ E.).	H. O. 1941; published May, 1902.	July 19	8.52 a. m. 9.13 a. m.	225 225–245	fne. br. M ..... fne. br. M .....
D. 4819	Hime Saki Lt., S 16° E., 3.8 miles (38° 09′ N., 138° 32′ 12″ E.).	....do.....	....do. .	9.58 a. m. 10.18 a. m.	245 245	fne. br. M ..... fne. br. M .....
D. 4820	Sawa Zaki, N. 23° W., 13.6 miles (Sado Id.) (37° 37′ N., 138° 19′ E.).	H. O. 1300	....do...	3.11 p. m. 3.43 p. m. 4.50 p. m. 5.35 p. m.	536 536 536 536	gn. M ..... gn. M..... gn. M..... gn. M.....
D. 4821	Sawa Zaki, North, 17 miles (Sado Id.) (37° 33′ N., 138° 12′ E.).	H. O. 1301; published June, 1892; ext. cor. May, 1904.	....do...	8.00 p. m. 8.00 p. m.	*600 *600	....
	From Nanao, Hondo, Japan, to Isuruga, Hondo, Japan.[b]					
D. 4822	No Saki, S. 80° W., 4.5 miles (37° 08′ 10″ N., 137° 08′ E.).	B. A. 2243; published July, 1895.	July 21	8.23 a. m. 8.38 a. m.	130 130	gn. M..... gn. M.....
D. 4823	No Saki, S. 79° W., 6.25 miles (37° 08′ 35″ N., 137° 10′ 05″ E.).	....do.....	....do...	9.26 a. m. 10.04 a. m.	545 545	gn. M..... gn. M.....
D. 4824	No Saki, S. 77° W., 7 miles (37° 09′ 45″ N., 137° 10′ 50″ E.).	....do.....	....do...	11.13 a. m.	**545	gn. M.**.....
H. 4878	Sudzu Misaki Lt., N. 60° W., 9 miles (37° 27′ 10″ N., 137° 28′ 40″ E.).	....do.....	....do...	3.30 p. m.	84	fne. gy. S., bk. Sp.
D. 4825	Sudzu Misaki Lt., N. 68° W., 11.5 miles (37° 27′ 30″ N., 137° 32′ 20″ E.).	....do.....	....do...	4.01 p. m. 4.11 p. m.	120 120–114	fne. gy. S., bk. Sp. fne. gy. S., bk. Sp.

[a] Shore collections were made at Nanao.

CRUISE OF THE ALBATROSS, 1906—Continued.

Temperatures.			Surface density.	Apparatus.	Trial.		Drift.		Remarks.
Air.	Surface.	Bottom.			Depth.	Duration.	Direction.	Distance.	
° F.	° F.	° F.				h. m.		mi.	
77	73	.....	.....	Int. 3.....	surface.	20	S. 39° W..	0.8	
77	73	.....	.....	K. 2, K. 4‡....	surface.	20	S. 39° W..	.8	
79	73	34.9	.....	Luc. sdr.....					
79	73	34.9	.....	12′ Tnr.....	botm..	20	NE. by E..	.7	Towed 5 minutes with 230 fms. wire; then veered out 20 fms. more.
81	73	33.9	.....	Luc. sdr.....					
81	73	33.9	1.02447	12′ Tnr.....	botm..	20	SE. by E..	.8	
84	74	32.9	.....	Luc. sdr.....					
84	74	32.9	1.02385	12′ Tnr.....	botm..	20	SE.....	.8	Shot failed to detach.
88	87	51.0	.....	Luc. sdr.....					
88	87	51.0	.....	12′ Tnr.....	botm..	20	SW. by S.	.8	
81	77	51.7	.....	Tnr.-Blish sdr.					
81	77	51.7	.....	12′ Tnr.....	botm..	20	SE.....	.8	
80	76	51.9	.....	Tnr.-Blish sdr.					
80	76	51.9	1.02403	12′ Tnr.....	botm..	20	W. by S...	.8	
82	75	33.7	.....	Luc. sdr.....					
82	75	33.7	.....	12′ Tnr.....	botm..	20	NE.....	.8	
81	75	33.1	.....	Luc. sdr.....					
81	75	33.1	.....	12′ Tnr.....	botm..	20	S. to SE..	.8	
80	76	32.4	.....	Luc. sdr.....					
80	76	32.4	1.02444	12′ Tnr.....	botm..	20	SW. ½° S..	.8	
81	76	32.4	.....	Int. 3; K.2, K.4§	300 fms.	20	SW. ½° S..	.8	400 fms. dredge wire out.
80	76	32.4	.....	7 therm.; wat. bot.	5-400 fms.	13 5	.....	.....	Therms. at 5, 15, 25, 50, 100 200, and 400 fms..
77	76	.....	.....	Int. 3.....	surface.	20	S. 74° W..	.7	
77	76	.....	.....	K. 2, K. 4 ‡...	surface.	20	S. 74° W..	.7	
82	80	39.4	.....	Luc. sdr.....					
80	78	39.4	.....	12′ Tnr.....	botm..	20	NE.....	.8	
80	78	32.8	.....	Luc. sdr.....					
83	80	32.8	1.02199	12′ Tnr.....	botm..	20	NE.....	.8	Stopped 5 minutes while veering out; wire fouled on reeling engine. Net came up foul of trawl beam.
85	80	.....	.....	12′ Tnr.....	botm..	20	NE.....	.7	Accumulator showed heavy strain; hove in at intervals. Net came up full of mud, but taillashings gave way and the catch was lost.
91	79	51.9	.....	Luc. sdr.....					
88	79	41.9	.....	Luc. sdr.....	.....	20	.....	.....	
88	79	41.9	1.02413	12′ Tnr.....	botm...	20	S.....	.8	

‡ Shore collections were made at Tsuruga.

DREDGING RECORDS OF THE NORTHWESTERN PACIFIC

Station No.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	From Nanao, Hondo, Japan, to Isuruga, Hondo, Japan—Continued.				*fms.*	
D. 4826	Sudzu Misaki Lt., N. 60° W., 12 miles (37° 25′ N., 137° 32′ E.).	B. A. 2243; published July, 1895.	July 21	4.42 p. m.	114	fne. gy. S., bk. Sp.
				4.53 p. m.	114	fne. gy. S., bk. Sp.
H. 4879	Sudzu Misaki Lt., N. 75° W., 20 miles (37° 26′ N., 137° 43′ E.).	H. O. 1301	....do...	6.42 p. m.	409	gn. M.....
D. 4827	37° 24′ N., 137° 43′ E	....do.....	....do...	8.00 p. m.	*400	.....
				8.00 p. m.	*400	.....
D. 4828	Sudzu Misaki Lt., N. 57° W., 16 miles (37° 23′ N., 137° 36′ E.).	....do.....	July 22	7.49 a. m.	163	gn. M.....
				8.06 a. m.	163	gn. M.....
D. 4829	Sudzu Misaki Lt., N. 58° W., 21 miles (37° 20′ N., 137° 41′ 30″ E.).	....do.....	....do...	9.21 a. m.	527	gn. M.....
				9.54 a. m.	527–548	gn. M.....
D. 4830	Sudzu Misaki Lt., N. 47° W., 23.2 miles (37° 16′ N., 137° 40′ E.).	....do.....	....do...	10.44 a. m.	548	gn. M.....
				11.13 a. m.	548	gn. M.....
D. 4831	Sudzu Misaki Lt., N. 68° W., 24 miles (37° 22′ 30″ N., 137° 47′ E.).	....do.....	....do...	1.08 p. m.	619	gn. M.....
				1.47 p. m.	619	gn. M.....
				2.58 p. m.	619	gn. M.....
D. 4832	O Shima (off Ando Zaki), N. 87° E., 8.5 miles (36° 14′ 30″ N., 135° 56′ 30″ E.).	B. A. 2174; published Jan., 1895.	July 23	8.22 a. m.	76	dk. gy. S.....
				8.32 a. m.	76–79	dk. gy. S.....
D. 4833	O Shima (off Ando Zaki), N. 80° E., 8.5 miles (36° 13′ 40″ N., 135° 56′ 30″ E.).	....do.....	....do...	9.03 a. m.	79	dk. gy. S., R .....
				9.12 a. m.	79	dk. gy. S., R .....
D. 4834	O Shima, N. 42° E., 15.7 miles (36° 03′ 30″ N., 135° 54′ E.).	....do.....	....do...	11.06 a. m.	130	gn. M.....
				11.15 a. m.	130	gn. M.....
D. 4835	O Shima, N. 44° E., 16.5 miles (36° 03′ 30″ N., 135° 52′ 30″ E.).	....do.....	....do...	12.56 p. m.	134	gn. M.....
				1.06 p. m.	134	gn. M.....
	From Tsuruga Hondo, Japan, to Saigo, Dogo Id., Oki Group (Sea of Japan).[a]					
D. 4836	Tateisha Zaki Lt., S. 58° E., 7.3 miles (35° 49′ 40″ N., 135° 53′ 10″ E.).	....do.....	July 24	10.33 a. m.	54	br-gn. M.....
				10.41 a. m.	54	br-gn. M.....
D. 4837	Tateisha Zaki Lt., S. 53° E., 8 miles (35° 50′ 30″ N., 135° 53′ E.).	....do.....	....do...	11.16 a. m.	*57	br-gn. M.*.....
D. 4838	Tateisha Zaki Lt., S. 58° 30′ E., 20.6 miles (35° 56′ 30″ N., 135° 39′ 15″ E.).	....do.....	....do...	1.04 p. m.	144	gn. M.....
				1.21 p. m.	144	gn. M.....
D. 4839	Kyo Ga Misaki Lt., S. 56° W., 20.3 miles (35° 57′ 45″ N., 135° 34′ E.).	....do.....	....do...	2.30 p. m.	140	gn. M.....
				2.44 p. m.	140	gn. M.....
D. 4840	Kyo Ga Misaki Lt., S. 41° 30′ W., 20.5 miles (36° 02′ N., 135° 30′ E.).	....do.....	....do...	3.54 p. m.	154	gn. M.....
				4.09 p. m.	154	gn. M.....
D. 4841	Kyo Ga Misaki Lt., S. 27° E., 19.5 miles (36° 04′ N., 135° 02′ E.).	H. O. 1301	....do...	8.03 p. m.	*300	.....
				8.03 p. m.	*300	.....
	From Saigo, Dogo Id., Oki Group, to Matsu Shima, Sea of Japan (off coast of Korea).[b]					
D. 4842	Saigo Misaki (Dogo Island), S. 64° W., 6.1 miles (36° 13′ N., 133° 27′ E.).	....do.....	July 26	9.09 a. m.	82	fne. gn. S., Sh....
				9.30 a. m.	82	fne. gn. S., Sh....

[a] Shore collections were made at Saigo.

CRUISE OF THE ALBATROSS, 1906—Continued.

Temperatures.			Surface density.	Apparatus.	Trial.		Drift.		Remarks.
Air.	Surface.	Bottom.			Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F				h. m.		mi.	
81	79	42.5	.....	Luc. sdr.....	.....	.....	.....	.....	
81	79	42.5	1.02403	12′ Tnr.....	botm...	20	W.....	0.8	
80	78	32.7	.....	Luc. sdr.....	.....	.....	.....	.....	
78	78	.....	.....	int. 3.....	surface.	20	SE.....	.7	
78	78	.....	.....	K. 2, K. 4 ‡...	surface.	20	SE.....	.7	
78	77	34.9	.....	Luc. sdr.....	.....	.....	.....	.....	
78	77	34.9	1.02420	12′ Tnr.....	botm...	20	NE.....	.8	
81	78	32.9	.....	Luc. sdr.....	.....	.....	.....	.....	
82	80	32.9	1.02427	12′ Tnr.....	botm...	20	S.....	.8	
86	80	32.7	.....	Luc. sdr.....	.....	.....	.....	.....	
86	80	32.7	1.02413	12′ Tnr.....	botm...	20	S.....	.8	
88	80	32.7	.....	Luc. sdr.....	.....	.....	.....	.....	
87	82	32.7	1.02431	12′ Tnr.....	botm...	20	S.....	.8	Net caught on bottom and torn.
95	82	32.7	.....	int 3; K. 2, K. 4 §	300 fms.	20 12	S.....	.8	400 fms. dredge wire out.
91	77	53.2	.....	Luc. sdr.....	.....	.....	.....	.....	
96	77	53.2	1.02365	9′ Alb.-Blk ...	botm...	20	W. by S ..	.8	
96	77	.....	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
96	77	.....	1.02410	9′ Alb.-Blk ...	botm...	12	W.....	.4	Heavy strain on wire; stopped at intervals while heaving in. Net came up torn and one bridle-stop carried away. Catch was saved.
90	77	34.9	.....	Luc. sdr.....	.....	.....	.....	.....	
90	77	34.9	1.02395	12′ Tnr.....	botm...	20	WSW.....	.8	
89	79	34.9	.....	Luc. sdr.....	.....	.....	.....	.....	
89	79	34.9	1.02410	12′ Tnr.....	botm...	20	WNW....	.8	
103	80	62.7	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
103	80	62.7	.....	12′ Tnr.....	botm...	20	NW. to NNE.	.8	
103	80	.....	.....	12′ Tnr.....	botm...	20	NW.....	.8	
93	80	33.9	.....	Luc. sdr.....	.....	.....	.....	.....	
93	80	33.9	1.02385	12′ Tnr.....	botm...	20	SE. by E..	.8	
87	79	34.0	.....	Luc. sdr.....	.....	.....	.....	.....	
84	79	34.0	1.02392	12′ Tnr.....	botm...	20	NW.....	.8	
81	79	33.9	.....	Luc. sdr.....	.....	.....	.....	.....	
81	79	33.9	1.02395	12′ Tnr.....	botm...	20	N.to NNE.	.8	
80	77	.....	.....	int. 3.....	surface.	20	W. by N..	.7	
80	77	.....	.....	K. 2, K. 4 ‡....	surface.	20	W. by N..	.7	
79	78	54.6	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
79	75	54.6	1.02375	12′ Tnr.....	botm...	20	NW.....	.8	

b Shore collections were made at Matsu Shima

DREDGING RECORDS OF THE NORTHWESTERN PACIFIC

Station No.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	From Saigo, Dogo Id., Oki Group, to Matsu Shima, Sea of Japan (off coast of Korea)—Continued.				*fms.*	
D. 4843	Dogo Island, S. E., 14 miles (36° 29′ 20″ N., 133° 01′ 20″ E.).	H. O. 1302; published Nov., 1891; ext. cor. June, 1005.	July 26	2.06 p. m.	100	gn. M., bk. S., Glob.
				2.22 p. m.	100	gn. M., bk. S., Glob.
D. 4844	36° 34′ N., 132° 50′ 20″ E	....do.....	....do...	4.13 p. m.	116	gn. M., gy. S., Glob.
				4.26 p. m.	116	gn. M., gy. S., Glob.
H. 4880	36° 42′ N., 132° 26′ E	....do.....	....do...	7.00 p. m.	571	gn. M
D. 4845	36° 43′ 30″ N., 132° 23′ 30″ E	....do.....	....do...	8.00 p. m.	*550	
				8.00 p. m.	*550	
D. 4846	36° 42′ N., 132° 30′ E	....do.....	July 27	7.52 a. m.	641	gy. and gn. M
				8.34 a. m.	641	gy. and gn. M
D. 4847	36° 41′ N., 132° 26′ E	....do.....	....do...	10.01 a. m.	**641	gy. and gn. M.**
				11.14 a. m.	**641	gy. and gn. M.**
D. 4848	36° 46′ N., 132° 16′ E	....do.....	....do...	1.12 p. m.	846	gn. M., Glob
				2.02 p. m.	846	gn. M., Glob
D. 4849	36° 46′ N., 132° 15′ E	....do.....	....do...	4.01 p. m.	**846	gn. M., Glob.**
D. 4850	Llancourt Rocks, NW. (mag.), 13.8 miles (36° 56′ N., 132° E.).	....do.....	....do...	8.02 p. m.	*600	
				8.02 p. m.	*600	
D. 4851	Boussole Rock, Matsu Shima, N. 76° W., 17 miles (37° 29′ N., 131° 18′ E.).	....do.....	July 28	8.02 a. m.	1,215	gn.-br. M
				9.18 a. m.	1,215	gn.-br. M
	From Matsu Shima, Sea of Japan (off coast of Korea), to Nagasaki, Japan.[a]			11.24 a. m.	1,215	gn.-br. M
D. 4852	C. Clonard, S. 88° W., 10 miles (36° 06′ 30″ N., 129° 50′ E.).	....do.....	July 30	7.54 a. m.	568	gn. M.(?)
				8.35 a. m.	568–400	gn. M. (dredge)
D. 4853	C. Clonard, S. 80° W., 9.8 miles (36° 08′ N., 129° 49′ E.).	....do.....	....do...	9.45 a. m.	400	gn. M
				10.08 a. m.	400	gn. M
D. 4854	C. Clonard, N. 31° W., 13.3 miles (35° 54′ N., 129° 46′ E.).	....do.....	....do...	1.04 p. m.	335	gn. M
				2.12 p. m.	335	gn. M
D. 4855	C. Clonard, N. 36° W., 5.5 miles (36° 01′ 30″ N., 129° 42′ E.).	....do.....	....do...	3.21 p. m.	70	gn. M
				3.35 p. m.	70–89	gn. M
D. 4856	C. Clonard, N. 50° W., 3.3 miles (36° 03′ 30″ N., 129° 41′ E.).	....do.....	....do...	4.08 p. m.	89	gn. M
				4.25 p. m.	89	gn. M
D. 4857	C. Clonard, S. 76° W., 8 miles (36° 08′ N., 129° 47′ E.).	....do.....	....do...	8.00 p. m.	*300	
				8.00 p. m.	*300	
D. 4858	C. Clonard, S. 7° W., 12 miles (36° 17′ N., 129° 40′ E.).	....do.....	July 31	7.49 a. m.	67	gn. M., S., P
				8.06 a. m.	67	gn. M., S., P
D. 4859	C. Clonard, S. 12° W., 12 miles (36° 17′ N., 129° 41′ E.).	....do.....	....do...	8.51 a. m.	93	gn. M
				9.06 a. m.	93	gn. M
D. 4860	C. Clonard, S. 23° W., 13 miles (36° 18′ N., 129° 44′ E.).	....do.....	....do...	10.01 a. m.	122	gn. M
				10.13 a. m.	122	gn. M
D. 4861	C. Clonard, S. 27° W., 16.5 miles (36° 19′ N., 129° 47 E.).	....do.....	....do...	1.04 p. m.	163	gn. M
				1.20 p. m.	163	gn. M
D. 4862	C. Clonard, S. 34° W., 18 miles (36° 20′ N., 129° 50′ E.).	....do.....	....do...	2.18 p. m.	184	gn. M
				2.35 p. m.	184	gn. M
D. 4863	C. Clonard, S. 38° W., 21 miles (36° 21′ N., 129° 53′ E.).	....do.....	....do...	3.34 p. m.	250	gn. M
				3.53 p. m.	250	gn. M
				4.50 p. m.	250	gn. M
D. 4864	C. Clonard, S. 41° W., 24 miles (36° 23′ N., 129° 58′ E.).	....do.....	....do...	8.02 p. m.	*800	
				8.02 p. m.	*800	
D. 4865	36° 32′ N., 129° 58′ E	....do.....	Aug. 1	7.52 a. m.	487	gn. M
				8.24 a. m.	487	gn. M

[a] Shore collections were made at Nagasaki.

CRUISE OF THE ALBATROSS, 1906—Continued.

Temperatures.			Surface density.	Apparatus.	Trial.		Drift.		Remarks.
Air.	Surface.	Bottom.			Depth.	Duration.	Direction.	Distance.	
° F.	° F.	° F.				h. m.		mi.	
80	76	39.9	.....	Luc. sdr.	.....	.....	.....	.....	
80	76	39.9	1.02372	12′ Tnr.	botm.	20	NW.	0.8	
79	76	35.9	.....	Luc. sdr.	.....	.....	.....	.....	
79	76	35.9	1.02375	12′ Tnr.	botm.	20	NW.	.8	
76	76	32.5	.....	Luc. sdr.	.....	.....	.....	.....	Shot failed to detach.
76	76	.....	.....	int. 3	surface.	20	NW. by W.	.7	
76	76	.....	.....	K. 2, K. 4‡	surface.	20	NW. by W.	.7	
74	76	32.3	.....	Luc. sdr.	.....	.....	.....	.....	Shot failed to detach.
86	76	32.3	1.02386	9′ Agassiz	botm.	20	NW.	.8	Wire fouled on reel.
86	76	.....	.....	12′ Tnr.	botm.	20	NW.	.8	Wire fouled on reel.
87	76	.....	.....	int. 3; K. 2, K. 4‡	300 fms.	20 15	NW.	.7	400 fms. dredge wire out; wire fouled on reel.
85	77	32.7	.....	Luc. sdr.	.....	.....	.....	.....	
85	78	32.7	1.02413	12′ Tnr.	botm.	30	NW.	1.2	Stopped heaving in 1½ m., wire fouling on reel.
83	79	.....	.....	12′ Tnr.	botm.	20	N. to W.	.8	
78	77	.....	.....	int. 3	surface.	20	NW.	.7	
78	77	.....	.....	K. 2, K. 4‡	surface.	20	NW.	.7	
87	78	32.8	.....	Luc. sdr.	.....	.....	.....	.....	
90	78	32.8	1.02413	9′ Agassiz	botm.	14	NNW.	.5	Stopped 5 m. while veering out to clear wire on reel. Stopped several times while heaving in for same reason.
79	78	32.8	.....	7 therm; wat. bot.	5–400 fms.	5	.....	.....	Therms. at 5, 15, 25, 50, 100, 200, and 400 fms.
88	78	32.6	.....	Luc. sdr.	.....	.....	.....	.....	
82	78	32.6	.....	9′ Agassiz	botm.	20	NNE. to NE.	.7	
84	79	32.4	.....	Luc. sdr.	.....	.....	.....	.....	
84	79	32.4	.....	9′ Agassiz	botm.	20	NE. to E.	.8	
80	80	32.4	.....	Luc. sdr.	.....	.....	.....	.....	
80	80	32.4	1.02307	9′ Agassiz	botm.	20	NNW.	.7	Tail lashings of net carried away; lost catch.
84	80	61.0	.....	Luc. sdr.	.....	.....	.....	.....	
89	79	61.0	1.02330	9′ Agassiz	botm.	20	E.	.8	
89	79	36.1	.....	Luc. sdr.	.....	.....	.....	.....	
89	79	36.1	.....	12′ Tnr.	botm.	20	E.	.8	One bridle-stop carried away; catch saved.
80	78	.....	.....	Int. 3	surface.	20	NE. by E.	.7	
80	78	.....	.....	K. 2, K. 4‡	surface.	20	NE. by E.	.7	
77	77	39.0	.....	Luc. sdr.	.....	.....	.....	.....	
77	77	39.0	1.02330	12′ Tnr.	botm.	20	E.	.8	
79	78	35.8	.....	Luc. sdr.	.....	.....	.....	.....	
79	78	35.8	1.02310	12′ Tnr.	botm.	20	E.	.8	
81	79	34.1	.....	Luc. sdr.	.....	.....	.....	.....	Shot did not detach.
81	79	34.1	1.02333	12′ Tnr.	botm.	17	E.	.6	Net came up torn.
78	79	33.4	.....	Luc. sdr.	.....	.....	.....	.....	
78	79	33.4	1.02302	9′ Agassiz	botm.	20	E.	.8	
85	79	32.9	.....	Luc. sdr.	.....	.....	.....	.....	
85	79	32.9	.....	9′ Agassiz	botm.	20	E.	.8	
85	79	32.7	.....	Luc. sdr.	.....	.....	.....	.....	
85	79	32.7	1.02310	9′ Agassiz	botm.	20	E.	.8	
80	79	32.7	.....	7 therm.; wat. bot.	5–200 fms.	5	.....	.....	Therms. at 5, 10, 15, 25, 50, 100, and 200 fms.
77	79	.....	.....	Int. 3	surface	20	E.	.7	
77	79	.....	.....	K. 2 K. 4‡	surface	20	E.	.7	
78	79	32.3	.....	Luc. sdr.	.....	.....	.....	.....	
78	79	32.3	1.02299	9′ Agassiz	botm.	20	E.	.8	

DREDGING RECORDS OF THE NORTHWESTERN PACIFIC

Station No.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	From Matsu Shima, Sea of Japan (off coast of Korea), to Nagasaki, Japan—Con.				*fms.*	
D. 4866	36° 32′ N., 129° 58′ 30″ E.	H. O. 1302.	Aug. 1	9.38 a. m. 10.46 a. m.	**487 **487	gn. M.** gn. M.**
D. 4867	36° 31′ N., 129° 46′ E.	...do...	...do...	1.01 p. m. 1.18 p. m.	150 150	gn. M., fne. gy. S. gn. M., fne. gy. S.
D. 4868	36° 32′ N., 129° 45′ E.	...do...	...do...	2.00 p. m.	**150	gn. M., fne. gy. S.**
D. 4869	36° 30′ N., 129° 42′ E.	...do...	...do...	2.57 p. m. 3.10 p. m.	94 94	gn. M., fne. gy. S. gn. M., fne. gy. S.
D. 4870	36° 30′ 30″ N., 129° 43′ E.	...do...	...do...	4.00 p. m. 4.22 p. m.	**94-60 60	gn. M., fne. gy. S** no spec.
D. 4871	36° 29′ 30″ N., 129° 43′ 30″ E.	...do...	...do...	4.35 p. m.	**60	
	In eastern channel of Korea Strait, vicinity of Oki Shima.					
D. 4872	34° 38′ 30″ N., 129° 59′ E.	...do...	Aug. 2	7.49 a. m. 8.02 a. m.	66 66	gn. M. gn. M.
D. 4873	34° 38′ N., 130° E.	...do...	...do...	8.39 a. m.	**66	gn. M.**
D. 4874	34° 38′ N., 130° 03′ E.	...do...	...do...	9.10 a. m. 9.18 a. m.	66 66	gn. S., brk. Sh. gn. S., brk. Sh.
D. 4875	Oki Shima, S. 24° W., 4 miles (34° 19′ N., 130° 09′ E.).	...do...	...do...	1.01 p. m. 1.10 p. m.	59 59	fne. gy. S., brk. Sh. fne. gy. S., brk. Sh.
D. 4876	Oki Shima, S. 29° W., 5.3 miles (34° 20′ N., 130° 10′ E.).	...do...	...do...	1.41 p. m. 1.49 p. m.	59 59	fne. gy. S., brk. Sh. fne. gy. S., brk. Sh.
D. 4877	Oki Shima, S. 37° W., 6.3 miles (34° 20′ 30″ N., 130° 11′ E.).	...do...	...do...	2.28 p. m.	**59	fne. gy. S., brk. Sh**.
D. 4878	Oki Shima, S. 58° W. 70° miles (34° 18′ 30″ N., 130° 14′ 30″ E.).	...do...	...do...	3.02 p. m.	**59	fne. gy. S., brk. Sh**.
D. 4879	Oki Shima, S. 70° W., 7.5 miles (34° 17′ N., 130° 15′ E.).	...do...	...do...	3.41 p. m.	**59	fne. gy. S., brk. Sh**.
D. 4880	Oki Shima, S. 79° W., 7.5 miles (34° 16′ N., 130° 16′ E.).	...do...	...do...	4.19 p. m.	**59	fne. gy. S., brk. Sh.**.
D. 4881	Oki Shima, N. 87° W., 8 miles (34° 15′ N., 130° 16′ E.).	...do...	...do...	4.53 p. m. 5.21 p. m.	**59-40 40	fne. gy. S., brk. Sh.** no spec., hrd. botm.
D. 4882	Oki Shima, N. 11° E. 5 miles (34° 09′ 30″ N., 130° 05′ 30″ E.).	...do...	...do...	8.00 p. m. 8.00 p. m.	*50 *50	
	From Nagasaki, Japan, to Kagoshima, Kagoshima Gulf, Japan. *[About 20 miles S W. of Nagasaki entrance, Eastern Sea.]*					
D. 4883	Nomo Zaki, N. 83° E. 10.25 miles. (32° 33′ 30″ N., 129° 32′ E.).	H. O. 1943; published July, 1903; ext. cor. Mar. 1905.	Aug. 8	1.00 p. m. 1.14 p. m.	53 53	dk. gy. S., brk. Sh. dk. gy. S., brk. Sh.
D. 4884	Nomo Zaki N. 76° E., 11.5 miles (32° 32′ N., 129° 30′ 45″ E.).	...do...	...do...	1.48 p. m.	**53	dk. gy. S., brk. Sh.**
D. 4885	Nomo Zaki, N. 74° E., 12 miles (32° 31′ 30″ N., 129° 30′ 15″ E.).	...do...	...do...	2.26 p. m.	**53	dk. gy. S., brk. Sh.**
D. 4886	Nomo Zaki, N. 70° E., 12.75 miles (32° 30′ 30″ N., 129° 29′ 45° E.).	...do...	...do...	3.00 p. m. 3.09 p. m.	53 53	dk. gy. S., brk. Sh. dk. gy. S., brk. Sh.
D. 4887	Nomo Zaki, N. 61° E., 15.5 miles (32° 27′ 45″ N., 129° 27′ 45° E.).	...do...	...do...	4.04 p. m. 4.14 p. m.	71 71	dk. gy. S., brk. Sh. dk. gy. S., brk. Sh.
D. 4888	Nomo Zaki, N. 57° E., 16.5 miles (32° 26′ N., 129° 27′ 30° E.).	...do...	...do...	4.48 p. m.	**71	dk. gy. S., brk. Sh.
D. 4889	Nomo Zaki, N. 64° E., 20.5 miles (32° 26′ N., 129° 22′ E.).	H. O. 1302.	...do...	8.01 p. m. 8.01 p. m.	*100 *100	

CRUISE OF THE ALBATROSS, 1906—Continued.

Temperatures.			Surface density.	Apparatus.	Trial.		Drift.		Remarks.
Air.	Surface.	Bottom.			Depth.	Duration.	Direction.	Distance.	
° F.	° F.	° F.				h. m.		mi.	
79	79			9′ Agassiz	botm	20	SW	0.8	
79	79			int.3; K.2,K.4§	300 fms.	20	W	.7	
						12			
80	78	33.4		Luc. sdr					
80	78	33.4	1.02310	9′ Agassiz	botm	20	SW. to NW	.8	
78	78		1.02289	9′ Agassiz	botm	20	NNE	.8	
81	78			Tnr.-Blish sdr					
81	78		1.02340	12′ Tnr	botm	20	E	.8	
79	78			12′ Tnr	botm	20	E	.8	
79	78		1.02330	Tnr.-Blish sdr					
78	78		1.02323	12′ Tnr	botm	30	E	.8	
80	78	59.7		Tnr.-Blish sdr					
80	78	59.7	1.02323	12′ Tnr	botm	20	ESE	.8	
80	78		1.02330	12′ Tnr	botm	20	E. by S	.8	
80	78			Tnr.-Blish sdr					
80	78			9′ Agassiz	botm	20	E. by S	.8	
81	80			Tnr.-Blish sdr					
81	80		1.02248	9′ Agassiz	botm	20	S. by E	.8	
83	81	62.1		Tnr.-Blish sdr					
83	81	62.1	1.02248	9′ Agassiz	botm	20	S. by E. ½° E.	.8	
83	81		1.02248	9′ Agassiz	botm	20	S. ½° E	.8	
81	81			9′ Agassiz	botm	20	S. by E	.8	
77	81			9′ Agassiz	botm	20	S	.8	
77	81		1.02237	9′ Agassiz	botm	20	S	.8	
77	81			9′ Agassiz	botm	20	SW	.8	
77	81	64.9		Tnr.-Blish sdr					
78	80			int. 3	surface	20	W. ½° N	.8	
78	80			K. 2, K. 4‡	surface	20	W. ½° N	.8	
86	83	61.7		Tnr.-Blish sdr					
86	83	61.7	1.02417	9′ Agassiz	botm	20	SW	.8	
89	83			9′ Agassiz	botm	20	SW	.8	
89	83		1.02370	9′ Agassiz	botm	20	SW	.8	
87	83	62.4		Tnr.-Blish sdr					Lost stray lead.
87	83	62.4		9′ Agassiz	botm	20	SW	.8	
87	83	59.7		Tnr.-Blish sdr					
87	83	59.7	1.02372	9′ Agassiz	botm	20	SW	.8	
87	83			9′ Agassiz	botm	20	SW	.8	
83	82			int. 3	surface	20	N. 81° W	.7	
83	82			K. 2, K. 4‡	surface	20	N. 81° W	.7	

DREDGING RECORDS OF THE NORTHWESTERN PACIFIC

Station No.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	[*10 to 20 miles S. W. of Goto Ids., Eastern Sea.*]				*fms.*	
D. 4890	Ose Saki Lt., N. 2° W., 10 miles (32° 26′ 30″ N., 128° 36′ 30″ E.).	H. O. 1302.	Aug. 9	7.50 a. m. 8.09 a. m.	135 135	rky..... rky.....
D. 4891	Ose Saki Lt., N. 8° E., 10.5 miles (32° 27′ N. 128° 34′ E.).	....do.....	....do...	9.47 a. m. 10.05 a. m.	181 181	gy. S., brk. Sh., R. gy. S., brk. Sh., R.
D. 4892	Ose Saki Lt., N. 15° E., 9.5 miles (32° 27′ 30″ N. 128° 33′ E.).	....do.....	....do...	10.57 a. m.	**181	gy. S., brk. Sh., R.**
D. 4893	Ose Saki Lt., N. 29° E., 5.5 miles (32° 32′ N., 128° 32′ 50″ E.).	B. A. 359; published Mar.,1883; ext. cor. June,1896.	....do...	1.02 p. m. 1.15 p. m.	106 106–95	gy. S., brk. Sh., P. gy. S., brk. Sh., P.
D. 8494	Ose Saki Lt., N. 41° E., 5 miles (32° 33′ N., 128° 32′ 10″ E.).	....do.....	....do...	2.58 p. m. 3.12 p. m.	95 95	gn. S., brk. Sh., P. gn. S., brk. Sh., P.
D. 4895	Ose Saki Lt., N. 42° E., 4.7 miles (32° 33′ 10″ N., 128° 32′ 10″ E.).	....do.....	....do...	4.21 p. m.	**95	gn. S., brk. Sh., P.**
D. 4896	Ose Saki Lt., N. 48° E., 6.8 miles (32° 32′ 30″ N., 128° 30′ E.).	H. O. 1302.	....do...	8.00 p. m. 8.00 p. m.	*125 *125	....
D. 4897	Ose Saki Lt., N. 75° E., 15.2 miles (32° 33′ N., 128° 19′ E.).	....do.....	Aug. 10	7.49 a. m. 8.45 a. m. 9.32 a. m.	207 207 207	fne. gy. S., brk. Sh., For. fne. gy. S., brk. Sh., For. fne. gy. S., brk. Sh., For.
D. 4898	Ose Saki Lt., N. 73° E., 14.3 miles (32° 33′ 30″ N., 128° 20′ E.).	....do.....	....do...	10.22 a. m.	**207	fne. gy. S., brk. Sh.. For.**
D. 4899	Ose Saki Lt., N. 83° E., 14.5 miles (32° 35′ N., 128° 19′ E.).	....do.....	....do...	11.08 a. m.	**207	fne. gy. S., brk. Sh., For.**
D. 4900	Ose Saki Lt., N. 10° E., 8 miles (32° 28′ 50″ N., 128° 34′ 40″ E.).	B. A. 359.	....do...	1.31 p. m. 1.51 p. m.	139 139	gy. S., brk. Sh.... gy. S., brk. Sh....
D. 4901	Ose Saki Lt., N. 9° E., 6.5 miles (32° 30′ 10″ N., 128° 34′ 40″ E.).	....do.....	....do...	2.34 p. m.	**139	gy. S., brk. Sh....
D. 4902	Ose Saki Lt., N. 10° E., 6 miles (32° 30′ 50″ N., 128° 34′ 40″ E.).	....do.....	....do...	3.15 p. m.	**139	gy. S., brk. Sh....
D. 4903	Ose Saki Lt., N., 22° E., 6 miles (32° 31′ 10″ N., 128° 33′ 20″ E.).	....do.....	....do...	3.56 p. m.	139 **107	gy. S., brk. Sh.**..
D. 4904	Ose Saki Lt., N. 27° E., 6 miles, (32° 31′ 20″ N., 128° 32′ 40″ E.).	....do.....	....do...	4.29 p. m. 4.41 p. m.	107 107	fne. gy. S., brk. Sh fne. gy. S., brk. Sh
	[*10 to 20 miles SW. of Koshika Ids., Eastern Sea.*]					
D. 4905	Tsurikake Saki Lt., S. 85° E., 18.5 miles (31° 39′ N., 129° 19′ E.).	H. O. 1302.	Aug. 11	7.49 a. m. 8.16 a. m.	369 369	no spec ..... no spec .....
D. 4906	Tsurikake Saki Lt., S. 85° E., 17.2 miles (31° 39′ N., 129° 20′ 30″ E.).	....do.....	....do...	9.34 a. m.	**369–406	.....
D. 4907	Tsurikake Saki Lt., S. 83° E., 14.7 miles (31° 39′ 30″ N., 129° 24′ E.).	....do.....	....do...	10.16 a. m. 10.53 a. m.	406 406	gy. Glob., Oz..... gy. Glob., Oz.....
D. 4908	Tsurikake Saki Lt., S. 78° E., 9.5 miles (31° 40′ N., 129° 29′ 40″ E.).	....do.....	....do...	1.06 p. m. 1.42 p. m. 2.17 p. m.	434 434 434	gy. Glob., Oz..... gy. Glob., Oz..... gy. Glob., Oz.....
D. 4909	Tsurikake Saki Lt., S. 86° E., 11.7 miles (31° 38′ 30″ N., 129° 27′ 30″ E.).	....do.....	....do...	3.33 p. m. 4.31 p. m. 4.45 p. m.	**434 **434 **434	gy. Glob., Oz**... gy. Glob., Oz**... gy. Glob., Oz.**...

CRUISE OF THE ALBATROSS, 1906—Continued.

Temperatures.			Surface density.	Apparatus.	Trial.		Drift.		Remarks.
Air.	Surface.	Bottom.			Depth.	Duration.	Direction.	Distance.	
° F.	° F.	° F.				h. m.		mi.	
80	82	52.3	.....	Luc. sdr.....					
80	82	52.3	1.02333	9′ Agassiz.....	botm..	2½	N.....	0.1	Heavy strain, one bridle-stop carried away; net badly torn.
82	81	50.2	.....	Luc. sdr.....					
82	81	50.2	.....	swabs.....	botm..	20	N.....	.7	Evidence of rough bottom.
83	81	.....	.....	9′ Agassiz.....	botm..	12	N.....	.4	Net came up torn; saved part of catch.
82	83	55.9	.....	Luc. sdr.....					
82	83	55.9	1.02312	swabs.....	botm..	1 00	N.....	1.5	
82	83	.....	.....	Tnr.-Blish sdr					
82	83	.....	.....	swabs.....	botm..	20	N.....	.8	
83	81	.....	1.02322	swabs.....	botm..	20	N.....	.8	
79	82	.....	.....	int. 3.....	surface	20	NW.....	.7	
79	82	.....	.....	K. 2, K. 4 ‡...	surface	20	NW.....	.7	
79	82	49.7	.....	Luc. sdr.....					
82	82	49.7	.....	int. 3; K. 2, K 4 §.	150 fms.	20 6	N.....	.8	200 fms. dredge wire out.
84	82	49.7	.....	8′ Alb.-Blk....	botm..	20	N.....	.8	
84	82	.....	.....	8′ Alb.-Blk....	botm..	20	N.....	.8	
81	82	.....	.....	8′ Alb.-Blk....	botm..	20	N.....	.8	
86	82	52.9	.....	Luc. sdr.....					
86	82	52.9	1.02282	swabs.....	botm..	20	NNE.....	.8	
88	82	.....	.....	8′ Alb.-Blk....	botm..	20	NNE.....	.8	
88	82	.....	1.02317	8′ Alb.-Blk....	botm..	20	WNW....	.8	
82	82	.....	1.02400	8′ Alb.-Blk....	botm..	20	WNW....	.8	
82	82	.....	.....	Tnr.-Blish sdr					
82	82	.....	.....	8′ Alb.-Blk....	botm..	20	WNW.....	.8	
84	83	43.4	.....	Luc. sdr.....					
84	83	43.4	.....	8′ Alb.-Blk....	botm..	20	E. ½ S....	.8	
83	83	.....	.....	12′ Tnr.....	botm..	20	E. ½ S....	.8	Towed 10 minutes with 650 fms. wire out; then veered to 700 fms. and towed 10 minutes longer.
83	83	42.6	.....	Luc. sdr.....					
86	84	42.6	1.02317	12′ Tnr.....	botm..	20	E. ½ S....	.8	
91	83	42.9	.....	Luc. sdr.....					Therms. at 5, 10, 15, 25, 50, 100, 200, and 400 fms.
87	84	42.9	.....	8 therm.; wat. bot.	5-400 fms.	5	.....	.....	
87	84	42.9	1.02308	12′ Tnr.....	botm..	20	W.....	.8	
87	85	.....	.....	9′ Agassiz.....	botm..	20	NW. by N	.8	
87	85	.....	.....	3 therm.....	5-25 fms	5	.....	.....	Therms. at 5, 10, and 25 fms.
88	85	.....	.....	int. 3; K. 2, K. 4§	300 fms.	20 13	NW. by N.	.8	400 fms. dredge wire out.

DREDGING RECORDS OF THE NORTHWESTERN PACIFIC

Station No.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	[*10 to 20 miles SW. of Koshika Ids., Eastern Sea*]—Con.				*fms.*	
D. 4910	Tsurikake Saki Lt., east, 12 miles (31° 37′ 40″ N., 129° 26′ E.).	H. O. 1302.	Aug. 11	8.01 p. m. 8.01 p. m.	*425 *425	....
D. 4911	Tsurikake Saki Lt., S. 88° E., 18 miles (31° 38′ 30″ N., 129° 19′ E.).	....do.....	Aug. 12	7.51 a. m. 8.22 a. m.	391 391	gy. Glob., Oz..... gy. Glob., Oz.....
D. 4912	Tsurikake Saki Lt., S. 84° E., 17.5 miles (31° 39′ 40″ N., 129° 20′ E.).	....do.....	....do...	9.40 a. m.	**391	gy. Glob., Oz.** ..
D. 4913	Tsurikake Saki Lt., S. 84° E., 15 miles (31° 39′ 10″ N., 129° 22′ 30″ E.).	....do.....	....do...	10.53 a. m.	**391	gy. Glob., Oz.**...
D. 4914	Tsurikake Saki Lt., N. 67° E., 13 miles (31° 33′ N., 129° 26′ 30″ E.).	....do.....	....do...	1.04 p. m. 1.36 p. m.	427 427	gy. Glob., Oz., brk. Sh. gy. Glob., Oz., brk. Sh.
D. 4915	Tsurikake Saki Lt., N. 62° E., 14.8 miles (31° 31,′ N. 129° 25′ 30″ E.).	....do.....	....do...	3.00 p. m.	**427	gy. Glob., Oz., brk. Sh.**
	[*About 90 miles WSW. of Kagoshima Gulf, Eastern Sea.*]					
D. 4916	Gwaja Shima, S. 37° E., 37.5 miles (30° 25′ N., 129° 06′ 40″ E.).	H. O. 2194; published Apr., 1905.	Aug. 13	7.50 a. m. 8.16 a. m.	361 361	gy. S., Glob., brk. Sh. gy. S., Glob., brk. Sh.
D. 4917	Gwaja Shima, S. 39° E., 37 miles (30° 24′ N., 129° 06′ E.).	....do.....	....do...	9.35 a. m.	**361	gy. S., Glob., brk. Sh.**
D. 4918	Gwaja Shima, S. 38° E., 34 miles (30° 22′ N., 129° 08′ 30″ E.).	....do.....	....do...	10.50 a. m.	**361	gy. S., Glob., brk. Sh.**
D. 4919	Kusakaki Jima, N. 18° E., 17.6 miles (30° 34′ N., 129° 19′ 30″ E.).	....do.....	....do...	1.06 p. m. 1.28 p. m. 2.24 p. m.	440 440 440	Glob., Oz..... Glob., Oz..... Glob., Oz.....
D. 4920	Kusakaki Jima, N. 10° E., 17.5 miles (30° 34′ N., 129° 22′ E.).	....do.....	....do...	3.43 p. m. 4.30 p. m.	**440 **440	Glob., Oz.*..... Glob., Oz.*.....
D. 4921	Kusakaki Jima, N. 190° W., 29 miles (30° 23′ 30″ N., 129° 36′ 30″ E.).	....do.....	....do...	8.01 p. m. 8.01 p. m.	*400 *400	....
	[*In Colnett or Vincennes Strait.*][a]					
D. 4922	Blake Reef (largest rock), S. 6° W.; Kuchino Id., r. t. S. 36° W.	....do.....	Aug. 14	7.46 a. m. 8.14 a. m.	60 60-273	Co..... Co.....
D. 4923	Blake Reef (largest rock), S. 25° W.; Kuchino Id., r. t. S. 48° W.; Nagada Saki Lt., N. 42° E.	....do.....	....do...	8.51 a. m. 9.11 a. m.	273 273	rky.(?)..... rky.(?).....
H. 4881	Blake Reef (largest rock), S. 17° W.; Kuchino Id., r. t. S. 42½° W.; Nagada Saki Lt., N. 48½° E.	....do.....	....do...	9.49 a. m.	316	Co., S., brk. Sh...
H. 4882	Blake Reef (largest rock), S. 4° W.; Kuchino Id., r. t. S. 31½° W.; Nagada Saki Lt., N. 56° E.	....do.....	....do...	10.20 a. m.	248	Co., S., brk. Sh., For.

[a] The position of stations D. 4922, D. 4923, H. 4881, H. 4882, H. 4883, are given by true bearings as observed on each station. The variation used is 4° 43′ west, instead of 3° 35′ west, as given on H. O. chart 2194, the former variation being the result of a determination made by swinging ship under favorable conditions in this vicinity on August 12, 1906. These bearings do not plot on H. O. chart 2194, owing to chart's inaccuracy. (Navigator.)

CRUISE OF THE ALBATROSS, 1906—Continued.

Temperatures.			Surface density.	Apparatus.	Trial.		Drift.		Remarks.
Air.	Surface.	Bottom.			Depth.	Duration.	Direction.	Distance.	
° F.	° F.	° F.				h. m.		mi.	
85	84	.....	.....	int. 3	surface.	20	W.....	0.8	
85	84	.....	.....	K. 2, K. 4 ‡....	surface.	20	W.....	.8	
85	83	41.9	.....	Luc. sdr.....	.....	.....	.....	.....	
85	83	41.9	1.02300	9′ Agassiz.....	botm ..	20	NNW. to NNE.	.8	
86	83	.....	.....	9′ Agassiz.....	botm ..	20	E.....	.8	
84	84	.....	1.02333	9′ Agassiz.....	botm ..	15	E.....	.6	
87	85	41.9	.....	Luc. sdr.....	.....	.....	.....	.....	
84	85	41.9	1.02320	9′ Agassiz.....	botm ..	20	S.....	.8	
85	84	.....	.....	9′ Agassiz.....	botm ..	29	SW.....	1.3	
88	84	42.7	.....	Luc. sdr.....	.....	.....	.....	.....	
88	84	42.7	1.02352	9′ Agassiz.....	botm ..	23	W.....	.9	
95	84	.....	.....	9′ Agassiz.....	botm ..	20	NW.....	.8	
86	84	.....	1.02360	9′ Agassiz.....	botm ..	13	E.....	.5	Accumulator registered over 3 tons. Net came up torn.
93	84	41.8	.....	Luc. sdr.....	.....	.....	.....	.....	
93	84	41.8	.....	8 therm.; wat. bot.	5-400 fms.	5	.....	.....	Therms. at 5, 10, 15, 25, 50, 100, 200, and 400 fms.
85	84	41.8	1.02401	9′ Agassiz.....	botm ..	20	SE. ½ E...	.8	
88	85	.....	.....	9′ Agassiz.....	botm ..	20	SE.....	.8	
88	84	.....	1.02392	Int. 3; K. 2, K. 4§	300 fms.	20	SW.....	.8	400 fms. dredge wire out.
84	84	.....	.....	int. 3.....	surface.	11 20	SE.....	.8	
84	84	.....	.....	K. 2, K. 4 ‡....	surface.	20	SE.....	.8	
87	84	79.2	.....	Luc. sdr.....	.....	.....	.....	.....	
87	84	79.2	1.02206	8′ Alb.-Blk....	botm ..	20	SE. to S..	.8	
87	84	46.6	.....	Luc. sdr.....	.....	.....	.....	.....	
87	84	46.6	.....	8′ Alb.-Blk....	botm ..	3	S.....	.1	Rough bottom. Accumulator registered over 3½ tons. Veered out 50 fms. more wire after 400 fms. were out. Gin block on berth deck broke loose; lost net, frame, weights, 450 fms. dredge rope, etc.
99	85	44.0	.....	Luc. sdr.....	.....	.....	.....	.....	
99	85	48.8	.....	Luc. sdr.....	.....	.....	.....	.....	

DREDGING RECORDS OF THE NORTHWESTERN PACIFIC

Station No.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	[*In Colnett or Vincennes Strait*]—Continued.				*fms.*	
H. 4883	Blake Reef (largest rock), south; Kuchino Id., r. t. S. 32° W.; Nagada Saki Lt., N. 35° E.	H. O. 2194	Aug. 14	11.02 a. m.	26	Only small piece of sponge came up in sounding cup.
D. 4924	Nagada Saki, N. 8° E., 18 miles (30° 5′ N., 130° 21′ 20″ E.).	....do.....	....do...	1.01 p. m. 1.20 p. m.	159 159	no spec., rky..... no spec., rky.....
D. 4925	Yaku Shima, r. t. N., 30° E., l. t. N. 20½° W.	....do.....	....do...	2.49 p. m. 3.06 p. m.	165 165	Co., S., bk. Sp.... Co., S., bk. Sp....
D. 4926	Yaku Shima, r. t. N. 22° E., l. t. N. 32½° W.	....do.....	....do...	3.56 p. m. 4.36 p. m.	**165 **165	Co., S., bk. Sp.**.. Co., S., bk. Sp.**..
D. 4927	29° 57′ N., 130° 41′ E.....	....do.....	....do...	8.00 p. m. 8.00 p. m.	*250 *250	....
D. 4928	29° 51′ N., 131° 02′ 30″ E.....	....do.....	Aug. 15	7.56 a. m. 9.21 a. m. 10.40 a. m.	1,008 1,008 1,008	gy. S., Glob..... gy. S., Glob..... gy. S., Glob.....
D. 4929	NE. point Yaku Shima, N. 16° W., 10 miles (30° 12′ 30″ N., 130° 43′ E.).	....do.....	....do...	2.57 p. m. 3.09 p. m.	84 84	brk. Sh., Co., P... brk. Sh., Co., P...
D. 4930	NE. point Yaku Shima, N. 19° W., 10.7 miles (30° 12′ N., 130° 44′ E.).	....do.....	....do...	3.56 p. m.	**84	brk. Sh., Co., P...
D. 4931	NE. point Yaku Shima, N. 16° W., 10.8 miles (30° 12′ N. 130° 43′ 40″ E.).	....do.....	....do...	42.6 p. m. 43.6 p. m.	83 83	brk. Sh., P., Co... brk. Sh., P., Co...
D. 4932	Sata Misaki Lt., N. 9° W., 30.5 miles (30° 29′ 30″ N., 130° 45′ E.).	....do.....	....do...	7.34 p. m. 7.34 p. m.	40* 40*	....
	[*Off Kagoshima Gulf, Eastern Sea.*]					
D. 4933	Sata Misaki Lt., N. 84° E., 8.5 miles (30° 59′ N., 130° 29′ 50″ E.).	....do.....	Aug. 16	74.6 a. m. 80.3 a. m.	152 152	rky..... rky.....
D. 4934	Sata Misaki Lt., N. 77½° E., 7 miles (30° 58′ 30″ N., 130° 32′ E.).	....do.....	....do...	8. 51 a. m.	**152–103	rky**.....
D. 4935	Sata Misaki Lt., N. 58° E., 4.5 miles (30° 57′ 20″ N., 130° 35′ 10″ E.).	H. O. 2187; published Oct., 1904.	....do...	9.42 a. m. 9.57 a. m.	103 103	St..... St.....
D. 4936	Sata Misaki Lt., N. 21° E., 5.7 miles (30° 54′ 40″ N., 130° 37′ 30″ E.).	H.O. 2194.	....do...	10.47 a. m.	**103	St.**.....
	[*In Kagoshima Gulf.*][a]					
D. 4937	Chirin Jima △, N. 27° W., 4.3 miles (31° 13′ N., 130° 43′ 10″ E.).	H. O. 2187	Aug. 16	20.2 p. m. 21.2 p. m.	58 58	M., lav., P..... M., lav., P.....
D. 4938	Chirin Jima △, W., 2.3 miles (31° 16′ 45″ N., 130° 43′ 40″ E.).	....do.....	....do...	3.02 p. m.	*70	.....
D. 4939	Chirin Jima △, S. 27° W., 2 miles (31° 18′ 30″ N., 130° 42′ E.).	....do.....	....do...	3.59 p. m.	*85	.....
D. 4940	Chirin Jima △, S. 7° E., 5.4 miles (31° 22′ 10″ N., 130° 40′ 10″ E.).	....do.....	Aug. 17	7.48 a. m. 8.05 a. m.	115 115	br. M., bk. Sp.... br. M., bk. Sp....
D. 4941	Chirin Jima △, S. 13½° E., 5.3 miles (31° 22′ N., 130° 39′ 20″ E.).	....do.....	....do...	8.52 a. m.	*117	.....
D. 4942	Chirin Jima △, S. 12½° E., 6.6 miles (31° 23′ 10″ N., 130° 39′ 10″ E.).	....do.....	....do...	9.40 a. m.	*118	.....

[a] Shore collections were made at Kagoshima.

CRUISE OF THE ALBATROSS, 1906—Continued.

Temperatures.			Surface density.	Apparatus.	Trial.		Drift.		Remarks.
Air.	Surface.	Bottom.			Depth.	Duration.	Direction.	Distance.	
° F.	° F.	° F.				h. m.		mi.	
99	85	79.2	.....	Luc. sdr.....	.....	.....	.....	.....	
93	86	55.8	.....	Luc. sdr.....	.....	.....	.....	.....	
93	86	55.8	.....	swabs.....	botm..	7½	SE.....	.2	Accumulator registered over 5 tons. Veered out 22 fms. more wire after 350 fms. were out. Hove in slowly. Frame badly bent.
106	85	53.5	.....	Luc. sdr.....	.....	.....	.....	.....	
106	85	53.5	1.02395	9′ Agassiz....	botm..	20	SE. to S...	.8	
96	86	.....	.....	9′ Agassiz....	botm..	20	S.....	.8	
91	85	.....	1.02447	int. 3; K. 2, K. 4§	100 fms.	20	S.....	.8	135 fms. dredge wire out.
85	85	.....	.....	int. 3.....	surface.	5 20	S.....	.8	
85	85	.....	.....	K. 2, K. 4‡....	surface.	20	S.....	.8	
83	85	36.8	.....	Luc. sdr.....	.....	.....	.....	.....	
86	84	36.8	1.02464	9′ Agassiz.....	botm..	40	SSW. to S.	1.6	
89	84	36.8	.....	int. 3; K. 2, K. 4§	300 fms.	20 12	S.....	.8	400 fms. dredge wire out.
92	86	74.8	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
92	86	74.8	.....	swabs.....	botm..	20	NE. to E..	.8	Stopped heaving in 11 minutes. Wire fouled in sheave.
91	86	.....	1.02413	9′ Agassiz....	botm..	20	NW.....	.8	
91	86	75.4	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
86	86	75.4	.....	9′ Agassiz.....	botm..	20	NW.....	.8	
84	84	.....	.....	int. 3.....	surface.	20	N.....	.8	
84	84	.....	.....	K. 2, K. 4‡....	surface.	20	N.....	.8	
84	84	56.0	.....	Luc. sdr.....	.....	.....	.....	.....	
84	84	56.0	1.02354	swabs.....	botm..	20	S.....	.8	
86	84	.....	1.02355	9′ Agassiz.....	botm..	20	S.....	.8	
85	84	60.6	.....	Luc. sdr.....	.....	.....	.....	.....	
85	84	60.6	.....	9′ Agassiz.....	botm..	20	S.....	.8	
86	84	.....	1.02352	9′ Agassiz.....	botm..	20	S. to W...	.7	Net slightly torn.
87	84	64.8	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
87	84	64.8	1.02282	9′ Agassiz.....	botm..	20	NNE.....	0.8	
86	84	.....	.....	9′ Agassiz.....	botm..	20	NNE.....	.8	
88	84	.....	1.02226	9′ Agassiz.....	botm..	30	NE. to E.	1.2	
86	84	59.8	.....	Luc. sdr.....	.....	.....	.....	.....	
86	84	59.8	1.02196	9′ Agassiz.....	botm..	20	WSW.....	.8	
86	84	.....	.....	9′ Agassiz.....	botm..	20	NNW.....	.8	
90	84	.....	1.02186	9′ Agassiz.....	botm..	20	NNW.....	.8	

DREDGING RECORDS OF THE NORTHWESTERN PACIFIC

Station No.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	[*In Kagoshima Gulf*]—Con.				*fms.*	
D. 4943	Chirin Jima ¿, S. 13° E., 8.1 miles (31° 24′ 35″ N., 130° 38′ 40″ E.).	H. O. 2187	Aug. 17	10.24 a. m. 11.13 a. m.	*119 *119	....
D. 4944	Yebisu Jima, W., 2.8 miles (31° 38′ 15″ N., 130° 46′ 50″ E.).	....do.....	....do...	1.32 p. m. 1.37 p. m.	43 43	bk. S., lav., P..... bk. S., lav., P.....
D. 4945	Yebisu Jima, S. 68° W., 1.4 miles (31° 38′ 45″ N., 130° 45′ E.).	....do.....	....do...	2.48 p. m. 2.57 p. m.	70 70	gn. M..... gn. M.....
	From Kagoshima, Kagoshima Gulf, Japan, to Kobe, Japan, via Bungo Channel and Inland Sea.					
D. 4946	Okiko Jima, N. 31° E., 4 miles (31° 29′ 10″ N., 130° 34′ 30″ E.).	....do.....	Aug. 20	8.58 a. m. 9.06 a. m.	39 39	br. S., brk. Sh., P. br. S., brk. Sh., P.
D. 4947	Okiko Jima, N. 17° E., 4.4 miles (31° 28′ 20″ N., 130° 35′ 30″ E.).	....do.....	....do...	9.40 a. m.	*51	.....
D. 4948	O Shima Lt., N. 11° E., 12 miles (31° 19′ N., 131° 23′ E.).	H. O. 1302	Aug. 21	8.10 a. m. 8.20 a. m.	65 65	dk. gy. vol. S., brk. Sh., P. dk. gy. vol. S., brk. Sh., P.
D. 4949	O Shima Lt., N. 13½° W., 16 miles (31° 15′ 30″ N., 131° 29′ 30″ E.).	....do.....	....do...	9.24 a. m. 9.37 a. m.	110 110	br. S., brk. Sh., For. br. S., brk. Sh., For.
D. 4950	O Shima Lt., N. 36½° W., 20 miles (31° 15′ N., 131° 39′ E.).	....do.....	....do...	11.06 a. m. 11.42 a. m.	529 529	gn. M., Glob..... gn. M., Glob.....
D. 4951	O Shima Lt., N. 54° W., 35.2 miles (31° 10′ 30″ N., 131° 58′ 30″ E.).	....do.....	....do...	1.49 p. m. 2.31 p. m. 3.48 p. m. 4.40 p. m.	703 703 703 703	gn. M., Glob..... gn. M., Glob..... gn. M., Glob..... gn. M., Glob.....
D. 4952	O Shima Lt., N. 73° W., 41.5 miles (31° 19′ N., 132° 11′ 30″ E.).	....do.....	....do...	7.32 p. m. 7.32 p. m.	*700 *700	....
D. 4953	31° 39′ N., 132° 54′ 40″ E.....	....do.....	Aug. 22	7.58 a. m. 9.14 a. m.	1,350 1,350	br. M., fne. bk. S., For. br. M., fne. bk. S., For.
D. 4954	32° 05′ N., 133° 02′ E.....	....do.....	....do...	1.10 p. m. 2.00 p. m.	957 957	br. M., fne. bk. S., For. br. M., fne. bk. S., For.
D. 4955	Ashizura Zaki, N. 58° E., 21.5 miles (32° 32′ N., 132° 39′ E.).	....do.....	....do...	7.30 p. m. 7.30 p. m.	*300 *300	....
D. 4956	Mizunoko Shima Lt., N. 22° W., 33 miles (32° 32′ N., 132° 25′ E.).	....do.....	Aug. 23	7.53 a. m. 8.33 a. m.	720 720	gn-br. M., fne. gy. S., For. gn-br. M., fne. gy. S., For.
D. 4957	Mizimoko Shima Lt., N. 22° W., 29 miles (32° 36′ N., 132° 23′ E.).	H. O. 549a; published July, 1874; ext. cor. Apr., 1894.	....do...	10.12 a. m. 10.47 a. m.	437 437	gn-br. M., fne. gy. S., For. gn-br. M., fne. gy. S., For.
D. 4958	Mizimoko Shima Lt., N. 26° W., 29.3 miles (32° 36′ 20″ N., 132° 24′ 30″ E.).	....do.....	....do...	1.04 p. m. 1.33 p. m.	405 405	gn.-br. M., fne. gy. S., For. gn.-br. M., fne. gy. S., For.
D. 4959	Mizimoko Shima Lt., N. 23° W., 28.5 miles (32° 36′ 30″ N., 132° 23′ 20″ E.).	....do.....	....do...	2.40 p. m.	**405-578	gn.-br. M., fne. gy. S., For.**
D. 4960	Mizimoko Shima Lt., N. 19° W., 30.5 miles (32° 34′ N., 132° 21′ 45″ E.).	....do.....	....do...	3.33 p. m. 4.07 p. m.	578 578	gn-br. M., fne. gy. S., For. gn-br. M., fne. gy. S., For.

CRUISE OF THE ALBATROSS, 1906—Continued.

Temperatures.			Surface density.	Apparatus.	Trial.		Drift.		Remarks.
Air.	Surface.	Bottom.			Depth.	Duration.	Direction.	Distance.	
° F.	° F.	° F.				h. m.		mi.	
90	84	.....	.....	9′ Agassiz....	botm ..	20	NNW.....	0.8	
96	84	.....	.....	int.3; K.2,K.4§	100 fms.	20	NNE. to NE.	.8	135 fms. dredge wire out.
						4			
89	84	64.4	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
89	84	64.4	1.02123	swabs	botm ..	47	W.....	1.8	
89	84	60.4	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
89	84	60.4	1.02200	9′ Agassiz....	botm ..	20	W.....	.8	
89	83	68.7	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
89	83	68.7	1.02199	9′ Agassiz....	botm ..	20	SE. to S..	.8	
88	84	.....	.....	9′ Agassiz....	botm ..	20	S.....	.8	
81	81	62.6	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
81	81	62.6	1.02456	9′ Agassiz....	botm ..	20	SE.....	.8	
82	82	57.8	.....	Luc. sdr.....	.....	.....	.....	.....	
88	84	57.8	1.02403	9′ Agassiz....	botm ..	20	SE.....	.8	
85	84	38.9	.....	Luc. sdr.....	.....	.....	.....	.....	
85	84	38.9	1.02413	9′ Agassiz....	botm ..	20	NE.....	1.0	Towing with current.
80	85	37.7	.....	Luc. sdr.....	.....	.....	.....	.....	
92	85	37.7	.....	9′ Agassiz....	botm ..	20	SE.....	.8	
92	86	37.7	.....	int.3; K.2,K.4§	300 fms.	20	SSE. to SSW.	.8	400 fms. dredge wire out.
						12			
88	85	37.7	.....	8 therm.; wat. bot.	10–600 fms.	5	.....	.....	Therms. at 10, 25, 50, 100, 200, 300, 400, and 600 fms.
85	85	.....	.....	int. 3.....	surface.	20	S. by E...	.8	
85	85	.....	.....	K. 2, K. 4 ‡...	surface.	20	S. by E...	.8	
84	85	35.8	.....	Luc. sdr.....	.....	.....	.....	.....	
85	86	35.8	1.02485	9′ Agassiz....	botm ..	20	NE.....	1.0	Stopped 2 minutes while veering out.
94	86	36.7	.....	Luc. sdr.....	.....	.....	.....	.....	
96	87	36.7	1.02414	int. 3 §.....	850fms..	20	NE.....	1.0	1,500 fms. dredge wire out.
						55			
84	83	.....	.....	int. 3.....	surface.	20	SW.....	.8	
84	83	.....	.....	K. 2, K. 4 ‡...	surface.	20	SW.....	.8	
82	84	37.5	.....	Luc. sdr.....	.....	.....	.....	.....	
88	83	37.5	1.02423	9′ Agassiz....	botm ..	20	NW.....	.8	Stopped 1½ minutes while heaving in to navigate ship clear of dredge wire.
85	83	39.8	.....	Luc. sdr.....	.....	.....	.....	.....	
88	83	39.8	1.02427	9′ Agassiz....	botm ..	20	NW. ½ N..	.8	
83	83	40.1	.....	Luc. sdr.....	.....	.....	.....	.....	
87	83	40.1	.....	9′ Agassiz....	botm ..	20	NW.....	.8	
82	82	.....	1.02415	9′ Agassiz....	botm ..	20	WSW	.8	
83	78	38.7	.....	Luc. sdr.....	.....	.....	.....	.....	
83	78	38.7	.....	9′ Agassiz....	botm ..	20	WSW	.8	

DREDGING RECORDS OF THE NORTHWESTERN PACIFIC

Station No.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	From Kobe, Japan to Yokohama, Japan.				*fms.*	
D. 4961	Tomaga Shima Lt., N. 18° E., 8.3 miles (34° 09′ 15″ N. 134° 56′ 40″ E.).	H. O. 549b; published Sept., 1874 ext. cor. Nov., 1904.	Aug. 27	2.16 p. m. 2.23 p. m.	33 33	fne. gy. S., M..... fne. gy. S., M.....
D. 4962	Tomaga Shima Lt., N. 18° E., 9.5 miles (34° 08′ N., 134° 56′ 20″ E.).	....do.....	....do...	2.59 p. m.	*36	.....
D. 4963	Tomaga Shima Lt., N. 8½° E., 11 miles (34° 06′ 15″ N., 134° 57′ 50″ E.).	....do.....	....do...	3.43 p. m.	*40–37	.....
D. 4964	Tomaga Shima Lt., N. 12½° E., 11.8 miles (34° 05′ 30″ N., 134° 56′ 40″ E.).	....do.....	....do...	4.15 p. m. 4.19 p. m.	37 37	fne. gy. S., M..... fne. gy. S., M.....
D. 4965	Hiro Misaki Lt., N. 20° W., 18.5 miles (33° 35′ 20″ N., 135° 10′ 50″ E.).	H. O. 2248; published Sept., 1905.	Aug. 28	10.10 a. m. 10.29 a. m.	191 191	dk. gn-gy. S., Sh.. dk. gn-gy. S., Sh..
D. 4966	Shio Misaki Lt., N. 85° E., 7.5 miles (33° 25′ 20″ N., 135° 36′ 20″ E.).	....do.....	Aug. 29	8.35 a. m. 8.58 a. m.	290 290–244	br. M., S., For.... br. M., S., For....
D. 4967	Shio Misaki Lt., N. 83° E., 6.5 miles (33° 25′ 10″ N., 135° 37′ 20″ E.).	....do.....	....do...	9.44 a. m. 10.06 a. m.	244 244–253	br. M., S., For.... br. M., S., For....
D. 4968	Shio Misaki Lt., N. 77° E., 5.5 miles (33° 24′ 50″ N., 135° 38′ 40″ E.).	....do.....	....do...	10.50 a. m. 11.10 a. m.	253 253	dk. gy. S., br. M., brk. Sh. dk. gy. S., br. M., brk. Sh.
D. 4969	Shio Misaki Lt., N. 77° E., 9.8 miles (33° 23′ 40″ N., 135° 33′ E.).	....do.....	....do...	1.26 p. m. 2.02 p. m. 3.20 p. m.	587 587 587	br. M., S., St..... br. M., S., St..... br. M., S., St.....
D. 4970	Shio Misaki Lt., N. 72° E., 7.6 miles (33° 23′ 30″ N., 135° 36′ 30″ E.).	....do.....	Aug. 30	8.39 a. m. 9.14 a. m.	500 500–649	br. M., bk. S., Sh.. br. M., bk. S., Sh..
D. 4971	Shio Misaki Lt., N. 75° E., 9.6 miles (33° 23′ 30″ N., 135° 34′ E.).	....do.....	....do...	10.17 a. m. 10.57 a. m.	649 649	br. gn. M., For... br. gn. M., For...
D. 4972	Shio Misaki Lt., N. 89° E., 11.5 miles (33° 25′ 45″ N., 135° 33′ E.).	....do.....	....do...	1.09 p. m. 1.35 p. m.	440 440	br. gn. M., For... br. gn. M., For...
D. 4973	Shio Misaki Lt., N. 82° E., 12.5 miles (33° 24′ 15″ N., 135° 30′ 30″ E.).	....do.....	....do...	2.45 p. m. 3.21 p. m.	600 600	br. M., St..... br. M., St.....
D. 4974	Shio Misaki Lt., N. 25° E., 8.7 miles (33° 18′ 10″ N., 135° 40′ 50″ E.).	....do.....	Aug. 31	8.38 a. m. 9.33 a. m.	905 905	br.-gn. M., For... br.-gn. M., For...
D. 4975	Shio Misaki Lt., N. 49° E., 7 miles (33° 21′ 30″ N., 135° 38′ 50″ E.).	....do.....	....do...	12.40 p. m. 1.19 p. m.	712 712–545	br. M., P., For... br. M., P., For...
D. 4976	Shio Misaki Lt., N. 59° E., 6.4 miles (33° 22′ 50″ N., 135° 38′ 30″ E.).	....do.....	....do...	2.36 p. m. 3.17 p. m.	545 545–544	br. M., sml. St.... br. M., sml. St....
D. 4977	Shio Misaki Lt., N. 65° E., 7 miles (33° 23′ N., 135° 37′ 40″ E.).	....do.....	....do...	4.20 p. m. 5.04 p. m.	544 544	br. M., fne. S..... br. M., fne. S.....
D. 4978	Kushino Zaki Lt., N. 49° W., 5 miles (33° 24′ 50″ N., 135° 56′ E.).	....do.....	....do...	7.37 p. m. 7.33 p. m.	*200 *200	....
D. 4979	33° 53′ N., 137° 42′ E.....	H. O. 1301	Sept. 1	7.58 a. m. 9.04 a. m.	943 943	br. M., fne. S., For. br. M., fne. S., For.
H. 4884	34° 03′ N., 137° 55′ E.....	....do.....	....do...	1.15 p. m.	974	br. M., fne. S., For.
D. 4980	34° 09′ N., 137° 55′ E.....	....do.....	....do...	2.18 p. m. 2.54 p. m.	507 507	br. M., fne. S., For. br. M., fne. S., For.
	From Hakodate, Hokkaido, Japan, to Otaru, Hokkaido, Japan, via Tsugaru Strait.[a] [*In the Sea of Japan.*]					
D. 4981	Benkei Mizaki Lt., S. 9° E., 8.8 miles (42° 58′ 15″ N., 140° 09′ 10″ E.).	B. A. 3438; published Oct., 1904.	Sept. 19	7.51 a. m. 8.17 a. m.	406 406–390	gn. M..... gn. M.....

[a] From Yokohama, Japan, to Hakodate, Hokkaido, Japan, straight run; no work en route.

CRUISE OF THE ALBATROSS, 1906—Continued.

Temperatures.			Surface density.	Apparatus.	Trial.		Drift.		Remarks.
Air.	Surface.	Bottom.			Depth.	Duration.	Direction.	Distance.	
° F.	° F.	° F.				h. m.		mi.	
82	78	70.1	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
82	78	70.1	1.02344	9′ Agassiz....	botm..	20	SW. by S.	0.8	
84	78	.....	.....	9′ Agassiz....	botm..	20	S. by E...	.8	
85	78	.....	.....	9′ Agassiz....	botm..	20	SW.....	.8	
85	78	66.6	.....	Tnr.-Blish sdr	.....	.....	.....	.....	
85	78	66.6	1.02358	9′ Agassiz....	botm..	20	SW.....	.8	
83	82	49.4	.....	Luc. sdr.....	.....	.....	.....	.....	
83	82	49.4	1.02413	9′ Agassiz....	botm..	20	NE.....	.8	
82	80	44.1	.....	Luc. sdr.....	.....	.....	.....	.....	
82	80	44.1	1.02382	9′ Agassiz....	botm..	20	ESE.....	.8	One bridle-stop carried away; catch was saved.
82	80	45.9	.....	Luc. sdr.....	.....	.....	.....	.....	
82	80	45.9	.....	9′ Alb.-Blk....	botm..	20	ESE	.8	
82	81	45.7	.....	Luc. sdr.....	.....	.....	.....	.....	
82	81	45.7	1.02385	9′ Agassiz....	botm..	20	SE. to SW.	.8	
81	81	38.9	.....	Luc. sdr.....	.....	.....	.....	.....	
82	80	38.9	1.02376	9′ Agassiz....	botm..	20	Wd. to Nd.	1.0	Stopped 1 minute while veering out.
81	80	38.9	.....	int. 3; K. 2, K. 4§	300 fms.	20	ESE	.8	400 fms. dredge wire out.
						15			
84	80	39.1	.....	Luc. sdr.....	.....	.....	.....	.....	
84	81	39.1	1.02376	9′ Agassiz....	botm..	20	W.....	.8	
84	81	38.1	.....	Luc. sdr.....	.....	.....	.....	.....	
84	81	38.1	1.02375	9′ Agassiz....	botm..	20	WNW....	.8	
83	82	39.8	.....	Luc. sdr.....	.....	.....	.....	.....	
81	82	39.8	.....	9′ Agassiz....	botm..	20	WNW....	.8	
82	82	38.2	.....	Luc. sdr.....	.....	.....	.....	.....	
82	82	38.2	1.02388	9′ Agassiz....	botm..	30	NW. by W. to N.	1.2	
82	81	36.6	.....	Luc. sdr.....	.....	.....	.....	.....	
88	82	36.6	1.02372	9′ Agassiz....	botm..	30	WNW....	1.2	
85	82	37.5	.....	Luc. sdr.....	.....	.....	.....	.....	
85	82	37.5	1.02392	9′ Agassiz....	botm..	30	NNW	1.2	Net came up foul of frame.
85	82	38.7	.....	Luc. sdr.....	.....	.....	.....	.....	
85	82	38.7	1.02382	9′ Agassiz....	botm..	20	WNW. to NNW.	.8	Towed 6 minutes with 900 fms. wire out; 14 minutes with 1,000 fms. wire out.
84	82	38.9	.....	Luc. sdr.....	.....	.....	.....	.....	
83	82	38.9	.....	9′ Agassiz....	botm..	20	ESE.....	.8	
81	82	.....	.....	Int. 3.....	surface.	20	ENE. ½ E..	.8	
81	82	.....	.....	K. 2, K. 4‡....	surface.	24	ENE. ½ E..	1.0	
82	82	36.4	.....	Luc. sdr.....	.....	.....	.....	.....	Shot did not detach.
82	82	36.4	1.02411	9′ Agassiz....	botm..	30	S. by E...	1.2	Net fouled on frame.
84	82	36.4	.....	Luc. sdr.....	.....	.....	.....	.....	
84	82	39.0	.....	Luc. sdr.....	.....	.....	.....	.....	
84	82	39.0	1.02423	9 Agassiz....	botm..	30	ENE. to E.	1.2	Net fouled on frame.
67	69	32.7	.....	Luc sdr.....	.....	.....	.....	.....	
67	68	32.7	1.02414	9′ Agassiz....	botm..	20	NNE.....	.8	

DREDGING RECORDS OF THE NORTHWESTERN PACIFIC

Station No.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	From Hakodate, Hokkaido, Japan, to Otaru, Hokkaido, Japan, via Tsugaru Strait.—Continued.					
	[*In the Sea of Japan.*]				*fms.*	
D. 4982	Benkei Mizaki Lt., S. 3° E., 10.5 miles (43° N., 140° 10′ 30″ E.).	B. A. 3438; published Oct., 1904.	Sept. 19	9.15 a. m. 9.39 a. m.	390 390–428	gn. M gn. M
D. 4983	Benkei Mizaki Lt., S. 2° E., 12 miles (43° 01′ 35″ N., 140° 10′ 40″ E.).	....do.....	....do...	10.35 a. m. 11.00 a. m.	428 428	gn. M. gn. M.
D. 4984	Benkei Mizaki Lt., S. 3° W., 15 miles (43° 04′ 20″ N., 140° 12′ 10″ E.).	....do.....	....do...	1.03 p. m. 1.24 p. m.	248 248–224	gn. M. gn. M.
D. 4985	Kamoi Mizaki Lt., N. 17° E., 15.2 miles (43° 05′ 20″ N., 140° 15′ 15″ E.).	....do.....	....do...	2.15 p. m. 2.33 p. m.	224 224	gn. M. (?) gn. M. (?)
D. 4986	Benkei Mizaki Lt., N. 35° E., 15 miles (43° 01′ 40″ N., 140° 22′ 40″ E.).	....do.....	....do...	3.45 p. m. 4.02 p. m.	172 172	fne. bk. S., bk. M. fne. bk. S., bk. M.
D. 4987	Kamoi Mizaki Lt., N. 76° E., 3.2 miles (43° 19′ 20″ N., 140° 17′ E.).	....do.....	Sept. 20	9.37 a. m. 10.06 a. m.	59 59	rky. rky.
D. 4988	Kamoi Mizaki Lt., S. 3° W., 3 miles (43° 23′ 10″ N., 140° 21′ 10″ E.).	....do.....	....do...	11.04 a. m. 11.13 a. m.	68 68	S. S.
D. 4989	Maruyama Zaki, S. 12° E., 6.1 miles (43° 23′ 10″ N., 140° 37′ E.).	....do.....	....do...	1.05 p. m. 1.17 p. m.	92 92	S. S.
	From Otaru, Hokkaido, Japan, to Korsakov, Aniwa Bay, Saghalin Id. (via Gulf of Tartary and La Perouse Strait).					
	[*In the Sea of Japan.*]					
D. 4990	43° 40′ N., 140° 58′ E	H. O. 2124	Sept. 21	7.14 p. m. 7.14 p. m.	*200 *200	....
D. 4991	Bomasiri Shima (off N. end of Rebun To), N. 50° E., 9.2 miles (45° 23′ 20″ N., 140° 48′ E.).	....do.....	Sept. 22	7.50 a. m. 8.16 a. m.	325 325	gn. M. gn. M.
D. 4992	Bomasiri Shima (off N. end of Rebun To), N. 52° E., 8 miles (45° 24′ N. 140° 49′ 10″ E.).	....do.....	....do...	9.16 a. m.	325**	gn. M.**
D. 4993	Bomasiri Shima (off N. end of Rebun To), N. 47° E., 5 miles (45° 25′ 30″ N., 140° 53′ E.).	....do.....	....do...	10.28 a. m. 10.42 a. m.	142 142	gy. M., S., G. gy. M., S., G.
D. 4994	Bomasiri Shima (off N. end of Rebun To), N. 66° E., 3.1 miles (45° 27′ 50″ N., 140° 54′ E.).	....do.....	....do...	1.05 p. m. 1.21 p. m.	190 190	br. M., fne. bk. S. br. M., fne. bk. S.
D. 4995	Bomasiri Shima (off N. end of Rebun To), S. 29° E., 5.8 miles (45° 33′ 40″ N., 140° 54′ E.).	....do.....	....do...	2.38 p. m. 2.50 p. m.	86 86	bk. S., P. bk. S., P.
D. 4996	Bomasiri Shima (off N. end of Rebun To), S. 19° E., 6.6 miles (45° 35′ N., 140° 55′ E.).	....do.....	....do...	3.30 p. m.	**86	bk. S., P.**
	[*In the Gulf of Tartary, off southwestern coast of Saghalin Id.*]					
D. 4997	47° 38′ 40″ N., 141° 24′ 30″ E...	H. O. 1777; published Aug., 1900; ext. cor. Oct., 1906.	Sept. 23	7.49 a. m. 8.14 a. m. 9.11 a. m. 10.01 a. m.	318 318 318 318	gn. M. gn. M. gn. M. gn. M.

CRUISE OF THE ALBATROSS, 1906—Continued.

Temperatures.			Surface density.	Apparatus.	Trial.		Drift.		Remarks.
Air.	Surface.	Bottom.			Depth.	Duration.	Direction.	Distance.	
° F.	° F.	° F.				h. m.		mi.	
66	68	37.7	.....	Luc. sdr.....	.....	.....	.....	.....	
59	68	32.7	.....	9′ Agass.z....	botm..	20	NE.....	0.8	
60	68	32.7	.....	Luc. sdr.....	.....	.....	.....	.....	
60	68	32.7	1.02434	9′ Agassiz.....	botm..	20	NE.....	.8	
64	68	33.0	.....	Luc. sdr.....	.....	.....	.....	.....	
64	68	33.0	1.02398	9′ Agassiz.....	botm..	20	E.....	.8	
66	68	33.1	.....	Luc. sdr.....	.....	.....	.....	.....	
70	69	33.1	.....	9′ Agassiz.....	botm..	20	SE.....	.8	
73	69	33.9	.....	Luc. sdr.....	.....	.....	.....	.....	
73	69	33.9	1.02405	9′ Agassiz.....	botm..	20	E. to ESE.	.8	Stopped heaving in for 1 minute.
75	68	44.8	.....	Tnr.-Blish sdr.	.....	.....	.....	.....	
75	68	44.8	.....	swabs.....	botm..	20	N.....	.8	Veered out to 150 fms. wire after towing 2 minutes with 100 fms.
78	70	45.0	.....	Tnr.-Blish sdr.	.....	.....	.....	.....	
78	70	45.0	1.02404	9′ Agassiz.....	botm..	20	NE.....	.8	
74	70	39.7	.....	Tnr.-Blish sdr.	.....	.....	.....	.....	
74	70	39.7	1.02405	9′ Agassiz.....	botm..	20	ESE.....	.8	
66	69	.....	.....	Int. 3; c.l.....	surface.	20	N. to E...	.8	
66	69	.....	.....	K. 2, K. 4‡....	surface.	20	N. to E...	.8	
66	67	33.0	.....	Luc. sdr.....	.....	.....	.....	.....	
66	67	33.0	1.02394	9′ Agassiz.....	botm..	20	SE.....	.8	
67	66	.....	.....	9′ Agassiz.....	botm..	20	E.....	.8	
66	66	35.1	.....	Luc. sdr.....	.....	.....	.....	.....	
66	66	35.1	1.02414	9′ Agassiz.....	botm..	20	E.....	.8	
66	67	34.0	.....	Luc. sdr.....	.....	.....	.....	.....	
66	67	34.0	1.02405	9′ Agassiz.....	botm..	20	ESE.....	.8	Evidence of rough bottom from action of accumulator. One bridle-stop carried away.
67	67	43.4	.....	Luc. sdr.....	.....	.....	.....	.....	
67	67	43.4	1.02408	9′ Agassiz.....	botm..	20	E.....	.8	
67	67	.....	.....	9′ Agassiz.....	botm..	20	E.....	.8	
62	60	32.8	.....	Luc. sdr.....	.....	.....	.....	.....	
62	60	32.8	1.02374	9′ Agassiz.....	botm..	20	E.....	.8	
63	60	32.8	.....	Int. 3; K. 2, K. 4§	250 fms.	20 14	W.....	.8	330 fms, dredge wire out. Nets touched bottom and badly torn.
67	60	32.8	.....	5 therm; wat. bot.	10-200 fms.	5	.....	.....	Therms. at 10, 25, 50, 100, and 200 fms.

DREDGING RECORDS OF THE NORTHWESTERN PACIFIC

Station No.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	[*In the Gulf of Tartary, off southwestern coast of Saghalin Id.*]—Continued.				*fms.*	
D. 4998	47° 39′ 10″ N., 141° 31′ 40″ E...	H. O. 1777; published Aug..1900; ext. cor. Oct., 1906.	Sept. 23	10.50 a. m. 11.03 a. m.	66 66	br. M., fne. gy. S.. br. M., fne. gy. S..
D. 4999	47° 38′ 20″ N., 141° 39′ E.....	....do.....	....do...	12.45 p. m. 1.01 p. m. 1.14 p. m.	31 31 31	gy. M., gn. S..... gy. M., gn. S..... gy. M., gn. S.....
D. 5000	47° 37′ 30″ N., 141° 42′ 30″ E...	....do.....	....do...	1.48 p. m.	**31	gy. M., gn. S**....
D. 5001	47° 35′ N., 141° 43′ E.....	....do.....	....do...	2.15 p. m. 2.21 p. m.	30 30	gn. M., gy. S..... gn. M., gy. S.....
D. 5002	47° 33′ 30″ N., 141° 45′ E.....	....do.....	....do...	2.53 p. m.	**30–35	gn. M., gy. S.**...
D. 5003	47° 32′ 30″ N., 141° 45′ E.....	....do.....	....do...	3.21 p. m. 3.28 p. m.	35 35–38	fne. gy. S., gn. M .. fne. gy. S., gn. M ..
D. 5004	47° 31′ N., 141° 44′ 30″ E.....	....do.....	....do...	3.59 p. m. 4.06 p. m.	38 38	gn. M..... gn. M.....
	[*In Aniwa Bay, approaching Korsokov, Saghalin Id.*][a]					
D. 5005	46° 04′ 40″ N., 142° 27′ 30″ E....	....do.....	Sept. 24	8.17 a. m. 8.30 a. m.	42 42–43	gn. M., fne. gy. S... gn. M., fne. gy. S...
D. 5006	46° 04′ N., 142° 29′ E.....	....do.....	....do...	8.57 a. m. 9.05 a. m.	43 43–42	gn. M., fne. gy. S... gn. M., fne. gy. S...
D. 5007	46° 03′ N., 142° 31′ E.....	....do.....	....do...	9.36 a. m. 9.44 a. m.	42 42	gn. M., fne. gy. S... gn. M., fne. gy. S...
D. 5008	46° 07′ 50″ N., 142° 37′ 20″ E....	....do.....	....do...	10.52 a. m. 10.59 a. m.	40 40	gn. M., fne. gy. S... gn. M., fne. gy. S...
D. 5009	46° 24′ 10″ N., 142° 40′ E.....	....do.....	....do...	1.35 p. m. 1.42 p. m.	25 25	gn. M..... gn. M.....
D. 5010	Korsokov Lt., N., 5° E., 9.5 miles (46° 30′ 30″ N., 142° 43′ 30″ E.).	....do.....	....do...	3.14 p. m. 3.23 p. m.	21 21–32	gn. M., S..... gn. M., S.....
H. 4885	46° 30′ 20″ N., 142° 44′ 30″ E....	....do.....	....do...	3.54 p. m.	32	gn. M., S.....
	From Korsokov, Aniwa Bay, Saghalin Id., to East Bay, Cape Patience, eastern coast of Saghalin Id. [*In Aniwa Bay.*]					
D. 5011	46° 18′ 30″ N., 143° 05′ 40″ E....	....do.....	Sept. 25	3.03 p. m. 3.13 p. m.	42 42	gn. M..... gn. M.....
D. 5012	46° 17′ 50″ N., 143° 08′ 30″ E....	....do.....	....do...	3.40 p. m.	**42–43	gn. M. **.....
D. 5013	46° 17′ N., 143° 09′ E.....	....do.....	....do...	4.17 p. m. 4.25 p. m.	43 43	?..... ?.....
	[*Off eastern coast, southern end of Saghalin Id., in Okhotsk Sea.*]					
D. 5014	46° 46′ N., 144° E.....	....do.....	Sept. 26	7.49 a. m. 8.15 a. m.	329 329	gn. M..... gn. M.....
D. 5015	46° 44′ N., 144° 02′ E.....	....do.....	....do...	9.53 a. m. 10.23 a. m.	510 510	gn. M..... gn. M.....
D. 5016	46° 44′ 30″ N., 143° 45′ E.....	....do.....	....do...	1.02 p. m. 1.24 p. m.	64 64	br. M., fne. bk. S., R., Co. br. M., fne. bk. S., R., Co.
D. 5017	Cape Tonin, N. 59° W. (tr.?), 12.5 miles (46° 43′ 30″ N., 143° 45′ E.).	....do.....	....do...	1.49 p. m.	**64	br. M., fne. bk. S., R., Co. **
H. 4886	Cape Tonin, N. 68° W., 17 miles (46° 43′ 30″ N., 143° 52′ 30″ E.).	....do.....	....do...	2.49 p. m.	82	br. M., bk. S., P...
D. 5018	Cape Tonin, N. 66° W., 21.3 miles (46° 41′ 30″ N., 143° 57′ 40″ E.).	....do.....	....do...	3.19 p. m. 3.31 p. m.	100 100	br. M., bk. S., P... br. M., bk. S., P...
D. 5019	Cape Tonin, N. 64° W., 23.3 miles (46° 40′ 15″ N., 144° E.).	....do.....	....do...	4.22 p. m. 4.39 p. m.	102 102	br. M., bk. S., P... br. M., bk. S., P...

[a] Shore collections were made at Korsokov.

CRUISE OF THE ALBATROSS, 1906—Continued.

Temperatures.			Surface density.	Apparatus.	Trial.		Drift.		Remarks.
Air.	Surface.	Bottom.			Depth.	Duration.	Direction.	Distance.	
° F.	° F.	° F.				h. m.		mi.	
60	60	35.9	.....	Luc. sdr.					
60	60	35.9	1.02388	9′ Agassiz	botm	20	S. by E	0.8	
61	60	42.5	.....	8 cod lines	botm	15	.....	.....	
61	60	42.5	.....	Tnr.-Blish sdr.					
61	60	42.5	.....	9′ Agassiz	botm	20	S	.8	
59	60	.....	.....	9′ Agassiz	botm	20	S	.8	
59	60	.....	.....	Tnr.-Blish sdr.					
59	60	.....	1.02374	9′ Agassiz	botm	20	S	.8	
59	60	.....	1.02368	9′ Agassiz	botm	20	S	.8	
59	60	42.4	.....	Tnr.-Blish sdr.					
59	60	42.4	.....	9′ Agassiz	botm	21	S	.8	
60	60	41.2	.....	Tnr.-Blish sdr.					
60	60	41.2	.....	9′ Agassiz	botm	20	S	.8	
59	58	?30.7	.....	Tnr.-Blish sdr.					
59	58	?30.7	1.02253	9′ Agassiz	botm	20	SE	.8	
59	58	30.1	.....	Tnr.-Blish sdr.					
59	58	30.1	.....	9′ Agassiz	botm	20	SE	.8	
59	58	34.8	.....	Tnr.-Blish sdr.					
59	58	34.8	1.02238	9′ Agassiz	botm	20	SE	.8	
67	59	33.9	.....	Tnr.-Blish sdr.					
67	59	33.9	.....	9′ Agassiz	botm	20	E. to SE	.8	
68	61	38.5	.....	Tnr.-Blish sdr.					
68	61	38.5	1.02248	9′ Agassiz	botm	20	SE	.8	
69	60	?47.1	.....	Tnr.-Blish sdr.					
69	60	?47.1	.....	9′ Agassiz	botm	20	SE	.8	
66	60	39.9	.....	Tnr.-Blish sdr.					
56	58	33.9	.....	Tnr.-Blish sdr.					
56	58	33.9	1.02248	9′ Agassiz	botm	20	S	.8	
55	58	.....	.....	9′ Agassiz	botm	20	S	.8	
55	58	36.7	.....	Tnr.-Blish sdr.					
55	58	36.7	1.02233	9′ Agassiz	botm	20	S	.8	
48	58	34.9	.....	Luc. sdr.					
48	58	34.9	1.02231	9′ Agassiz	botm	20	W	.8	Dredge wire caught in sheave below accumulator. Lost 216 fms. wire, frame, net, weights, floats, etc.
48	58	35.9	.....	Luc. sdr.					
48	58	35.9	1.02239	9′ Alb.-Blk	botm	20	W	.8	
48	54	[b]29.8	.....	Luc. sdr.					
48	54	[b]29.8	1.02258	9′ Agassiz	botm	05	W	.2	Net slightly torn.
49	54	.....	.....	9′ Alb.-Blk	botm	13	WSW	.4	Net badly torn.
53	58	30.0	.....	Luc. sdr.					
53	57	30.4	.....	Luc. sdr.					
52	57	30.4	1.02241	9′ Agassiz	botm	20	SSW	.8	Stopped 1 minute while heaving in. Net badly torn.
52	57	32.1	.....	Luc. sdr.					
52	57	32.1	.....	9′ Agassiz	botm	20	SSW	.8	

[b] Result of 2 trials with same thermometer; a third trial with another thermometer registered 29.7°.

DREDGING RECORDS OF THE NORTHWESTERN PACIFIC

Station No.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	[Off eastern coast, Saghalin Id., vicinity of Cape Patience, in Okhotsk Sea.][a]				*fms.*	
D. 5020	48° 32′ 45″ N., 145° 07′ 30″ E. (approx. position).	H. O. 1960; published July, 1901.	Sept. 27	8.02 a. m. 8.30 a. m.	73 73	gn. M., S., P..... gn. M., S., P.....
D. 5021	48° 32′ 30″ N., 145° 08′ 45″ E. (approx. position).	....do.....	.....do...	9.04 a. m. 9.14 a. m.	73 73	gn. M., S., P..... gn. M., S., P.....
D. 5022	48° 35′ 30″ N., 145° 20′ E. (approx. position).	....do.....	.....do...	10.23 a. m. 10.39 a. m.	109 109	gn. M., crs. bk. S.. gn. M., crs. bk. S..
H. 4887	Flat Hill, N. 52° W.; Cape Patience, N. 86° W. (48° 40′ N., 145° 08′ E.).	....do.....	.....do...	12.47 p. m.	73	S., P.....
D. 5023	Flat Hill, N. 53° W.; Cape Patience, S. 77° W. (48° 43′ 30″ N., 145° 03′ E.).	....do.....	.....do...	1.32 p. m. 1.45 p. m.	75 75	S., P..... S., P.....
D. 5024	Flat Hill, N. 48° W.; Cape Patience, S. 74° W. (48° 43′ 10″ N., 144° 59′ 30″ E.).	....do.....	.....do...	2.37 p. m. 2.49 p. m.	67 67	S., P..... S., P.....
D. 5025	Flat Hill, N. 45° W.; Cape Patience, S. 68° W. (48° 43′ 30″ N., 144° 56′ 45″ E.).	....do.....	.....do...	3.40 p. m. 3.49 p. m.	52 52	P..... P.....
	From East Bay, Cape Patience, Saghalin Id., southward to Yezo Strait; from Yezo Strait through Kimashiri Strait; thence through Goyomai Strait to Hakodate, Hokkaido, Japan. *[In the Okhotsk Sea.]*					
D. 5026	48° 36′ 10″ N., 145° 17′ 30″ E.	....do.....	Sept. 28	9.38 a. m. 9.52 a. m.	119 119	gn. M., bk. S., G.. gn. M., bk. S., G..
D. 5027	48° 27′ 30″ N., 145° 23′ 30″ E.	....do.....	.....do...	10.50 a. m. 11.15 a. m.	188 188	fne. gy. S., P. (?).. fne. gy. S., P. (?)..
D. 5028	48° 25′ N., 145° 30′ E.	....do.....	.....do...	1.05 p. m. 1.27 p. m.	241 241	gn. M., bk. S., P.. gn. M., bk. S., P..
D. 5029	48° 22′ 30″ N., 145° 43′ 30″ E.	H. O. 1777	.....do...	2.31 p. m. 3.02 p. m.	440 440	bk. S., G..... bk. S., G.....
D. 5030	46° 29′ 30″ N., 145° 46′ E.	....do.....	Sept. 29	8.16 a. m.	1,800	br. M.....
				9.58 a. m.	1,800	br. M.....
				1.18 p. m.	1,800	br. M.....
				2.23 p. m.	1,800	br. M.....
	[North entrance to Yezo Strait.]					
H. 4888	Shiretoko Misaki, S. 30½° W., 16.2 miles (44° 35′ N., 145° 31′ E.).	H. O. 2124	Sept. 30	6.20 a. m.	752	fne. dk. S., P.....
H. 4889	Shiretoko Misaki, S. 59½° W., 14 miles (44° 29′ N., 145° 36′ 30″ E.).	....do.....	.....do...	8.47 a. m.	1,319	br. M.....
H. 4890	Shiretoko Misaki, N. 78° W., 11.5 miles (44° 19′ 30″ N., 145° 35′ 30″ E.).	....do.....	.....do...	10.37 a. m.	1,299	br. M.....
	[In Yezo Strait.]					
H. 4891	44° 0′ N., 145° 32′ 10″ E.	....do.....	Sept. 30	12.47 p. m.	756	br. M.....
D. 5031	44° 04′ N., 145° 32′ E.	....do.....	.....do...	1.20 p. m. 1.32 p. m.	86 86	dk. S., G..... dk. S., G.....

[a] Anchored in East Bay night of Sept. 27; no landing was made.

CRUISE OF THE ALBATROSS, 1906—Continued.

Temperatures.			Surface density.	Apparatus.	Trial.		Drift.		Remarks.
Air.	Surface.	Bottom.			Depth.	Duration.	Direction.	Distance.	
° F.	° F.	° F.				h. m.		mi.	
50	48	30.9	.....	Tnr.-Blish sdr.	.....	.....	.....	.....	
50	48	30.9	1.02078	9′ Agassiz....	botm ..	20	ESE.....	0.8	
50	48	30.9	.....	Tnr.-Blish sdr.	.....	.....	.....	.....	
50	48	30.9	.....	9′ Agassiz....	botm ..	20	ESE.....	.8	
54	49	30.1	.....	Luc. sdr.....	.....	.....	.....	.....	
52	49	30.1	.....	9′ Agassiz....	botm ..	30	ESE.....	1.2	
52	48	.....	.....	Tnr.-Blish sdr.	.....	.....	.....	.....	
52	48	30.9	.....	Tnr.-Blish sdr.	.....	.....	.....	.....	
52	48	30.9	1.02101	9′ Agassiz....	botm ..	20	SSW.....	.8	
52	48	30.9	.....	Tnr.-Blish sdr.	.....	.....	.....	.....	
52	48	30.9	.....	9′ Agassiz....	botm ..	20	SSW.....	.8	
51	48	31.7	.....	Tnr.-Blish sdr.	.....	.....	.....	.....	
51	48	31.7	.....	9′ Agassiz....	botm ..	20	S.....	.8	
49	47	30.4	.....	Luc. sdr.....	.....	.....	.....	.....	
49	47	30.4	1.02147	9′ Agassiz....	botm ..	20	SSE.....	.8	
51	48	32.0	.....	Luc. sdr.....	.....	.....	.....	.....	
51	48	32.0	1.02140	9′ Agassiz....	botm ..	20	SSE.....	.8	
50	49	33.3	.....	Luc. sdr.....	.....	.....	.....	.....	
50	49	33.3	1.02111	9′ Agassiz....	botm ..	20	SSE.....	.8	
51	49	35.3	.....	Luc. sdr.....	.....	.....	.....	.....	
51	49	35.3	1.02141	9′Agassiz....	botm ..	30	SSE.....	1.2	
54	53	[b]35.4	.....	Luc. sdr.....	.....	.....	.....	.....	Action of sounding machine suggested bottom at 1,251 fms. Hove in 26 fms. wire, then let out again, getting bottom at 1,800 fms. Shot did not detach.
55	54	[b]35.4	1.02262	9′ Agassiz....	botm ..	22	S. 7° W...	.9	Stopped 5 minutes while heaving in to repair winch.
56	54	[b]35.4	.....	int.3; K.2,K.1§	300 fms.	20 15	SE.....	.8	400 fms. dredge wire out.
56	54	[b]35.4	.....	9 therms.; wat. bot.	10–800 fms.	5	.....	.....	Therms. at 10, 25, 50, 100, 200, 300, 400, 600, and 800 fms.
58	56	36.2	.....	Luc. sdr.....	.....	.....	.....	.....	
62	62	35.8	.....	Luc. sdr.....	.....	.....	.....	.....	
61	62	35.8	.....	Luc. sdr.....	.....	.....	.....	.....	Shot did not detach.
63	63	36.1	.....	Luc. sdr.....	.....	.....	.....	.....	
63	63	43.7	.....	Luc. sdr.....	.....	.....	.....	.....	
64	63	43.7	1.02374	9′ Agassiz....	botm ..	14	SW.....	.5	Accumulator showed heavy strain.

[b] Therm. tripped at 1,251 fms.

DREDGING RECORDS OF THE NORTHWESTERN PACIFIC

Station No.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	In Yezo Strait—Continued.				*fms.*	
D. 5032	44° 05′ N., 145° 30′ E.	H. O. 2124	Sept. 30	2.14 p. m.	300	br. M., fne. bk. S., G.
				2.41 p. m.	300–533	br. M., fne. bk. S., G.
D. 5033	44° 04′ 20″ N., 145° 28′ E.	....do....	....do...	3.31 p. m.	533	gn. M., fne. bk. S..
				4.04 p. m.	533	gn. M., fne. bk. S..
	[*Off Otchishi Saki, eastern end of Hokkaido, Pacific Ocean.*]					
H. 4892	43° 08′ 30″ N., 145° 52′ E.	....do....	Oct. 1	1.04 p. m.	53	crs. bk. S.....
D. 5034	43° 05′ 30″ N., 145° 57′ 40″ E.	....do....	....do...	1.50 p. m.	127	crs. bk. S., G.....
				2.08 p. m.	127–322	crs. bk. S., G.....
D. 5035	43° 05′ N., 146° E.	....do....	....do...	2.44 p. m.	322	crs. bk. S., rky....
				3.17 p. m.	322	crs. bk. S., rky....
	[*South coast of Hokkaido.*]					
D. 5036	Urakawa Lt., N. 44½° E., 16.8 miles (41° 58′ E., 142° 30′ 30″ E.).	....do....	Oct. 2	12.58 p. m.	464	br. M.....
				1.24 p. m.	464	br. M.....
H. 4893	Urakawa Lt., N. 51° E., 14 miles (42° 01′ N., 142° 31′ 40″ E.).	....do....	....do...	2.38 p. m.	418	br. M.....
D. 5037	Urakawa Lt., N. 52½° E., 11.9 miles (42° 02′ 40″ N., 142° 33′ 20″ E.).	....do....	....do...	3.11 p. m.	349	?.....
				3.36 p. m.	349–175	?.....
D 5038	Urakawa Lt., N. 47° E., 10.6 miles (42° 02′ 40″ N., 142° 36′ E.).	....do....	....do...	4.07 p. m.	175	fne. bk. S., br. M., brk. Sh.
				4.24 p. m.	175	fne. bk. S., br. M., brk. Sh.
D. 5039	42° 11′ N., 141° 57′ E.	....do....	Oct. 3	7.51 a. m.	326	gn. M.....
				8.14 a. m.	326–269	gn. M.....
D. 5040	42° 14′ 20″ N., 142° E.	....do....	....do...	8.57 a. m.	269	gn. M.....
				9.17 a. m.	269–140	gn. M.....
D. 5041	42° 16′ 30″ N., 142° 04′ E.	....do....	....do...	10.00 a. m.	140	br. M., fne. bk. S., Co., S.
				10.13 a. m.	140–61	br. M., fne. bk. S., Co., S.
D. 5042	42° 17′ 30″ N., 142° 07′ 30″ E.	....do....	....do...	10.49 a. m.	61	br. M., fne. bk. S., Co., S.
				11.04 a. m.	61	br. M., fne. bk. S., Co., S.
D. 5043	42° 10′ 20″ N., 142° 15′ 20″ E. (approx. position).	....do....	....do...	1.05 p. m.	330	br. M., fne. bk. S., Co., S.
				1.29 p. m.	330–309	br. M., fne. bk. S., Co., S.
D. 5044	42° 10′ 40″ N., 142° 14′ E. (approx. position).	....do....	....do...	2.15 p. m.	309	gy. S., Co., S.....
					309–359	gy. S., Co., S.....
D. 5045	42° 11′ 10″ N., 142° 12′ E. (approx. position).	....do....	....do...	3.24 p. m.	359	br. M., fne. bk. S., Co., S.
				3.48 p. m.	359	br. M., fne. bk. S., Co., S.
	From Hakodate, Hokkaido, Japan, to Yokohama, Japan.[a]					
D. 5046	Kinka San Lt., N. 76° W., 7.25 miles (38° 15′ 07″ N., 141° 44′ 20″ E.).	H. O. 2190; published June, 1906.	Oct. 10	8.35 a. m.	82	dk. gy. S., P.....
				8.47 a. m.	82	dk. gy. S., P..... Sh., P.
D. 5047	Kinka San Lt., N. 60½° W., 11.6 miles (38° 12′ 50″ N., 141° 49′ 15″ E.).	H. O. 1300	....do...	9.40 a. m.	107	dk. gy. S., brk. Sh., P.
				9.56 a. m.	107	dk. gy. S., brk. Sh., P.
D. 5048	Kinka San Lt., N. 61° W., 15.4 miles (38° 09′ 24″ N., 141° 52′ 30″ E.).	....do....	....do...	10.53 a. m.	129	dk. gy. S., brk. Sh.
				11.08 a. m.	129	dk. gy. S., brk. Sh.
H. 4894	Kinka San Lt., N. 68° W., 18 miles (38° 10′ N., 141° 57′ E.).	....do....	....do...	12.33 p. m.	144	dk. gy. S., brk. Sh., For.
D. 5049	Kinka San Lt., N. 76½° W., 21 miles (38° 12′ N., 142° 02′ E.).	....do....	....do...	1.18 p. m.	182	dk. gy. S., brk. Sh., For.
				1.35 p. m.	182	dk. gy. S., brk. Sh., For.

[a] Shore collections were made at Shimidzu.

CRUISE OF THE ALBATROSS, 1906—Continued.

Temperatures.			Surface density.	Apparatus.	Trial.		Drift.		Remarks.
Air.	Surface.	Bottom.			Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.				h. m.		mi.	
64	63	34.9	.....	Luc. sdr.....	.....	.....	.....	.....	
63	64	34.9	.....	9′ Agassiz....	botm..	20	W.....	0.8	
60	64	35.9	.....	Luc. sdr.....	.....	.....	.....	.....	
60	64	35.9	1.02385	9′ Agassiz....	botm..	20	W.....	.8	Net fouled on frame.
63	59	44.3	.....	Luc. sdr.....	.....	.....	.....	.....	
61	58	35.1	.....	Luc. sdr.....	.....	.....	.....	.....	
61	58	35.1	1.02353	9′ Agassiz....	botm..	20	SE.....	.8	
60	58	37.5	.....	Luc. sdr.....	.....	.....	.....	.....	
60	58	37.5	.....	9′ Agassiz....	botm..	2	ENE.....	.....	Forward 9 in. block on berth deck carried away from stanchion. The accumulator registered over 4 tons at the time. Lost frame, net, floats, weights, etc.
55	63	37.9	.....	Luc. sdr.....	.....	.....	.....	.....	
55	63	37.9	1.02395	9′ Agassiz....	botm..	20	W.....	.8	
56	64	37.9	.....	Luc. sdr.....	.....	.....	.....	.....	
56	65	37.9	.....	Luc. sdr.....	.....	.....	.....	.....	
56	65	37.9	.....	9′ Agassiz....	botm..	5	ESE.....	.2	Accumulator registered over 4 tons. Net torn from bolt rope.
56	64	37.1	.....	Luc. sdr.....	.....	.....	.....	.....	
56	64	37.1	.....	9′ Alb.-Blk...	botm..	20	SSW.....	.8	
52	62	37.9	.....	Luc. sdr.....	.....	.....	.....	.....	
52	62	37.9	1.02405	9′ Alb.-Blk....	botm..	20	NNE.....	.8	
53	62	37.1	.....	Luc. sdr.....	.....	.....	.....	.....	
53	62	37.1	.....	9′ Alb.-Blk....	botm..	20	NNE.....	.8	
52	62	41.1	.....	Luc. sdr.....	.....	.....	.....	.....	
52	62	41.1	1.02384	9′ Alb.-Blk ...	botm..	20	NNE.....	.8	Net slightly torn.
51	61	49.8	.....	Luc. sdr.....	.....	.....	.....	.....	
51	61	49.8	.....	9′ Agassiz.....	botm..	20	WNW. to W.	.8	
52	63	37.9	.....	Luc. sdr.....	.....	.....	.....	.....	
52	63	37.9	1.02385	9′ Agassiz.....	botm..	20	N	.8	
52	64	b32.1	.....	Luc. sdr.....	.....	.....	.....	.....	
52	64	b32.1	.....	9′ Agassiz.....	botm..	20	N	.8	
52	64	38.0	.....	Luc. sdr.....	.....	.....	.....	.....	
52	64	38.0	1.02401	9′ Alb.-Blk....	botm..	20	NNW ...	.8	
56	63	50.8	.....	Luc. sdr.....	.....	.....	.....	.....	
56	63	50.8	1.02356	9′ Alb.-Blk ...	botm..	20	SSE. to S..	.8	
59	63	49.6	.....	Luc. sdr.....	.....	.....	.....	.....	
59	63	49.6	.....	9′ Alb.-Blk ...	botm..	20	S. to SSW.	.8	
60	63	40.7	.....	Luc. sdr.....	.....	.....	.....	.....	
60	63	40.7	.....	9′ Alb.-Blk ...	botm..	20	SSW.....	.8	
61	61	38.0	.....	Luc. sdr.....	.....	.....	.....	.....	
61	59	37.8	.....	Luc. sdr.....	.....	.....	.....	.....	
59	59	37.8	.....	9′ Alb.-Blk ...	botm..	20	S. to SSW.	.8	

b Reading of thermometer verified.

DREDGING RECORDS OF THE NORTHWESTERN PACIFIC

Station No.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	From Hakodate, Hokkaido, Japan, to Yokohama, Japan—Continued.				*fms.*	
D. 5050	Kinka San Lt., N. 78° W., 25.7 miles (38° 11′ 30″ N., 142° 08′ E.).	H. O. 1300	Oct. 10	2.52 p. m.	266	dk. gy. S., brk. Sh., For.
				3.11 p. m.	266	dk. gy. S., brk. Sh., For.
D. 5051	Kinka San Lt., N. 78½° W., 29.2 miles (38° 11′ N., 142° 12′ E.).	....do.....	....do...	4.16 p. m.	399	dk. gy. S., brk. Sh., For.
				4.40 p. m.	399	dk. gy. S., brk. Sh., For.
D. 5052	37° 57′ 45″ N., 142° 04′ E.....	....do.....	....do...	7.00 p. m.	*400	.....
				7.27 p. m.	*400	.....
	In Suruga Gulf, Japan.					
D. 5053	Omai Saki Lt., S. 58° W., 26 miles (34° 49′ 20″ N., 138° 40′ 15″ E.).	B. A. 953; published Feb., 1895.	Oct. 12	7.52 a. m.	503	gn. M.....
				8.20 a. m.	503	gn. M.....
D. 5054	Omai Saki Lt., S. 54° W., 29.5 miles (34° 52′ 45″ N., 138° 42′ 20″ E.).	....do.....	....do...	9.54 a. m.	282	gn. M., brk. Sh., For.
				10.12 a. m.	282	gn. M., brk., Sh., For.
D. 5055	Omai Saki Lt., S. 55° W., 31 miles (34° 53′ N., 138° 44′ 15″ E.).	....do.....	....do...	11.11 a. m.	124	gn. M., gy. S. brk. Sh. P.
				11.24 a. m.	124	gn. M., gy. S. brk. Sh., P.
D. 5056	Ose Saki, N. 37° E., 5 miles (34° 57′ 35″ N., 138° 43′ 35″ N.).	....do.....	....do...	1.06 p. m.	258	gn. M., brk. Sh., For.
				1.25 p. m.	258	gn. M., brk. Sh., For.
D. 5057	Ose Saki, N. 75° E., 11.5 miles (34° 58′ 40″ N., 138° 34′ E.).	....do.....	....do...	3.17 p. m.	270	gy. M.....
				3.36 p. m.	270	gy. M.
D. 5058	Ose Saki, S. 86° E., 7.8 miles (35° 02′ 10″ N., 138° 37′ 50″ E.).	....do.....	Oct. 13	8.07 a. m.	*575	.....
D. 5059	Ose Saki, S. 57° E., 7.3 miles (35° 05′ 30″ N., 138° 39′ 50″ E.).	....do.....	....do...	9.13 a. m.	297	gy. S.....
				9.34 a. m.	297-197	gy. S.....
D. 5060	Ose Saki, S. 53° E., 7.3 miles (35° 06′ N., 138° 40′ 10″ E.).	....do.....	....do...	10.17 a. m.	197	crs. bk. S.....
				10.37 a. m.	197	crs. bk. S.....
D. 5061	Ose Saki, S. 67° E., 8.5 miles (35° 04′ 50″ N., 138° 38′ E.).	....do.....	....do...	12.35 p. m.	332	br. M., fne. gy. S..
				12.57 p. m.	332-250	br. M., fne. gy. S..
D. 5062	Ose Saki, S. 65½° E., 9.2 miles (35° 05′ 20″ N., 138° 37′ 10″ E.).	....do.....	....do...	1.42 p. m.	250	gn. M.....
				1.59 p. m.	250	gn. M.....
D. 5063	Ose Saki, N. 87° E., 7.5 miles (35° 01′ 10″ N., 138° 38′ 50″ E.).	....do.....	....do...	3.25 p. m.	*650	.....
D. 5064	Ose Saki, S. 85½° E., 7.7 miles (35° 02′ 10″ N., 138° 38′ E.).	....do.....	Oct. 15	8.10 a. m.	*575	.....
D. 5065	Ose Saki, S. 57½° E., 7.5 miles (35° 05′ 40″ N., 138° 39′ 30″ E.).	....do.....	....do...	9.17 a. m.	235	bk. S., brk. Sh....
				9.33 a. m.	235-211	bk. S., brk. Sh....
D. 5066	Ose Saki, S. 52° E., 7.3 miles (35° 06′ 05″ N., 138° 40′ 20″ E.).	....do.....	....do...	10.12 a. m.	211	fine bk. S.....
				10.29 a. m.	211-293	fine bk. S.....
D. 5067	Ose Saki, S. 50° E., 6.5 miles (35° 05′ 50″ N., 138° 41′ 15″ E.).	....do.....	....do...	11.09 a. m.	293	bk. S., brk. Sh....
				11.29 a. m.	293	bk. S., brk. Sh....
D. 5068	Ose Saki, S. 18° E., 0.9 miles (35° 02′ 25″ N., 138° 46′ 55″ E.).	....do.....	....do...	1.02 p. m.	77	bk. S., brk. Sh....
				1.17 p. m.	77-131	bk. S., brk. Sh....
D. 5069	Ose Saki, S. 6½° E., 1.7 miles (35° 03′ 10″ N., 138° 47′ E.).	....do.....	....do...	1.51 p. m.	131	M., S., brk. Sh....
				2.03 p. m.	131-108	M., S., brk. Sh....

CRUISE OF THE ALBATROSS, 1906—Continued.

Temperatures.			Surface density.	Apparatus.	Trial.		Drift.		Remarks.
Air.	Surface.	Bottom.			Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.				h. m.		mi.	
58	60	37.9	.....	Luc. sdr.....	.....	.....	.....	.....	
58	60	37.9	1.02360	9′ Alb.-Blk ...	botm ..	20	S.....	0.8	
57	62	38.1	.....	Luc. sdr.....	.....	.....	.....	.....	
57	63	38.1	.....	9′ Alb.-Blk ...	botm ..	20	W.....	.8	Net came up foul of frame.
57	62	.....	.....	2 K. 1‡.....	surface.	20	SSW. ¾ W.	.8	
57	62	.....	.....	Int. 3, e. l.....	surface.	20	SSW. ¾ W.	.8	First trial failed.
66	74	34.9	.....	Luc. sdr.....	.....	.....	.....	.....	
66	74	34.9	.....	9′ Alb.-Blk ...	botm ..	20	NE.....	.8	
71	74	45.3	.....	Luc. sdr.....	.....	.....	.....	.....	
71	74	45.3	1.02387	9′ Alb.-Blk ...	botm ..	20	NE. to S..	.8	
72	74	56.6	.....	Luc. sdr.....	.....	.....	.....	.....	
72	74	56.6	1.02389	9′ Alb.-Blk ...	botm ..	20	S. by W...	.8	
78	74	46.0	.....	Luc. sdr.....	.....	.....	.....	.....	
78	74	46.0	.....	9′ Alb.-Blk ...	botm ..	20	N. by E...	.8	
72	74	44.8	.....	Luc. sdr.....	.....	.....	.....	.....	
70	73	44.8	.....	9′ Alb.-Blk ...	botm ..	6	W.....	.3	Net badly torn: part of catch lost.
63	70	.....	.....	Int. 3; 2 K. 1§	300 fms.	20 10	NNE	.8	400 fms. dredge wire out.
65	70	45.0	.....	Luc. sdr.....	.....	.....	.....	.....	
70	69	45.0	1.02234	9′Alb.-Blk....	botm ..	20	N.....	.8	
73	69	50.0	.....	Luc. sdr.....	.....	.....	.....	.....	
66	70	50.6	1.02268	9′ Alb.-Blk....	botm ..	20	SW.....	.8	
68	72	43.7	.....	Luc. sdr.....	.....	.....	.....	.....	
68	72	43.7	1.02301	9′ Alb.-Blk...	botm ..	20	N.....	.8	One corner of net torn from frame.
77	72	47.7	.....	Luc. sdr.....	.....	.....	.....	.....	
77	72	47.7	.....	9′ Alb.-Blk...	botm ..	14	NE.....	.6	Accumulator showed heavy strain; hove in at intervals. Net torn from bolt ropes and badly wrecked; small part of catch saved.
72	74	.....	.....	Int. 3; 2 K. 1 §..	300 fms.	30 12	E.....	1.2	400 fms. dredge wire out.
64	69	.....	.....	Int. 3; 2 K. 1 §..	300 fms.	20 14	NNE.....	.8	400 fms. dredge wire out.
69	69	48.5	.....	Luc. sdr.....	.....	.....	.....	.....	
72	69	48.5	.....	9′ Alb.-Blk....	botm ..	20	NE.....	.8	
74	69	50.8	.....	Luc. sdr.....	.....	.....	.....	.....	
73	72	50.8	.....	9′ Alb.-Blk....	botm ..	20	E.....	.8	
73	72	45.0	.....	Luc. sdr.....	.....	.....	.....	.....	
73	72	45.0	.....	9′ Alb.-Blk...	botm ..	20	NNE.....	.8	
75	72	63.0	.....	Luc. sdr.....	.....	.....	.....	.....	
80	72	63.0	.....	12′ Thr.....	botm ..	20	N.....	.8	Net slightly torn.
84	73	55.8	.....	Luc. sdr.....	.....	.....	.....	.....	Shot did not detach.
84	73	55.8	.....	9′ Agassiz....	botm ..	14	E.....	.6	Net caught on bottom; both bridle-stops carried away and frame badly bent. Tail of net fouled on beam.

DREDGING RECORDS OF THE NORTHWESTERN PACIFIC

Station No.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	In Suruga Gulf, Japan—Con.				*fms.*	
D. 5070	Ose Saki, S. 8° W., 1.8 miles (35° 03′ 25″ N., 138° 47′ 40″ E.).	B. A. 953; published Feb., 1895.	Oct. 15	2.33 p. m. 2.47 p. m.	108 108	M., S., brk. Sh.... M., S., brk. Sh....
D. 5071	Ose Saki, S. 53½° W., 2.6 miles (35° 03′ 10″ N. 138° 49′ 50″ E.).	....do.....	....do...	3.30 p. m. 3.40 p. m.	57 57	?..... ?.....
D. 5072	Omai Saki Lt., S. 37° W., 11.7 miles (34° 44′ 55″ N., 138° 22′ 20″ E.).	....do.....	Oct. 16	8.26 a. m. 8.45 a. m.	284 284–148	gy. M..... gy. M.....
D. 5073	Omai Saki Lt., S. 32½° W., 12.3 miles (34° 46′ N., 138° 21′ 50″ E.).	....do.....	....do...	9.55 a. m. 10.11 a. m.	148 148	gy. M..... gy. M.....
D. 5074	Omai Saki Lt., S. 37½° W., 6.4 miles (34° 40′ 45″ N., 138° 18′ 30″ E.).	....do.....	....do...	1.00 p. m. 1.09 p. m.	47 47	gy. M..... gy. M.....
D. 5075	Omai Saki Lt., S. 38½° W., 3.3 miles (34° 38′ 15″ N., 138° 16′ 15″ E.).	....do.....	....do...	2.05 p. m. 2.11 p. m.	22 22	fne. br. S..... fne. br. S.....
	Off entrance of Suruga Gulf.					
D. 5076	Mikomoto Sima Lt., N. 44° E., 8.4 miles (34° 28′ 30″ N., 138° 49′ 40″ E.).	....do.....	Oct. 17	11.09 a. m. 11.29 a. m.	265 265	gy. S., brk. Sh ... gy. S., brk. Sh....
H. 4895	Mikomoto Sima Lt., N. 40° E., 8 miles (34° 28′ 20″ N., 138° 50′ 35″ E.).	....do.....	....do...	12.34 p. m.	361	gy. S., brk. Sh., sml. St.
H. 4896	Mikomoto Sima Lt., N. 63° E., 10.4 miles (34° 29′ 55″ N., 138° 45′ 30″ E.).	....do.....	....do...	1.26 p. m.	279	gy. S., brk. Sh., sml. St.
D. 5077	Mikomoto Sima Lt., N. 88° E., 12.5 miles (34° 34′ 8″ N., 138° 41′ 45″ E.).	....do.....	....do...	2.18 p. m. 2.45 p. m. 3.46 p. m.	520 520 520	fne. bk. S., M. (?).. fne. bk. S., M. (?).. fne. bk. S., M. (?) .
	Off Omai Saki Lt. (20 to 40 miles distant).					
D. 5078	Omai Saki Lt., N. 22° E., 25.5 miles (34° 12′ 20″ N., 138° 02′ 30″ E.).	H. O. 1301	Oct. 19	1.05 p. m. 1.36 p. m.	514 514–475	fne. gy. S., Glob.. fne. gy. S., Glob..
D. 5079	Omai Saki Lt., N. 29° E., 24 miles (34° 15′ N., 138° E.).	....do.....	....do...	2.27 p. m. 3.00 p. m.	475 475–505	P..... P.....
D. 5080	Omai Saki Lt., N. 23½° E., 28 miles (34° 10′ 30″ N., 138° 40″ E.).	....do.....	....do...	3.51 p. m. 4.21 p. m.	505 505	fne. gy. S., Glob... fne. gy. S., Glob...
D. 5081	Omai Saki Lt., N. 18½° E., 23 miles (34° 14′ N., 138° 05′ E.	....do.....	....do...	6.48 p. m. 6.48 p. m.	*500 *500	....
D. 5082	Omai Saki Lt., N. 22° E., 33 miles (34° 05′ N., 137° 59′ E.).	....do.....	Oct. 20	7.59 a. m. 8.41 a. m.	662 662	gn. M., fne. S., Glob. gn. M., fne. S., Glob.
D. 5083	Omai Saki Lt., N. 23½° E., 34.5 miles (34° 04′ 20″ N., 137° 57′ 30″ E.).	....do.....	....do...	10.04 a. m. 10.57 a. m.	624 624	fne. gy. S., Glob.. fne. gy. S., Glob..
D. 5084	Omai Saki Lt., N. 29½° E., 41 miles (34° N., 137° 49′ 40″ E.).	....do.....	....do...	1.13 p. m. 2.17 p. m. 4.22 p. m.	918 918 918	gn. M., fne. S., Glob. gn. M., fne. S., Glob. gn. M., fne. S., Glob.
	In Sagami Bay, Hondo, Japan.					
D. 5085	Joka Sima Lt., N. 84° E., 14.3 miles (35° 06′ 45″ N., 139° 19′ 45″ E.).	B. A. 953	Oct. 23	8.37 a. m. 9.18 a. m.	622 622	gn. M., fne. bk. S.. gn. M., fne. bk. S..
D. 5086	Joka Sima Lt., East, 14 miles (35° 08′ 15″ N., 139° 20′ E.).	....do.....	....do...	10.34 a. m. 11.03 a. m.	292 292	gn. M., crs. bk. S.. gn. M., crs. bk. S..

CRUISE OF THE ALBATROSS, 1906—Continued.

Temperatures.			Surface density.	Apparatus.	Trial.		Drift.		Remarks.
Air.	Surface.	Bottom.			Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.				h. m.		mi.	
84	73	57.6	.....	Luc. sdr.....					
88	73	57.6	.....	swabs.....	botm..	20	E.....	0.7	Lost 1 tangle swab.
87	73	70.8	.....	Luc. sdr.....					
84	73	70.8	.....	9′ Alb.-Blk...	botm..	22	SSE. to WSW.	.8	
69	74	44.1	.....	Luc. sdr.....					
71	75	44.1	1.02370	9′ Alb.-Blk...	botm..	20	NW.....	.8	One bridle-stop carried away.
72	75	54.6	.....	Luc. sdr.....					
72	75	54.6	.....	9′ Alb.-Blk...	botm..	8	NNE.....	.4	Water shoaled during haul. A heavy strain on wire. Hove in slowly, stopping at intervals. Both bridle stops carried away, but catch was saved.
75	77	74.9	.....	Luc. sdr.....					
75	77	74.9	.....	9′ Alb.-Blk...	botm..	20	W. by N..	.8	
75	73	75.0	.....	Tnr.-Blish sdr.					
75	73	75.0	.....	9′ Alb.-Blk....	botm..	20	WNW....	.8	
76	76	43.8	.....	Luc. sdr.....					
76	76	43.8	1.02387	9′ Alb.-Blk...	botm..	1	ESE.....	.....	Net caught on bottom. Accumulator showed heavy strain. Lost frame, but saved bridle, floats, weights, and part of net.
74	75	39.6	.....	Luc. sdr.....					
74	75	43.4	.....	Luc. sdr.....					
73	73	38.9	.....	Luc. sdr.....					
72	73	38.9	1.02377	Int. 3; 2 K. 1 §..	300 fms.	20 13	W.....	.8	400 fms. dredge wire out.
73	75	38.9	.....	7 therm.; wat. bot.	10–400 fms.	5	.....	.....	Therms. at 10, 25, 50, 100, 200, 300, and 400 fms.
70	75	38.9	.....	Luc. sdr.....					
72	76	38.9	1.02397	9′ Alb.-Blk...	botm..	20	NNW.....	.8	Net fouled on frame; lost 1 float.
72	76	39.1	.....	Luc. sdr.....					
75	74	39.1	.....	9′ Agassiz....	botm..	20	ENE.....	.8	Towed 4 minutes with 650 fms. wire out; then veered out to 700 fms.
72	75	38.7	.....	Luc. sdr.....					
72	75	38.7	1.02386	9′ Agassiz....	botm..	20	SW.....	.8	
70	75	.....	.....	Int. 3, c. 1	surface.	21	NNE.....	.8	
70	75	.....	.....	2 K. 1‡.....	surface.	21	NNE.....	.8	
69	75	37.7	.....	Luc. sdr.....					
71	75	37.7	1.02377	9′ Agassiz....	botm..	40	West.....	1.6	
71	75	38.1	.....	Luc. sdr.....					Shot did not detach.
72	75	38.1	1.02392	9′ Agassiz....	botm..	20	NW.....	.8	
70	75	36.8	.....	Luc. sdr.....					
70	75	36.8	1.02407	9′ Agassiz....	botm..	1 00	W. to N..	2.4	Towed 3 minutes with 1,400 fms. wire out; then veered out to 1,500 fms.
69	75	36.8	.....	Int. 3; 2 K. 1 §..	300 fms.	20 15	ENE. ½ E.	.8	400 fms. dredge wire out.
61	70	37.8	.....	Luc. sdr.....					
61	70	37.8	1.02407	9′ Alb.-Blk...	botm..	20	NW.....	.8	
61	70	43.7	.....	Luc. sdr.....					
61	70	43.7	1.02370	9′ Alb.-Blk...	botm..	20	N.....	.8	

DREDGING RECORDS OF THE NORTHWESTERN PACIFIC

Station No.	Position.	Chart.	Date.	Time of day.	Depth.	Character of bottom.
	In Sagami Bay, Hondo, Japan—Cont'd.				*fms.*	
D. 5087	Joka Sima Lt., S. 84½° E., 14.8 miles (35° 09′ 40″ N., 139° 19′ 05″ E.).	B. A. 953	Oct. 23	12.52 p. m. 1.28 p. m.	614 614	gn. M..... gn. M.....
D. 5088	Joka Sima Lt., S. 65° E., 7.7 miles (35° 11′ 25″ N., 139° 28′ 20″ E.).	....do.....	Oct. 25	8.48 a. m. 9.12 a. m.	369 369–405	gn. M..... gn. M.....
D. 5089	Joka Sima Lt., S. 60° E., 6.6 miles (35° 11′ 25″ N., 139° 29′ 50″ E.).	....do.....	....do...	9.54 a. m. 10.18 a. m.	405 405	gn. M..... gn. M.....
	In Uraga Strait (entrance Gulf of Tokyo).					
D. 5090	Joga Shima Lt., N. 6° W., 4.4 miles (35° 03′ 50″ N., 139° 37′ 30″ E.).	H. O. 1291; published Oct., 1891; exp. cor. Jan., 1906.	Oct. 26	8.13 a. m. 8.34 a. m.	200 200	P., bk. S..... P., bk. S.....
D. 5091	Joga Shima Lt., N. 15° W., 4.2 miles (35° 04′ 10″ N., 139° 38′ 12″ E.).	....do.....	...do...	9.35 a. m. 9.50 a. m.	197 197	gn. M., crs. bk. S., P. gn. M., crs. bk. S., P.
D. 5092	Joga Shima Lt., N. 19° W., 3.5 miles (35° 04′ 50″ N., 139° 38′ 18″ E.).	....do.....	....do...	10.40 a. m. 10.55 a. m.	70 70	crs. bk. S..... crs. bk. S.....
D. 5093	Joga Shima Lt., N. 8° W., 5 miles (35° 03′ 15″ N., 139° 37′ 42″ E.).	....do.....	....do...	10.47 p. m. 1.10 p. m.	302 302	crs. bk. S..... crs. bk. S.....
D. 5094	Joga Shima Lt., N. 18½° W., 3.7 miles (35° 04′ 42″ N., 139° 38′ 20″ E.).	....do.....	....do...	1.57 p. m. 2.12 p. m.	88 88	bk. S., brk. Sh.... bk. S., brk. Sh....
D. 5095	Joga Shima Lt., N. 28° W., 3 miles (35° 05′ 34″ N., 139° 38′ 36″ E.).	....do.....	....do...	3.06 p. m. 3.17 p. m.	58 58	fne. bk. S., brk. Sh. fne. bk. S., brk. Sh.

CRUISE OF THE ALBATROSS, 1906—Continued.

Temperatures.			Surface density.	Apparatus.	Trial.		Drift.		Remarks.
Air.	Surface.	Bottom.			Depth.	Duration.	Direction.	Distance.	
°F.	°F.	°F.				h. m.		mi.	
61	70	37.5	.....	Luc. sdr.....	.....	.....	.....	.....	
61	70	37.5	1.02354	9' Alb.-Blk...	botm..	20	NNW. to NW. by N.	0.8	
71	70	41.8	.....	Luc. sdr.....	.....	.....	.....	.....	
71	70	41.8	1.02347	9' Alb.-Blk...	botm..	20	SE. to S..	.8	
71	71	40.0	.....	Luc. sdr.....	.....	.....	.....	.....	
71	71	40.0	.....	9' Alb.-Blk...	botm..	20	South	.8	Accumulator indicated heavy strain. Hove in slowly, stopping at intervals. Lost frame, net, floats, etc.
62	66	47.6	.....	Luc. sdr.....	.....	.....	.....	.....	
63	68	47.6	1.02293	9' Alb.-Blk...	botm..	16	N.....	.6	Net badly torn.
65	69	47.6	.....	Luc. sdr.....	.....	.....	.....	.....	
65	69	47.6	1.02357	9' Alb.-Blk...	botm..	20	N.....	.8	
64	69	56.3	.....	Luc. sdr.....	.....	.....	.....	.....	
64	69	56.3	.....	9' Alb.-Blk...	botm..	20	WNW. to NW.	.8	
64	69	43.9	.....	Luc. sdr.....	.....	.....	.....	.....	
64	70	43.9	1.02354	9' Alb.-Blk...	botm..	10	N.....	.4	
64	69	54.8	.....	Luc. sdr.....	.....	.....	.....	.....	
64	69	54.8	1.02347	9' Alb.-Blk....	botm..	20	NW.....	.8	
67	69	57.8	.....	Luc. sdr.....	.....	.....	.....	.....	
67	69	57.8	.....	9' Alb.-Blk....	botm..	30	NNW.....	.12	

Serial Temperature Observations During the Northwestern Pacific Cruise of the Albatross, 1906.

Station No.	Date.	Position of thermometers.												Water specimen.		Remarks.
		Surface.	5 fms.	10 fms.	15 fms.	25 fms.	50 fms.	100 fms.	200 fms.	300 fms.	400 fms.	600 fms.	800 fms.	Depth.	Density.	
	1906.	°	°	°	°	°	°	°	°	°	°	°	°	*Fms.*		
D. 4820	July 19	76	71.0	.....	[a] 72.7	57.6	51.8	46.9	33.9	.....	32.8	.....	.....	400	1.02478	In the Sea of Japan.
D. 4851	July 28	78	72.7	.....	[a] (?)	60.7	55.2	45.9	33.0	.....	32.9	.....	.....	400	(?)	In the Sea of Japan.
D. 4863	July 31	79	70.1	70.1	65.1	60.8	55.3	38.1	32.9	.....	.....	.....	.....	200	1.02330	In the Sea of Japan.
D. 4908	Aug. 11	84	[a] (?)	[a] (?)	79.5	[a] (?)	68.3	60.9	49.0	.....	43.6	.....	.....	400	1.02408	In the Eastern Sea.
D. 4909	...do....	85	[a] 82.6	80.5	.....	69.7	.....	.....	.....	.....	.....	.....	.....	[c]	[c]	In the Eastern Sea.
D. 4919	Aug. 13	84	[a] 83.9 [b] 83.9	[a] 84.0 [b] 82.6	[a] 83.3 [b] 80.5	81.9	72.2	68.1	48.8	.....	43.1	.....	.....	400	1.02485	In the Eastern Sea.
D. 4951	Aug. 21	85	.....	84.1	.....	85.5	81.1	64.8	53.9	45.9	40.6	38.0	.....	600	1.02477	Pacific Ocean.
D. 4997	Sept. 23	60	.....	58.7	.....	47.5	36.9	34.0	32.0	.....	.....	.....	.....	200	1.02408	In the Gulf of Tartary.
D. 5030	Sept. 29	54	.....	52.7	.....	31.8	(a) [b] 32.1	31.8	33.8	34.1	35.2	35.9	35.9	800	1.02428	In the Okhotsk Sea.
D. 5077	Oct. 17	75	.....	75.4	.....	72.3	62.1	56.3	50.0	52.2 [b] 42.5	40.3	.....	.....	400	1.02407	Off entrance of Suruga Gulf.

[a] Did not trip. [b] Second trial. [c] No water specimen.

UNUTILIZED FISHES AND THEIR RELATION TO THE FISHING INDUSTRIES

By Irving A. Field

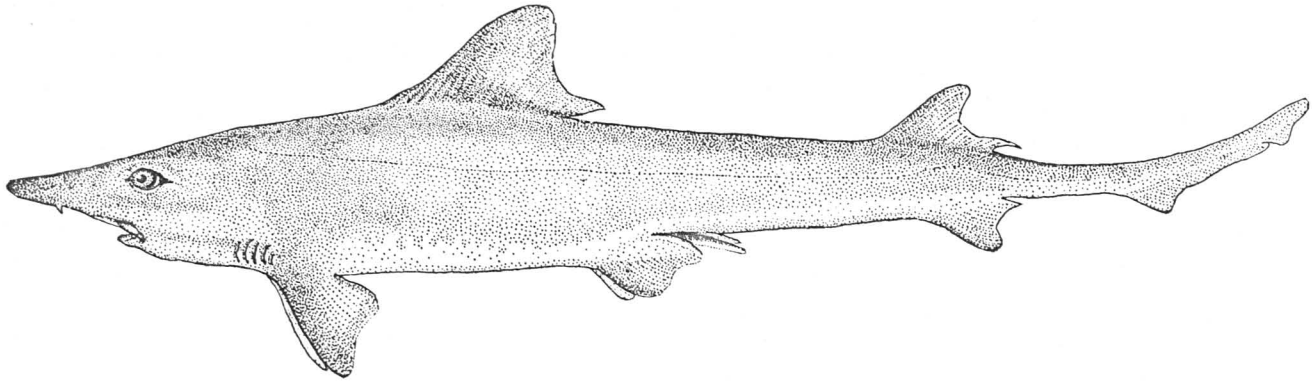
Bureau of Fisheries Document No. 622

Blank page retained for pagination

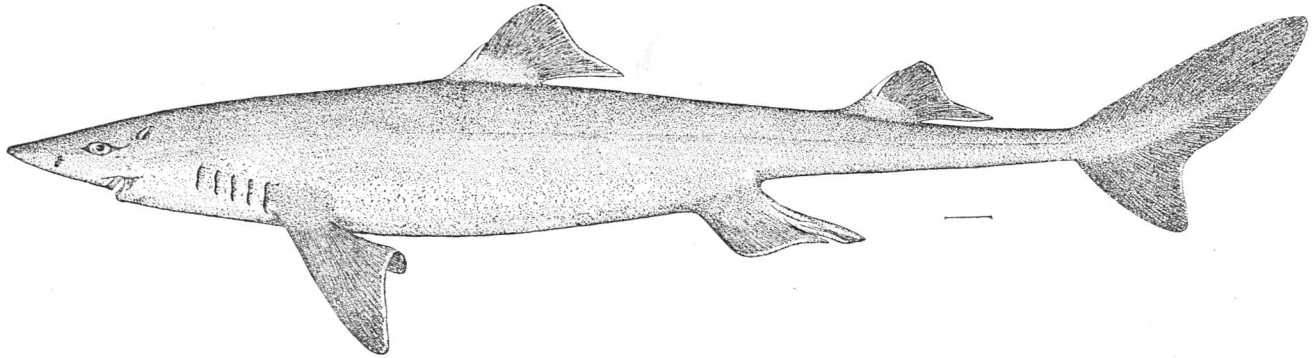
CONTENTS.

	Page.
Introduction	7
Plan and method of investigation	8
Review of literature of the food of fishes	9
The smooth dogfish	10
Characters and distribution	10
Breeding habits	11
Food	11
Examination of digestive tracts	11
Estimate of destructiveness	14
Feeding habits	15
The sand shark	16
General characters	16
Food	16
Examination of digestive tracts	16
Estimate of destructiveness	18
The horned dogfish	18
General appearance and habits	18
Distribution and abundance	19
Feeding habits	20
Variety of food	21
Destructiveness	21
The summer skate	23
Characters of the fish	23
Reproduction	24
Uses	24
Food	25
Examination of digestive tracts	25
Estimate of destructiveness	27
The common killifish	27
General appearance and distribution	27
Food	28
Examination of digestive tracts	28
The cunner	30
Characters and distribution	30
Uses	30
Food	30
Examination of digestive tracts	31
Possible destructiveness	34
The toadfish	34
General appearance, abundance, and habits	34
Food	35
Examination of digestive tracts	35
Estimate of destructiveness	36

Page.
The goosefish or angler---- 36
Peculiar appearance and local names---- 36
Reproduction---- 37
Uses---- 37
Food---- 37
Examination of digestive tracts---- 38
Estimate of destructiveness---- 39
Methods of controlling destructiveness of dogfish---- 40
Inadequate suggestions---- 40
Possible uses of dogfish---- 41
Skin---- 41
Liver---- 42
Skeleton and fins---- 42
Flesh---- 43
Food qualities of smooth dogfish---- 43
Canning of horned dogfish---- 44
Utilization the solution of the problem---- 46
Measures adopted in Canada---- 46
Efforts in Massachusetts---- 47
Recommendation of the Bureau of Fisheries---- 48
Literature cited---- 49



1. SMOOTH DOGFISH (MUSTELUS CANIS).



2. HORNED DOGFISH (SQUALUS ACANTHIAS).

UNUTILIZED FISHES AND THEIR RELATION TO THE FISHING INDUSTRIES.

By Irving A. Field.

INTRODUCTION.

The destruction of food fishes by fishes of little or no commercial value is a subject of obvious importance to the fishing industries. To preserve for his own uses the species he values, it becomes necessary for man to control the depredations of his rivals.

Under normal conditions the balance among the different forms of life is maintained by natural laws. Where great destructive forces are at work upon a species that species will be found to be endowed with great powers of reproduction. The lobster, for example, wholly defenseless in its early stages, and even when mature the prey of a host of enemies, is able to perpetuate itself because of its enormous fecundity, there being a biennial production of about 15,000 eggs by each mature female lobster. The smooth dogfish, on the other hand, a most destructive enemy of the lobster but itself comparatively free from enemies, produces from four to a dozen young at a time, and these are practically adult in form at birth.

The natural balance, however, is seriously disturbed by man, for whose purposes the supply of one species is exhaustively drawn upon, while another, perhaps destructive, form undergoes no diminution. To offset the drain upon the valuable species, close seasons have been created to afford them protection during the breeding periods, fish hatcheries have been established to replenish their numbers, and sometimes the destruction of their natural enemies has been sought by means of bounties or through the introduction of parasites. Effective methods of lessening the destructiveness of the useless marauders, however, are the important factor lacking in present conditions. While the struggle for existence has grown constantly more severe for the lobster, which has man as a new enemy, the smooth dogfish has continued unmolested, and thus increased in numbers. And so with the other commercial species and their nonvalued enemies. With the fish culturist's aid and the legislator's care a species may be able to maintain itself even against the combined agencies of its natural enemies and man; but the struggle is increasingly difficult, and it is ultimately hopeless in some cases. The possible advantage

to the fishing industry through the elimination or control of the greatest destructive factor remains, moreover, always of untold immensity.

PLAN AND METHOD OF INVESTIGATION.

The relative value or uselessness of fishes for man's purposes is determined not only by the possibilities of direct economic utilization, but by the interrelations of the species as well. A knowledge of their feeding habits, therefore, is of the utmost importance in an effort to devise means of controlling the destructive enemies of valuable forms, and it is through study of this subject that the present investigation seeks its end. The work, which was undertaken for the Bureau of Fisheries at its Woods Hole laboratory in 1902 and continued through succeeding years to 1906, has consisted of observation of the feeding habits and examination of the food of seven predatory fishes common in the vicinity, and of the horned dogfish in addition, and these results form a basis for suggestions designed to lead to a lessening of the destruction.

The method of investigation was to secure as many as possible of the valueless fishes in question from various localities in the vicinity of Woods Hole, and immediately after capture to preserve the entire contents of the stomach or the whole digestive tube of each. A separate dish received this content from each fish, and over it was poured a formalin solution of about 2 per cent strength. Further action of the digestive juices was thus prevented, and the material was preserved for study at convenience.

Such fishes as the shark and dogfish were taken almost exclusively from the traps of the Bureau of Fisheries set in Buzzards Bay. A few sand sharks were taken from the Marine Biological Laboratory trap in Vineyard Sound, and a dozen or more smooth dogfish were caught by hook and line or by a trawl set in Buzzards Bay. The other species here discussed were caught in a 150-foot seine, set by two or more men with a boat about a favorite haunt of the fishes, which were then drawn to shore and the desired specimens sorted out. From the sharks and dogfishes, which feed on large living forms, only the contents of the stomach were preserved, since in these fishes by the time food has entered the spiral valve it has become so ground up and so far digested that it is rarely possible to identify anything.

At the laboratory the various ingredients composing the contents of each stomach, or whole digestive tract, as the case might be, were ascertained quantitatively and, when possible, the total number of any given sort of animal which had been swallowed was recorded. For the smaller fishes this meant a minute microscopical examination of the entire contents of the digestive tube. Where a given species of animal was found in too great abundance or too badly preserved

to be counted exactly, the relative terms "little," "moderate," and "much" were used in the record, "little" meaning that there was sufficient quantity to be identified, "moderate" that at least one-fourth of the stomach was filled, and "much" that the stomach was well filled with the species or substance indicated. The data thus obtained were tabulated to show the date and locality of capture of the fish, number of specimens (fishes) examined, and the number of specimens containing each kind of food. The form of tabulation adopted is that of Dr. Peck (1896), excepting the addition of the locality.

REVIEW OF LITERATURE OF THE FOOD OF FISHES.

Notwithstanding the importance of the subject, study of the food of fishes has not been very extensive, and the literature is very meager. Verrill and Smith (1873) have given a list of invertebrate-animals found in the stomachs of fishes taken in Vineyard Sound. Peck (1894) made a study "On the food of the menhaden," which species he found to be entirely dependent upon micro-organic material filtered from the water by means of specially modified gillrakers. In a later paper (1896) he shows that ultimately all fishes are dependent, either directly or indirectly, upon this micro-organic material. He characterized the food of the squeteague by this concrete instance:

> On the morning of July 23 there was taken a large specimen whose stomach contained an adult herring. In the stomach of the herring were found two young scup (besides many small crustacea), and in the stomach of one of these scup were found copepods, while in the alimentary tract of these last one could identify one or two of the diatoms and an infusorian test among the mass of triturated material which formed its food. This is an instance of the universal rule of this kind of food; the squeteague captures the butterfish or squid, which in turn have fed on young fish, which in their turn have fed upon the more minute crustacea, which finally utilize a microscopic food supply.

These two papers of Dr. Peck are probably the most serious contributions that we now have on the food of fishes. Peterson (1893) devotes a portion of one chapter in his paper to the food of the flatfishes. Kendall (1898) treats of the food of a few of the more important members of the cod family, commercially the most valuable group of fishes found on our Atlantic coast. His purpose was to explain "the phenomena of the withdrawal of certain fishes from a region where they have been abundant, the presence of large numbers one year and their scarcity the next, their disappearance for long periods and their sudden reappearance." The paper consists chiefly of a record of an examination of the stomach contents of numerous specimens taken on the shores of the New England States and the Canadian maritime provinces. McIntosh (1899) in his introductory chapter gives a "general review of the resources of the sea and the influence of man thereon." He emphasizes Dr. Peck's

idea that there is a complex cycle involving the whole series of marine forms, from the minute micro-organic matter (animal and vegetable) to the fishes. Scott (1899) gives a few notes on the food of young fishes which frequent the British coast in the vicinity of Piel. Linton (1901) in his Parasites of Fishes of the Woods Hole Region has a record of food found in the alimentary tract of the fishes he examined for parasites. Scott (1902) made a special study of the food of small and immature fishes, and describes also the food of several larger species. He shows that minute crustacea form the chief constituent in the food of the young of many species which when adult live mostly on other organisms.

These researches on the food of fishes, it will be observed, vary greatly in character and purpose. In one case the object was to find new species to add to a local faunal list; in others it was to find out the primary food basis of the fishes; another author wished to explain irregular and sudden migrations of fishes, and still another studied the food in order to study the parasites of fishes. Much therefore remains to be learned about a most important factor in many scientific and economic questions.

THE SMOOTH DOGFISH.

CHARACTERS AND DISTRIBUTION.

The smooth dogfish (*Mustelus canis*) has a slender, elongated body, tapering from the dorsal fin back to the slender heterocercal tail. The color is a uniform slaty gray on the back and sides and a light pearl gray on the ventral surface. The skin is thickly beset with minute, hard, sharp tubercles—the placoid scales; to the hand passing forward over it the sensation is that of feeling a fine sandpaper. The head, broad and depressed, terminates in a moderately sharp snout. The mouth is small and situated on the ventral side of the head. It lies transversely, somewhat crescentic in shape. The teeth are flat and pavement like, well adapted for crushing rather than for seizing and holding prey. A pair of nostrils open on the ventral side of the head, one in front of each corner of the mouth. Two round small apertures, the spiracles, open dorso-laterally, one behind each eye. There is no operculum, the branchial clefts opening as five pairs of slits, which lie in a vertical position on each side of the neck. There are two dorsal fins and two sets of paired fins, the anterior pair, or pectorals, being situated ventro-laterally just behind the head, and the posterior pair, or pelvic fins, being located on the ventral side just anterior to the cloacal opening. In the male the inner sides of the pelvic fins are modified into stiff fleshy rods called claspers. The average length of the smooth dogfish is about 3 feet, but occasionally

specimens are taken that measure as much as 5 feet. The distinctive characters of the species are shown in figure 1, plate I.

The smooth dogfish is of wide distribution. It occurs in great numbers along our Atlantic coast from Cape Cod to Florida, and is found in the Pacific, along the coast of California. It abounds also on the Atlantic coast of southern Europe and in the Mediterranean.

BREEDING HABITS.

The mode of reproduction in this species is very different from that of most other fishes, fertilization being internal. The eggs develop inside of the egg tubes, and the young when born are similar to adults except in size. They are vigorous and swim about actively. A female smooth dogfish, which was opened in the summer of 1904 by Dr. Linton at the Fisheries' laboratory at Woods Hole, contained 8 young, which measured about 12½ inches each. They were about ready to be born. I have never found more than 12 embryos nor less than 4 in a pregnant female. How long a time intervenes between fertilization and birth of the young has not been determined.

FOOD.

Several writers in past years have incidentally devoted a paragraph to the food of the smooth dogfish. None of them, however, has made a thorough study of the subject. Verrill and Smith (1873) state:

> Several specimens caught at Woods Hole contained lobsters (*Homarus americanus*), spider crabs (*Libinia canaliculata*), rock crabs (*Cancer irroratus*).

Goode (1884) gives merely the general statement that "it feeds upon crabs, lobsters, and other bottom-loving invertebrates."

Linton (1901) says:

> The alimentary canals usually contain crabs (*Panopeus, Platyonichus, Cancer, Libinia*, etc.); squid, annelids, and fish have also been noted.

In the Standard Natural History, vol. III, appears the statement:

> It is harmless and feeds on the crabs and shells which abound on the bottom in favored localities.

EXAMINATION OF DIGESTIVE TRACTS.

The accompanying table is in general agreement with all that the foregoing writers have said concerning the food of the dogfish, except that the species is not harmless. A careful study of the table, which gives the results of examinations of 388 specimens, will show not only that the smooth dogfish is destructive to crustaceans in general, but that it is especially the enemy of the valuable American lobster. About 16 per cent of the 388 fishes contained lobster in varying quantities, from a leg or chela up to two whole lobsters measuring as much as 7 inches in length.

STATEMENT OF THE FOOD OF

NOTE.—Figure outside parenthesis denotes number of smooth dogfish; quantity

Date.	Locality.	Specimens examined.	Number of stomachs containing—					
			Rock crabs.	Spider crabs.	Lobsters.	Menhaden.	Lady crabs.	Squids.
1902.								
July 16	Bay traps...	1	.....	1 (little)	.....	1 (much)	.....	.....
18	Katama bay	2	.....	.....	.....	.....	.....	.....
21	Bay traps...	3	.....	.....	.....	2 (much)	.....	.....
23	.....do.....	2	.....	.....	.....	2 (much)	.....	1 (little)
28	.....do.....	1	.....	1 (little)	.....	1 (much)	.....	.....
Aug. 21	.....do.....	2	.....	1 (3)	1 (little)	2 (2)	1 (1)	.....
23	Katama bay	4	3 (5)	2 (5)	.....	.....	1 (2)	.....
1903.								
June 30	Bay traps...	5	.....	2 (little)	.....	4 (much)	.....	.....
July 1	.....do.....	1	.....	1 (little)	1 (mod.)	1 (mod.)	.....	.....
2	.....do.....	3	.....	.....	3 (3)	.....	.....	.....
13	.....do.....	7	1 (2)	.....	2 (much)	6 (much)	.....	.....
19	.....do.....	8	1 (1)	3 (3)	4 (much)	1 (little)	.....	.....
20	.....do.....	6	3 (3)	2 (2)	1 (little)	.....	.....	1 (1)
21	.....do.....	18	3 (5)	2 (much)	.....	1 (much)	.....	.....
24	Wareham ..	3	2 (5)	1 (little)	.....	.....	.....	.....
25	Bay traps...	14	6 (much)	1 (little)	3 (much)	.....	.....	3 (much)
29	.....do.....	15	9 (9)	3 (much)	3 (mod.)	5 (mod.)	2 (2)	4 (much)
31	.....do.....	6	5 (10)	1 (1)	2 (little)	.....	1 (1)	.....
Aug. 4	.....do.....	3	2 (much)	.....	.....	.....	.....	1 (mod.)
6	.....do.....	20	9 (20)	6 (8)	5 (much)	2 (little)	3 (3)	2 (4)
7	.....do.....	7	4 (6)	2 (2)	.....	.....	.....	1 (1)
10	.....do.....	5	1 (1)	1 (2)	1 (1)	.....	.....	.....
11	.....do.....	23	8 (9)	.....	1 (1)	2 (little)	1 (1)	3 (mod.)
16	.....do.....	3	1 (1)	1 (1)	.....	.....	1 (1)	.....
17	.....do.....	11	3 (4)	1 (1)	2 (2)	1 (mod.)	2 (little)	2 (3)
18	.....do.....	5	3 (3)	1 (1)	1 (1)	.....	.....	2 (2)
24	.....do.....	41	12 (12)	10 (12)	4 (much)	5 (5)	.....	1 (1)
26	.....do.....	14	3 (3)	3 (6)	.....	.....	3 (3)	1 (1)
28	.....do.....	10	1 (1)	2 (3)	3 (3)	.....	.....	.....
1904.								
July 2	Bay traps...	7	3 (6)	1 (little)	3 (3)	2 (2)	.....	.....
5	.....do.....	1	.....	.....	.....	.....	1 (1)	.....
6	.....do.....	17	3 (3)	3 (6)	3 (3)	.....	9 (11)	2 (little)
7	.....do.....	7	2 (3)	1 (1)	2 (little)	.....	2 (2)	.....
9	.....do.....	13	7 (13)	1 (2)	.....	.....	4 (4)	5 (6)
11	.....do.....	3	3 (4)	.....	1 (little)	1 (1)	.....	1 (1)
16	.....do.....	5	2 (2)	1 (1)	1 (1)	.....	2 (3)	1 (little)
18	.....do.....	5	3 (5)	.....	.....	.....	1 (little)	1 (little)
19	.....do.....	3	1 (3)	.....	1 (little)	.....	.....	.....
20	.....do.....	1	1 (1)	.....	.....	.....	.....	.....
23	.....do.....	2	.....	.....	2 (3)	.....	.....	.....
25	.....do.....	3	1 (2)	2 (2)	.....	.....	1 (1)	.....
29	Bay trawl ..	4	4 (5)	1 (1)	.....	.....	.....	.....
Aug. 1	Bay traps...	2	2 (4)	1 (3)	.....	.....	.....	.....
3	.....do.....	3	1 (4)	2 (4)	.....	.....	1 (1)	.....
4	.....do.....	17	5 (5)	4 (4)	3 (much)	.....	1 (1)	1 (little)
5	.....do.....	3	.....	2 (2)	1 (1)	.....	.....	.....
9	.....do.....	8	3 (5)	1 (2)	2 (2)	.....	.....	.....
10	.....do.....	2	1 (1)	.....	.....	.....	.....	.....
11	.....do.....	5	3 (4)	2 (2)	.....	.....	1 (1)	.....
13	.....do.....	2	1 (1)	.....	1 (little)	.....	1 (1)	.....
16	.....do.....	6	2 (mod.)	1 (2)	1 (1)	.....	.....	1 (1)
17	.....do.....	6	3 (4)	1 (1)	2 (little)	.....	.....	.....
19	.....do.....	4	3 (much)	2 (2)	.....	1 (1)	.....	2 (mod.)
20	.....do.....	2	1 (3)	.....	.....	1 (1)	.....	.....
24	.....do.....	1	.....	.....	1 (little)	.....	.....	.....
25	.....do.....	5	.....	1 (2)	.....	3 (mod.)	.....	.....
30	.....do.....	8	.....	3 (3)	1 (1)	.....	.....	.....
	Total[a]...	388	185 (169+)	78 (90+)	62 (26+)	44 (12+)	39 (41+)	36 (21+)
	Per cent.....		34.77	20.1	15.99	11.31	10.05	9.27

[a] The importance of the "plus" in the totals of food (the figures in parentheses) must not be overlooked. In many cases the quantities not reckoned in figures were consider-

THE SMOOTH DOGFISH EXAMINED.

of given species eaten is included within parenthesis. (mod. = moderate.)

Number of stomachs containing—								
Nereis.	Eel-grass.	Hermit crabs.	Razor clams.	Gebia.	Fish, species undetermined.	Other matter undet.	Nothing.	Miscellaneous.
					2 (mod.)			2 (3 prawns).
							1	
						1		
1 (3)							1	1 sculpin, 1 silverside, 1 *Mytilus*.
1 (little)								2 (3 puffers), 1 pebble.
								1 scup.
								Caudal 1/3 of a bonito.
1 (2)								
1 (1)	2 (little)					1	10	4 pocket crabs.
	1 (little)			2 (2)				
	1 (little)			1 (1)	2 (little)	1		
								1 scup, 1 *Solenomya* velum, jaw of a squeteague.
2 (3)						1		1 *Phascaloscoma*, 1 stickleback.
					1 (little)			1 lamellibranch.
7 (12)	5 (much)			1 (1)		2		1 *Callianassa*, 944 *Callianassa* eggs (?). *Tubularia couthouyi*.
1 (3)					1 (little)	2		1 lamellibranch.
4 (6)	2 (much)	3 (3)		1 (1)		2	6	
2 (3)		1 (1)	1 (1)			1		1 red grape, knot of weed, 4 annelids.
		1 (1)	1 (1)		1 (little)			
			2 (2)		1 (little)			
2 (2)	6 (much)	2 (little)	1 (little)		3 (mod.)		12	
			2 (mod.)				6	
							4	
	1 (little)							
1 (1)	2 (little)	2 (3)	3 (5)					2 amphipods.
							2	2 pebbles covered with algæ and hydroids.
			1 (1)					3 snail shells.
					2 (little)			
		1 (1)			1 (1)			
		1 (1)						
			1 (1)					
			1 (1)					
1 (2)		1 (1)	1 (1)					Several pieces of carrot and potato.
1 (little)	1 (little)				1 (little)		2	
	1 (little)							
			1 (1)		2 (little)		2	
		1 (1)						
1 (1)	1 (little)		1 (1)					
1 (2)								
	1 (little)						1	
		1 (1)						
		1 (1)			1 (much)			
		1 (little)						
	2 (little)	1 (1)						
1 (1)								
28 (40+)	26	17 (15+)	16 (15+)	5 (5)	18 (1+)	11	47	
7.21	6.70	4.38	4.12	1.28	4.63	2.88	12.11	

able, and their sum, represented by the "plus," is no insignificant factor in the total, although it can not be adequately expressed.

ESTIMATE OF DESTRUCTIVENESS.

The significance of the foregoing results is made apparent upon the reduction to figures of the damage resulting to the lobster fisheries from the presence of 100,000 smooth dogfish in a locality like Buzzards Bay during a single season. It is, of course, impossible to make even an approximate estimate of the number of any kind of fish that are present in a given area of considerable extent. But judging from the great numbers that are taken in the traps and from the fact that smooth dogfish can be caught in almost any part of Buzzards Bay where a baited hook is let down, it may be assumed that the number of smooth dogfish in that region is not less than 100,000, and this, to my mind, is a very conservative estimate. By a series of experiments it was found that a smooth dogfish can completely digest and pass off from the stomach a rock crab or lobster in from 65 to 84 hours. Several medium-sized smooth dogfish were kept in a large cod car for five days to make sure that their alimentary tracts were clean. Rock crabs and large pieces of lobster were then forced down their throats, and at intervals of from 12 to 20 hours fish were caught and killed and the digestive tract contents examined. After about 65 hours the shells of crabs or lobsters were soft and flaky and could be mashed and molded by the fingers. After about 84 hours, or half a week, nearly all traces of the stomach contents had passed into the intestine. Judging from these facts, in order for 16 per cent of the smooth dogfish constantly to contain lobster material, that number would have to take, on the average, a lobster twice each week. Sixteen per cent of $100{,}000 \times 2 = 32{,}000$, which would represent the number of lobsters per week consumed by 100,000 smooth dogfish. Since these fish are common in Buzzards Bay for not less than twenty weeks of each year, we would then have $20 \times 32{,}000 = 640{,}000$, the minimum number of lobsters probably destroyed in Buzzards Bay during one season by this agency.

From data collected, and by this same method of calculation, there is obtained for the principal species eaten the following estimate of the number of individuals of each destroyed each year in the region of Buzzards Bay by every 100,000 smooth dogfish:

ESTIMATE OF FISH DESTROYED EACH YEAR BY EVERY 100,000 DOGFISH IN BUZZARDS BAY.

Species.	Number destroyed.	Species.	Number destroyed.
Rock crab (*Cancer irroratus*)	1,390,800	Puffer (*Spheroides maculatus*)	20,000
Spider crab (*Libinia canaliculata*)	804,000	Scup (*Stenotomus chrysops*)	20,000
Lobster (*Homarus americanus*)	639,600	Gasteropod (*Lacuna vincta*)	20,000
Menhaden (*Brevoortia tyrannus*)	452,400	Sculpin (*Myoxocephalus æneus*)	10,000
Lady crab (*Platyonichus ocellatus*)	402,000	Silverside (*Menidia notata*)	10,000
Squid (*Loligo pealii*)	370,800	Sea mussel (*Mytilus edulis*)	10,000
Nereis (*virens* or *limbata*)	288,400	Bonito (*Sarda sarda*)	10,000
Eelgrass (*Zostera marina*); comparatively little.		*Solenomya velum*	10,000
Fish (species undetermined)	185,200	Squeteague (*Cynoscion regalis*)	10,000
Hermit crab (*Eupagurus pollicaris*)	173,200	*Phascalosoma*	10,000
Razor clam (*Ensatella americana*)	164,800	Stickleback (*Gasterosteus bispinosus*)	10,000
Gebia affinis	49,600	*Callianassa*	10,000
Pocket crab (*Panopeus*)	20,000	Amphipods	10,000
Prawn (*Palæmonetes*)	20,000	Total	5,120,800

FEEDING HABITS.

The unnatural conditions surrounding the fishes in the traps involve the above results in a considerable degree of error. For more nearly accurate calculation it is necessary to consider, in addition to the above factors, what the dogfish had met with during its short experience in captivity and also what is its normal habit of feeding. In the traps it was generally crowded into close quarters with menhaden, squids, puffers, scups, bonitos, squeteagues, and other fishes. Any food taken in the trap had to come from this list, and that food was taken in the trap is very evident upon a glance at the above table. On the other hand, the crustaceans (except the spider crab) and the molluscs were rarely, if ever, taken in the traps, so that such of these as were found in the dogfish were most likely taken in their natural haunts.

The study of a number of live dogfish kept in the shark pool of the Woods Hole station shed considerable light on their habits of feeding. This pool is about 100 feet long by 25 feet wide, with a depth of the water varying from about 4 to 7½ feet, according to the tide. Except when the tide was quite high, it was an easy matter to see the bottom and the fishes swimming about.

The usual habit of the dogfishes was to swim close to the bottom, searching for food over every square inch of the ground. If a rock crab or spider crab were thrown into the pool, they soon found it. They would turn over on their sides to seize it, and then dart rapidly off, shaking it much as a terrier would shake a rat. After swallowing the crab, the dogfish kept up its active swimming, often returning to the place where the food had been found, just as if hoping more might be discovered there. The experiment of throwing in food was repeated several times, always with the same result. A tame loon, which was kept in the pool for a week or two, was often

bothered by the dogfishes coming up and seizing it by the legs, but no harm came to the loon from this experience.

Besides the few sharks, skates, and cunners, there were put into the pool a number of menhaden which had been inoculated with a germ known to cause a disease in this fish. It was noticed that as long as the menhaden remained normally active they were not molested by the dogfish, but as soon as one began to show signs of the disease by turning on its side and swimming in circles, it was attacked and eaten by the dogfish.

It is pretty safe to conclude, therefore, that the smooth dogfish is normally a bottom feeder and does not prey upon active fishes like bonito, menhaden, scup, etc., unless in close quarters with them or unless it encounters them in a weakened, helpless condition. It feeds primarily upon crustaceans, chief among which are the rock crab, spider crab, and the lobster. To diminish by 95 per cent the number of teleost fishes given in the foregoing list as destroyed by every 100,000 smooth dogfish would be much more nearly to approximate the actual truth. The number of crustaceans consumed is probably much greater than the estimate.

THE SAND SHARK.

GENERAL CHARACTERS.

The sand shark (*Carcharias littoralis*) has an elongate body, which, however, is much heavier than that of the smooth dogfish; the head is rather pointed, mouth ventral, and jaws set with long, very sharp teeth; skin covered with sharp tubercles, which are larger and far less numerous than those of the smooth dogfish. The sand shark is of a gray color and measures from 4 to 6 feet in length. According to Jordan and Evermann it is "rather common on our Atlantic coast, especially between Cape Cod and Cape Hatteras."

FOOD.

But two references to the food of the sand shark have been found. Verrill and Smith (1873) say:

> Many specimens taken at Woods Hole in July and August contained lobsters (*Homarus americanus*) in abundance, *Cancer irroratus*, and squids (*Loligo pealii*).

Linton (1901) reports:

> Fish (menhaden, sea bass, scup, and butterfish noted) and squid.

EXAMINATION OF DIGESTIVE TRACTS.

During July and August, 1904, 66 sand sharks were examined for the purpose of determining their food. The results are given in the accompanying table.

Statement of the Food of the Sand Sharks Examined.

Note.—Figure outside of parenthesis denotes number of sand sharks; number or amount of given species eaten is included within parenthesis.

Date.	Locality.	Specimens examined.	Number of stomachs containing—									
			Menhaden.	Alewives.	Flounders.	Scups.	Butterfish.	Eelgrass.	Bonitos.	Fish, species undetermined.	Nothing.	Miscellaneous.
1904.												
July 5	Bay trap	2	1 (1)								1	
6	do	5	4 (5)	1 (1)	2 (2)			1 (little)		1 (little)		
7	do	5	1 (1)								4	
8	do	5									5	
9	do	6	2 (3)	1 (1)			1 (1)			1 (1)	2	
11	do	3	2 (3)	1 (1)		1 (1)		1 (little)				1 squid
19	do	2				1 (1)						
20	do	3	3 (4)									
29	do	1	1 (1)									
Aug. 4	do	2	2 (2)									
8	do	2	1 (2)				1 (2)					1 squeteague; 1 sea robin.
9	do	2	1 (1)	1 (1)	1 (1)			1 (little)				
10	do	2	2 (2)									
11	Sound trap	11		1 (2)		1 (1)				9 (mod.)		
13	Bay trap	1					1 (1)					
16	Sound trap	3	1 (1)		1 (1)				2(6 young)			
17	Bay trap	2									2	
18	do	2	2 (4)									
23	do	2	2 (4)									
26	do	2	2 (4)									
30	do	3								3 (little)		
	Total[a]	66	27 (38)	5 (6)	4 (4)	3 (3)	3 (3)	3 (little)	2(6 young)	14 (1+)	14	
	Per cent		40.9	7.57	6.06	4.54	4.54	4.54	3.03	21.21	21.21	

[a] See note on page 12.

608—07—3

ESTIMATE OF DESTRUCTIVENESS.

The foregoing figures show that the food of the sand shark consists almost entirely of fish. No lobster, crab, or other crustacean was found in any of the stomachs, which fact is at variance with the report of Verrill and Smith, who state that the sand shark feeds extensively on these forms. My observations accord more closely with Dr. Linton's. It should be taken into account, however, that the sharks examined were taken from unnatural surroundings, namely, the traps, where they were held in close quarters with most of the species of fish found within them. But, taking the data as collected, and estimating the number of sand sharks in the vicinity where these were taken (Buzzards Bay and Vineyard Sound) at only 25,000, and allowing to each sand shark four fish per week, a most conservative estimate, the numbers eaten by sand sharks in one month would be as follows:

ESTIMATE OF FISH DESTROYED EACH MONTH BY 25,000 SAND SHARKS IN BUZZARDS BAY AND VINEYARD SOUND.

Species.	Number destroyed.	Species.	Number destroyed.
Menhaden (*Brevoortia tyrannus*)	167,600	Butterfish (*Poronotus triacanthus*)	18,160
Alewife (*Pomolobus pseudoharengus*)	30,280	Bonito (*Sarda sarda*)	12,120
Flounder (*Paralichthys dentatus*)	24,240		
Scup (*Stenotomus chrysops*)	18,160	Total	270,560

The sand shark is to be characterized as a fish which is destructive to fishes of food or other commercial value, although not nearly so destructive as the horned dogfish, which will be considered next.

THE HORNED DOGFISH.

GENERAL APPEARANCE AND HABITS.

In general appearance the horned dogfish (*Squalus acanthias*) very much resembles the smooth dogfish. It has the same slender, elongate body covered with numerous sharp tubercles (placoid scales), the ventrally placed mouth and nostrils, and the characteristic spiracles. The color is slaty above, with a line of whitish spots extending along either side of the back. The under portions fade out almost to white. The horned dogfish is to be distinguished from the smooth dogfish by its small sharp teeth and a rather high dorsal spine in front of each of the two dorsal fins. In length the adults vary from 2 to 3 feet and in weight from 5 to 15 pounds. They are strong, active swimmers, and roam about the shoals and deeper waters in great schools, pursuing their prey like a pack of wolves. The name

dogfish has probably been applied because of this character, and is given to numerous other shark-like fishes having this same habit. Like the smooth dogfish, the young of the horned dogfish are carried by the parent, and when born are similar to the adults and ready to enter into vigorous activities. This species is represented in figure 2, plate 1.

DISTRIBUTION AND ABUNDANCE.

The range of the horned dogfish is wide. During the summer and fall months it is abundant along the Atlantic coast from Newfoundland to Cape Cod, and during the winter occurs as far south as Cuba. This same species is also found along the European shores, where it is known by various names, such as "picked dog," "horned dog," "spur dog," "skittle dog," and "hoe."

A comparison of successive years with reference to the periods of abundance of this species along the coast shows that the horned dogfish remain longer now than formerly and furthermore are making their way into hitherto unfrequented regions. Captain Atwood writes that when he first went fishing, in 1810 to 1820, they appeared in the spring and were abundant for a day or two, after which they disappeared. Not one would be seen all summer, but they would return again about the middle of September and stay into November. During the early sixties they were present all summer. Storer (1867) says that they appeared in the spring and autumn and frequently occurred in immense numbers in shallow water or near the shore, but rarely remaining for more than three or four days. He speaks of having seen a few thrown out from the nets at Provincetown as late as June 27, 1847. He further says that they return again in September to remain until the middle of November. Goode (1884) speaks of their appearing at Provincetown, Mass., a little while after the mackerel and disappearing a short time before them. Smith (1898) in his paper entitled "The Fishes Found in the Vicinity of Woods Hole," says of dogfish:

> Less abundant than formerly and comparatively scarce in 1897. When the fish factory was established at Woods Hole this was the principal fish utilized in the manufacture of oil and guano; later the scarcity or irregularity of the supply necessitated the use of menhaden.

The Report of the Commissioner of Fisheries for 1903 says:

> Dogfish appeared on the coast in and near Penobscot Bay in unwonted numbers in 1902, and committed great havoc among the deep-water fishes. They appeared earlier than usual, being found near Monhegan Island as early as the middle of May and becoming quite plentiful all along the coast in June, but August appears to have been, as usual, the month of greatest abundance.

Capt. B. R. Kelley, in his letter published at the end of this chapter, writes that they appeared at Provincetown on July 14, 1904 (which

was about fifteen days later than in the previous year), and were never before so plentiful. They remain all summer and leave about the last of November. Mr. H. E. Duff, of Petit de Grat, Cape Breton, Canada, writes that in that region—

> They appear in small numbers about the middle of July, getting more plentiful later on, say September, October, and November. They disappear say December, as we get them at times when winter fishing is going on. They are here at the time of our mackerel fishing, summer and fall. There is no fishing for dogfish for any purpose—only fishermen growling and swearing at the dogfish.

FEEDING HABITS.

Storer, in his History of the Fishes of Massachusetts (1867), states that the food of the horned dogfish is "mackerel and other fishes and offal and garbage thrown upon the bottoms by the fishermen." Goode (1887) says that it preys upon cod. Cunningham (1896) says it preys upon such small bony fishes as herring and pilchard. Smith (1898) says: "When the horned dogfish first comes in May, it feeds largely on ctenophores." Linton (1901) found bits of eel grass and the test of a young sea urchin in one specimen, and states that Mr. C. F. Silvester reports having found fish of various kinds in the stomachs of dogfish from Provincetown.

Biologists, however, have given comparatively little space to this subject. The character of the food of this dogfish is best known through the observations and experiences of the fishermen. Wolf-like in their habits, roving in great schools, constantly in search of prey, these fish have wrought such havoc to the mackerel, herring, cod, haddock, and other fisheries all along the coast that there is no question in any fisherman's mind as to what the horned dogfish eats. In the Fish Commission Bulletin for 1884 Captain Collins tells of a great school of dogfish which, completely surrounding a school of mackerel, closed in on all sides and from underneath and devoured almost the entire school. According to Captain Collins, a similar performance was twice witnessed off Wood Island by Capt. Joseph Smith, of Gloucester. The Report of the Commissioner of Fisheries for 1903 tells how a fleet of fishing boats about Mount Desert Rock was driven from the fishing grounds by horned dogfish early in July and could not return again until well into September. The dogfish took both the bait and the trawls and attacked the fish that had been caught, which in this case were principally haddock and hake. All that the fishermen could get were heads of haddock and hake and a great many worse than worthless dogfish.

While at Provincetown, August 20, 1903, I had opportunity to make some observation of the abundance and voracious habits of this fish. Captain Kelley took a fishing party out in his sloop to a point in the harbor about 500 feet from the shore, where stands the harbor

light-house. During the first fifteen or twenty minutes several hake and two large pollock were caught. Then the dogfish began to appear in great numbers. While one man was trying to land a hake it was attacked by half a dozen dogfish, which followed it clear to the surface, biting and tearing it so that all the luckless fisherman got for his share of the catch was the head, and a portion of the spinal column with a few bits of flesh clinging to it. This experience is one common to all the ground fishermen of that region. Soon all that we could catch were dogfish. In less than two hours' time 78 were landed, which was about as fast as our lines could be baited, thrown overboard, pulled up, and the dogfish taken off; it usually took longer to get the fish off the hook than to get them on it. They grew more and more plentiful as the fishing went on. Often they were seen swimming about the boat close to the surface of the water, but only for a short time, when they would dart downward out of sight. Captain Kelly and other fishermen said that outside the harbor they were larger and much more abundant.

VARIETY OF FOOD.

A statistical study of the food of the horned dogfish, as of the other species dealt with in this paper, was not possible in these investigations, owing to the scarcity of specimens obtainable during July and August in the vicinity of Woods Hole, where the work was conducted. The variety of food taken by the dogfish, however, is well shown in the following instances: Of some 90 specimens taken at Provincetown August 20 and 21, 1903, 31 contained the little jellyfish *Cydippe*, about 75 to each dogfish; 11 specimens contained squid (*Ommastrephes*), which were probably stolen bait; 3 contained the remains of 4 small crustaceans; 2 contained annelids; 1 contained a hake; 1 an insect; 1 an isopod; 47 were empty. Three dogfish taken in a trap at Nomans Land August 2, 1904, contained 1 a *Nereis*, 1 a squid, and 2 contained fish too far digested to be identified. Of 20 or 30 specimens from Gloucester, received at the Harvard Zoological Laboratory during the past two years, all whose stomachs were not empty contained fish. The fish were too far digested to be identified in most cases, but the greater part recognizable were herring.

The recent report of the Massachusetts Board of Fish Commissioners upon the damage done by dogfish in 1905 records the food of 674 dogfish whose stomachs were examined. Fish, apparently marketable species, were found in most instances. A few of the dogfish had eaten ctenophores.

DESTRUCTIVENESS.

This evil has become greater in the last few years, and the fishermen state that it is now the most serious they have to contend with. The dogfish in countless numbers overwhelm the nets, mutilating and

devouring the gilled fishes, thus depriving the fishermen of the fruits of their labor; and they become themselves entangled in the net, which they bite with their sharp teeth and tear in their writhings until it is beyond repair. They drive away or destroy the great schools of squid, upon which the fishermen depend for bait, and they even crowd into lobster pots. The following letter from Capt. B. R. Kelley, of Provincetown, Mass., represents the feelings of the fishermen upon the subject of the horned dogfish:

Your letter of inquiry about dogfish at hand, which I am pleased to answer. I will answer your inquiries in order as you asked them.

First. There is no one in Provincetown who is using the dogfish for any profit.

Second. There is no commercial use being made of the dogfish either for oil, skins, glue, fertilizer, or food.

Third. The dogfish never were so plentiful as they are this year. They came about fifteen days later than last year, making their appearance in large quantities July 14, and were very large in size. July 25 small ones came in large quantities, and they ate our nets up so badly we had to stop fishing for mackerel, and unless some method for destroying the dogfish can be found mackerel will cost the consumer more than 30 cents and cod and haddock more than 12 cents per pound. We have had to take our nets out and dry them and put them away for the season, and now our boats lay in the harbor, practically of no use to us until the dogfish thin out. As for ground fishing, it is impossible to keep a hook on the bottom. Some of our large vessels have lost hundreds of dollars' worth of trawls. I have heard some of our fishermen say that if something is not done to exterminate the dogfish they will have to give up fishing in the south channel, or, in other words, the southeast part of Georges Banks. I will describe to you just how plentiful the dogfish were. Southeast from Nomans Land in June last we dared not put our nets in the water at night unless it looked as if the weather was going to be very fine through the night, because if there came up a blow in the night and we could not get our nets they would fill up with dogfish before morning and we would lose them. I wish you could see some of our nets that were eaten by the dogfish. I know of no fish that can do so much damage in the same time as the dogfish can. There have been not hundreds, but thousands, of dollars' worth of gill nets destroyed by these dogfish. We can not keep any bait in our lobster pots. Some of the lobster fishermen tell me the pots have from one to five dogfish in them some mornings. Our harbor and bay are full of them.

Some of our fishermen in years gone by have been in the habit of catching bass on the back side of Cape Cod by throwing a line from the shore, but the last two years they can not keep a hook in the water two minutes before a dogfish will have the bait. These fish are of the largest kind.

You wanted to know about what time these fish leave our coast. Probably that varies, as they do coming on the coast. Last year the body of the fish left the last of November. Our fishermen were doing a good business catching mackerel in our bay, but there have not been any seen since the appearance of the dogfish from Cape Cod to Eastport, Me., and our fishermen have come to the conclusion, whether their idea is right or wrong, that the dogfish have eaten up all of the live bait that the mackerel feed on. Now, Mr. Field, if something is not done to exterminate the dogfish the consumers will have to pay more than

25 cents for a mackerel and more than 10 or 12 cents for a pound of cod or haddock.

If Massachusetts would pay as much to exterminate these dogfish as they do to exterminate the brown-tail moth, I think the money would be spent for a much better purpose. I think I have not exaggerated one word in this letter in regard to the damage this fish is doing to the community. I think there is no pencil can give him his due. He is not even fit to make guano of.

The facts show that the horned dogfish is not hated without due cause. Not only does it devour and drive away valuable food fishes and bait, but it robs and injures or destroys the nets, seines, trawls, and other fishing gear to such an extent that the fishermen all along the coast from Cape Cod to Newfoundland are crying for means to rid them of this "pest." Canada has decided upon a plan of action, and measures are under consideration elsewhere. These will be discussed in a later chapter of this report.

THE SUMMER SKATE.

CHARACTERS OF THE FISH.

The summer skate (*Raja erinacea*) has a broad, flat body, rhomboidal in outline, from which extends a rather long tail. The upper parts are variously armed with sharp spines. The color is a light brown above, with small round spots of dark brown; the under parts are white. The mouth, with its much-curved jaws, is small and ventral in position. The teeth are small, and all are blunt in the females, though in the males the middle ones are sharp. They are adapted, as in the smooth dogfish, for crushing rather than for seizing and holding prey. The nostrils open on the ventral side of the head in front of the mouth, with the corners of which they are connected by a groove. Five pairs of gill slits are visible behind the mouth. Two apertures, the spiracles, open dorsally, one behind each eye. The broad flaps on the sides of the body constitute the pectoral fins. The posterior or pelvic pair of fins lie ventrally on either side of the cloacal opening. In the males the inner sides of these fins are modified into stiff rods, called claspers, which together serve as an organ of copulation. In length the summer skate measures from 1 to 2 feet, the females being larger than the males. This fish, because of its flat body, ventral mouth, spiracles through which water may be inspired from above, dorsally placed eyes, and the whole upper surface pebbly in appearance, is admirably adapted to live on the bottom of the ocean. It is abundant on the Atlantic coast from Maine to Virginia, and is known to the fishermen by the names "bonnet" and "tobacco box."

REPRODUCTION.

Reproduction in the skate is accomplished by means of eggs deposited singly, each inclosed within a thin, tough, horny case, which may be described as pillow-shaped, with a long tapering tube projecting from each of the four angles. The empty cases are often found cast up along the shore and are popularly known as "mermaid's purses." Fertilization is internal, as in the dogfish. As soon as an egg is impregnated it becomes surrounded by a layer of gelatinous albumen and inclosed in the chitinous shell, which is secreted by a shell gland. The egg is then laid by the mother in some favorable place, and within the shell envelope the young skate develops, well protected. When fully formed, it escapes by rupturing the case. In spring, summer, and fall a single female skate may deposit a great number of eggs, the production being continued during this period.

USES.

On our Atlantic coast it may be said that skates in general are little used as food. In other parts of the globe, however, they have no little recognition. To quote Yarrell (1836):

> The skate as food are held in very different degrees of estimation in different places. In London particularly large quantities are consumed, and the flesh is considered delicate and well flavored; but on some parts of the coast, though caught in considerable numbers both by lines and nets, the flesh is seldom devoted to any purpose beyond that of baiting pots for catching crabs and lobsters.
>
> Skate are in best condition for the table during autumn and winter. In spring and early part of summer they are usually maturing eggs or young, and their flesh is then soft and woolly.

Gunther (1880) says of the skates that "all are eatable, and some of them are brought to market."

Four years later Goode wrote:

> They are all troublesome to the fisherman, clogging his lines and pound nets; but none of them are of the slightest economical value, except the so-called "barn-door skate" (*Raia lævis*), which is occasionally salted for use by the fishermen of Portsmouth, N. H., and which has in the last two or three years attracted some notice in New York. Miss Corson, in her cooking school, has called attention to its excellent qualities as a food fish, and skates may be found on the bill of fare at certain restaurants * * * Only the "wings" or the fleshy flaps to the pectoral fins are used.

The most recent mention of skates as food is by Jordan (1905), who says:

> Most of the species belong to the typical genus *Raja*, and these are especially numerous on the coast of all northern regions, where they are largely used as food. The flesh, although rather coarse and not well flavored, can be improved by hot butter, and as "raie au beurre noir" is appreciated by the epicure.

In San Francisco the French and Italians are said to buy skates, which they relish as a food. The trade, however, is very small.

At Chilmark, Marthas Vineyard, during these observations, the only purpose for which skates were seen to be used by the fishermen was as bait for lobster and eel pots. Skates have, however, been used as fertilizer. Goode (1887) reports having seen them at factories put in the boilers with certain other fishes. An article in the Yarmouth Register for June, 1870, states that Mr. Wilson Reyder, of Barnstable, used many cartloads of skates for manure; and that Enoch F. Reyder found it remunerative to boil them down and convert them into guano, after oil had been extracted from the livers. Skates are not utilized extensively in this country, however. Moreover, little seems to be known about their general habits and economic relations.

FOOD.

A general account in the Standard Natural History, vol. III, states the food of the skate to be shellfish, crabs, flounders, and other bottom frequenting forms. To capture the prey "the ray swims rapidly over a fish, and then settles down upon it, holding it from escape with its broad body; then by suitable muscles, the jaws are protruded beyond the rest of the surface and the object is taken in."

The best food record of the species is contributed by Linton (1901), and reads thus:

> Usually crustacea and annelids, but bivalve mollusks, squid, and fish are also frequently found in the stomach. In the summer of 1899 thirty-two skates were examined and the following food material noted: Crabs (hermit, *Cancer*, *Callinectes*, *Panopeus*, and others), shrimps, amphipods, annelids, squid, bivalve mollusks, small fish.

EXAMINATION OF DIGESTIVE TRACTS.

My own results, obtained from the examination of the alimentary tracts of 516 summer skates, and briefly shown in the accompanying table, are thoroughly in accord with the foregoing statements. More than 29 per cent of the 516 skates contained crabs (*Cancer*, *Ovalipes*, *Panopeus*, and *Pagurus*), most of which were the common rock crab (*Cancer irroratus*). The shrimp (*Crago septemspinosus*) is also devoured in great numbers, nearly 15 per cent of the skates containing it in larger or smaller quantities; and a few specimens contained amphipods in considerable numbers, making the total number of skates which had eaten crustacea very large.

STATEMENT OF THE FOOD OF THE SKATES EXAMINED.

NOTE.—Figures outside of parenthesis denote number of skates; numbers or amounts of given species eaten are included within parenthesis.

Date.	Locality.	Specimens examined.	Number of stomachs containing—									
			Crabs.	Shrimps.	Small fishes.	Squids.	Nereis.	Razor clams.	Amphipods.	Nothing.	Matter undetermined.	Miscellaneous food.
1905.												
July 7	Buzzards Bay	2	2 (4)	.....	2 (2)	.....	.....	.....	.....	.....	.....	Little eel grass.
8	.....do.....	2	1 (4)	1 (2)	1 (1)	.....	.....	1 (3)	.....	.....	.....	1 pebble.
17	Menemsha Bight.	26	8 (much)	.....	1 (little)	.....	2 (2)	3 (mod.)	.....	4	9	Knot of eel grass; 1 pebble.
18	.....do.....	31	11 (much)	1 (1)	9 (much)	.....	2 (2)	.....	.....	5	4	Fragments of lobster.
19	.....do.....	20	4 (4)	6 (12)	3 (little)	2 (much)	.....	1 (little)	.....	2	5	
22	.....do.....	30	8 (much)	5 (6)	6 (much)	3 (mod.)	2 (2)	.....	.....	6	7	
27	.....do.....	6	1 (2)	2 (3)	.....	.....	2 (2)	.....	2 (73)	3	.....	
28	.....do.....	8	6 (9)	1 (2)	.....	.....	1 (1)	.....	3 (43)	1	.....	
31	.....do.....	24	8 (8)	3 (10–)	2 (much)	.....	2 (2)	4 (4)	.....	7	.....	Do.
Aug. 3	.....do.....	14	5 (8)	3 (10–)	1 (little)	.....	1 (1)	2 (2)	1 (1)	4	1	
8	.....do.....	55	14 (18)	4 (5)	16 (73)	1 (1)	1 (1)	4 (mod.)	.....	21	3	
9	.....do.....	26	7 (9)	6 (14)	2 (little)	1 (1)	2 (2)	.....	.....	13	1	
10	.....do.....	2	1 (2)	.....	.....	.....	.....	.....	.....	1	.....	
11	.....do.....	56	17 (24)	2 (2)	4 (much)	.....	.....	2 (2)	2 (much)	32	2	
12	.....do.....	4	1 (1)	.....	.....	.....	.....	.....	.....	3	.....	
17	.....do.....	14	2 (3)	.....	.....	.....	3 (4)	.....	2 (8)	2	8	
18	.....do.....	50	7 (7)	3 (much)	1 (1)	3 (3–)	1 (1)	.....	1 (1)	11	22	Little alga.
19	.....do.....	10	2 (4)	2 (3)	.....	2 (2)	2 (2)	.....	2 (much)	2	3	
21	.....do.....	57	15 (33)	14 (25)	17 (much)	12 (14)	6 (6)	1 (1)	2 (much)	1	12	Do.
22	.....do.....	24	8 (19)	9 (34)	1 (little)	2 (2)	1 (1)	1 (1)	.....	6	6	
23	.....do.....	34	15 (34)	9 (25)	1 (little)	5 (little)	2 (3)	.....	3 (11)	5	8	
24	.....do.....	21	11 (19)	5 (14)	1 (1)	2 (little)	2 (2)	.....	.....	4	3	Do.
	Total[a]	516	154 (212+)	76 (168+)	68 (78+)	33 (23+)	32 (34)	19 (13+)	18 (137+)	133	95	
	Per cent	.....	29.06+	14.72+	13.17+	6.39+	6.20+	3.68	3.48	25.93	18.41	

[a] See note on page 12.

Small fishes (*Ammodytes*, *Pomolobus*, *Paralichthys*), but for the most part the sand eel (*Ammodytes americanus*), had been consumed by some in large numbers, and no doubt form a considerable part of the skate's food supply. Many of the small fishes it was impossible to identify on account of the advanced stage of digestion.

It was surprising to find squid (*Loligo pealii*), which is a very active swimmer, in as many as 6 per cent of these sluggish fishes. This was doubtless due to the fact that the skates were taken from the traps, which swarmed with squids to such a degree that it was an easy matter to seize one in such close quarters. Under natural conditions it is most likely that squids are rarely taken.

The sea worm (*Nereis*) appears as a factor in the skate's diet. Over 6 per cent of the specimens examined contained annelids of this genus, which must have been eaten before the fish entered the traps. The razor clam (*Ensatella americana*) was found in over 3 per cent of the number. Other mollusks are probably eaten, although, strange to say, none were found in the above 516 specimens. As many as 26 per cent had empty stomachs, and over 18 per cent contained matter so far digested that it was impossible to determine its nature. Knots of eel grass and algæ were sometimes found, probably consumed accidentally with other food. The stomachs of two skates contained each a good-sized pebble, which no doubt was also swallowed with food. In one stomach was found a small portion of a lobster.

ESTIMATE OF DESTRUCTIVENESS.

Judging from the above data, the summer skate is a harmless species, whose food is confined to the smaller crustacea (crabs, shrimps, and sand fleas), small fishes, sea worms, and small mollusks, The food is, as might have been expected, similar to that of the smooth dogfish (*Mustelus canis*); but on account of its small size the summer skate is not able to commit the same depredations upon the lobster. Doubtless the larger species, like the barn-door skate (*Raja lævis*) and the big skate (*Raja ocellata*), eat lobsters to a great extent. Indeed, fishermen have told me that they have found lobsters in the stomachs of barn-door skates, and there is little doubt that a systematic study of the food of these skates would confirm the statement.

THE COMMON KILLIFISH.

GENERAL APPEARANCE AND DISTRIBUTION.

The common killifish (*Fundulus heteroclitus*) is a small shore fish varying from 3 to 6 inches in length, with a short, deep, thick-set body and a blunt head, flattened from above. The males are of a

greenish color on the back and sides and orange-yellow below, with numerous spots of white or yellow scattered over the body. Jordan and Evermann give the distribution, "Coast of Maine to the Rio Grande, everywhere very common in brackish waters, often burying itself in the mud in shallow lagoons."

FOOD.

Upon this subject Linton (1899) says:

The following fish from Waquoit Bay were examined in 1899: August 7, twenty-six, alimentary canals filled with green mud, consisting of a variety of vegetable débris, enormous numbers of diatoms and foraminifers in considerable number. August 28, twenty-two, alimentary canals filled with vegetable material (eel grass, etc.). A specimen from Katama Bay, August 28, 1900, had a shrimp and other small crustaceans in the alimentary tract.

EXAMINATION OF DIGESTIVE TRACTS.

The tabulated statement made up from my examination of 134 specimens shows that the killifish consumes an enormous number of diatoms. In many cases the whole alimentary canal was packed full of these organisms, mostly of the genus *Pleurosigma*. Small crustaceans like prawns and sand fleas constitute the principal food of this fish, however. The number it consumes amounts to millions each year. The algæ noted in the stomachs were of the red, brown, and green kinds, and were probably taken in with the small crustaceans which were living upon them, the latter being the food sought by the fish. In these observations the common killifish was not found to prey on any living forms of direct value to man.

Statement of the Food of the Killifish Examined.

Note.—Figure outside parenthesis denotes number of killifish; number or amount of species eaten is included within parenthesis.

Date.	Locality.	Specimens examined.	Number of stomachs containing—												
			Diatoms.	Small crustacea.	Algæ.	Prawns.	Amphipods.	Molgula.	Nereis.	Eel grass.	Fish, species undetermined.	Snails.	Lady crabs.	Soft-shelled clams.	Matter undetermined.
1902.															
July 24	Great Harbor	28	1 (much)	13(much)	3(much)	4 (9)	1 (little)	.....	.....	2 (little)	.....	.....	1 (mod.)	.....	2(much)[a]
28	do	20	.....	14(much)	1(much)	3 (8)	1 (much)	.....	2 (2)	.....	.....	.....	.....	.....	.....
Aug. 7	do	2	1 (much)	1(much)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1 (much)
11	do	17	4(v.much)	.....	7(much)	2(much)	7 (much)	.....	.....	2 (little)	.....	.....	1 (little)	.....	.....
13	Katama Bay	8	.....	2(much)	2 (mod.)	3(much)	.....	.....	3 (4)	.....	4 (mod.)	.....	.....	.....	.....
18	Great Pond	30	26(v.much)	3(much)	24(much)	.....	1 (little)	2 (5)	1 (1)	2 (little)	2 (mod.)	5 (23)	.....	2 (few y'g)	(b)
1903.															
July 3	do	24	16(v.much)	2 (little)	.....	2 (4)	3 (much)	7 (101)	1 (1)	2 (little)	.....	.....	.....	.....	7 (much)
19	Eel Pond	5	1 (little)	5(much)	2(much)	.....	1 (little)	.....	1 (1)	.....	.....	.....	.....	.....	.....
	Total	134	49	40	39	14 (21)+	14	9 (106)	8 (9)	8	6	5 (23)	2	2	10
	Per cent	.....	36.57	29.85	29.1	10.44	10.44	6.71	5.97	5.97	5.97	3.73	1.49	1.49	7.46

[a] These stomachs also contained *Solenomya velum*.

[b] These stomachs also contained many crustacean eggs.

THE CUNNER.

CHARACTERS AND DISTRIBUTION.

The cunner, or chogset, is a small fish varying from 8 to 12 inches in length, with a rather stout body and moderately pointed head. Upon the upper jaw there are five conspicuous canine teeth, and about four on the lower jaw. The color is a brownish-blue shaded with yellowish-brown above and brassy on the sides. There is, however, considerable individual variation in the coloration. The distribution of the species, according to Jordan and Evermann, is "Atlantic coast from Labrador to Sandy Hook." Within this range it abounds about rocks, wharves, and bridges, where large numbers are caught by hook and line or by nets. There are numerous popular names applied to this fish. It is called "cunner" in Maine and Massachusetts. "Chogset" is a name of Indian origin. In New York it is called "burgall," at Provincetown it is "sea-perch," and at Salem "nipper."

USES.

In former years the cunner fried was much esteemed as a fish for the table. Storer tells of immense quantities being brought to market between the middle of June and late October. At Boston, in order to have them alive for market, they were kept in cars with latticed sides, and these cars, 3 feet deep and 12 or 15 feet long, were anchored in deep water where the tide constantly flowed through them, providing a fresh supply of water for the fishes. As many as 5,000 fish were sometimes kept in a single car, and the daily market supply was taken from these, the cars being replenished every week or two, according to the demand. Goode, in 1888, said that the cunner was used as an article of food from Eastport, Me., to Boston, but elsewhere was rarely eaten and often regarded with disgust. He estimated the catch of the Irish market boats for Boston at 300,000 pounds and that of the other towns and states on the New England coast at from 200,000 to 250,000 pounds. For the past ten years the demand for this fish has steadily decreased, and now very few are marketed. The live cars at Boston are no longer known, and what few fish are sold are purchased by the poorer class of people. The price is 10 or 15 cents a dozen.

FOOD.

The food of the cunner includes a wide range of species—in fact, almost anything. Goode (1888) says:

> Their food is very similar to that of the tautog, except that they can not swallow very large shells. They feed also upon dead animal matter and are among the most important scavengers of our harbors.

Linton (1899) describes the cunner's food as "seaweed, hydroid stems, bryozoa, tunicates, annelids, small crustaceans (*Caprella*, shrimps, etc.), univalve mollusks found in the stomach and intestine—in short, just such food as the fish would get by browsing on the material which grows on wharf piles and similar places."

EXAMINATION OF DIGESTIVE TRACTS.

During the summers of 1902 and 1903 the digestive tracts of 306 cunners were examined, with the results shown in the accompanying table:

Statement of the Food of the Cunners Examined.

Note.—Figure outside of parenthesis denotes number of cunners; number or amount of species eaten is included within parenthesis.

Date.	Locality.	Specimens examined.	Number of stomachs containing—										
			Sand fleas.	Eelgrass.	Snails.	Small mollusks.	Prawns.	Small crustaceans.	Fish, species undetermined.	Eelgrass seeds.	Botryllus.	Rock crabs.	Algæ.
1902.													
July 3	Eel Pond	8	2 (much)	2 (little)			2 (5)	4 (much)	3 (little)				
4	do	3						2 (much)	2 (little)				1 (little)
11	do	5	5 (much)	3 (little)			1 (little)		5 (little)				
12	Great Harbor	6	2 (much)	1 (mod.)		5 (much)	4 (4)	1 (few)	3 (little)		15 (much)		
12	Eel Pond	25	13 (much)			4 (little)	1 (2)	3 (much)	6 (little)				
16	do	12	12 (v. much)			1 (little)	1 (2)		1 (little)		3 (much)		
18	Katama Bay	5					3 (7)				1 (little)	3 (12)	
19	Eel Pond	9	2 (little)				3 (3)		1 (little)		4 (much)		5 (much)
24	Great Harbor	6		1 (little)				4 (much)					
25	Hadley Harbor	12	7 (much)	9 (much)	9 (much)		1 (1)	4 (much)	3 (mod.)				2 (little)
Aug. 1	do	26	17 (v. much)	18 (much)	11 (much)	10 (little)	2 (2)		12 (mod.)				
6	Great Harbor	17	16 (v. much)	2 (little)		2 (little)	1 (1)						2 (little)
7	do	18	7 (much)	5 (little)		2 (little)	1 (1)						1 (little)
9	Hadley Harbor	21	10 (much)	13 (much)	5 (much)	13 (much)	4 (much)						3 (little)
13	Katama Bay	12			1 (1)	1 (21)	3 (much)	4 (much)				4 (7)	2 (much)
23	do	32	1 (little)			5 (33)	6 (10)	4 (much)				10 (16)	1 (little)
1903.													
July 10	Hadley Harbor	25	14 (much)	20 (much)	9 (much)	6 (little)	2 (4)	4 (much)		11 (much)			
19	Eel Pond	35	26 (much)	24 (much)	4 (29)	2 (little)	5 (12)	6 (much)		9 (much)	6 (much)		
Aug. 6	Hadley Harbor	23	13 (much)	16 (much)	16 (83)	2 (2)	2 (5)	1 (little)		10 (much)		1 (3)	
26	Eel Pond	16	15 (much)	8 (much)		1 (few)		1 (1)		1 (1)			
	Total[a]	306	162	122	55 (113+)	54 (56+)	42 (59+)	38 (1+)	36	31 (1+)	29	18 (38)	17
	Per cent		52.94	39.86	17.97	17.64	13.72	12.41	11.76	10.13	9.47	5.88	5.45

[a] See note on page 12.

STATEMENT OF THE FOOD OF THE CUNNERS EXAMINED—Continued.

Date.	Locality.	Specimens examined.	Number of stomachs containing—								
			Teleost eggs.	Lady crabs.	Hydroids.	Nereis.	Hermit crabs.	Pipefish.	Matter undetermined.	Nothing.	Miscellaneous food.
1902.											
July 3	Eel Pond	8	1 (few)								
4	do	3							1 (much)		
11	do	5							4 (mod.)		
12	Great Harbor	6							3 (much)		
12	Eel Pond	25								2	
16	do	12				2 (2)					
18	Katama Bay	5		1 (¼)			1 (2)				
19	Eel Pond	9							2 (much)		
24	Great Harbor	6							1 (little)		
25	Hadley Harbor	12	1 (much)	3 (much)					1 (little)		
Aug. 1	do	26	4 (119)	2 (much)			2 (3)		11 (much)		
6	Great Harbor	17				1 (2)		1 (1)		1	1 eel.
7	do	18									
9	Hadley Harbor	21		1 (little)	3 (much)				1 (much)		4 *Solenomya* velum.
13	Katama Bay	12				1 (1)	1 (1)		1 (little)		8 sand-shrimps.
23	do	32	4 (230)				3 (much)	3 (7)	2 (much)		1 (4 *Hyas*). 2 (4 *Panopeus*), 2 (2 *Molgula*).
1903.											
July 10	Hadley Harbor	25	1 (18)		1 (much)	2 (2)			22 (much)		2 silversides.
19	Eel Pond	35	3 (12)	1 (1)		1 (1)			13 (much)	3	2 *Pecten*.
Aug. 6	Hadley Harbor	23		1 (much)	5 (much)	1 (1)		1 (1)	6 (much)		Bryozoa. Weed stalk.
26	Eel Pond	16							4 (much)		10 isopods. 1 stickleback.
	Total[a]	306	14 (379+)	9 (1¼+)	9	8 (9)	7 (6+)	5 (9)	72	6	
	Per cent		4.57	2.94	2.94	2.61	2.14	1.63	23.53	1.96	

[a] See note on page 12.

POSSIBLE DESTRUCTIVENESS.

It will be observed that enormous numbers of small crustaceans, principally sand fleas (Amphipoda) and the prawn (*Palæmonetes*), go to make up the cunner's food supply. Many molluscs are eaten also, the gasteropods (*Bulla* and *Odostomia*) and the pelecypods (*Mytilus*, *Pecten*, *Nucula*, and *Solenomya*) being identified. The column headed "Fish, species undetermined" most likely represents flesh picked from dead bodies of fishes, since it was invariably in pieces, with nothing to indicate that a whole fish had been swallowed. Furthermore, cunners in the Eel Pond and about the Revenue Wharf at Woods Hole were often seen feeding upon dead fish and refuse matter lying on the bottom. This is in support of Dr. Goode's statement that "they are among the most important scavengers of our harbors." Thus the cunner is a useful fish. The column headed "Teleost eggs," however, suggests that the cunner may also do evil. If the alimentary canals of 4 per cent of the cunners contain the eggs of fishes during the months of July and August, when very few fish are spawning, the question arises, how many would be found containing fish spawn in May and June, when many valuable food fishes are spawning? And since the cunner also feeds largely upon sand fleas, prawns, and other small crustaceans, is there not ground for suspicion that many young lobsters fall victims to it? Only a careful study of the cunner's food supply in various localities during May and June will give an adequate answer to these queries. Certainly, during the months of July and August the cunner, as here shown, is not a destructive fish, but rather a useful harbor scavenger.

THE TOADFISH.

GENERAL APPEARANCE, ABUNDANCE, AND HABITS.

The toadfish (*Opsanus tau*) varies from several to 16 inches in length. It has a robust body with a slimy, scaleless surface and a large broad head, bearing a wide, capacious mouth. The general color is a dusky olive, the sides being marked with indistinct blackish bars, and the whole body being sometimes spotted with yellow or whitish. In appearance it somewhat resembles a toad, and this fact gives it its name. It is quite common from Cape Cod to Cuba. On the lower Potomac River, Maryland, Smith (1892) reports it "exceedingly numerous, especially on the oyster beds in shallow water." Shoal water, which is well grown up with eel grass (*Zostera marina*) and where there are plenty of large stones and empty tomato cans, is the ideal place for the toadfish, furnishing it protection and abundance of food. The eggs are laid in some empty tin can or under a rock and guarded by the parent until the young

come forth. The fish is so ugly in appearance that it is rarely eaten. Dr. Smith states, however, that it "is sometimes eaten by the negroes and is said to be well flavored."

FOOD.

Of the food of the toadfish Verrill and Smith (1873) say:

Several specimens examined at Great Egg Harbor, N. J., April, 1871, contained young edible crabs (*Callinectes hastatus*) of various sizes up to those with the carapax 2 inches broad; shrimp (*Crangon vulgaris*); prawn (*Palæmonetes vulgaris*); *Ilyanassa obsoleta*; various fishes, especially the pipefish (*Syngnathus peckianus*), and the anchovy (*Engraulis vittatus*). A specimen caught at Woods Hole in July contained the common rock crab (*Cancer irroratus*).

Linton (1901), in his food notes of this species, records the following:

Littorina littorea, Ilyanassa obsoleta, Tritia trivittata, Urosalpinx cinerea, usually with hermit crabs; *Crepidula fornicata, Pecten irradians, Cancer irroratus, Palæmonetes vulgaris, Eupagurus longicarpus;* bones and other fragments of fish; a partly digested toadfish. I have seen a toadfish in the aquarium in the act of swallowing another of its own species but little smaller than itself. In the alimentary canal of a small specimen two shells of *Utriculus canaliculatus* (*Bulla*) were found.

EXAMINATION OF DIGESTIVE TRACTS.

Great difficulty was experienced in getting in the vicinity of Woods Hole a sufficient number of toadfish for this study. Prior to 1902 the species was considered common in that locality, but since then attempts to collect it have been almost in vain. Only very few have been found in places where they were hitherto very common. Nearly all of the 33 specimens examined in the present work were collected at the mouth of the Wareham River.

STATEMENT OF THE FOOD OF TOADFISH EXAMINED.

NOTE.—Figure outside of parenthesis denotes number of toadfish; number or amount of the species eaten is included within parenthesis.

Date.	Locality.	Specimens examined.	Number of stomachs containing—					
			Hermit crabs.	Rock crabs.	Crepidula.	Fish.	Amphipods.	Miscellaneous.
1905.								
July 2	Wareham ..	5	5 (78)	.....	5 (20)	1 (little)	.....	2 fiddler crabs. A little vegetable matter.
4	Eel pond ...	1	.....	.....	.....	1 (little)	.....	Few small crustaceans. 1 lady crab. 2 pocket crabs.
Aug. 9	Hadley Harbor.	1	1 (3)	.....	.....	.....	.....	
16	Wareham ..	4	... .	3 (9)	.....	.....	4 (29)	1 *Gebia.* 1 *Callianassa.* 3 prawns.
1903.								
July 6	Wareham ..	9	6 (29)	5 (11)	2 (6)	3 (mod.)	.....	1 common killifish. 3 pebbles.
10	Hadley Harbor.	1	1 (2)	1 (2)	.....	.....	.....	5 teleost eggs.
24	Wareham ..	12	9 (71)	10 (23)	2 (2)	.....	.....	1 (7 snails).
	Total.....	33	22 (183)	19 (45)	9 (28)	5	4 (29)	
	Per cent	.....	66.6	57.5	27.2	15.1	12.1	

ESTIMATE OF DESTRUCTIVENESS.

With such a small number of specimens as a basis, it is hardly possible to estimate the economic importance of the toadfish so far as its food is concerned. The table indicates, however, that it feeds largely upon the hermit crab (*Eupagurus longicarpus*), which usually inhabits the shell of the snail (*Littorina littorea*), so common along our shores, and which it is impossible for the toadfish to separate from the shell. As many as 15 or 20 of these snail shells containing hermit crabs have been recorded from the alimentary canal of a single toadfish, and the shells were found throughout the whole length of the intestinal tract, which makes it clear that they are eliminated by way of the anus and not regurgitated, as popularly supposed. Other crustaceans, as the rock crab (*Cancer irroratus*), pocket crab (*Panopeus depressus*), lady crab (*Ovalipes ocellatus*), prawn (*Palæmonetes vulgaris*), and *Gebia*, enter largely into the food supply of the toadfish. Small molluscs, like *Crepidula* and other gasteropods, are also eaten. Small fishes are preyed upon to some extent, and probably more so than is indicated in the table. Such species as the common killifish, cunner, and silversides are most apt to be the victims, since they frequent the places natural to the toadfish. The fact that five teleost eggs were found in a Hadley Harbor specimen suggests that the toadfish may be destructive to the eggs of fishes spawn in shoal places and in ponds connected with the sea.

The statements of Verrill and Smith (1873) and of Linton (1899) regarding the food of the toadfish compare very closely with the results here found. The diet of the toadfish consists almost entirely of crustaceans, small molluscs, and small fishes. The destruction of hermit crabs, which are valuable scavengers, and fish spawn is the principal damage done. The number of toad fish in the Woods Hole region, however, is so small that the harm done by them in that locality can not be of any serious consequence.

THE GOOSEFISH, OR ANGLER.

PECULIAR APPEARANCE AND LOCAL NAMES.

The goosefish (*Lophius piscatorius*) is well known to Atlantic coast fishermen by its singularly ugly appearance. The body is flat dorsoventrally and very broad across the head, from which it tapers abruptly back to a short tail. The mouth is very wide, is surrounded with a fringe of barbels, and has an enormous capacity. Each jaw is set with a double row of teeth, which are directed backward. The dorsal fin, of six spines, has the first of these located on the snout just behind the upper jaw and bears on the tip a flaglike membrane. In color the goosefish is a mottled brown on the upper parts, with the

under portions white. The average length of the adult is about 3 feet. The singular appearance and habits of the goosefish have gained it numerous appellations. In Massachusetts the fishermen know it by the names "goosefish," "angler," or "fishing frog." In Maine it is the "monkfish," in Rhode Island the "bellows-fish," in eastern Connecticut the "molligut," and in South Carolina "all-mouth." The early colonial writers refer to it as the "greedigut." It is also known as the "wide-gap," "kettle-maw," and "sea devil."

The goosefish is fairly common on both the east and west shores of the Atlantic. On the west coast it ranges from Newfoundland to Cape Hatteras, and on the east coast from the Shetland Islands to the Mediterranean Sea. It is most abundant in the northern waters.

REPRODUCTION.

The spawning season begins about the middle of summer. During July and August, 1905, at Menemsha Bight, great quantities of the spawn were seen in and about the fish traps. Each batch was contained in a great floating, jelly-like mass 20 or 30 feet long and 4 or 5 feet wide, which contained many thousands of eggs. The larval fish develops from the egg very rapidly, and, according to Cunningham (1896), when hatched is much more advanced in development than are the young of most fishes with separate floating eggs.

USES.

Very little commercial use has ever been made of the goosefish. It is rarely eaten by man, although the flesh is said to be palatable and used in Italy and in certain parts of Great Britain. It is sometimes used for baiting lobster pots when other kinds of bait are not available, and it has also been used with menhaden for guano.

FOOD.

The food and feeding habits of this enormously voracious fish form a subject of considerable general interest. Its reputed manner of capturing prey is very curious. Lying concealed in weed on the bottom, it is said to hold erect its first dorsal spine, which is tipped with the flag-like membrane. The "flag" serves as a lure to attract hungry and unwary fishes, which come and nibble at the tender-looking morsel; but as soon as the "flag" is touched a cavern is opened and the innocent fishes are engulfed between the jaws of the goosefish.

Several observers have written briefly concerning the food of the goosefish, and from a few of these I will quote.

Verrill and Smith, 1873:

A specimen caught in Vineyard Sound in June contained crabs, *Cancer irroratus*, and squids, *Loligo pealii*.

Goode, 1884:

They feed upon other fish—often on large ones, their swallowing powers being practically unlimited. Mackerel, sculpins, sea ravens, dogfish, crabs, squids, and lobsters have been found in their stomachs by observers of the United States Fish Commission. They often attempt to feed on each other. The common name refers to the fact that they have been known to swallow live geese. A fisherman told me he once saw a struggle in the water and found that a goosefish had swallowed the head and neck of a large loon, which had pulled it to the surface and was trying to escape. There is authentic record of seven wild ducks having been taken from the stomach of one of them. Slyly approaching from below, they seize birds as they float upon the surface. They annoy the fishermen by swallowing the wooden buoys attached to the lobster pots. Mr. Minot, of Magnolia, Mass., caught one by using his boat anchor for a hook.

Linton, 1901:

August 30, 1887, a specimen taken south of Cuttyhunk had in its stomach a large quantity of mud which was rich in mollusks, annelids, and small crustaceans.

August 5, 1899, a small specimen had in stomach a winter flounder almost as large as the goosefish.

August 18, 1899, alimentary canal with fragments of fish.

EXAMINATION OF DIGESTIVE TRACTS.

The following table classifies the food of 46 goosefish which were collected from the fish traps at Menemsha Bight, Marthas Vineyard. From this table it will be seen that squid (*Loligo pealii*) and skates (*Raja erinacea*) constitute the chief food of the goosefish, each of these species being found in 17.39 per cent of the total number examined. Flounders (*Paralichthys dentatus*, *Lophopsetta maculata*, *Pseudopleuronectes americanus*) are eaten in large numbers, and it should be added that the specimens removed from the stomachs were all large, averaging a foot or more in length. Lady crabs (*Ovalipes ocellatus*) were present in 8 per cent of the goosefish, and undoubtedly constitute an important item in their diet. Sand eels (*Ammodytes americanus*) and squeteague (*Cynoscion regalis*) were each found on two occasions. There was also a sea robin (*Prionotus carolinus*), a butterfish (*Poronotus triacanthus*) and an eel (*Anguilla chrysypa*), besides such miscellaneous material as eel grass, two skate eggs, pieces of starfish, and a sand dollar.

STATEMENT OF THE FOOD OF THE GOOSEFISH EXAMINED.

NOTE.—Figure outside of parenthesis denotes number of goosefish; number or amount of the species eaten is inclosed within parenthesis.

Date.	Locality.	Specimens examined.	Number of stomachs containing—						
			Squids.	Skates.	Flounders.	Lady crabs.	Sand eels.	Squeteagues.	Nothing.
1905.									
July 17	Menemsha Bight[a]	9	3(9)	3(3)	4(6)	.....	.....	1(1)	2
18	do	2	.....	.....	.....	.....	.....	.....	2
19	do	1	.....	.....	.....	.....	.....	.....	1
20	do	2	.....	.....	.....	.....	.....	.....	2
21	do.[b]	8	3(5)	[c]1	.....	.....	.....	.....	4
22	do	2	.....	.....	.....	.....	2(5)	1(1)	.....
25	do	3	.....	1(1)	.....	.....	.....	.....	2
26	do	2	.....	1(1)	.....	.....	.....	.....	1
27	do.[d]	2	1(1)	.....	.....	.....	.....	.....	.....
Aug. 23	do	2	.....	.....	.....	.....	.....	.....	2
1906.									
July 14	do.[e]	10	.....	1(1)	2(2)	4(9)	.....	.....	4
Aug. 29	do.[f]	3	1(1)	1(1)	1(1)	.....	.....	.....	.....
	Total	46	8(16)	8(7+)	7(9)	4(9)	2(5)	2(2)	20
	Per cent	.....	17.39	17.39	15.21	8.69	4.34	4.34	43.48

[a] 1 sea robbin.
[b] Knot of eel grass; 2 skate eggs.
[c] Fragment.
[d] 1 butterfish.
[e] 1 eel, 21 inches long; pieces of starfish.
[f] Few fish bones; 1 sand dollar.

ESTIMATE OF DESTRUCTIVENESS.

A summary of the literature dealing with the food of the goosefish will show how wide a range of the animal kingdom is utilized. The list of species eaten includes annelid worms, echinoderms (starfish, sand dollars), squids, and other molluscs, crustaceans (lobster, rock crab, lady crab), fishes (dogfish, skates, eels, sand launce, mackerel, butterfish, squeteague, sculpins, sea raven, flounders), and water fowls (loons, ducks, geese). The great variety, however, is not the only factor of the food of the goosefish to be considered; quantity is of even greater importance. One look at the enormous mouth and capacious stomach, which together constitute about one-half of the fish, is sufficient to convince one that the amount of food consumed at one time is enormous. A single meal will sometimes approximate about one-half the weight of the goosefish. It is no wonder that the early colonial writers applied the name greedigut. The reason for such an appetite remains a puzzle, however. If all the nourishment in such meals is assimilated, where and how is the energy used? Apparently not entirely for tissue building or in active locomotion.

Data concerning the food and economic relations of the goosefish are still incomplete, but it is clear that it is a voracious consumer of certain useful food fishes, particularly the flounder. So long as the numbers do not increase greatly beyond the present abundance, however, the injury done to the fisheries by the goosefish will remain unappreciable.

METHODS OF CONTROLLING DESTRUCTIVENESS OF DOGFISH.

The study of the food of the eight fishes just considered shows that the smooth dogfish (*Mustelus canis*), the sandshark (*Carcharias littoralis*), and the horned dogfish (*Squalus acanthias*) are very destructive to our fishing industries. The two dogfishes are by far the most harmful. The smooth dogfish, as has been shown, destroys lobsters by the hundred thousand, and the horned dogfish destroys mackerel, herring, etc., by the millions, besides injuring nets, trawls, and other fishing gear to the extent of thousands of dollars' worth each year. Fishermen all along our coast are seeking means to be rid of these pests. It is quite evident that the time has come to consider carefully this serious condition and to provide some means of controlling the devastation.

INADEQUATE SUGGESTIONS.

Prince (1904) considers the reduction of the numbers of dogfish to be no easy matter and their total extermination practically impossible. He lists the suggestions offered to the Canadian government for reducing the numbers of horned dogfish as follows:

(1) Liberate alive some hundreds of dogfish, having securely fastened outside their bodies (by means of hooks, wires, etc.) glittering and gaudy streamers or jingling chains or bells, calculated to terrify and frighten away the schools of dogfish, on the old principle of setting at liberty a rat with a bell hung to its neck.

(2) Inoculate a number of dogfish with some fatal or contagious disease, thus securing the infection and death of all the schools of dogfish which may hover near, on the principle adopted in reducing the pest of rabbits in Australia some years ago.

(3) Dynamite the great schools of dogfish when they appear.

(4) Employ government cruisers and their men in capturing these pests or let the government employ special vessels for the purpose until the plague is reduced.

(5) Pay a bounty of 1 cent for every 5 tails ($2 per 1,000) * * *.

(6) Pay a bounty on basis of the weight of the dogfish captured, say, so much per 100 pounds * * *. Thus the suggested rates range from 10 to 15 cents per 100 pounds to 25 cents per 100 pounds.

(7) Pay a bounty on the total yield of oil, a fixed rate on each gallon of oil produced by a factory being guaranteed to a firm or company carrying on reduction works.

(8) Use of long seines of strong cord, 1,000 yards or more in length, under departmental direction, and surround the schools as is done with the schools of sharks in India.

Most of the above methods are inadequate for solution of the problem. Dr. Prince pointed out that the first three in the list would as likely prove harmful to valuable fishes as to the pest. Methods 4, 5, 6, and 8 would involve unnecessary expense. There is a natural tendency to jump at the conclusion that a bounty is the only way to

settle a matter of this kind. A fair bounty, to be sure, would stimulate the fishermen in their efforts to catch the dogfish. But if one will stop to consider that the number of dogfish just off the eastern American shores probably runs up into the hundreds of millions, perhaps billions, he can realize how great would be the expense involved in this method for simply reducing the number by 5 per cent. A bounty placed on the dogfish would prove to be more expensive, more useless, and more absurd than a bounty placed on the English sparrow. The most sensible and practical suggestion given above is no. 7. This method makes the dogfish to some degree pay the expense of bringing about its own destruction. But why not make the dogfish pay the whole bill, besides yielding a comfortable income to those who engage in the fishery? A consideration of the useful products which may be obtained from the dogfishes will help to show that this is possible.

POSSIBLE USES OF DOGFISHES.

Goode (1884) says that the smooth dogfish constitutes an important bait in the local fisheries of Bermuda. According to Cunningham (1896), the horned dogfish is salted down for bait by the English fishermen in some localities. It has also been dried and used for fuel on some parts of Cape Cod.

SKIN.

The skin of the dogfish is in itself a useful product. It is durable, nonporous, and covered with numerous small, pointed denticles closely set together. The denticles are spinelike in form and similar in structure to mammalian teeth, consisting of an inner portion of dentine covered by an outer layer of enamel. Each is inserted firmly into a plate of osseus tissue which lies within the skin. In other sharks the denticles are larger and much less numerous. This durable material has been used in numerous ways. Turners, cabinetmakers, and carpenters of Europe have used it for scraping and smoothing their work before polishing. Metal workers and others have used it to advantage for polishing purposes. Fishermen have long used it for polishing their metallic mackerel jigs and the woodwork on shipboard. In the East it is used for polishing ivory. In France the skin, when prepared with the placoid scales in place and dyed, usually green, is used for covering cardcases, jewel boxes, sword sheaths, desk ornaments, etc., and may also be used to advantage as a covering for the handles of such articles as swords and tennis rackets, on which it is desirable to get a firm grip. This commodity is called "galuchat."

When prepared for polishing purposes, the shark or dogfish skins are merely dried after being thoroughly cleaned of all adhering

flesh, but when prepared for leather or ornamental purposes they are tanned, generally by an alum process. The ordinary method is to soak the skins in fresh water four or five days, then in a lime-water for from two to six days, then wash them free of lime and soak them in a mixture of bran and water. They are next thoroughly fleshed and put in an alum-salt solution for two or three days, after which they are dried and are then ready for use.

LIVER.

The liver, because of its rich supply of oil, has heretofore contributed the most valuable product from the dogfish. In recent years, however, petroleum products have so largely displaced the fish oils that now the business of extracting dogfish oil has become unprofitable in many localities where formerly it was an important enterprise. Stevenson (1903) states that the livers of dogfish sell in Boston and Gloucester for 25 or 30 cents per bucket of 2½ gallons. During August, September, and October a bucket of livers will yield 6 quarts of oil. At other seasons the yield is less. Stevenson further says that large quantities of dogfish oil are sold in Oregon, Washington, and British Columbia, owing to the high prices of other oils on the Pacific coast, and much of this oil is exported. In 1876 Victoria exported about 60,000 gallons, at 40 cents per gallon. The annual product at present is said to exceed 200,000 gallons. On the New England coast the annual product probably does not exceed 10,000 gallons, and most of this is combined with cod oil, which is sold for currying purposes.

Dogfish oil has been used for lubricating and lighting purposes. It burns with a bright flame and does not carbonize the wick. It is also used in tanneries and in steel tempering. It makes a valuable body for paints which are to be applied to out-of-door objects in exposed places. In some localities it is used in the preparation of wool for weaving. It has also been refined for medicinal uses and is claimed by some to be as good as cod-liver oil—in fact, much of the cod-liver oil sold on the market heretofore has been adulterated with dogfish oil. The constituents of the latter are about the same as those of cod oil, except in the quantity of iodine. When perfectly clean, from fresh livers, and the oil properly refined, there seems to be no reason for assuming that the dogfish-liver oil for use as a medicine is inferior to the cod.

SKELETON AND FINS.

The skeleton and fins of the dogfish are cartilaginous and rich in glue, which may be of some value. It is reported that Canada has planned to reduce the dogfish plague by operating three reduction plants, erected at a cost of $9,000 each, to convert the fish into fer-

tilizer and glue, the government to buy all the dogfish that the fishermen will bring in. An official of one of the largest glue manufactories says that all attempts to make glue from dogfish have proved failures, and he does not think that a marketable quality of glue can be obtained from that kind of fish. But simple boiling of the cartilaginous parts for a short time will extract a considerable quantity of glue which is about as good as ordinary mucilage, or perhaps even stronger as an adhesive. It remains to be seen whether the Canadian government can make a marketable quality. If the experiment is successful a new value will be created for the dogfish.

FLESH.

The flesh is perhaps the most valuable part of the dogfish, though few people have come to appreciate it. The offensive name, prejudice toward sharks in general as voracious man-eaters, and failure to prepare the fish properly for the table have prevented the dogfish from becoming one of our staple food fishes. Tenison-Woods (1882) says that the flesh of sharks as a rule contains more nutriment than any fish flesh. If this statement is correct, the dogfish, which is a shark, and which has a tender, well-flavored flesh, ought to constitute a very valuable food. In Nova Scotia, Ireland, Scotland, and Norway horned dogfish have been dried in considerable quantities as food for cattle. Pigs are said to thrive well upon this food in the winter and even cows show a great liking for it. In many parts of the world dogfish are eaten by man and even highly prized as a food. Simmonds (1879) says that in Norway the horned dogfish is considered a delicacy and is also dried as split stockfish for home consumption and for export to Sweden. Goode (1884) writes that at Folkstone, England, the smooth dogfish is dried and goes by the name of "Folkstone beef." In Bermuda it is known as the "nursefish" and highly esteemed as a food by the negroes. Smitt (1895) says of the horned dogfish:

> The flesh of the picked dogfish (*Squalus acanthias*) is quite white and free from the disagreeable smell with which the larger sharks are tainted. It is said to be fairly palatable, and it is eaten in Bohuslan both fresh, either boiled or fried, and cured, either salted or dried, in the last case usually after lyeing. So, too, in Norway, where, however, it is not much esteemed. In Scotland and in southern Europe the picked dogfish is also frequently used for food. In a dried state it is a marketable commodity.

The eggs of the dogfish are used for making puddings, pancakes, etc., and otherwise as a substitute for fowl's eggs.

Food qualities of smooth dogfish.—Some test of the food qualities of the smooth dogfish was made in July, 1903, during the course of the present investigations. Fried smooth dogfish was sampled by about a dozen members of the scientific staff of the Bureau of Fish-

eries at Woods Hole, Mass., and all acknowledged that the flesh was tender and well flavored. Some said it was like halibut, while others thought it tasted more like swordfish. The fish had been prepared by cutting it up into cross sections about three-quarters of an inch thick, soaking these in salt water for three hours, then washing in fresh water a few moments to remove most of the salt, rolling the pieces in flour and frying them in lard, using as little grease as possible. Two days later, smooth dogfish prepared in the same manner was served under the simple name of "fish" on two tables at the "mess" of the Marine Biological Laboratory. Everyone who ate of it pronounced the fish very palatable, even after learning what kind of fish he had eaten. On several other occasions smooth dogfish, fried, was served to various members of the Fish Commission staff, their wives, and friends, and all testified to its excellence. When cooked thus the flesh is somewhat dry, but very delicate in texture, tender, and sweet. It is also entirely free from bones, which gives an added pleasure to the eating of it. Under a less disagreeable name, the fish would doubtless find a ready market. Mr. E. F. Locke, superintendent of the Fisheries station at Woods Hole, writes that while in Noank, Conn., in October, 1906, he learned of shipments of dogfish and sand sharks from there to New York that fall, and their sale at 15 to 25 cents per fish.

Canning of horned dogfish.—The horned dogfish also is a good food, as is being demonstrated at the present time in Cape Breton, where, by a packer at Petit de Grat, it was first canned for market. A dozen cans of the product, packed by the method employed for salmon, were sent to the writer to be sampled, and when prepared for the table in various ways (fried, scalloped, creamed, etc.) were highly praised for flavor and palatability. The proprietor of a hotel in Nova Scotia gives the following testimonial:

We instructed our chef to prepare the can of dogfish handed me by you in such a way as to suit our star boarders, and, with Pope, I may say, "Hard task to hit the palate of such guests."

Whether a rose by any other name would smell as sweet or not, I can not tell, but masquerading under the nom de plume of "Japanese halibut" they were adjudged fine.

We planked them, and consider they are well adapted for that mode of cooking. In case some would not know how to prepare them in that way, allow me to explain that we secure an oak, birch, or beech plank about 2 inches thick and get the fish made into orders or shares, lay them on the smooth plank without greasing them, as there is oil enough in the fish, and cook them in the oven, first seasoning them. The smoke and acid from the wood combine to make a most palatable dish.

The Inverness News, of Inverness, Cape Breton, under the date November 24, 1904, printed the following article:

CAPE BRETON HALIBUT, ALIAS "DOGFISH."

A representative of the News has been shown a sample of canned dogfish * * * and we must say it compares favorably with any tinned fish we have seen. It is perfectly white in color, and the flavor is excellent. There is no doubt that all that is necessary is to have this fish introduced into foreign markets in order to create such a demand for it as will enable our fishermen to find a ready sale for all the dogfish they can catch. * * * [At a hotel in Port Hood, the chef] a few days ago gave his guests, by request, some * * * prepared dogfish, which figured on his bill of fare under the nom de plume of "Cape Breton halibut." Some of the traveling guests pronounced it first class and differing very little in taste from the halibut they were used to eat. We publish below an extract from the Maritime Merchant, Halifax, of November 4, 1904, on "The dogfish as an article of commerce":

"A few more years may show us that we have been extremely slow in recognizing a good thing in the dogfish, and since he is so plentiful, and we have such incentives to destroy him, an industry may arise in this province because of him that will add to the importance, value, and more successful conduct of our fishing industry. The other day a firm in Halifax had an inquiry for 250 quintals of dried dogfish. 'Never mind what I am going to do with them,' said the inquirer, 'I can sell them at a price.' So dried dogfish may be a staple article in ten years, 'dog oil' may be as important article of commerce as cod oil, and people may even be putting up emulsions of 'dog-liver oils' for coughs and colds. And why not? The dogfish is a cleaner living fish than many of those we are accustomed to eat every day, his meat cooked fresh is said to taste like a nice quality of halibut, and the oil he renders is good enough to deceive experts as to its origin. Wherever our prejudice against the dogfish arose, we unquestionably have it, and it may be hard to shake, but it can be done, and likely will, and then the beast we have cursed with many curses will have equal honor with the cod which has yielded us so much wealth. It may be that the prevailing high price of dried cod will be the beginning of the end of our prejudice, for quite likely the inquiry for dried dogfish has originated with some one who found the prevailing price of cod too high for some export market, and realizing the unmistakable firmness of the situation, saw the advisability of obtaining a substitute if possible. What more natural than to experiment with dogfish, which opens out large and makes up into a nice looking article? Of course, even if it should be accepted in foreign markets (as we have no doubt it would) we could not assume that it would also become popular at home. But it is not necessary that it should. If we can export dried dogfish and thereby increase our trade, what more could we want? Nevertheless we believe that if our fishermen get into the habit of catching and curing it, the idea that it is edible will gradually work into the minds of the more particular people, and in another generation the prejudice against the much maligned 'dog' may vanish entirely. Is it too much, then, to hope that the present day 'scourge' may be a profit-bringing blessing in the future?"

Samples of canned dogfish have been sent to England, France, and Japan, and orders from those countries are confidently expected. An establishment at Charlottetown, Prince Edward Island, has successfully marketed an experimental pack, and a company in Halifax,

Nova Scotia, has gone into the business on a large scale, packing some two or three thousand cases in 1906 as a beginning, with the expectation of putting out as much as 50,000 cases in 1907. Both tall and flat cans are used, the product labeled " Ocean white-fish."

Dogfish are so abundant that they can be sold at a profit by the fishermen for half a cent apiece. They can also be packed at small expense. The prepared article may therefore be sold very cheaply and at the same time yield a fair profit. Stevenson (1899) gives a list and description of most of the methods employed for preserving fishery products for food, some of which might well be applied to the dogfishes. A good, dry, salt fish, meat extract, or fish flour ought to be made from them.

UTILIZATION THE SOLUTION OF THE PROBLEM.

Attempt has been made to show that the dogfishes really yield products valuable to man. If the effort to convey this idea has succeeded, it now remains for some enterprising firms to undertake the business of utilizing these fishes in one or more ways. If the Cape Breton pioneer in the packing of dogfish succeeds in making a good market for his product, a debt of gratitude will be due him by all who are affected by the fishing industries. In the writer's opinion, the only way to be rid of the excessive depredations of these fishes is to have a large and steady demand for them in the market. Mere sporadic attempts, like putting a bounty on the dogfish for a year, or even several years, will prove expensive and will have no lasting effect. Only a continuous destruction of the dogfish will keep down its great numbers below the devastating limit, and such a destruction can not be maintained unless it be made profitable. Consideration of the uses to which the fish may be put serves to show that we may perhaps look here for a practicable solution of this problem.

MEASURES ADOPTED IN CANADA.

The action of the Department of Marine and Fisheries of Canada is the first remedial measure so far in operation against the dogfish. The reduction works already referred to are located at Canso, Nova Scotia, and Shippegan, on Chaleur Bay, New Brunswick. A third plant is said to be contracted for. The works at Canso were visited by the Massachusetts Board of Fish Commissioners, who report thereon as follows:

> October 2 and 3, 1905, we personally inspected at Canso the first of the dogfish reduction works to be put into operation under the auspices of the Department of Marine and Fisheries of Canada.
>
> This establishment began operations about September 15, and was designed to reduce about 10 tons of dogfish or fish offal daily. The machinery used was furnished by the American Process Company, and is of the type generally used in menhaden factories in this country, and with certain modifications in

the whale factories of Newfoundland. At the time of beginning operations Mr. Cox was obliged to make a week's trip among the fishermen to explain the plan and to induce them to bring in the dogfish caught. As soon as shipments began to come from points outside of Canso, e. g., Arichat, Petit de Grat, etc., the Canso fishermen began to save their dogfish. The result was a great surprise to all. It had not been realized how many dogfish had been hooked and thrown overboard again. One of the fishermen had 2 trawls set with 1,500 hooks on each. He tended the first trawl as soon as the second trawl was set, and nearly every hook had a dogfish. On October 2, in spite of the fact that notice had been sent out the two days previous that, on account of the overwhelming quantities which came in, no dogfish would be received until October 4, we saw 8 loads from steamers, small schooners, and dories brought and landed upon the dock. Three dories brought 7 tons, 3 small schooners brought 17 tons, and 1 small steamer brought 8 tons—a total of 32 tons. The price paid for the fish delivered on the dock was at that time $6 per ton if livered and $5 if unlivered. These prices include the livers. Even at $4 per ton the dogfish would have been a bonanza for the fishermen. Two men in a dory could easily make $7 to $8 a day per man, catching dogfish within 1 mile of their homes.

Since our visit we learn that many improvements in the process have been developed, and several new mechanical devices are to be instituted. The results of treating the livers separately from the bodies have been much more satisfactory. The drying process has been much accelerated, and has resulted in a quality of fertilizer which more readily becomes available for plant food in the soil.

There is a probability that certain special parts may be conserved in such a manner as to be used for some of the purposes for which the yolks of hen's eggs are now demanded. The embryo dogfish ("pups") may be found to be satisfactory bait and thus be worth handling separately. Further investigation may disclose internal organs which can be converted into gelatin, after the manner of the "sounds" of sturgeon, hake, weakfish, etc. But above all, the flesh and the offal are converted into a valuable fertilizer, which will be of great assistance in increasing the crops of potatoes, fruits, and garden truck, by furnishing a type of fertilizer much needed on account of the short season for pushing the crops to the rapid maturity necessary.

We learn that the plant has been inspected and has received the approval of the officials of the Department of Marine and Fisheries. The general sentiment among the fishermen is favorable to the project. The chief objections are found among the opponents of the present government, who claim to see therein a shrewd political move. Be that as it may, the project promises the destruction of a vast number of dogfish, thereby benefiting the public and the fishermen through the improvement of the bait and food fisheries. It furnishes a market for what was previously a waste product of the fisheries, or, even worse, a waste product which was positively injurious unless removed at considerable expense. In addition, it is a direct benefit to the farmers and to all citizens and landowners, since it furnishes a valuable fertilizer readily available at a low price. It is therefore not strange that such efficient action should have strengthened the political party which made such a project possible.

EFFORTS IN MASSACHUSETTS.

Massachusetts has taken more active steps toward the solution of the dogfish question than any other of the United States. A special investigation was conducted by the State Board of Fish Commis-

sioners, and their report sets forth the amount of damage directly caused to the fishing interests by dogfish. At least 70 vessels directly by dogfish to the fishing interests. At least 70 vessels reported heavy losses, and hundreds of fishermen testify to similar misfortunes. The recommendations of the Massachusetts commissioners are for the encouragement of economic uses of the dogfish by means of a bounty to the fishermen or a subsidy to every industry directed toward the utilization of the dogfish. The utility of this fish as a cheap and wholesome food is particularly emphasized for the reason of its satisfactory taste, lack of odor, consistency when cooked or canned, and its freedom from bones. The inferior parts, it is suggested, could be used in feeding poultry and cattle. Other commercial possibilities for the dogfish are in the way of currying oil from the liver, polishing leather from the skin, and guano from the waste parts. The conclusion reached is that some plan must be put into practical operation whereby fishermen may receive a satisfactory remuneration for catching and bringing dogfish to shore. The report closes by calling attention to the following facts:

1. The annual damage by dogfish to marketable fish and fishing gear owned in Massachusetts is not less than $400,000. (See pp. 21, 22.)

2. This damage falls directly upon the fishing industry, but indirectly and ultimately upon the purchasing public.

3. The inroads of the dogfish upon the profits of the fishermen have at present a decided tendency to drive capable men from our maritime industries. If this continues the difficulty of securing men for the Navy will be greatly augmented. (Massachusetts now furnishes more men than any other State except New York.)

4. This damage is not confined to the coast of Massachusetts, but extends over practically the entire coast of the North Atlantic Ocean. The Dominion of Canada has already made a substantial move. Under the direction of its Department of Marine and Fisheries three dogfish reduction works have been established for securing oil and fertilizer from the dogfish. The industry of canning dogfish for food is being fostered by the same department and is developing with abundant promise of success.

5. On our Atlantic coast are numerous glue manufactories and menhaden rendering plants where dogfish could be converted into oil and fertilizer, provided the catching and transportation of dogfish could be made to yield a living profit.

6. The theory and practice of subsidies and protection to "infant industries" is prominent in the development of the United States. Our fishing industry is to-day sorely in need of a small degree of protection through a subsidy, bounty, or other governmental assistance, whereby an industry may be established which shall make the capture of dogfish as profitable as is the capture of the staple market fish.

RECOMMENDATION OF THE BUREAU OF FISHERIES.

The dogfish is a scourage to almost every state on the Atlantic coast. Yet so difficult is it to secure concerted action which would be effective in controlling the evil that appeal has been made to the general government. The Bureau of Fisheries, however, having no

authority to act in such a matter, is compelled to await legislation by Congress. During the session of 1906–7 the efforts of the Massachusetts commissioners and the petitions that poured in from all sections of the coast led to the introduction of a bill providing a bounty of 2 cents for every dogfish killed along the coast between Cape Hatteras and Eastport, Me. The Bureau of Fisheries, however, drafted another bill as substitute for this. (See Report of the Commissioner of Fisheries for 1906.) Instead of the proposed bounty, which was considered undesirable as a precedent as well as inefficient for results, the substitute bill proposes to vote a sum of money to be used in "determining the most effective methods of reducing the numbers of dogfish and of capturing them in wholesale quantities; in demonstrating the economic value of dogfish as a source of fertilizer, oil, and leather, and the most suitable methods of utilizing them for such purposes; and in testing the usefulness of the dogfish as food when used fresh or prepared by salting, smoking, and canning; and in developing the domestic and foreign markets for such preparations." This, it is thought, would afford a practical solution of the problem.

LITERATURE CITED.

COLLINS, J. W.
1884. Note on the destruction of mackerel by dogfish. Bulletin U. S. Fish Commission, vol. IV, 1884, p. 248.

CUNNINGHAM, J. T.
1896. The natural history of marketable marine fishes of the British islands. XVI+368 p., 2 maps. London.

COMMISSIONER OF FISH AND FISHERIES.
1904. Report of the Commissioner. Report U. S. Fish Commission 1903, p. 114.

GOODE, G. BROWN.
1884 and 1887. The fisheries and fishery industries of the United States, sec. I and II. U. S. Fish Commission.
1888. American fishes. 496 p., illus. New York.

JORDAN, DAVID S.
1905. A guide to the study of fishes, vol. I, 624 p., vol. II. 599 p., 428 illus. New York.

——— and EVERMANN, BARTON W.
1896–1900. Fishes of North and Middle America. Bulletin No. 47, U. S. National Museum, 4 vols., 3,313 p., pl. I–CCCXCII.

KENDALL, W. C.
1898. Notes on the food of four species of the cod family. Report U. S. Fish Commission 1896, p. 177–186.

KINGSLEY, J. S.
1888. Standard Natural History, vol. III, Elasmobranchs, p. 68–69.

LINTON, EDWIN.
1901. Parasites of fishes of the Woods Hole region. Bulletin U. S. Fish Commission, vol. XIX, 1899, p. 267–304, pl. XXXIII–XLIII.

McIntosh, W. C.
1899. The resources of the sea, as shown in the scientific experiments to test the effects of trawling and of the closure of certain areas off the Scottish shores. xvi+248 p., illus., tab.

Peck, J. I.
1894. On the food of the menhaden. Bulletin U. S. Fish Commission, vol. xiii, 1893, p. 113–126, pl. 1–8.
1896. The sources of marine food. Bulletin U. S. Fish Commission, vol. xv, 1895, p. 351–368, pl. 64–71.

Peterson, C. G. Joh.
1894. On the biology of our flatfishes and on the decrease of our flatfish fisheries. Report of the Danish Biological Station, vol. iv, 1893, p. 1–147, 2 pl., charts 1–17.

Prince, Edward E.
1904. The dogfish plague in Canada. Thirty-sixth Annual Report of Marine and Fisheries for 1903, p. xliii–lviii. Ottawa.

Scott, Andrew.
1899. Observations on the habits and food of young fishes. Proceedings and Transactions of the Liverpool Biological Society, vol. xiii, p. 90–93.

Scott, Thomas.
1902. Observations on the food of fishes. Twentieth Annual Report of the Fishery Board for Scotland, pt. iii, p. 486–541.

Simmonds, P. L.
1879. The commercial products of the sea. viii+484 p., 2d ed. New York.

Smith, Hugh M.
1892. Notes on a collection of fishes from the Lower Potomac River, Maryland. Bulletin U. S. Fish Commission, vol. x, 1890, p. 63–72, pl. xviii–xx.
1898. The fishes found in the vicinity of Woods Hole. Bulletin U. S. Fish Commission, vol. xvii, 1897, p. 85–111, pl. iii.

Smitt, F. A.
1895. A history of Scandinavian fishes, pt. ii, p. 567–1240, 246 fig. Stockholm.

Stevenson, Charles H.
1899. The preservation of fishery products for food. Bulletin U. S. Fish Commission, vol. xviii, 1898, p. 385–563, pl. i–xliii.
1903. Aquatic products in the arts and industries. Report U. S. Fish Commission 1902, p. 177–279, pl. 10–25.

Storer, David Humphrey.
1867. A history of the fishes of Massachusetts, 288 p., 16 pl. (1853–1867.) Cambridge.

Tenison-Woods.
1882. Fish and fisheries of New South Wales. xi+213 p., 45 pl.

Verrill, A. E., and Smith, S. I.
1873. Report upon the invertebrate animals of Vineyard Sound and the adjacent waters, with an account of the physical characters of the region. Report U. S. Fish Commission 1871–1872, p. 295–778, pl. i–xxxviii.

Yarrell, William.
1836. A history of British fishes, vol. ii, 628 p., illus. London.

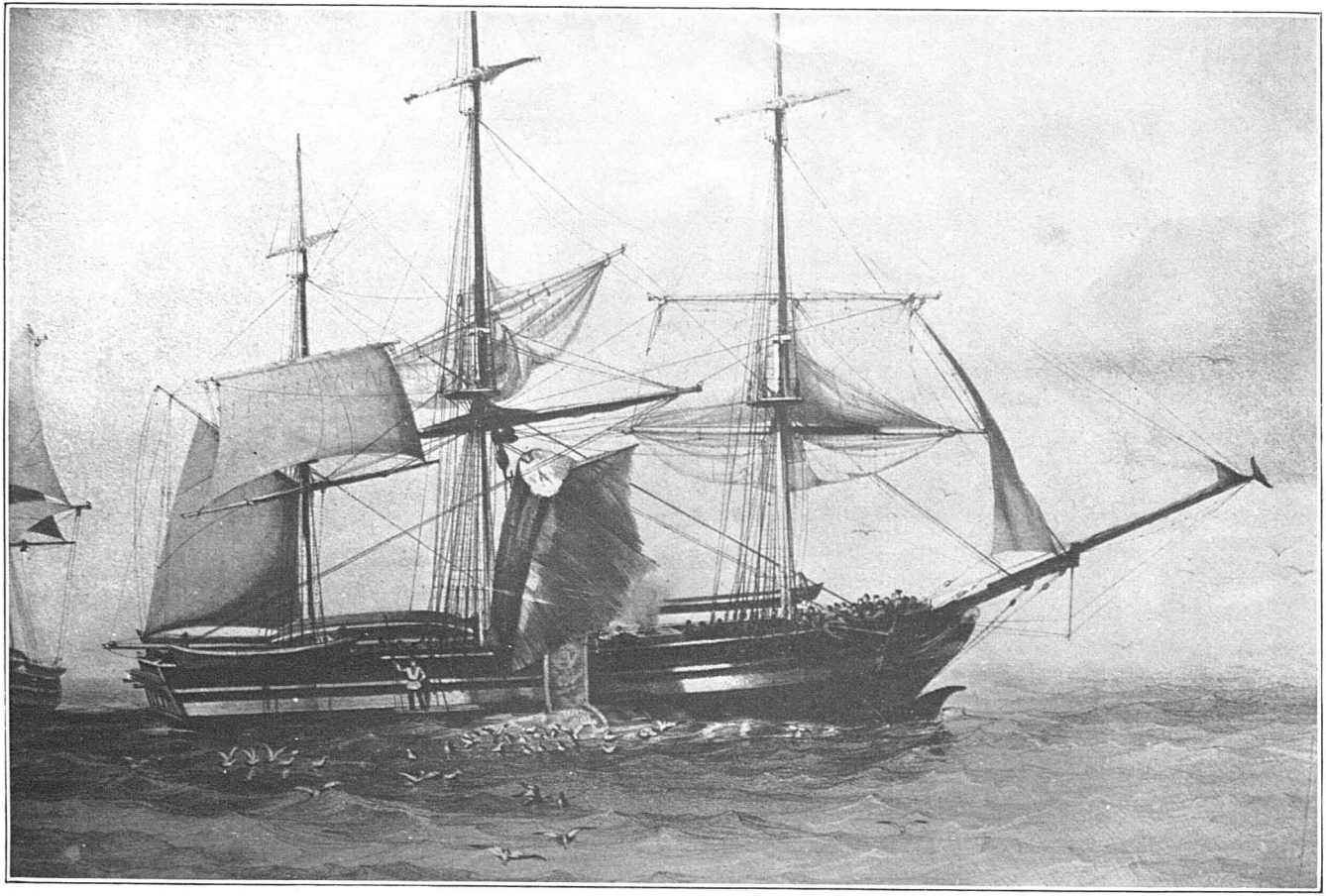
WHALEBONE: ITS PRODUCTION AND UTILIZATION

By CHARLES H. STEVENSON

Bureau of Fisheries Document No. 626

CONTENTS.

	Page.
Baleen	3
Extracting and cleaning the baleen	4
Yield and values of whalebone	6
Utilization of whalebone	8



RAISING A SIDE OF WHALEBONE INTO THE SHIP.

(From a painting in New Bedford.)

WHALEBONE: ITS PRODUCTION AND UTILIZATION.

By CHARLES H. STEVENSON.

BALEEN.

The garniture of the mouth of the whalebone whales is totally different from that of the sperm whale. Instead of teeth, there is a strainer-like appendage called baleen, or whalebone, consisting of several hundred horny, elastic slabs or plates, which are attached to each side of the upper jaw. The number of slabs on each side ranges from 260 to 360. This number, as well as the length and quality, varies with the species and the size of the whale. The longest slabs are in the middle of each side, and they gradually decrease in length toward the ends of the jaw. When the whale's mouth is closed, the baleen fits into deep grooves; when the mouth is opened, the baleen springs forward so as to fill entirely the space between the jaws, permitting the water to pass through, but imprisoning the small mollusks upon which the animal feeds.

The lower edge of each slab of baleen, as it hangs from the upper jaw, is fringed with hair which resembles that of a horse's mane or tail, but is coarser and more brittle when dry. The external surface of the slabs has the appearance of enamel; the interior is fibrous and partakes of the nature of the hair-like fringe. The color is usually a dull grayish-black or bluish-black, with occasional longitudinal streaks of a light horn color. The texture is lamellar in the direction of the breadth of the blade. The material is regarded as a peculiar development of hair, each slab an agglomeration of hairs covered with enamel, the rigidity and elasticity of the substance resulting from the peculiar structure. In its chemical and principal physical properties it resembles horn perfectly, and it is particularly interesting as indicating the transition from hair to horn.

The different species of bone-bearing whales yield baleen differing much in length, formation, and quality. The choicest is the baleen from the bowhead of the Arctic Seas, which has constituted the great bulk on the market during the last forty years. Some of this is very long, single slabs measuring 10 feet or more in length, the width at the butt approximating 10 or 12 inches. Formerly the Arctic fishermen secured baleen 15 feet in length, but in late years 12 feet is about the maximum. The outer edge is frequently curved, and the slabs taper gradually and gracefully from the base to the fringy end. The external and likewise the internal fibers are black-

ish, slender, and flexible. They are also parallel and quite even, so that the slab may be split its entire length to any required degree of thinness. On its removal from the mouth and before it is dried the material is so elastic and flexible that it is almost unbreakable, but when dry it is somewhat brittle.

The Pacific or Northwest right whale yields baleen nearly as long as that of the Arctic or bowhead whale, but heavier, coarser, and more brittle. The edge of the slabs is more nearly straight than in the Arctic species, and the hairy fringe along the edges is much thicker and coarser—indeed, it is quite bristly toward the apex. The South Sea whalebone is shorter and less curved on its outer edge than even that of the Pacific or Northwest right whale, and has fibers rather coarser than the Arctic but finer than the Northwest whalebone. Little of this is now brought in.

The baleen of the finback whale is very short, rarely exceeding 4 feet in length; it is 10 or 12 inches broad at the base, rapidly running to a point and becoming triangular in shape. The slabs are somewhat rigid crosswise and the fringe is from 2 to 4 inches long. The fibers are much coarser than those in baleen of the right whales, and this variety is consequently in much less demand, the selling price during recent years rarely equaling one-tenth that of the bowhead whalebone. The average yield of the finback whales taken by the United States fleet is about 250 pounds to each animal. The baleen from the humpback whale is even shorter and of poorer quality than that from the finback; its low value and the small quantity that may be obtained from an individual do not warrant the trouble of saving it.

EXTRACTING AND CLEANING THE BALEEN.

The baleen is not firmly secured to the jaw of the whale and may be readily detached. About 12 inches of it is embedded in the gum, while the remainder hangs free. In its normal condition it appears to be partly supported or propped up by the throat, tongue, and lips, which, however, relax their hold after death and the material is loosened by its own weight. When a dead whale is found it is often the case that the baleen has already started from the jaw, and this is likewise true at times when a whale remains a day or so alongside the ship before cutting-in. Under these circumstances it is sometimes necessary to lash the baleen to the jaw while in the act of hoisting on board.

In extracting the baleen the fishermen hoist the upper jaw on board with the layer of bone attached and separate them on deck. Cutting spades are pushed along the groove between the gum and jaw bone, and in most cases the entire mass is suspended in the cutting tackle so that the weight of the whalebone assists in detaching it from the jaws. In this manner it is started on either side and sev-

ered the entire length of the jaw. All that remains to be done is to separate the mass into pieces of convenient size, containing from 3 to 6 slabs each. To do this the men work with spades and axes, dividing the slabs by cutting through the gum and removing all the blubber and meat and likewise much of the gum.

While in the gum, the baleen is not liable to injury from dampness, and may be stowed in the hold, where it remains until the crew have time to clean it. When the season is over and the ship is on the passage to port, it is brought up on deck again and the slabs are carefully separated one from the other by cutting through the gum with an ax. This operation is performed by careful and experienced men, for any mutilation or hacking of the material would seriously affect its value. While the slabs are being separated by some of the men, others are busily engaged in removing the particles of gum with a small hand scraper. The slabs are then carefully washed in salt water in order to remove all foreign substances, and are thoroughly dried by exposure to the atmosphere.

If a long sea voyage intervenes before a market is reached, the drying must be carefully attended to, otherwise the whalebone is liable to become damaged. As much of the Arctic whalebone at the present time is landed at San Francisco and is consequently but a short time at sea, there is not this necessity for its being so carefully dried. It is discharged on arrival of the vessel in port and placed in stands out of doors where it is thoroughly dried by the action of the sun and wind. Occasionally the whalebone is bunched at sea, but as a rule this is done in port after the slabs have been overhauled and examined. Each bundle contains about 22 full-length slabs and weighs about 80 pounds. Before bunching the baleen is assorted into grades and sizes. That measuring less than 6 feet in length is known as "undersize," and is sold at reduced price. From the time of its removal from the head of the whale to the completion of the manufacturing process great care must be taken to avoid cutting or damaging the surface, the slightest nick reducing the value.

The quantity of whalebone obtained from the different species of whales varies greatly. The bowhead produces far more than any other, and the right whale comes next in this regard. Even whales of the same species and of equal size and yield of oil may produce widely different quantities. It is commonly supposed that the age of the whale has much to do with the weight of the whalebone, the substance continuing to gain in solidity after the animal attains maturity. As a general average for the fleet the yield in the bowhead whale is from 15 to 20 pounds to the barrel of oil, a 100-barrel whale yielding from 1,500 to 2,000 pounds of baleen, while in the right whale the yield is usually about 11 pounds to the barrel of oil. The extreme production on record is 3,100 pounds, obtained from a bowhead whale by the steamer *Mary and Helen* in Bering Sea, October 20, 1883.

YIELD AND VALUES OF WHALEBONE.

In the early days of the whale fishery the valuable qualities of whalebone were not well known, and comparatively little of the product was saved. The first importation into England is supposed to have been in the year 1594, when a quantity was picked up among the wreckage of a Biscayan ship. It is stated that from 1715 to 1721 at least £100,000 per annum was paid to the Dutch for whalebone, the price approximating £400 per ton.[a] The price advanced at times to £700 per ton[b], but toward the end of the eighteenth century it decreased to £50 per ton.

In the beginning of the nineteenth century whalebone sold so cheap that few vessels brought any great quantity home, it being more profitable to fill the hold with oil. During the first two decades of the nineteenth century the annual receipts in port from the American fisheries did not exceed 50,000 pounds, worth about 10 cents per pound. The demand then increased, raising the price to 25 cents in 1829, when the whalemen brought in over half a million pounds. Owing to a decrease in value to 13 cents, the amount secured decreased to 266,432 pounds in 1833. Based on the product of oil, it seems probable that had all the whalebone been saved the total yield during that year would have exceeded 1,500,000 pounds, worth, at the present market price, about $9,000,000. For ten years following 1833 the price fluctuated between 13 and 30 cents, and the product ranged to upward of 2,500,000 pounds. From 1844 to the outbreak of the civil war the output averaged about 2,800,000 pounds annually, the greatest for one year being 5,692,300 pounds in 1853, and the price gradually increased to $1 per pound. Since 1860 there has been a large decrease in the whalebone output; in 1862, for the first time for many years, it fell below 1,000,000 pounds, and only once since then has it exceeded that amount, viz, in 1867, when it was 1,001,397 pounds. From that time to 1902 it ranged between 100,000 and 900,000 pounds, and in 1903 the yield was only 74,850 pounds, the smallest since early in the nineteenth century. Of the whalebone taken by American vessels during the last twenty-five years, more than 90 per cent has been secured by the North Pacific fleet, mostly in the Arctic Ocean, and the remainder mainly by the Hudson Bay and the Atlantic Ocean fleets. The total product landed from the American fisheries during the nineteenth century doubtless exceeded 90,000,000 pounds, worth about $450,000,000 at the present market valuation.

The reduction in the yield of whalebone has been largely counterbalanced by increase in the value per pound. Indeed the rise in price during the last thirty years has been remarkable. In 1871 the average

[a] Henry Elking, A view of the Greenland trade and whale fishery, with the national and private advantage thereof, p. 65. (London, 1722, 8°.)

[b] David Macpherson, Annals of commerce, manufactures, fisheries and navigation, vol. III, p. 371. (London, 1805, 4°.)

value at the dock was 70 cents per pound. In 1877, owing to the disaster to the Arctic fleet in the preceding year, the price jumped to $3.50 per pound, and the average for the year approximated $2.50. It continued to increase until it reached $6.70 in the summer of 1891, the price during that year averaging $5.38. In the ensuing nine years it ranged from $4 to $2.50. The small yield in the last three years has occasioned very high prices, and in March, 1904, the market for Arctic bone was $6.25 per pound.

The quantity of whalebone secured by vessels of other nations is small. The Scotch whalers operating in the vicinity of Greenland and Baffin Land secure about 15,000 pounds annually. Were it not for the occasional successes of the American vessels in the Arctic, whalebone would be at a prohibitive price, and probably more of it would be found in museums than in commercial warehouses.

The following summary, compiled from various sources, but especially the Whalemen's Shipping List, shows the quantity and value of whalebone received from the American fleet each year since 1820:

STATEMENT OF THE PRODUCT OF WHALEBONE IN THE UNITED STATES DURING EACH YEAR SINCE 1820.

Year.	Production.	Average value per pound.	Year.	Production.	Average value per pound.
	Pounds.			*Pounds.*	
1821	62,893	$0.12	1864	760,450	$1.80
1822	50,799	.12	1865	619,350	1.71
1823	103,404	.13	1866	920,376	1.37
1824	133,472	.13	1867	1,001,397	1.18
1825	152,534	.15	1868	900,850	1.02
1826	79,368	.16	1869	603,603	1.28
1827	106,255	.18	1870	708,365	.85
1828	137,323	.25	1871	600,655	.77
1829	563,654	.25	1872	193,793	1.28
1830	514,991	.20	1873	206,396	1.08
1831	279,279	.17	1874	345,560	1.10
1832	442,881	.13	1875	372,303	1.21
1833	266,432	.14	1876	150,628	1.96
1834	343,324	.21	1877	160,220	2.50
1835	965,192	.21	1878	207,259	2.46
1836	1,028,773	.25	1879	286,280	2.34
1837	1,753,104	.20	1880	464,028	2.00
1838	1,200,000	.20	1881	368,322	1.63
1839	1,900,000	.18	1882	271,999	1.71
1840	2,000,000	.19	1883	254,037	2.87
1841	2,120,000	.20	1884	426,968	3.55
1842	2,410,000	.23	1885	463,990	2.68
1843	1,127,270	.36	1886	352,490	2.73
1844	2,532,445	.40	1887	585,011	3.12
1845	2,195,054	.34	1888	384,572	2.78
1846	3,252,939	.34	1889	253,113	3.50
1847	3,841,680	.31	1890	309,710	4.22
1848	3,003,000	.25	1891	297,768	5.38
1849	2,281,100	.22	1892	369,885	5.35
1850	2,869,200	.32	1893	411,315	3.08
1851	2,916,500	.34	1894	278,800	2.95
1852	1,259,900	.51	1895	114,960	2.83
1853	5,652,800	.35	1896	207,850	3.95
1854	3,445,200	.39	1897	178,100	3.50
1855	3,707,500	.45	1898	246,120	3.10
1856	2,592,700	.58	1899	320,100	2.70
1857	2,058,850	.97	1900	207,650	2.50
1858	2,571,200	.92	1901	99,050	2.65
1859	1,923,850	.88	1902	109,980	4.20
1860	1,337,650	.80	1903	74,850	5.25
1861	1,038,450	.66	1904	123,300	5.80
1862	763,500	.88	1905	79,900	4.90
1863	488,750	1.53	1906	96,600	4.50

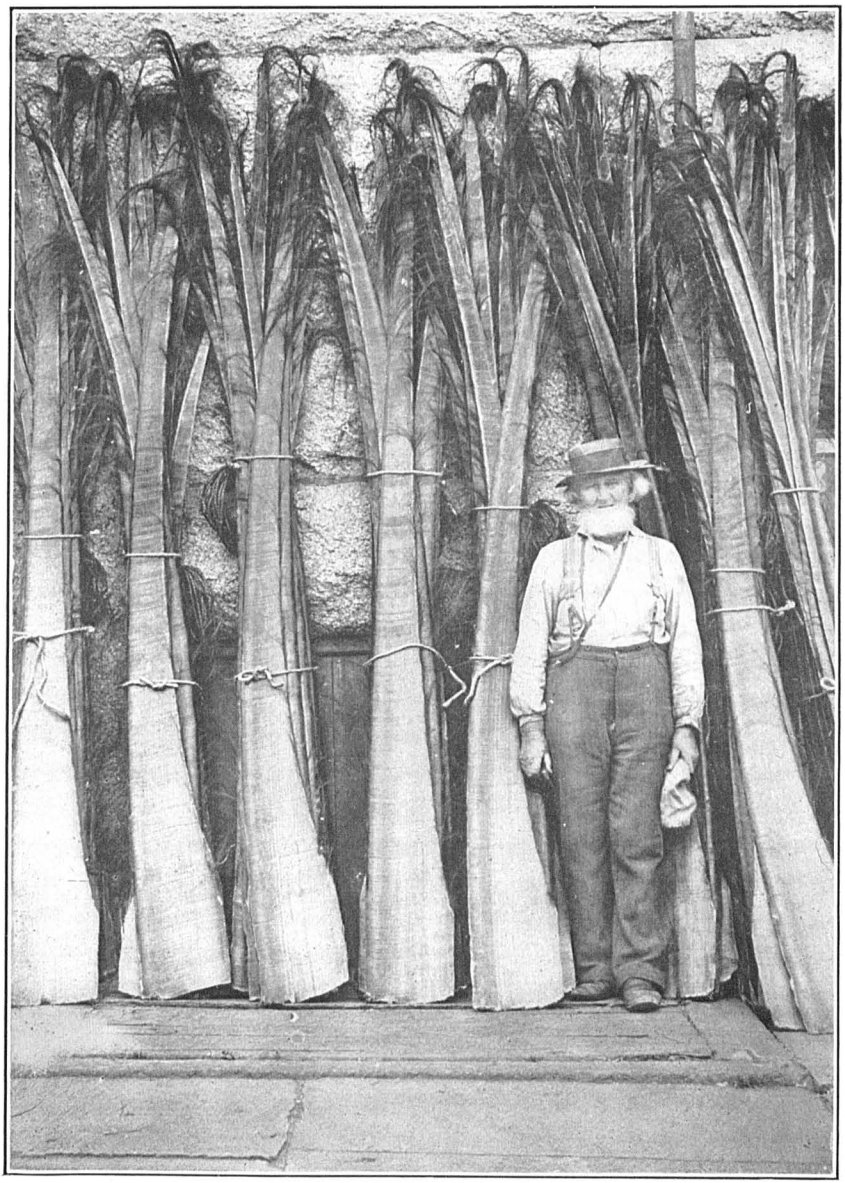
UTILIZATION OF WHALEBONE.

The economic value of whalebone is due to its combined qualities of lightness, elasticity or springiness, and flexibility even when split into very thin strips. It has also the property of permanently retaining any shape that may be given to it when it is heated and then cooled under compression. Although many substitutes have been introduced, such as steel, cattle horn, and turkey quills, nothing has yet been found that competes with it in a combination of all the qualities above noted. It is therefore unrivaled as material for use in whips, corsets, for dress stays, and similar purposes.

The cutting of whalebone, that is, changing the rough slabs into the forms and sizes suitable to the different uses, is carried on principally in New York City and Boston. There are four factories in New York City and one in Boston. The number of workmen employed is small, rarely exceeding forty, all told. The equipment consists of two or three long narrow water tanks, a steam box or two, half a dozen drawknives, a splitting machine, a transverse cutting knife, a miscellaneous lot of rulers, knives for cutting and scraping, and a very large amount of experience in determining the qualities of the material and the needs of the market.

Whalebone is received at the factory in bundles containing 15 to 25 long single slabs which have been roughly cleaned. The first operation in working it consists in cutting off the hair or fringe along the edge with a knife or a pair of shears. This hair ranges in length from 2 or 3 to 18 inches or more, and about one-fourth of an ounce in weight is secured from an average slab weighing 4 pounds. It is sold at 10 to 15 cents per pound to brushmakers, who combine it with other bristle materials and use it in the manufacture of clothes brushes and the like. Formerly it was employed to some extent in upholstery, but at present the product is too small for that purpose.

The fiber or grain of whalebone is not uniform throughout a single slab. That on the lower side, or edge of the slab as it rests in the mouth of the whale, is far more flexible and durable than that on the upper side. The lower portion is known as "grain bone," that from the upper side is the "back bone," and between these is the "dividing-line bone." A 5-pound slab, measuring 12 inches at the base, yields usually about 1 pound of "backs," one-half pound of "dividing line," and 3½ pounds of "grain bone." The grain bone is the best for all uses. That from the back is entirely devoid of fibrous appearance; it does not split in a straight line, but cuts like horn, and its flexibility and durability are of a low order. The dividing-line bone, as the name indicates, is where the two grades above mentioned merge together. This difference in quality determines largely the special uses to which each portion of the material is put.



BUNDLES OF WHALEBONE AS RECEIVED AT THE FACTORY.

To make the material workable, the clean slabs are soaked in tepid water for one or two weeks and then subjected to the action of steam in a closed box for forty to sixty minutes, whence they come forth ready to be cut into strips of the required form and size. Each slab is then fastened, back down, in a bench vise and the cutting is done entirely by draw knives operated by hand labor. The first cutting to be made is the removal of the "front." This is the lower edge of the slab, beginning 30 inches from the butt and following the grain of the fiber to the base. It is 3 or 4 inches wide at the base, narrowing quickly to a point at the top, is very thin, and furnishes the best quality of dress bone, selling at the present time at about $10 per pound. It is cut in the manner presently to be described for "dress bone."

After the "front" comes the "whip bone," the lengths of which range from 30 to 72 inches. By means of draw knives adjustable to any depth, strips are cut from the steamed slab at right angles to the surface, until the cut pieces reach a length of about 72 inches, or the thickness of the slabs reaches the maximum required for whips. It is desirable that the cross section of these whip pieces be square, and to accomplish this the depth at which the knife blade is set is increased at each successive cutting. As the thickness of the slab following the grain decreases in proceeding from the butt to the top, it is manifestly impossible to have the cross section of the whip pieces square at all points, and a medium is followed in having it square about 18 inches from the butt. To avoid changing the gauge of the knife at each successive cutting, six or eight knives gauged at different depths are used. The whip-bone pieces sell for about $7.50 per pound at present. If they are cut less than 30 inches in length, as is sometimes the case, the price is lower, say $6 to $7 per pound. Some cutters prepare no whip bone whatever, and in that case this part of the slab is cut into dress bone.

In preparing dress bone the cutting knives are adjusted to a depth of five-sixteenths of an inch, or in some rare instances three-eighths of an inch, so as to remove from the slab a strip of that depth, the thickness[a] being, of course, the same as the thickness of the slab at the place of cutting, and the length running the full length of the fiber. These strips are known as full-length cuts. An examination of the edge of them reveals on either side a layer of dense horny nonfibrous material known as "shell" or "shell bone," sandwiching a layer of dark fibrous material called "grain bone." The shell bone is far more valuable than the grain bone, owing to the fact that it is perfectly pliable and may be worked without danger of splitting, whereas the grain portion is liable to split when pierced by a needle.

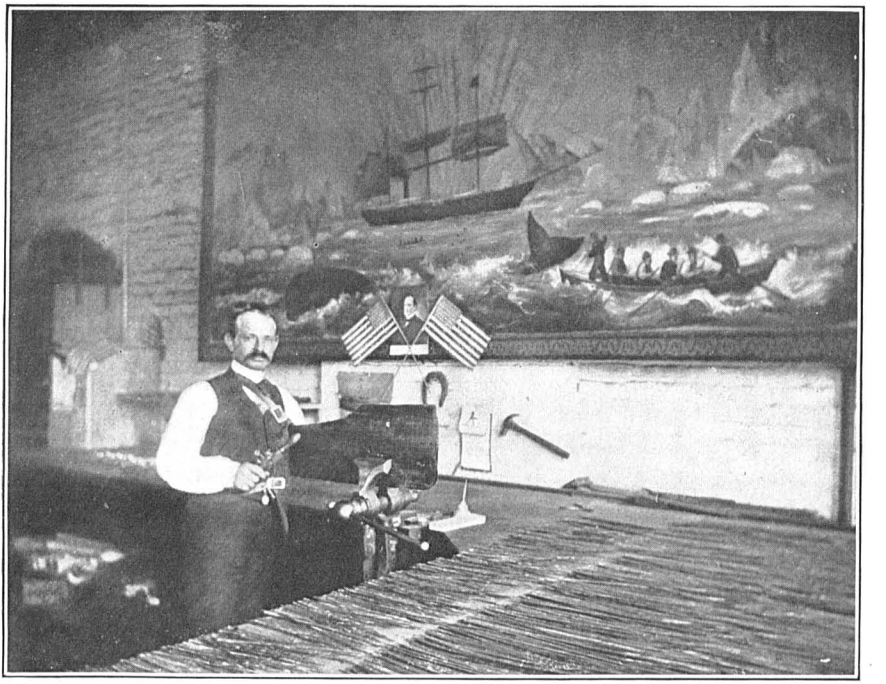
[a] This is really the width rather than the thickness, but whalebone cutters use the terms width and thickness with reference to the original position of the material in the slab.

These full-length cuts, which are nearly always five-sixteenths of an inch thick, are reduced to lengths of 36 inches, thoroughly steamed, run through the splitting machine, and split parallel with the original surface of the slab into thin strips about 1 millimeter (one twenty-fifth of an inch) in thickness. The splitting machine consists of a horizontal knife about 2 inches wide, fixed in a frame on the edge of a table, and subject to changeable gauge by means of screws. As the whalebone is pushed against the edge of the sharp knife a spring holds it down firmly, to assure cutting the full thickness of the gauge. In splitting the cut pieces the shell bone on either side is first removed in strips and then the grain bone is split.

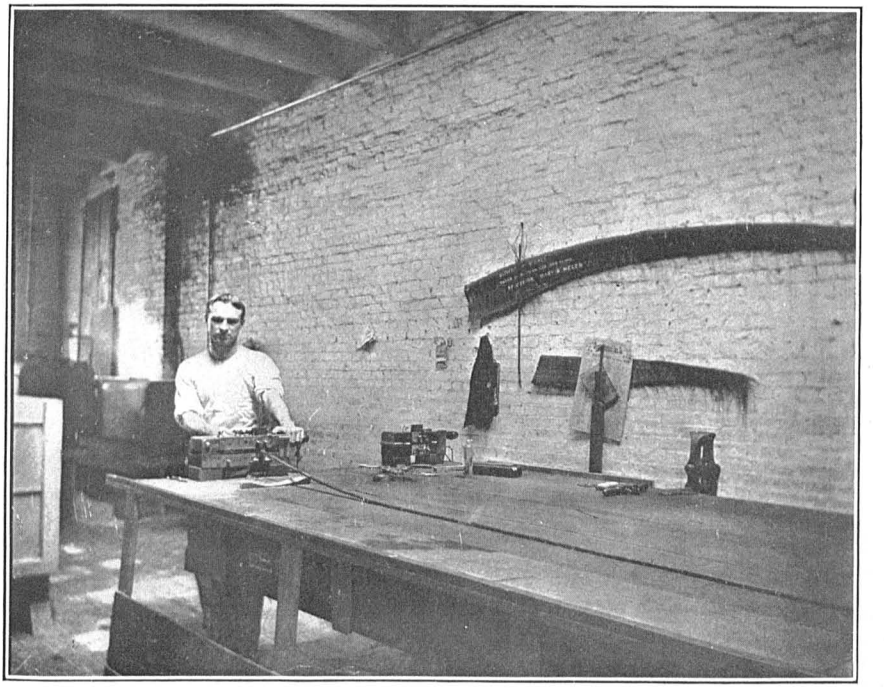
The strips of shell bone are next scraped with a sharp knife to remove the membranous tissue upon the surface, and are then bundled in gross lots ready for the dressmaking trade. Each piece is 36 inches long and, as a rule, five-sixteenths of an inch wide. The thickness ranges from 0.7 millimeter to 1.4 millimeters, and is usually 0.8, 1, or 1.2 millimeters. The last three measurements correspond to 2, 2½, and 3 pounds, respectively, to the gross. Strips of shell bone 0.7 millimeter in thickness weigh about 1¾ pounds to the gross, and those 1.4 millimeters thick approximate 3½ pounds to the gross. At the present time the market price of dress bone strips is $9 to $10 per pound for ordinary grades. They are always packed in gross lots, and prices are quoted by the gross rather than by the weight.

Some of the shell bone is very light in color, even approaching whiteness, although this is rare, not over 200 pounds of "white bone" being secured annually in America. The lighter the color the more desirable it is as a rule, and for the white or colorless upward of $30 per pound is received by the cutters. This is not because of any peculiar merit in the material itself, but because it is more suitable for use with white dress material. The light bone exists in small streaks only, and until it goes through the steam box there is difficulty in determining whether it will come out very light or not. The cutters make no attempt to account for the cause of this light coloring.

The thin strips of grain bone, after leaving the splitting machine, are cut into different lengths, varying from 8 to 16 inches, and in widths as low as one-eighth of an inch, according to orders from the corset makers. The transverse cutting is done by means of a vertical knife, operated by a lever handle. The longitudinal cutting is quickly accomplished by running each strip against a small vertical knife set in a frame and gauged from the side at the proper distance to produce strips of the desired width. These short pieces are neatly bundled and sold at the present time for about $6.50 per pound. They are commonly known as "corset bones." They are liable to split if pierced by a needle, and are slipped into jackets or casings instead of being sewed into the garments.



CUTTING A SLAB OF WHALEBONE.



SPLITTING WHALEBONE.

As previously noted, the bone from the back or upper edge of the slab is of lower grade than the grain bone. There is relatively little shell on it, and also a complete absence of the fibrous condition noted in the middle of the grain bone. If cut parallel with the surface of the slab in the manner already described, it is extremely liable to warp, curl up, and split, and would sell very low, from 75 cents to $2 per pound. In recent years it has been customary in working up the backs to cut them at right angles with the surface of the slab instead of parallel therewith; or, as the cutters express it, they are cut "edgeways instead of sideways." This reduces the tendency to warp and split, due largely to the very small quantity of shell on the edges of the strips. This portion of the slab is not suitable for dress bone, and is cut up into corset bone as already described. When cut edgeways it sells for $5 or $6 per pound.

There is a small demand for grain bone in the form of slender round pieces about 1 millimeter in diameter and from 25 to 40 inches long. Some years ago large quantities of these, in lengths of 25 to 28 inches, were used in men's felt hats, being placed under the sweat bands to impart stiffness to the brim. Those 27 inches long, the average length, weigh 4 ounces to the gross. The demand for these at present is very small. Small quantities of slender strips in lengths of 36 to 40 inches are purchased by silk spinners, who use them as turning sticks in their spinning work. These pieces are also employed to a small extent for winding on ornamental sword hilts; this use, however, is more popular in Japan than in this country.

In the various processes of splitting and cutting there is considerable fiber left over in pieces not sufficiently large for use in corset bone. These are commonly split in bristle sizes and used in the manufacture of coarse stiff brushes. They appear to be especially suited for flue brushes. The usual selling price of these bristles is about $1 per pound.

The shavings of membranous tissue resulting from scraping the shell bone are commonly sold to upholsterers at 15 or 20 cents per pound. This product is considerable in working Northwest bone; but as Arctic bone constitutes the greater part of that used nowadays, the quantity of shavings produced is very small. They are especially sought after for bedding material.

When whalebone was cheaper, canes made from this material were somewhat popular, and a few are made even at present. The Arctic whalebone is rarely thick enough for this purpose, and usually the back portion of the Northwest bone is employed. Sometimes after the shaping these canes are steamed, twisted, and then set by dipping them into cold water, so that they will retain the twisted shape. The Northwest bone is also sometimes used for making "bare-bone" whips—that is, whips made entirely of whalebone and without wrapping.

Formerly whalebone was extensively used in making frames or ribs for umbrellas and parasols. These old umbrellas were very durable, but they closed up somewhat like a lettuce in shape. Artists' sketching umbrellas and carriage shades are still made of this material, but they are expensive. Whalebone was in large demand for the manufacture of hoops, when that article of dress was fashionable. It was used in making brooms, also, especially those used by chimney sweeps. Another use was as covering for telescopes and other tubes; for this purpose the hair-like fringe and strips made from waste pieces were employed. These were employed also to make imitation haircloth for covering chairs and sofas. The Alaskan natives and the Indians of Washington have made use of whalebone for various purposes, such as in the manufacture of fishing nets, fish hooks, hunters' traps, etc.

The scarcity of whalebone has led to the introduction of many substitutes for use in corset and dressmaking, but so far few satisfactory ones have been found. Horn and rattan have been tried repeatedly without success, as they are liable to break and lack the resistance and lightness of whalebone. Thin strips of steel covered with rubber or other composition are in many respects the best substitute. Their fatal defects are their tendency to rust and their sharp edges which cut the fabric. While they have largely replaced whalebone in the cheaper grades of corsets, these defects prevent their use in dresses and the best corsets. Furthermore they can not be cut to the lengths desired. A very successful substitute, owing to its cheapness, is a preparation of turkey quills sold under a trade name; but this is by no means equal to whalebone.

O

SOME OBSERVATIONS ON SALMON AND TROUT IN ALASKA.

By F. M. CHAMBERLAIN,
Naturalist, U. S. Fisheries Steamer Albatross.

Bureau of Fisheries Document No. 627.

Blank page retained for pagination

CONTENTS.

	Page.
Introduction	5
Distinctive characters of the species	6
Common names	6
Differentiating marks in adults	6
Designations of young salmon	7
Hybridization	10
Resemblance of the young	11
Detailed descriptions of the young	13
Humpback salmon	13
Dog salmon	14
King salmon	15
Coho salmon	16
Sockeye salmon	17
Steelhead trout	19
Charr, or Dolly Varden trout	19
The basins studied	20
Conditions controlling the work	20
Method used to determine migratory movements	21
The Naha	22
Character of the stream	22
Yield of salmon	23
Catch of young salmon in the trap	25
Yes Bay Stream	27
Karluk River	28
Suitability as a spawning stream	28
Movements of young salmon as shown by trial catches	28
Conditions reported in British Columbia	30
Summary of observations	31
Young salmon in fresh water	31
The sockeye	31
Movement of fry above the lakes	31
Food and feeding	32
Food supply in relation to the hatching season	34
Growth in fresh water	34
Migration of yearlings	36
King salmon	40
Age and season of migration	40
Effect of change from fresh to salt water	42
Food	43
Coho salmon	44
Earliest migrations	44
Food and habits	44

Young salmon in fresh water—Continued. Page.
Dog salmon ... 47
Humpback salmon ... 48
Trout and charr ... 48
Sea habits of young salmon ... 50
Notes afforded by collections and records ... 50
The sockeye ... 50
King salmon ... 53
Coho ... 53
Dog and humpback salmon ... 55
Conclusions from available data ... 57
Abundance of food ... 57
Return of adults to fresh water ... 59
Approach of schools ... 60
Food and feeding ... 61
The sockeye ... 61
King salmon ... 64
Coho ... 64
Humpback and dog salmon ... 65
Relation of food supply to number of adult salmon ... 65
Age of adult salmon ... 66
Salmon-marking experiments ... 66
Methods ... 66
Regeneration of lost parts ... 67
Salmon in the Trocadero, at Paris ... 68
Factors influencing return to fresh water ... 69
Sex instincts versus condition of nutrition ... 69
The different runs ... 70
Temperature ... 71
Currents ... 73
Ascent of streams ... 74
Interval between arrival and spawning ... 75
Parent streams ... 76
"Introduction into streams not previously frequented" ... 77
"Return of marked salmon" ... 78
"Distinctive and characteristic runs" ... 78
Variations in weights and measurements ... 79
Variations in counts ... 89
Streams not utilized by sockeyes ... 92
Relation of size of run to spawning area ... 93
Selection of spawning ground ... 94
Conditions required by the sockeye ... 94
Preferences of the king salmon ... 96
Spawning streams chosen by the coho, dog, and humpback salmon ... 97
Nature of spawning beds selected ... 98
Deposit of eggs ... 99
Completeness of spawning ... 100
Percentage of natural production ... 101
Relation of spawning habits to number of fish ... 102
Changes incident to maturation ... 104
Return of adults to salt water ... 106
Enemies of young salmon ... 107
Geographical glossary ... 109

LOWER PART NAHA BASIN

BASED ON STENOMETER AND COMPASS SURVEY

BY

E.L. Goldsborough

AND

F.M. Chamberlain

scale of feet

0 1000 2000 3000

N.

W. E.

Magnetic

S.

Grace Peak 2100 ft.

Cliff

Emma Creek

Gibson Cr.

JORDAN LAKE

46 70 100 108 26 100 110 50 18 50 114 116 50 88 16 32

Spawning Ground

Windlass Trail

Station #3

Bradford Trail

Naha River

Koosnek I.

HECKMAN LAKE

18 86 70 72 124 128 128 102

Nursery Pond

Fortmann Hatchery

Dam

Rack

McCune Cr.

Rapids

Station #4

Al Buhring Cutoff Trail

Old Indian Smoke-house

Telephone Trail

Humpback and Steelhead beds

Station #1 Seining Beach

Humpback and Coho beds

Dorr Falls

Mallard Cr.

ROOSEVELT LAGOON

58 48 62 64 100 50

Skow Bay

Goose I.

Knights I.

Cape Horn

Old Saltery

Hirsch Rapids Station #2

NAHA BAY

Steelhead Cr.

Falls

Trout Lakes

Trail Cr.

U. Cannery

Herring Spawning Ground

Oil Works

Flume Creek

SOME OBSERVATIONS ON SALMON AND TROUT IN ALASKA.

By F. M. CHAMBERLAIN,
Naturalist, U. S. Fisheries Steamer Albatross.

INTRODUCTION.

To assist in the solution of various problems, it was deemed desirable in connection with the Alaska salmon investigation of 1903 to establish shore stations. The work at these stations was to comprise not only the study of the habits of the salmon in fresh waters and adjacent bays, but, in addition, a reconnaissance of all the neighboring basins with reference to available hatchery sites, observation of the methods employed in taking fish for the canneries, an inquiry into the sea habitat and the factors influencing the return of the adult fish, an inquiry into the efficiency of the hatcheries then operated, and a general study of the biological features of territory immediately adjacent to the stations. The facilities offered by the establishments of the Alaska Packers' Association at Loring and at Karluk determined the adoption of the Naha and Karluk rivers as localities for this work.[a]

The greater part of the data obtained at these shore stations is contained in unpublished reports. In the present paper are presented such of the facts as bear upon the natural history of the salmon and, with a view to the application of these results in future work, some notes on the methods used in the inquiry. Most of the material contained herein relates to young salmon, but the known facts in the life of the adult, including the spawning period, are considered, and mention is made also of the trout as associated with the salmon. A chapter differentiating and describing the species, particularly in the finger-

[a] The observations in the latter region were made between the early part of May and September, 1903, by the late Cloudsley Rutter, naturalist of the steamer *Albatross*, assisted by M. H. Spaulding, of Stanford University. At Loring the work was carried on during 1903 and 1904 in charge of the writer, assisted at different times by E. L. Goldsborough and H. D. Aller, of the Bureau of Fisheries, and H. C. Fassett, fishery expert on the steamer *Albatross*. During the summer of 1905 observations along some of the above lines were continued by the writer at Yes Bay, in connection with other work of the *Albatross*, with the assistance of Mr. Fassett and of J. S. Burcham, of Stanford University.

ling stage, is followed by a detailed record of the field observations on the young, and upon these data, which are largely statistical, is based the succeeding discussion of the habits of the salmon from the time of the migration of the young until the return of the adults to the spawning beds. Liberal use has been made in this discussion of the results of previous workers on the subject, and, in addition to the collections and notes made by the shore parties in Alaska in 1903, 1904, and 1905, all of the *Albatross* collections of young salmon now in possession of the Bureau have been studied. The concluding chapters of the report are given to the discussion of questions relating to the adult salmon, and contain in tabular form the statistics of weights and measurements of nearly 10,000 sockeye salmon, with anatomical counts of about 4,600 of these. In the entire paper the sockeye, as the most valuable commercial salmon of Alaska, has been made the main feature.

DISTINCTIVE CHARACTERS OF THE SPECIES.

COMMON NAMES.

The most common appellations of the various species as they are known in Alaska are used in this paper. There seems to be no reason why, for example, the words "quinnat," "chinook," and "king," which in a loose way pertain, respectively, to the Sacramento, Columbia, and Alaskan *tschawytscha*, should be continued to the confusion of readers. The "blueback" of the Columbia differs in no specific essential from the "sockeye" of Alaska. Names based on characters common to several species, such as "red," "silver," etc., are especially apt to be confusing. The name "trout" as here applied to small fingerlings may include steelhead, rainbow, and cutthroat. Individual variations in both trout and salmon overlap the limiting points in most characters, but in the salmon the sum of various characters sets the five American species distinctly apart. Careful examination has so far failed to show any distinguishing character to differentiate the young of these trouts. Indeed, apparently no specific difference is constant in the adult.

DIFFERENTIATING MARKS IN ADULTS.

Fishermen and large handlers of salmon roughly but very accurately distinguish the adults of different species by certain obvious characters. The king salmon is known by the small black spots on the tail. The tail of the humpback is spotted, but with larger oblong spots. The backs of both king and coho are commonly spotted, the spots of the coho being as a rule smaller than those of the king, but these spots are not noted by fishermen. Rarely the sockeye shows a few spots, particularly on the tail, but these are never distinct as in the other species. (To the sea-run form only does this statement

apply; the dwarf lake-dweller is spotted.) The steelhead, also a spotted fish, is at once recognized by its slimness, the square tail fin, and the deep caudal peduncle. It is difficult to pick up a steelhead by grasping the tail, whereas a salmon may be readily so held. Salmon without spots—sockeye, dog salmon, and sometimes the coho—are somewhat confusing. The sockeye is usually distinguishable by the blue back after death, the sharp nose, and the narrow maxillary, while the tail fin lacks the produced pointed lobes of the dog salmon; also the scales are firmer and show a clean-cut paving, and the flesh is intensely red. The coho and dog salmon scales when silvery appear to be of a finer and more delicate texture than those of the sockeye. This is especially notable in the dog salmon. The female dog salmon is usually very deep, both dorsoventrally and in lateral thickness—"plumpness." The caudal peduncle is less compressed than in other species and the curves joining it to the body are shorter than in the coho. In the Alaska fisheries the dog-salmon males are seldom taken until the secondary sex characters begin to be developed—the "hook-bill" and dirty coloration.[a] The produced caudal rays mentioned above and the light color of the flesh are distinguishing marks in this species. The coho is distinguished from the dog by less delicate scales and deeper peduncle, by its small pupil, and in general by the occurrence of spots often at first overlooked.

In closer examination one will consider the greater length and fineness of the gillrakers in the sockeye, the increased number of anal and branchiostegal rays in the king, the fine scales of the humpback, the large and few pyloric cœca of the coho. The dog salmon possesses no single diagnostic mark, but differs from the other species respectively in each character as mentioned above. Changes incidental to the spawning period will be noted under that head.

DESIGNATIONS OF YOUNG SALMON.

The lack of a distinctive terminology for the young of fishes has led to much confusion in the interpretation of reports of fish culturists and investigators, more or less consequent acrimonious debate, and some legal entanglements. In an effort to settle this matter for the benefit of American writers and readers, the American Fisheries Society in 1905 adopted the following nomenclature:[b]

Fry=fish up to the time the yolk sac is absorbed and feeding begins.

Advanced fry=fish from the end of the fry period until they have reached a length of 1 inch.

Fingerlings=fish between the length of 1 inch and the yearling stage, the various sizes to be designated as follows: No. 1, a fish 1 inch in length and up to 2 inches;

---

[a] "In handling a large number of dog salmon in 1907 it was observed at Juneau early in September that many green silvery males were being taken in the traps at Shelter Island and vicinity. Among these were several dog-salmon grilse." (Fassett.)

[b] Report of the Commissioner of Fisheries for fiscal year ended June 30, 1906, p. 24.

no. 2, a fish 2 inches in length and up to 3 inches; no. 3, a fish 3 inches in length and up to 4 inches, etc.

Yearlings=fish that are 1 year old, but less than 2 years old from the date of hatching. These may be designated no. 1, no. 2, no. 3, etc., after the plan described for fingerlings.

These definitions have been generally adopted in government and state reports and are the ones used in this paper. The use of the French term "alevin" instead of "fry" for the larval stage of salmonids has been abandoned here for the reason that the French writers do not restrict the term to that period of development of the young fish. Though the use of "alevin" has had the support of such authorities as Francis Day[a], Livingston Stone[b], and Cloudsley Rutter[c], it seems unnecessary, if not even absurd, to continue the use of a foreign word and give it a meaning not recognized in the language from which it is drawn, more especially as even the writers mentioned above did not make a strict application of the term.

Some French writers[d] have apparently endeavored to make a technical use of the terms "alevin" and "fretin," but their example has not been followed by later writers, and the word alevin seems to be used now to designate the young of the salmon in the most general way.[e] In the same manner the German word "Brut," or "Jungbrut," has about the same latitude as has been given hitherto to the word "fry" in English, nor does the German term "Setzlinge" admit of strict application.[f]

The words "larva" and "larval" have been used by many writers in descriptions of the young salmonids. Others would restrict these terms to fishes exhibiting a greater change in the stages, such as the eels and the ladyfish. As in neither case is there a complete metamorphosis, this limitation is scarcely tenable. The terms, however, are not yet current among fish culturists.

The great diversity of size among species and among individuals of a given species at the time of hatching, as well as the intimate dependence of fish growth upon environment, in some cases may

[a] Francis Day, British and Irish Salmonidæ, p. 43, 44, and 82, 1887.

[b] Livingston Stone, Domesticated trout, p. 151, 6th ed., 1901.

[c] Cloudsley Rutter, Natural history of the quinnat salmon, Bulletin U. S. Fish Commission, vol. XXII, 1902, p. 69 and 72.

[d] Larbalétrier, Albert, Traité-Manuel de Pisciculture d'eau douce, p. 220, 1886: "Alevins.—Les jeunes poissons venant d'éclore portent le nom *d'alevins*. Toutefois, il est à remarquer que cette dénomination s'applique surtout aux jeunes des saumons, truites et ombres-chevalier, tant qu'ils n'ont pas résorbé la vésicule; après, ils constituent le *fretin;* pour les carpes et autres cyprins, quelques auteurs préfèrent l'appellation de *feuilles*. Cette distinction ne nous semble pas nécessaire; d'ailleurs, nous ne sommes pas seul à penser de la sorte, car le nom d'alevin tend à se généraliser."

[e] C. Raveret-Wattel, La Pisciculture, vol. II, 1907, p. 185.

[f] Paul Vogel, Ausführliches Lehrbuch der Teichwirthschaft, p. 334, 341, 347, 349, 1898.

seem to introduce inconsistency into the definitions adopted. Thus under some circumstances a yearling charr might be found of less size than a salmon fry; but it is believed that by use of the above nomenclature an exact interpretation of language will always be made possible. As in all instances involving individual characters, physiological and physical limits may overlap. Salmon fry usually begin to feed before the complete absorption of the yolk, a remnant of the yolk being persistent even for some time after the ventral walls have united and all outward appearance of the sac has been lost; and hence the migrating young of the salmon could with equal propriety be termed fry, since many still have yolk remnants, or fingerlings, since they have begun to a small degree to feed and have become over an inch in length. In this paper, in all cases where the schools contain many individuals with the embryonic fin membrane still evident, the term "fry" is retained. In case of the humpback and dog salmon young which were taken in salt water, it is sometimes impossible to know whether "fingerling" or "yearling" is the proper designation, but since it seems probable that the greater number were less than one year of age, the term "fingerling" is used. In the case of the coho the distinction is even more doubtful, but is applied with as much discrimination as the state of our knowledge permits.

The terms "parr" and "grilse" have come into American use from the British writers on Salmonidæ, but the latter designation has attained a meaning somewhat different from the original.

"Grilse," as applied to the Atlantic salmon (*Salmo salar*) by both American and British writers, refers to the incompletely grown fish which return from the sea to the rivers to spawn. Unlike the Pacific salmon (*Oncorhynchus*), the Atlantic salmon, both male and female, mature perfect sex products before completing their growth, and after spawning in the same manner as the grown fish of one or more years' greater age, return to the sea as "grilse-kelts" to continue their growth and return the following season (or second year after) as "salmon." What are known as "grilse" among Pacific salmon are the small males, presumably lacking at least one year of the usual age of adults of the species, which leave the sea for the spawning beds, mature perfect milt, but after "spawning" die in the same manner as fully grown males. Females in no instance show this precocity. While there are sometimes small females among mature fish, they grade into the regular size in such manner that they can only be supposed to be those individuals which by heredity or unfavorable environment have failed by a greater or less degree to reach the standard size. (See p. 86–87.)

The term "parr" is applied in general to young fish still in fresh water and showing the dark bars or parr marks. They may be fingerlings, or yearlings, or even adults. The males of this stage in the

case of the Pacific salmon in some instances mature perfect spermatozoa, but whether they spawn and die immediately afterwards is not known, nor is it known definitely whether fingerling parrs may develop the sex product.

The terms "smolt" (frequently still spelled and pronounced "smelt") and "kelt" as used for stages of the Atlantic salmon hardly have parallels in the case of the Pacific salmon. If any of the genus *Oncorhynchus* return to sea as kelts, it has not yet been fully demonstrated, and almost the entire weight of evidence is against the belief that it ever occurs. The term "smolt" (French "tacon") is applied, in contradistinction to parr, to that stage of *Salmo salar* when, in fresh water, the parr marks are lost and the young fish assumes its livery of silver in preparation for its descent to the sea.[a] It might be used with some propriety of the yearling migrating sockeye, but it seems undesirable to confuse further the meaning of words which have their proper use only with the eastern species.

HYBRIDIZATION.

The question of natural hybridization has never been investigated, though it has long been well known that trout may be artificially crossed and fertile hybrids produced.[b] That the species of salmon may be variously crossed with success has also been demonstrated, but owing to the difficulty of retaining them in fresh water until of breeding age the fertility of salmon hybrids has not been proved. Rarely adult salmon are taken which seem to possess characters of two species, but on the basis of predominating characters they have been assigned to one or the other of the species and the possibility of a hybrid ignored. The differences in time and place selected by the different species of salmon for spawning minimizes the possibility of natural hybridization; and the deficient vitality of crossed eggs and hybrid fry is, perhaps, sufficient to account for the failure of most if not all such accidental product when natural vicissitudes must be overcome. Moreover, the young of the different species of salmon are distinct and show characteristically distinct habits. This is not so evident, however, in Alaskan trout. Rainbows and steelheads spawn together in the Naha. Spawning cutthroats have not been noted there because they do not happen to inhabit that portion of the Naha which was under observation; but their segregation is inconstant. One species or the other may be most numerous in the lower or upper reaches of a stream. In the Naha basin cutthroats are more numerous

[a] Day, op. cit., p. 90.

[b] For a full discussion of hybridization of trout, see "British and Irish Salmonidæ" by Francis Day, p. 47–50, 254–270, pl. x and xi, 1887, and Paul Vogel, op. cit., p. 308, 311.

in the upper sections of the system; at Yes Bay the case is reversed. If the fry and fingerlings of the three recognized species possess any distinctive marks or habits these have so far escaped detection.

RESEMBLANCE OF THE YOUNG.

By one who knows the adult salmon, the young of the salmon are not apt to be confused with any fishes except trout. Of the fishes having an adipose dorsal they are readily distinguishable from the capelin, smelt, and eulachon by the siphon-shaped stomach and numerous cœcal appendages; the grayling is known by its high dorsal fin; the whitefish by its comparatively small mouth.

The young of the true trout very greatly resemble the spotted species of salmon, and are distinguishable mainly by the short anal fin. The salmons usually show at least 14 fully developed—that is, full length—rays, exclusive of the 3 to 5 short, simple (unbranched) rays in the front of the fin. Sometimes there are but 13, and in rare instances only 12, while the number may be increased to 17 in the sockeye, which normally has 14, and in the king salmon, with 16 as a normal, the extreme will doubtless be still greater. The trout have normally 10 to 12 developed rays in the anal, but while this seems little separated from the number given for the salmon, as a rule the extra length of the fin in the latter may be noted by even a casual comparison. When spread the fin of the trout fingerling shows a rounded outline, the front rays somewhat more evenly graduated than in the salmon and the hinder rays much higher in proportion, causing it to resemble the dorsal in general outline. The anal of the salmon fingerling usually has a slightly concave outer margin, the hinder rays being shortened. The charr (Dolly Varden, or "salmon trout"), in addition to the characters of the anal as just described for the true trout, is distinguishable by the peculiarly mottled coloration, and in the advanced stages also by the less compressed body.

The different species of salmon (*Oncorhynchus*) are not usually difficult to distinguish from one another, yet individual variations sometimes confuse the determination. While in adults the sum of various differentiating characters makes it possible to decide the species, the late development of some characters greatly increases the problem in immature examples. It is possible that some local variations obtain; for example, sockeye fingerlings from Wood River seem to have a much smaller eye than fingerlings of the same size and species in Southeast Alaska. There is also much variation in the length and number of gillrakers in the young of this species and perhaps also in those of the humpback salmon. From the number of specimens at present available for study it can not be determined whether or not this variation is of geographical origin.

The humpback (*O. gorbuscha*) is unique among the salmons in never developing the parr marks. It is usually entirely silvery in all the young stages, and is the only one of the salmons whose young up to some 6 inches in length, taken in fresh water, will show no parr marks even under the scales. As possible exceptions to this must be noted the dwarf sockeye, whose young are as yet unknown, and perhaps small mature fishes returning for spawning.

The fingerlings of the dog salmon (*O. keta*) have the parr marks sometimes much reduced, and those readily disappear in poorly preserved specimens. But where several examples are at hand the greater average size in the younger stages, the slightly different outline, and the presence of these marks will always distinguish them from the humpback.

Of the four species of strongly marked fingerlings the steelhead (*Salmo gairdneri*) may be recognized by its short anal, as noted above for trout, and by its small size taken at the season of migration. The sockeye (*O. nerka*), king (*O. tschawytscha*), and coho (*O. kisutch*), being all for some time resident in fresh water and hence very variable in size, require close inspection for trustworthy identification. In general, in the fingerling stage the sockeye will be recognized by its more slender and tapering form, and by the more nearly circular outline of the parr marks, though this latter does not always hold true. The coho is usually distinguishable by the orange tints of the lower fins (a character rarely absent) and by the white front margins of both anal and dorsal, but especially by the falcation of the anal through the extreme production or elongation of the first developed rays. The king, very similar to the coho in general outline, does not exhibit this extreme form of the anal, and in the specimens examined from the Karluk River the parr marks are larger and the marking of the back much more notable. In a careful examination the sockeye can almost always be identified by the greater length and number of the gillrakers, and the king by the greater number of branchiostegal and anal fin rays. (See detailed descriptions following.)

In salt water the parr marks are rapidly covered by the brilliancy of the silver, so that, except the king and coho, which are spotted, all the species soon become plain. It is not known when the spots of the adult humpback first appear. Whether this obliteration of the parr marks by the silver overcast is caused by the salt water may be questioned, although in the trout, which are known to run indifferently in salt and fresh water, the change is marked, fish from salt water being much more silvery. I have taken one example of sockeye yearling in Jordan Lake that seems almost as silvery as the salt-water individuals of the same size, but it is entirely unlikely that it had returned from the sea.[a]

[a] See under smolt, p. 10. Day, op. cit., p. 90.

Another change with residence in the sea is a rapid increase in proportional depth. This is most marked in the coho. Seven examples from the head of Naha Bay, May 31, length 98 to 117 mm., had depth 4.6 to 5, while in four examples taken August 2, at the cannery wharf, 154 to 210 mm. length, the depth is 3.75 to 4.4, which approaches the normal depth of the adult fish with matured sex products (3.5 to 4+).

DETAILED DESCRIPTIONS OF THE YOUNG.

The following key will assist in the identification of small fingerlings. In larger examples—as large fingerlings and yearlings—the specific characters of the adult must be the main reliance.

KEY FOR IDENTIFICATION OF YOUNG SALMON AND TROUT BETWEEN 1 AND 2 INCHES IN LENGTH.

With adipose fin, large mouth, moderate dorsal fin, siphon-shaped stomach.

a. Anal fin long, at least 12 developed rays, the last of these much shorter than the first, giving the fin a straight or concave margin or outline.....SALMON.
  b. Showing no distinct parr marks. Back dark in dead examples.....*gorbuscha.*
  bb. Usually with distinct parr marks.
    c. Parr marks less distinct, mainly above lateral line, body comparatively slender; gillrakers short, equal to less than 2 interspaces; eye small. *keta.*
    cc. Parr marks more distinct, showing below lateral line; body rather slender or deep; eye large.
      d. Gillrakers long, equal to or greater than 2 interspaces; body rather slender; parr marks tending to become circular.....*nerka.*
      dd. Gillrakers short; body deep; parr marks well defined bars.
        e. Parr marks narrower than interspaces, often orange coloration on fins; branchiostegals and anal rays few, 13 or 14; anal with marginal stripes.....*kisutch.*
        ee. Parr marks wider than interspaces, branchiostegals and anal rays many, 15 to 16, anal not striped.....*tschawytscha.*

aa. Anal fin short, fewer than 12 developed rays, the last not much shorter than the first, the entire fin thus having a convex outline or margin, the height great in proportion to length of base.....TROUT and CHARR.
  b. Parr marks as bars, body compressed, depth carried well toward tail..TROUT.
  bb. Parr marks as roundish blotches with mottling above and below, body less compressed, tapering rapidly toward tail.....CHARR.

THE HUMPBACK SALMON, *Oncorhynchus gorbuscha* (Walbaum).

The humpback fry (pl. 1, fig. 3) at the time of closure of the ventral walls average about 35 to 36 mm. in total length. Depth, greatest just behind pectorals, 6 in length (exclusive of caudal rays); in ill-nourished examples the slenderness becomes marked, this usually quite notable in late migrants; head about 3.5; eye 2.5 in head; nose round and blunt, tip of lower jaw scarcely reaching profile; contour in front of dorsal fin little arched; lunation of caudal slight; pectoral rounded, 2 or a little more in head (measured from axil to tip of longest ray); longest ray of dorsal about 2.5 to 3; longest ray of anal 3 to 3.75; greatest length of ventral equal to or somewhat greater than greatest height of anal; gillrakers long and close-set, about 5–13 developed, longest equal to half diameter of pupil, and to the distance from first to fourth (3 interspaces) at upper end of lower limb.

In life, back green to bronzy, changing to indigo blue upon death; the sides silvery with brassy luster and green tints; ventral surface silvery white, usually without marks of any kind, but rarely with a few faint short parr marks above the lateral line; a narrow median dark line on back; membranes of caudal greenish, with black punctulations; dorsal similar with a narrow darker front margin; pectorals and lower fins colorless; iris greenish silver.

In preserved specimens, particularly formalin specimens, a magnifier shows minute punctulations over almost the entire side, the back, and the dorsal and caudal membranes, and sometimes on the maxillary, chin, and throat.

The humpback fingerling (pl. II, fig. 2) is little changed from the fry described, except in size. It is the most slender species of the genus, with head long and pointed. In 20 examples from Karluk Beach 65 to 92 mm. in total length, the average depth was 5.57 in length to base of middle caudal rays, extremes 5.12 to 6; in 6 examples 83 to 92 mm. long the depth was 5.54, head 4.4, eye 3.8 in head, pectoral a little less than 2, dorsal 2.26, anal a little more than 3, ventral 2.46. Branchiostegals 11–12 to 12–13; gillrakers 10 to 13 upper limb and 16 to 19 in lower limb, longest from 1⅓ to 1½ times diameter of pupil and spanning 4 to 5 interspaces. The length and number of the gillrakers is not infrequently greater than in the sockeye fingerling, but the absence of visible scales in the smaller individuals, and their delicacy and small size in the larger of the humpbacks, as well as the more slender body outline, will distinguish these fingerlings from the sockeye. In the adult humpback the gillrakers are 11–17 to 13–19, the longest 1⅔ to 2 times diameter of pupil, covering 4 interspaces.

Colors of the fingerling: The dusky of the dorsal shows as a diffuse blotch on the front and distal portions, the dusky of caudal more intense toward the points of the lobes and at the base, but less marked than in the dog salmon; a little dusky appears in the axil of pectoral. A few small black blotches on the upper side were noted in a few of some fingerlings reared at the Clackamas station.

At this stage the scales, though very thin and delicate, may be made out with a magnifier or a good eye. The lateral line is a mere furrow and shows no tubing. In the dog salmon of the same or much less size the scales are evident and tubes of the lateral line distinct.

In the Karluk specimens examined the ovaries are ribbon-like, whereas in other species the ovaries are more cylindrical and usually somewhat swelled at the anterior end.

The Dog Salmon, *Oncorhynchus keta* (Walbaum).

The dog-salmon fry (pl. I, fig. 5) attains a length of about 40 mm. by the time the ventral walls are fully united, perhaps a greater length than the fry of any other salmon of the genus. It resembles the humpback in general shape. Greatest depth just behind pectorals, 5.5 to 6 in body; head 4; eye about 2.66 in head; pectoral 1.75 to 2; dorsal about 2; anal about 2.5; ventral equal to anal; gillrakers little more than tubercles, about 5–11 to 12 may be made out, longest about one-fourth diameter of pupil, equal to about one interspace.

In life, ground color bright grass green, becoming slightly darker on back and paling on lower side to an overcast on the silver; occasionally a brassy luster on back; lower parts silvery with the palest green iridescence; back with very fine black punctulations, fusing into numerous small black spots about the size of pupil from nape to base of caudal; a median dark line on back in front of dorsal, not marked back of dorsal. The punctulations cover sides to axil of pectoral in front, to about halfway between lateral line and ventrals, and surround caudal peduncle, becoming coarse and scattered below. The parr marks, from 6 to 12 in number, lie mainly above lateral line.

Pectoral and lower fins uncolored, caudal and dorsal greenish, fading distally, black punctulations on membranes, dorsal with blackish front margin. Iris brassy.

In preserved specimens the general color is silvery, with the dusky shades as described for the humpback, but never so dark on the back. Parr marks along lateral line elliptical or oval in shape, narrower and longer (deeper) toward the head; greatest diameter equal to eye, usually more numerous and narrower than in the sockeye, and not becoming bars as in the coho and king; also more subdued by the silver overcast than in the two last-mentioned species; along median dorsal line a row of small blotches sometimes coalescent into a mere stripe, the area between this and the parr marks usually spotted with round dots less than half diameter of pupil; occasionally a few broken blotches below. Dorsal and caudal membranes and first ray of pectoral dusky; other fins immaculate.

The dog-salmon fingerling (pl. II, fig. 3) is less slender in outline than the humpback, which, except that the dog salmon is obviously scaled, it otherwise resembles.

In 26 examples from Whidby Island, taken June 30, 1903, 78 to 122 mm. total length, sexes in equal numbers, the average depth is 5.1 in body (4.87–5.4); head 4.4; eye 3.3 in head; pectoral 2–; dorsal 2+; anal 3; ventral 2.4; developed anal rays 13 and 14; branchiostegals 13–13 to 14–15; gillrakers 8–12 to 9–15, longest about equal to pupil, spanning about 3 interspaces (sometimes only 2); scales 130 to 146, average 139. In specimens from Dundas Bay, July 24, 67 to 103 mm., the gillrakers are somewhat shorter, ⅔ to once the diameter of pupil, covering 2 to 3½ interspaces; scales 129 to 136, average 132.

In fingerlings from Naha Bay, July 2, 50 to 65 mm. in length, the parr marks are still apparent. In sea-run examples from Karluk Beach, July 24, up to 100 mm., they scarcely show through the scales, but are quite evident when the scales are stripped. The other coloration much as in the late fry stage; chin dusky; several rays of the pectoral with punctulations; tip of dorsal, except last ray, distinctly black; tip of caudal black, marked even in fork, this black tip of caudal distinguishing them roughly from the humpback of the same size, though the scaling must be the final test.

The King Salmon, *Oncorhynchus tschawytscha* (Walbaum).

The young king salmon (pl. I, fig. 4, figure and description from Karluk River specimens) at the time of the complete union of the ventral walls are from 35 to 37 mm. average length. In general outline they are less slender and tapering than the humpback or dog salmon. The depth, greatest in the region of front of dorsal, 4.25 in body; head about 3.33 to 3.5; eye 2.5 in head; pectoral 1.75, vertical fins high, dorsal 1.5; anal 2; ventrals 2.33; gillrakers about 4–11, short and well separated, longest equal to one-half diameter of pupil, spanning 1 interspace. The increased number of branchiostegal and anal fin rays (about 16 in each) help to distinguish this species.

Ground color of specimens in alcohol silvery, and except breast and in front of ventrals, with fine punctulations; about 9 to 12 long narrow parr marks usually equal to or greater in width than the silvery interspaces and lying about equally on either side of lateral line; a dark median dorsal line in front of dorsal fin, not so evident in caudal region; between this and the parr marks numerous round or oval blotches about size of pupil, the larger of these alternating with the parr marks so that it gives the upper end of these the appearance of being symmetrically margined by the silvery of the ground color; caudal lunation comparatively deep. In the Sacramento the caudal sometimes has a reddish tinge, and shades of yellow may appear on the ventrals and anal.

Yearlings (pl. III) from Karluk Lagoon, about 137 mm. long, have the following measurements: Depth 4.4; head 4; eye 3.5–4; pectoral 1.6–1.7; dorsal 1.8–2; anal 2.3–3; ventral 2.2–2.3; greatest depth about midway between pectoral and dorsal, gracefully tapered to tip of the rather sharp nose. Gillrakers 10–13; longest equal to or less than diameter of pupil, spanning about 2 interspaces. (In adults

from Oregon the longest gillraker is about 1¾ to 2 times diameter of pupil, covering 3 interspaces.)

Color silvery, dark above; top of head, back, and sides to lateral line more or less thickly spotted with small roundish black spots about half diameter of pupil and less; distal portion of dorsal dusky, sometimes nearly black; caudal dusky; inner side of outer rays of pectoral dusky; anal and ventrals unmarked; parr marks visible under silver. Distinguished at sight from coho by the longer anal and the usually somewhat smaller eye, but definitely by the more numerous and finer branchiostegals and greater number of pyloric cœca.

The Coho Salmon, *Oncorhynchus kisutch* (Walbaum).

The coho fry (pl. 1, fig. 6) at the time of hatching is about 27 mm. in total length, the sac about 10 mm. The greater size and the peculiar shape of the yolk sac distinguish the coho from the sockeye.

These fry average about 35 mm. total length at closure of ventral walls. The ventral membrane on either side of the ventral fins is persistent for a long period. In general shape the coho fry and small fingerlings much resemble the king salmon. Greatest depth just in front of dorsal, about 5 in body; thence diminishing toward nose; dorsal outline arched; head about 3.75; eye 2.5 in head; pectoral 2; vertical fins high, the front rays in both soon becoming extended; dorsal about 1.75; anal 2; ventrals 2.75; caudal lunation shallow. Gillrakers very short, little more than tubercles, about 5–10.

In Steelhead Creek, May 29, migrating fry had a ground color of smoky green with brassy iridescence, black punctulations everywhere except on throat and breast; these punctulations finest and most numerous on back, becoming coarser and more scattered on lower side; lower side with a red overshade or iridescence; membranes of fins with punctulations, but on pectoral and ventral these punctulations only close to body; remainder of these fins brownish orange; caudal-fin membranes orange ground, the fine black punctulations giving a dark effect, upper and lower (dorsal and ventral) margins clear brown, most pronounced on rudimentary rays, membrane between ray branches colored and dotted as between rays; membranes of dorsal with very pale orange shade deepening on rear, front with black margin equal in width to a central membrane, sometimes a narrow orange margin in front of this; anal membranes distinctly orange with punctulations as in caudal, these becoming close near margin at extremity of long rays and forming a black band about equal in width to two rays and joining membrane, tips of these rays and membranes white, giving the fin a white front margin and a black submargin equal to two or three times the width of white; adipose with orange front and top margin; dentary surface of mandible orange-brown at tip; maxillary uncolored, with scattered punctulations; iris bronzy to brassy; cheek with bronzy ground; opercular face dark; parr marks one-third to one-fourth as wide as long, increasing posteriorly in relative width (antero-posterior), and extending about equally above and below lateral line, the first partly under opercular flap, the last roundish and usually about under adipose fin, the penultimate sometimes under adipose; a narrow dark median line on back; smaller round spots on back sometimes alternate with parr marks. Viewed from above in water, the back shows ground color bronzy, with a few scattered dark spots, narrow supraorbital stripes ending at nostril, the median dark line showing distinctly with bronze bands of about equal width on either side.

In alcohol entire surface dusky, with punctulation except on a little of breast, some of the lower surface of head, and the paired fins. Parr marks present as 8 or 9 short and narrow bars, about one-half the width of the interspaces (variable but not usually so broad as in the king), and equal in length (depth) to about half depth of body, lying about evenly divided by lateral line, becoming more nearly round toward

the caudal; a dark blotch at base and front of dorsal; tips of front anal rays immaculate, forming a distal white stripe along front of fin.

A fingerling 58 mm. in length (pl. II, fig. 4) has a depth of 4 in body; head 3.5; eye 3 in head; pectoral 1.5; dorsal (longest ray) 1.33; anal 1.25; ventral 2 (some of the first dorsal and anal rays are variably produced); gillrakers, 8–14, longest one-half diameter of pupil, spanning about 2 interspaces.

Markings much as in earlier stages, but with additional markings on back. Short oval or triangular blotches appear between the parr marks, and numerous small, round, dark spots become irregularly scattered over entire upper surface, including top of head. The orange tints of the fry and smaller fingerlings largely disappear at about this size, the time of the change varying greatly in different localities. In the same degree the falcation of anal and dorsal shows local and individual variation, but it is always notable. The tips of the first 4 to 6 rays of both these fins, with the outer membrane, retain the orange color or become white, to form a stripe about half the width of the pupil at the margin of the fin; this lies upon a submarginal band of black of similar width. The distinctness of these bands is variable, but in no case are they entirely absent in fingerlings of 40 to 100 mm., or even more, when in fresh water. At a certain point the elongated rays seem to stop growth in extension while the remainder of the fin continues its normal increase in size until the permanent form has been reached, after which all the growth proceeds together. Examples of 130 to 150 mm. show traces of the peculiarity of both growth and color, but later there is no variation from the normal shape as found also in the king.

A sea-run yearling (pl. IV) from Karluk Beach, June 18, 1903, 150 mm. in length, had depth 4.75; head 4; eye 3.66 in head; snout nearly equal to eye; pectoral 1.5; dorsal 2; anal 2.8; ventral 2; gillrakers 9–14, longest equal to diameter of pupil, spanning about 3 interspaces (in adults from 1½ to 2 times pupil, spanning 2¾ to 4 interspaces). Life colors (Rutter) "back olive brown, thickly spotted with black, dorsal dusky, except last ray is pale. Caudal yellowish by transmitted light, tip dusky, the dusky portions greater on lobes; pectoral yellowish; parr marks distinct; iris somewhat golden." In alcohol 11 parr marks quite distinct, a little broader than interspaces and depth about half depth of body, spots on back round, the largest about ½ diameter of pupil, covering top of head and back as far as lateral line—extending on to upper edge of caudal; anal and pectorals with very few punctulations, lower parts silvery.

The Sockeye, *Oncorhynchus nerka* (Walbaum).

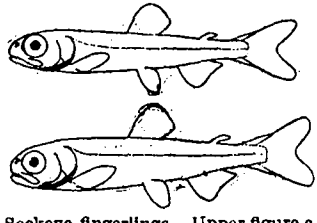
The sockeye fry at time of hatching measures some 24 mm. in total length, the sac itself about 9 mm., varying in individuals. The yolk sac is approximately cylindrical in general outline, sometimes slightly deeper (dorso-ventrally) at the posterior end. It has little tendency to become pointed at the posterior ventral extremity, as in the coho.

The ventral walls become completely united and the yolk disappears externally when the young sockeye measures about 32 mm. in total length. At this stage both dorsal and ventral outlines are arched (the dorsal the more in alcoholic specimens by reason of the contraction of the softer ventral tissues). The greatest depth is near the middle of the body just in front of the dorsal, about 4.75 to 5.5 in length to base of caudal rays (end of scaling). In poorly nourished examples the depth is greatly decreased in proportion to the length. Head about 3.75; nose rounded, blunt, length about equaling half diameter of eye; eye about 2.5 in head; pectoral and dorsal about 2; anal and ventral about 2.66 in head; gillrakers 5–14, in length about two-fifths diameter of pupil, spanning 2 to 3 interspaces.

General color silvery, becoming dusky above. There is less tendency to metallic iridescence than in the coho, and the fins do not show the orange tints of the latter.

The ventral surface is immaculate, including all the lower fins. The fine punctulations with which the upper parts are shaded extend from just behind the gill-openings to slightly below the lateral line and posteriorly approach more and more the ventral surface until, at the caudal peduncle, they reach the lower fin membrane. The individual punctulations are larger and more separated on the lower side; the close setting above gives the back a marked dusky color. The membranes of the rayed dorsal and the caudal are similarly dusky. A single row of small blotches sometimes merging together occupies the median dorsal line from top of head to base of caudal. Along the lateral line or a little below it anteriorly the parr marks appear, from seven to ten small, rounded, or elliptical blotches about half the diameter of the eye and more or less evenly distributed between the gill-openings and base of caudal; the depth of color and the approach to circularity of outline increase toward the caudal region; a dark spot on the opercle and one at the base of caudal complete this row. A second row of similar but smaller blotches sometimes appears between the lateral row and the median dorsal line. In transparent specimens the black of the inner ventral linings may show through slightly. Tip of chin dusky.

The small fingerlings (pl. I, fig. 2), 35 to 50 mm. in length, show some change in shape. The caudal peduncle becomes slim in proportion to the length and the general outline is more tapering; the greatest depth, at a point about midway between base of pectorals and front of dorsal, is about 5 in body; both ventral and dorsal outlines are more nearly straight to base of caudal than in small fry. In larger and well-fed examples the ventral outline is slightly more arched. In poorly nourished and unthrifty examples the greatest depth is through base of pectorals, the caudal peduncle looks deep and thin in comparison, and the depth in front of dorsal is less than one-fifth the body length. (See text figures.)



Sockeye fingerlings. Upper figure a poorly nourished example, lower well nourished.

In markings the general duskiness encroaches on the ventral region, only the belly, breast, and lower head parts (except the chin) remaining immaculate. The median dorsal marking may be a row of blotches, or these may merge into a nearly solid stripe, which in individuals of 50 mm. up usually fades into the general duskiness. In most of the smaller individuals the parr marks are rounded blotches little larger than the pupil, varying in number from 8 to 12 and more or less evenly distributed along the lateral line. The second row above may or may not be present.

Specimens from Karluk between 40 and 50 mm. long show considerable variation from the markings just described. The parr marks are elliptical, about twice as deep as wide, except over anal and on peduncle. These long bars are mainly *below* the lateral line. They much resemble the markings of the dog salmon. These specimens also vary from the more southerly examples in the smallness of the eye and in the fewer and shorter gillrakers. Their identification is not absolute.

At about 80 mm. length (pl. II, fig. 1) the fingerling assumes the graceful outlines of the adult, depth 4.5-5 in body, average 4.6; head 3.66-4.12, average about 4; eye nearly 3 in head, pectorals 1.5-2, average 1.66; dorsal 1.66-2.3, average 1.8; anal about 2.5; ventrals about 2; gillrakers very variable, 12-20 to 13-22; longest ¾ to once diameter of eye, spanning 3 to 6 interspaces. In fresh water the general color is silvery over dark. Punctulations cover the entire body, except a narrow area between chin and ventrals. The parr marks are more or less elliptical, with a depth about equal to diameter of eye and almost obliterated by the silvery. Occasional fresh-water specimens wholly silvery, sea-run individuals probably always so.

A yearling (pl. V), from Karluk Beach, 165 mm. in length, had depth 5; head little more than depth, 4.5; eye about 3.5 in head; pectoral 1.5; dorsal 2.2; anal 2.66; ventral 2; gillrakers as in adult—that is, having about the same proportion to diameter

of pupil. In life "back grassy green, thickly spotted; a dark blotch on distal half of anterior dorsal rays, posterior rays colorless; tips of caudal lobes dusky; lower fins colorless; no trace of parr marks; iris washed with golden" (Rutter). In alcohol the dark of the back reaches the lateral line in front, then rises under dorsal to about the fifth row of scales above lateral line, and on caudal peduncle approaches the line to about third row of scales. Numerous round dark spots about one-third diameter of pupil on back from nape to caudal, sometimes falling into about 2 irregular rows on each side, with others scattered, sometimes wholly irregular and often continuing on to top of head; the interspaces about twice size of spots. Dusky of dorsal includes all but tips of last 3 or 4 rays; axil and inner surface of upper part of pectoral slightly dusky; tip of chin and adipose fin dusky. When scales are removed, round parr marks may be noted in specimens up to 200 mm. in length.

Almost from the first free-swimming stage the sockeye may be distinguished from any species except the humpback by the length, number, and fineness of the gillrakers. The humpback at times exhibits a greater number of gillrakers, and these of greater proportionate length, than the sockeye from the same locality. In this case, however, the small sockeye fingerlings may be recognized by the color, and the larger by their coarser scales, greater depth, and larger eye.

The Steelhead Trout, *Salmo gairdneri* (Richardson).

There are three accepted species of trout in Alaskan waters—the steelhead, rainbow, and cutthroat. I have been able to find but one type of fry, and am even unable to find distinguishing marks in the young of known species grown in the hatcheries. The fry here described I have called steelhead, for the reason that it is found in abundance migrating to the sea from streams in which large numbers of steelheads are known to spawn. The description may be taken in general as applying also to the rainbow and cutthroat trout fry.

This fry (pl. 1, fig. 7), at the time of closure of the ventral walls, averages between 30 and 32 mm. in total length. Depth about 6; head 3.5 in body; eye 3 in head; pectoral 1.66; dorsal 2; anal 2.25; ventral 2.5. Head pointed; greatest depth through middle in front of dorsal; gillrakers very short and well separated; about 5–10 to be made out by counting the faintly developed tubercles, longest about one-third diameter of pupil, equal to or less than one interspace.

General color silvery, sometimes with brassy iridescence, parr marks 9 to 12, deep and narrow, usually dark and contrasting sharply with the silvery interspaces. Body, except belly in front of ventrals, and fins, except the paired ones, with punctulations; dorsal with front rays black; anal with posterior rays less shortened than in salmon, which character with the fewer rays gives the fin a more rounded appearance

The Charr, or Dolly Varden Trout, *Salvelinus malma* (Walbaum).

The charr fry (pl. 1, fig. 8) has undergone complete absorption of the yolk sac at 26 mm. length. It is slender, with greatest depth through pectoral, much resembling in shape and general appearance the larger sockeye of a somewhat later stage. Depth about 5 in body; head 3.5; eye 3 in head; pectoral 1.5; dorsal 1.66; anal 2.25; ventral 2.5; gillrakers about 4 to 7 or 8, somewhat longer in proportion than in the steelhead, longest equal to about one-half eye, equal to or slightly greater than an interspace.

Of lighter general ground color than the steelhead, the parr marks occurring as 7 to 10 round blotches about the size of the eye, along lateral line; other similar blotches on back. Lower fins immaculate. Readily distinguishable by the slim tapering shape, general brownish color, size and shape of blotches, and anal fin.

In fingerlings, about 40 mm. long, depth about 4.5, greatest between dorsal and pectoral; head 3.66; eye nearly 4 in head; pectoral 1.4; dorsal 1.6; anal and ventral

about 1.87; gillrakers about 5–9, the longest about equal to diameter of the very small pupil and spanning one interspace. An irregular row of alternating blotches below the parr marks, faintly present in fry, becomes more distinct and the back becomes thickly mottled with spots about size of pupil; otherwise the color much as in fry. This species is unusually thick (laterally) in proportion to depth, and is not so much flattened as the salmons and true trouts. This character becomes noticeable in the fingerlings, and together with the peculiar mottling makes them readily distinguishable without counting the anal.

THE BASINS STUDIED.

The two regions from which most of the original material in this paper is derived are the basins of the Naha and the Karluk rivers. From the Naha as a central locality, the conditions existing in adjacent basins received some attention, and salmon from Yes Bay, Karta Bay, Moira Sound, Boca de Quadra, and the streams of Annette Island were examined. These latter waters have been described in the reports of the operations of the steamer *Albatross* in Alaska.[a] The accompanying sketch map of the Naha region illustrates typical conditions as found in most of the smaller sockeye streams in Alaska.

CONDITIONS CONTROLLING THE WORK.

The Naha as an observation station is ill adapted for a small party on account of its complexity and extent, though rendered advantageous by the Alaska Packers' Association establishment and the generous assistance extended by that corporation. The successful conduct of any inquiry, however, requires either a sufficient number of observers to carry on the work simultaneously at all parts of the area to be covered, or a sufficiently small area to permit the party available to cover the entire territory readily; and of indispensable importance in fishery investigations is sufficient apparatus, such as boats, suitable nets, etc., to apply continuously any given line of experiment or study. For the best work on the Naha the absolute control of at least 4 boats would have been necessary, and even with this complement, the distance from the nearest habitable quarters at the mouth of the stream to the spawning ground of the fish is such that the round trip is practically a day's journey, leaving little time for observations en route or at the extremity of the trip. Another complicating feature, objectionable from one standpoint, desirable from another, is the presence of the brackish-water lagoon. Had it been possible readily to reach the mouth of the river above the lagoon, the trap could have been set there, as was to be desired; the lagoon

[a] Moser, Bulletin U. S. Fish Commission, vol. XVIII, 1898, p. 1–178, and vol. XXI, 1901, p. 173–398, and 399*–401*. It should be noted that in the descriptions of the Moira Sound region, vol. XVIII, p. 78–80, the descriptions for Kegan and Old Johnson stream have been transposed; the figures for the catch, however, are correctly assigned.

would thus have been a part of the salt-water approaches. Under the circumstances, however, it was necessary to operate the trap at the rapids below the lagoon, where it was subject to the rise and fall of tide. This necessity may to a certain extent have altered results.

METHOD USED TO DETERMINE MIGRATORY MOVEMENTS.

The apparatus used for taking the migrating young was a sort of fyke trap made from a regulation collecting seine used by the Bureau, and was similar in principle of operation to the gear used by Rutter in the California investigation and by Babcock in the Fraser (p. 30). The conversion of the seine into a trap was accomplished by sewing on a bag of coarse bobbinet to surround and extend beyond the netting bag of the seine. This latter was then opened and a small funnel of bobbinet laced to the opening. The large bobbinet bag was closed at the hinder end by tying with a cord, so that it could be readily opened and the contents shaken into a bucket. With a short seine pole and bridle at either end the contrivance was then ready to hang across the current for operation. For successful results the current must be sufficiently rapid to keep the bag distended—otherwise the fish will not enter it—yet not strong enough to burst the fabric. In water too swift the smaller fish are pressed against the web and drowned. The rise and fall of the tide at station 2 in the Naha vitiated the statistics to a degree. With such a contrivance careful weight must be given to the state of the water. Muddy, swift water as at flood time always shows an increased catch, due doubtless in part to the favorable influence on the operation of the apparatus as well as to increased movement of the fish.

This apparatus as ordinarily operated is very defective. Estimates of numbers of migrating fish based upon its results can be only very distantly approximate. In no case can the entire current of a large stream be occupied, and only in exceptional cases will the net at all times reach from top to bottom. In the Naha and Sacramento tests, the lead line was frequently some distance from the bottom; in the Fraser River inquiry, however, it appears that the net was set on the bottom. Only by repeated tests can it be determined on which side of the stream the net will be most effective. On the Sacramento I made a few tests as to its efficacy at the side and center of the channel, respectively, but results were not definite, since other factors necessarily entered into the question. A complete experiment would require several of these traps to be operated simultaneously in different parts of the stream. In any current where fine-meshed fabric can hold, moreover, the stronger fish can breast the stream and escape. This defect of the device used is called to attention by Mr. Babcock in his report for British Columbia. The objections stand only against estimates of total number of migrants based on the catch made.

THE NAHA.

CHARACTER OF THE STREAM.

The Naha River rises in the upper central part of Revillagigedo Island, Southeast Alaska. Its extreme upper part has not been explored, but doubtless possesses no characters of note differing from the usual mountain stream of that region. As a whole the stream is somewhat peculiar in the large number of lakes (four) in its course, but the total surface area of these four lakes is no greater in proportion to the volume of the stream than may be found in other instances, for example, the Karta River. The upper two of these lakes are of no great importance to the present salmon run, since a fall of some 30 feet, together with a series of broken cascades below the ower one, now prevents the ascent of the salmon. The two lakes are connected by a short reach of the stream which offers no obstruction to the passage of fish between them. The lower one, known as Patching Lake, is well stocked with cutthroat and Dolly Varden trout, and seems to contain also the dwarf form of the sockeye. In the spring of 1903 a plant of sockeye fry was made in the connecting stream, making the original presence of the dwarf form subject to some doubt. Patching Lake is the largest of the four lakes and is probably the deepest. It is between 2 and 3 miles in length and less than one-half mile in width. Depths of 140 feet have been sounded.

In the lower course of the river, and yet accessible to salmon, are two lakes, Heckman Lake, about 1½ miles in length, and Jordan Lake, of about 1 mile. At the mouth of the stream is a brackish-water lagoon, about 1 mile in length, known as Roosevelt Lagoon. This latter receives the salt water from Naha Bay at ordinary and spring tides. Its surface water shows brackish everywhere except in time of flood waters, and the greater depths are doubtless quite salt.

The greatest depth in Heckman Lake is about 130 feet, in Jordan Lake somewhat less. The area and shallowness of these lakes, together with their exposed situation, admit of an early acquisition of high surface temperatures. Fortmann Hatchery is located at the head of Heckman Lake adjacent to the most important natural spawning ground of the sockeye. These beds are about 6 miles from tide water, one-half of this distance being occupied by the lagoon and lakes. As originally found they were about 400 yards in length and of perhaps 15 or 20 yards average width, the whole more or less covered with logs and drift. In addition to these, small parts of the section of the river connecting Jordan and Heckman lakes were used; also McCune Creek at the upper end of Heckman Lake, and unimportant areas of Emma Creek, a small tributary of Jordan Lake. All of these beds are also frequented by the coho and humpback salmon, but the greater number of these two species do not reach Heckman

Lake. Their most prolific grounds are that section of the main river between the lagoon and Jordan Lake, a large area being afforded by the stream just below and immediately above Dorr Falls. In addition they occupy the many small creeks which enter the lagoon, the river, and the lakes. King and dog salmon enter the Naha in too small numbers to indicate their preferences, but king salmon have been seined at the hatchery, and it is probable that in all such streams they go as far upstream as possible. But one king salmon fry was taken during the present work, that from the lower river on June 11, 1903. A few dog-salmon fry were noted migrating from Gibson Creek. They formed a scarcely notable percentage in the catches in the main stream.

A considerable part of the shores of both Heckman and Jordan lakes is of gravel and apparently not unsuitable for "nests." It may be that when the stream was crowded the shores were used, but at no time were sockeyes observed to spawn about the lake shores as in other basins. The portion of the stream between these two lakes was not inspected, but the area of suitable ground for beds is said to be small, the channel being very rough. A few cohos spawn just above Jordan Lake, but inspection by the hatchery superintendent has shown that the sockeyes do not frequent this section of the river.

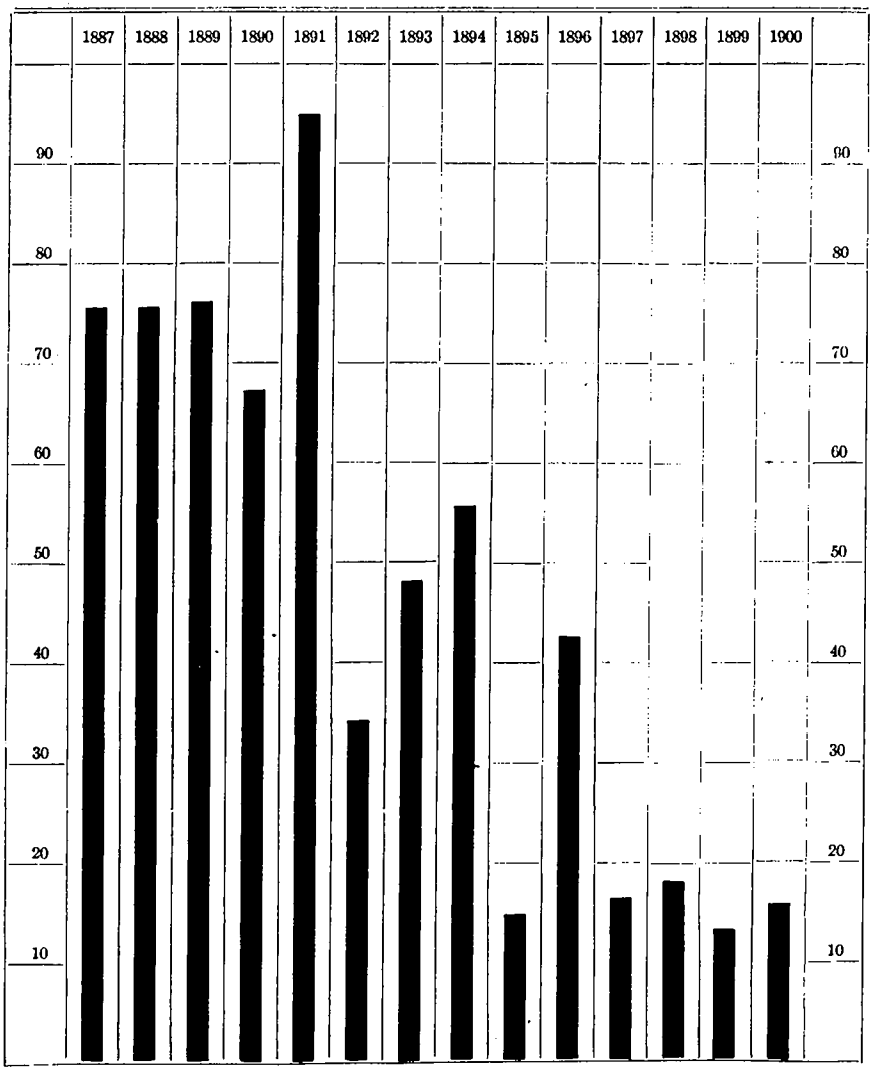
YIELD OF SALMON.

As a sockeye stream the Naha has been one of the most productive of the smaller streams of Southeast Alaska, a fact which may be due in part to its having been so unremittingly fished. The long, narrow bay which receives the river furnished excellent fishing grounds, and the shallow upper end an excellent foundation for a fence. In the following table is shown in round numbers the yield of the Naha and the important adjacent streams for each year from 1887 to 1900:

YIELD OF THE NAHA AND IMPORTANT ADJACENT STREAMS, 1887–1900.

Year.	Naha.	Yes Bay.	Karta Bay.	Quadra.	Total.
1887	75,000				75,000
1888	75,000				75,000
1889	76,000				76,000
1890	68,000				68,000
1891	96,000				96,000
1892	34,000				34,000
1893	49,000	26,000			75,000
1894	56,000	22,000			78,000
1895	15,000	42,000		97,000	154,000
1896	43,000	46,000	84,000	137,000	310,000
1897	16,000	61,000	23,000	65,000	165,000
1898	18,000	44,000	106,000	98,000	266,000
1899	13,000	69,000	56,000	166,000	314,000
1900	15,000	80,000	63,000	175,000	335,000

THE CATCH OF SOCKEYES FROM THE NAHA RIVER, IN THOUSANDS.



The large catch in 1891 was due to close fencing as well as abundance of fish. It will be noted, as shown in the accompanying block table, that the decline in numbers, while in general gradual, is most marked in four-year periods after this date. It also will be remarked that the heavy catches do not coincide in the different basins, pointing to a shifting of the general run under different circumstances. Conclusions based on the commercial catches, however, require not only accuracy in the statistics, but details as to the efforts made to take all fish arriving in the given waters. These details, unfortunately, we do not have. Yet these figures undoubtedly indicate the

possibility of fishing out a given stream, and with this is carried the implication that at least the greater part of the supply of any stream must be derived from the fry produced in that stream.

CATCH OF YOUNG SALMON IN THE TRAP.

To determine facts regarding the migration of the young salmon into salt water, a trap such as is described on page 21 was placed below Hirsch Rapids on the Naha, at station 2 (see map, p. 112). The location was chosen on account of its accessibility, as stated above. The catch made by this apparatus is shown in the following table (no. 1). As the trap was operated in salt water, the catches included sticklebacks, perch, blennies, occasional trout, etc., which are grouped under "Other fishes."

TABLE 1.—CATCH MADE BY TRAP AT STATION 2, NAHA BAY, 1903 AND 1904.

Date.	Surface temperature.	Sockeye.		Coho.		Humpback, fry.	Dog salmon, fry.	Other fishes.	Remarks.
		Yearlings.	Fry.	Yearlings.	Fry.				
1903.	°F.								
Apr. 21	.....	.....	.....	.....	.....	695	.....	17	
22	40	.....	.....	.....	.....	2,830	.....	(a)	Net broken by large steelhead, and catch partly lost.
23	39	.....	.....	.....	.....	150	.....	(?)	Net slipped.
28	.....	.....	.....	.....	.....	3,825	1	9	River rising; 15-foot net.
May 11	40	.....	.....	.....	.....	1,175	.....	1	Net upset by tide.
17	.....	480	1	19	(b)	2,200	(?)	24	River falling.
23	45	800	1?	40	(?)	260	(?)	(?)	15-foot net.
24	.....	375	.....	(?)	.....	275	.....	(?)	Do.
June 2	44	650	15	(?)	.....	40	1	15	Do.
11	51	.....	.....	.....	.....	.....	.....	.....	No catch; 15-foot net.
13	52	3	.....	.....	.....	3	.....	.....	15-foot net.
14	52	2	.....	.....	.....	1	.....	2	Do.
July 1	53	1	.....	.....	1	.....	c8	.....	
2	53	3	.....	.....	1?	.....	c4	.....	
Aug. 12	.....	.....	.....	.....	.....	.....	.....	.....	No catch.
1904.									
May 17	.....	10	.....	.....	.....	7	.....	4	15-foot net.
18	.....	99	.....	.....	.....	223	.....	9	25-foot net.
19	44½	803	.....	12	1	2,365	.....	89	
21	43½	334	.....	104	.....	585	.....	100	
22	45	556	.....	58	.....	52	.....	40?	
23	.....	674	.....	25	2	50	.....	100	River falling.
24	47	408	.....	12	.....	20	.....	55	
25	48½	349	.....	6	3	.....	.....	100	
26	50	247	.....	6	.....	3	.....	30	
27	49½	34	.....	12	.....	.....	.....	55	Spring tides.
28	48	91	.....	10	.....	.....	.....	65	
29	48	211	.....	50	.....	1	.....	135	
31	.....	732	.....	31	3	1	.....	45	
June 1	50	597	.....	3	8	2	.....	40	
2	49½	832	.....	6	3	5	.....	40	
3	52	692	.....	.....	.....	.....	.....	20	
4	51½	108	.....	1	.....	1	.....	21	No reason known for small catch.
5	.....	1,157	.....	5	1	18	.....	52	
7	50½	13	.....	.....	1	1	.....	1	15-foot net.
8	51	186	.....	.....	2	5	.....	6	25-foot net.
10	52	83	.....	.....	2	.....	.....	17	
13	51½	50	.....	1	.....	.....	.....	1	
18	49½	30	.....	.....	6	.....	.....	30	
22	49	15	.....	.....	1	.....	.....	25	
26	50	11	.....	.....	.....	.....	.....	3	
30	.....	4	.....	.....	.....	.....	.....	7	
July 9	59	.....	.....	.....	6	.....	.....	1	
10	60½	.....	.....	.....	7	.....	.....	2	
Sept. 2	.....	.....	.....	.....	.....	.....	.....	.....	Perch and sticklebacks.

a Several. b Few. c Not fry but parrs, average 50 mm.

During the season of 1903 a 35-foot trap was used except where otherwise indicated in the table; in 1904 a 45-foot trap.

In 1903, in 17 sets of the trap at Hirsch Rapids, station 2, between April 21 and August 12, on only three occasions were sockeye fry taken, twice a single example and the other time fifteen. In six trials from April 21 to May 11 no sockeyes were taken; on May 17, 23, 24, and June 2, a total of over 2,000 sockeye yearlings from 52 to 97 mm. total length, together with over 2,500 humpback fry, were taken. Thus it would seem if any great number of sockeye fry were migrating more would have been found in the net.

In 1904, between May 17 and June 30, at the same point, over 8,300 sockeye yearlings were taken, as well as over 3,300 humpback fry and nearly 350 coho fry, but no sockeye fry.

In 1903 a trap was placed in the Naha at station 1 as soon as the lagoon was sufficiently clear of ice to permit use of a boat, April 12 to 19, thus probably securing the earliest movement of humpback fry. At this time all the lakes above were entirely covered with ice. April 19 a set at station 3, just below Jordan Lake, took only humpback and dog-salmon fry. It can not be that the run of sockeye fry was over before the work was begun, since great numbers were only recently hatched, nor is it likely that it occurs later in the summer, for no fry of any kind were taken in a trap set August 12, 1903, July 9, 10, and September 2, 1904, nor in one set in the outlet of Yes Lake, July 18 to 21, and August 5 to 26, 1905.

A remote opportunity for error lies in the fact that, Roosevelt Lagoon being salt water at the bottom, a deep-water fish, which the young sockeye undoubtedly is to an extent, might pass the rapids at high water and go under the trap. But this is extremely improbable, since in British Columbia waters, where the migration has been studied, the fry passed in the same manner and at the same season as the yearlings. It is further shown to be unlikely by the fact that a trap set below the mouth of Jordan Lake at station 3, May 15, 16, and 17, 1903, took only 2 or 3 sockeye fry, while securing some 12,000 humpback. At the same point June 2 and 3 only 14 sockeye fry were taken. At this date the humpback run was practically over. Nor did a trap set at the foot of Heckman Lake, station 4, May 12 to 14, show any considerable movement, 6 sockeye fry being taken, with 250 yearlings.

In 1903 the first movement of sockeyes at salt water was noted May 17. May 11 a trap set at station 2, in which over 1,000 humpback fry were taken, failed to secure any sockeyes. The migration probably began on the high water of May 12 to 15; 300 yearlings were taken on the latter date below Jordan Lake. May 17, 220 were taken in a trap spanning about one-third of the channel at station 2; on the 23d over 800 were secured by a trap of half the size, spanning about one-fifth the channel; in this small trap 375 were taken on the

24th and 650 on June 2. After this latter date the catch fell away; June 3, only 9 yearlings were taken below Jordan Lake, and at station 2 on the 13th and 14th but 5 were obtained.

These trials indicate that the migration in 1903 began about the middle of May and practically ended early in June, though stragglers continued to show into July. The maximum occurred about May 23, after high water in the river and on high tides in the bay.

In 1904 the run had begun before the work was commenced. The first trial was made at station 2, May 17, and though the trap was badly damaged, 10 yearlings were taken. On the 19th, with a trap covering about 60 per cent of the channel, 863 yearlings were secured. The run continued with variations till June 5, when a maximum catch of 1,157 was made. After this date the catch rapidly decreased, only 83 being taken on the 10th, 50 on the 13th, 4 on the 30th, and none July 9 and 10.

In comparing the runs of these two seasons it must be noted that the conditions varied materially. In 1903 the heavy ice kept the river closed until an unusually late date. The lakes were not entirely clear from ice until about May 12, and the temperature of the river did not rise above 40° until after the middle of May. In 1904, at the time of arrival of the working party, May 16, the river had reached a temperature of about 44° and the ice had been gone for several weeks. By the latter part of May the temperature had risen to 50°, and by June 2 to 52°. In 1903 this latter temperature was not reached till June 13, yet in 1904 the run continued over almost the same period as in 1903, reaching its maximum perhaps somewhat later. This fact must be related to the much greater output of the hatchery for the latter year. In 1902 about 10,000,000 fry were liberated, under primitive conditions; the following year nearly 30,000,000 were planted under somewhat better conditions. The product of natural spawning is a negligible factor.

YES BAY STREAM.

Yes Bay is about 30 miles north of the Naha on Behm Canal. The river is somewhat larger than the Naha and about 1 mile in length below the lake. Yes Lake is nearly 4 miles in length and of average width less than one-half mile. The greatest depth is 230 feet. Above this lake the river offers about three-fourths of a mile of excellent spawning ground, at the end of which the further ascent of fish is cut off by high falls. These falls were passable at one time, perhaps, as Dolly Varden trout have been taken above them. At a considerable elevation are other lakes of less extent that have not yet been explored.

Yes Lake has no tributaries that are occupied by spawners except the main stream. The sockeyes use the upper river above the lake.

This section is also frequented by cohos, steelheads, and an occasional king. Humpbacks spawn mainly in the lower river. The Yes Bay hatchery is located on the section of the river immediately above the lake.

The trap maintained at the foot of Yes Lake July 18 to 21 and August 5 to 26, 1905, made no catch of migrating fry or yearlings. It was evident that the migration was entirely over at that time. A trap of the same kind installed during the spring of 1907 at the same point made heavy catches of young, but at the time of writing this report the material has not been specifically identified. Most of the data regarding the summer residence of young in the lake were drawn from observations in this locality.

KARLUK RIVER.

SUITABILITY AS A SPAWNING STREAM.

The Karluk River is a much larger stream than the Naha.[a] It is about 20 miles in length and several times the volume of the Naha. The lower course is one continual rapid, but presents no falls to obstruct the ascent of the fish. The upper course is of moderate current and affords excellent spawning ground, while in addition there are many sloughs to act as nursery ponds for the young. The lake is estimated to be 8 miles in length and 2 in width, depth unknown; two much smaller lakes are tributary to the main body. There are numerous small streams entering the main lake, some of which, as the outlets of the tributary lakes, are of considerable length and suitable for spawning ground, while others are swift mountain torrents with rough beds which offer but small areas for the fish. The shores of the lakes also are utilized for spawning. The river proper falls into a lagoon some 2 miles in length, into which the salt water flows from about half tide, so that it is largely brackish. The outlet of this lagoon to the sea is narrow and gives rise to strong currents in each direction somewhat as in the Naha. Near the head of the lagoon is located the Karluk hatchery. The Karluk River has been good for an annual output of about 2,000,000 sockeyes, besides small runs of king and coho and occasional large runs of humpbacks.

MOVEMENTS OF YOUNG SALMON AS SHOWN BY TRIAL CATCHES.

The least inconvenient means of access to Karluk Lake is by portage from Larsens Cove, Uyak Bay, to Nicolai's barabara, a trip of 5 miles; thence by river, too shallow for a boat and too deep for good walking, 6 miles more to the lake. The labor required to bring to the lake the necessaries of life, and the consequent lack of scientific

[a] A full description, by Dr. Tarleton H. Bean, may be found in Bulletin U. S. Fish Commission, vol. IX, 1889, p. 165 et seq.

outfit, will account for the meager results the observers obtained in certain lines.

At this station the main attention was given to adult fishes. These were taken in a small pound or trap spanning about one-fourth the outlet on the shoal side and built for taking the incoming fish. A trap for young was operated a few times in connection with this pound and was also set a few times in tributary creeks. The party was equipped with a single net so constructed, and the débris from the lake soon accomplished its ruin. On account of this shortage of proper gear the movement of fry and yearlings from Karluk Lake was not followed with any definiteness. Five sets were made with a 25-foot net rigged as above described, with the following results:

June 5, over night, sculpins, sticklebacks, 150 salmon parrs, a few salmon fry, a few trout fry.

June 25, over night (between pound and shore), 738 sculpins, 530 sticklebacks, 23 trout, 32 salmon parrs, 16 salmon fry.

June 27, over night, sculpins, sticklebacks, 8 trout, 2 salmon parrs, 2 salmon fry; 12 m. to 5 p. m., a few sculpins and sticklebacks.

June 28, over night, sculpins, sticklebacks, 1 salmon parr, no fry.

June 30, 12 m. to 4.30 p. m., 3 sculpins, 165 sticklebacks, 1 salmon parr.

It will be noted that all these results show but a slight movement of sockeye fry from the lake. It may be they had reached the river prior to the first set of the net, though not all had passed down the stream. Throughout May and June the sloughs of the upper part of the Karluk River contained many sockeye fry or small fingerlings. In a haul May 22 nearly a thousand were taken, many with remnants of yolk. June 21 large schools of small fingerlings were numerous in the upper river, and some were taken with the dip net. June 30 a few fingerlings averaging nearly 2 inches in length were taken in a pool of the river. Such fish seem to have disappeared soon after this date, since the observers made no further note of them. Fry and small fingerlings were abundant in the lagoon during June, July, and into August, but as these may have been the hatchery output, their presence indicates nothing regarding migration habits, except that they all apparently passed out into the sea during the summer.

It would seem that the station party would have noted any large movement from the lake had it occurred, since their camp was established at its mouth early in May, before the ice had left it. But this is not necessarily true. At that season daylight lasts from about 3 a. m. till 10 p. m. The young salmon travel little in daylight, and it might easily be that a considerable movement could have occurred without remark. It might be thought possible that the numerous fry in the river were the product of eggs spawned below the lake by fish arriving after low temperatures obtained. That this is highly

improbable, however, appears from the fact that such eggs could not have hatched and the young developed by the time the fry were noted. Ripe fish would scarcely fail to enter the lake up to the time that ice formed upon it. It was shown that while ice is on the lake the temperature of the river is not much above 34° F. At this temperature the sockeye eggs would require about two years to develop into migrating fry.

CONDITIONS REPORTED IN BRITISH COLUMBIA.

The observations made in British Columbia, under the direction of J. P. Babcock, on the Fraser and Wannuck rivers (see Annual Reports of the Fisheries Commissioner for British Columbia, 1902–1904) should be noted here. In the spring of 1902, following the big run of 1901, fry were abundant in Lake Creek, the outlet of Seton Lake, and apparently migrated downstream at the same time with the yearlings. In 1903 swimming fry were seen in Lake Creek as early as January, remaining till April. They seemed to move downstream in April and May, after which none was seen either in Lake Creek or in Seton Lake. The movement of the yearlings began on the spring floods early in April and continued to June, being the heaviest the first two weeks in May. Observations at Lytton, in the main river, found fry and yearlings, the latter least in number, traveling together between April 1 and July 13 in both the Fraser and Thompson rivers. In 1904 no fry or yearlings were found in the rivers. This was supposed to be due to the absence of spawners in the waters above in 1902 and 1903. It would seem, however, that if the movement of fry in 1903 was marked there should have been a corresponding number of yearlings to show in 1904. It is impossible to believe that the product of the 1902 eggs all left the waters as fry. Trials in the Wannuck River at Rivers Inlet, north of the Fraser, in 1904, discovered an abundant movement of both fry and yearlings between April 13 and July 1. The fry were in greater abundance than the yearlings and the height of the run was between May 22 and June 16. This greater abundance of fry as compared with the number of yearlings is thought by Mr. Babcock to be due merely to the operation of the trap. Both fry and yearlings drift downstream tail first. The tail coming in contact with the net, the fish would attempt to rush upstream and avoid the obstacle. If the net were set in water of moderate current the stronger yearlings would be able thus to avoid it and escape, whereas the weaker fry would be more likely to enter it. In swift currents both are forced into the trap.

SUMMARY OF OBSERVATIONS.

From these various records it would seem that in the larger rivers, as the Karluk and Fraser, many sockeye fry leave their nursery waters as soon as they are able to swim and feed, or at the beginning of the fingerling stage; that in the smaller streams, as the Naha, this number is small and, in comparison to the number resident for one season, negligible; that in all cases a portion, perhaps the greater, remain in the lakes for one winter and migrate in the following spring as yearlings. Whether any spend a second winter in the fresh water has not been demonstrated. This residence of large numbers of young in fresh waters with a definite and apparently anticipated movement seaward the second spring of their existence is unique in this species. While some king and coho young spend the summer in the vicinity of their birthplace there is no evidence that these summer residents do not pass to the sea as a rule during the fall, or for that matter at any convenient time. Their continued stay seems to depend largely on the period of rainless weather that obtains on the Pacific coast during the summer months. Only a small remnant of the lake-inhabiting fingerlings of these two species spend a winter in fresh water. Humpback and dog salmon all leave for the sea almost as soon as they are able to swim. This habit of the sockeye is doubtless connected closely with the habit of lake spawning, or is even the immediate effect of that cause. Further, it probably has given rise to the dwarf form, of which no analogue exists in the other species.

YOUNG SALMON IN FRESH WATER.

THE SOCKEYE.

MOVEMENT OF FRY ABOVE THE LAKES.

The sockeye fry when hatched or planted in the tributaries of a lake linger a little while on the nursery ground. Small plants made in pools near Loring in 1903 remained a considerable time after the absorption of the yolk sac, and the same fact was noted at the nursery pond at Fortmann Hatchery the following year. Similar observations were made also at Karluk. The first creek entering at the foot of Karluk Lake is a small creek consisting of three pools connected by short rapids and fed entirely by springs. A few sockeyes frequent it for spawning, the greater percentage, apparently, being weak fish that are unable to continue the journey. It may be, too, that this creek remains open late in the fall and finds favor with late-coming fish. On July 14 a net was set across the mouth, taking in daylight 4 adult salmon, 1 stickleback, and 1 sculpin. At night 6 adults and 87 young sockeyes, 7 sticklebacks and 1 sculpin were taken. Of these young 11 were feeding and had reached an average length of 41 mm.

They contained insects, larvæ, and crustaceans. The remainder were recently out of the fry stage, and only a few had begun to eat. This indicates that some of the young remained some time longer in the pools than they would have done in a stream of different character. Their late development is doubtless due to the cold spring water. Nets set across one of the principal spawning creeks on July 16 and 27 took very few fry.

After some days, perhaps when growing necessity for food demands activity, sockeye young, as fry or small fingerlings, drop down the stream into the lake or maybe the sea. During the season of observation on the Naha none was ever seen in the stream below the lakes, though cohos in abundance were resident there throughout the summer. Nor were any ever seen by the writer about the margins of any Alaskan lakes except in the one instance mentioned below. Sockeyes apparently are never resident in the streams and never found in them except during the migratory movement.

While adequate observations are lacking, it is probable that the fry travel in schools. In the Karluk they were observed by Rutter to school while in the sloughs, though they have nowhere been seen to migrate in schools. In the lakes they remain during daylight in comparatively deep water. Rutter notes that they were at no time seen in abundance about the shores of Karluk Lake; Babcock states that they were not seen in Seton Lake after May. In the Naha lakes they were seen but once, June 11, a small school in Heckman Lake near the outlet, and a few in Jordan Lake in company with numerous cohos. They were taken in Alturas Lake outlet by Evermann on July 20 with fingerlings of the same species. Later in the season young sockeyes were obtained in Alturas Lake only by sinking the seine to the bottom in water of considerable depth, 15 to 60 feet. In Yes Lake in 1905 they were taken by surface hauls of a 130-foot seine after dark in the latter part of August and September, and the same means were used successfully in the Naha lakes later in that season.

FOOD AND FEEDING.

In the lakes and in all waters where such food is available, young sockeyes subsist largely upon small crustacea and associated forms, most of which have a diurnal movement to and from the surface, varying with the light. In the evening they rise to near the surface, and, with the coming of daylight, or shortly preceding day, retire to greater depths.[a] In 1905 from August to November a number of tows with fine nets in Yes Lake and the Naha lakes showed that crustaceans are ordinarily absent from the surface during daylight.

[a] The diurnal movement of plankton Crustacea, by Chancey Juday. Transactions Wisconsin Academy of Sciences, vol. xiv, 1904, p. 534–568.

They could be taken in small numbers by sinking the net several fathoms. In Klawak Lake, however, on October 1 copepods seem to have been abundant near the surface at any time of day, but this was noted in comparatively shallow water, whereas the trials on the other lakes had been made in water of greater depth. As these forms have little horizontal movement it may be that their presence in Klawak Lake during the day was to be accounted for by the shallowness of the water.

On the approach of darkness many of these crustaceans congregate near the surface, and with that come the young sockeyes. Taken soon after dark, these young fish commonly had the stomach filled with crustacea, with a number of insects, mostly flies and winged ants, in the esophagus. Over the entire surface of Yes Lake on a quiet evening of August or September the presence of young fish could be marked by the ripples. Sometimes they would jump clear of the water, but more usually merely rise to the surface, apparently to snap up the floating insects which they then sought. The depth at which the fish remain during daylight is unknown, but is probably not great. As noted above, they were obtained in Alturas Lake in 15 to 60 feet. Whether any lived at the greater depth is unknown, since the seine had to be landed through lesser depths. It is unlikely they much exceed such depth, since in summer the lower parts of small lakes are unsuitable for the support of animal life.[a]

Small fingerlings taken in Karluk River May 22 were feeding on crustacea, insects, and insect larvæ. June 21 their food was almost wholly insects and larvæ; in the lagoon July 24 it was mainly insects, but with some crustacea. Specimens of slightly advanced size (average 42 mm.) from Wood River, Western Alaska, submitted by the collector without notes, contain both crustacea and insects. Some small fingerlings taken July 14 in the small creek tributary to Karluk Lake contained insects and in one instance crustacea.

In Yes Lake October 12 tows immediately off the mouth of the inflowing river in water of 47° F. took very few crustacea. These were probably not from the river water, for it, being somewhat colder, would sink to the greater depths on entering the lake. October 17 a net set over night in the river just above the lake took very few crustacea; river temperature 43° and lake 46° F. September 12 a net was set at the foot of the lake in the outflow for fifty minutes and no crustacea taken; at the same time tows were made just above this set net and a few crustacea taken, but much fewer than were usually taken in the main body of the lake. It would seem from these few trials that there is a scarcity of crustacea in both sections of the river,

[a] See E. A. Birge, Gases dissolved in the waters of Wisconsin lakes. Transactions American Fisheries Society, 1906, p. 143–163.

but the matter needs further investigation. Even these slow-moving forms may be able to avoid the action of the current at the foot of lakes and remain within the lake boundaries.

FOOD SUPPLY IN RELATION TO THE HATCHING SEASON.

The relation of food supply to the season of hatching has not yet been worked out. In the latitudes in which the sockeye is found it is improbable that any fry reach the feeding stage in advance of the opening of the streams from ice, unless when the spawn is deposited on the lake shores. In this latter event they would seek subsistence in the lake waters. It is shown above that these fingerlings feed to some extent upon surface forms when in streams or lakes at a season when such food is present. Their more natural food appears to be the subsurface plankton. The abundance of this material may be an important factor in determining the time of departure from fresh water.

This question has an important bearing in fish cultural work. The use of spring or heated water may shorten the incubation period to such an extent that fry reach the feeding stage in advance of the natural production of their food. To liberate them in that event must be disastrous; to retain and feed them artificially nullifies the economic advantage obtained in hastening the incubation.

The temperature at which the most thrifty fry may be produced is another question that should be taken up. There are some data to show that low temperatures increase the number of temperature units required to effect the hatching. In long periods of depressed temperatures errors in the thermometer or its reading will be a greater factor than in short periods of observation. But if very cold water does retard the hatching, then such temperatures may or may not be advantageous. The success of certain methods in handling an insect-feeding species in waters that never freeze can be no criterion as to the best methods for a species of different habits living in different waters.

GROWTH IN FRESH WATER.

Fifty-nine young sockeyes taken in Yes Lake August 24, 1905, varied from about 32 to 66 mm. total length, with an average of about 46 mm.; 66 seined on September 10 varied from 35 to 75, with an average of 50 mm.; 59 taken September 26 and 27 varied between 34 and 82 mm., with an average of 45 mm. Assuming that these by the following spring would reach the same size as the Naha fish taken in 1903 when under the most nearly natural conditions, an average length of 65 mm., they would have to increase from 15 to 20 mm. in length from September to May.

Since the deeper water of the lakes will not fall much below 39° F., the point of maximum density, and since with the approach of cold weather the diffusion of oxygen will become more general, there seems to be no reason, unless there is a cessation of activity due to the cold, why fingerlings should not feed more or less during the winter. Some species of crustaceans are known to reach their maximum numbers during the winter. This question has not been investigated for Alaskan lakes, nor are any data yet available upon which to base conclusions. Fry from the previous season's spawn in Yes Lake are ordinarily able to begin to feed about the middle of April, at which time they are somewhat over 30 mm. average length. By the latter part of August they have reached an average length of about 45 mm., a 50 per cent increase in a period of about four months. That this is crudely approximate is shown by averages in the three catches cited above.

Should the figures for the Naha yearlings show the approximate size of the Yes Lake migrants, these have little greater growth to make between August and May than they make between April and September. This would require little increase in size during the winter, since the lakes seldom freeze over before January, and up to that time feeding on the lake plankton can be continuous. Dr. Evermann's data from Alturas Lake, as showing rapidity of growth, are rendered inaccurate by the necessity of comparing small fingerlings from shallow water with the larger fish from deeper water, but show clearly that the yearlings there attain a larger size than in the Alaskan lakes studied. His specimens of July averaged 48 mm.; those of September 9, 83 mm.

It is interesting to note that while the young taken in Yes Lake in September did not fall below 45 mm., 46 specimens obtained in Heckman Lake October 2 averaged only 36 mm. and 28 taken on October 7 averaged but 40 mm. With this diminished size was noted a corresponding slimness and lean condition (fig., p. 18). It is also to be stated that the surface tows for food material in Heckman Lake, as compared with the material from Patching and Yes lakes, showed a diminution in number and general size of the crustacean life. These facts raise the question of the possibility of overstocking waters with fry. Of course, in case the surplus of young fish leave the parent waters as fry, as would seem to be indicated by the observations of the British Columbia parties, there could scarcely be any danger from this source. But the writer's observations in the Naha failed to reveal any such movement there and it is not unreasonable to suppose that some condition exists there which alters the habits of the fish in that respect. If that is true, and all the sockeye young spend one winter in the lake, then, with the increased millions which artificial hatching is able to turn out, a serious menace is offered to

the natural food supply of the waters, since no steps are taken, or perhaps can be taken, to increase that supply. It is notable that Patching Lake, where wholly natural conditions yet exist, showed a more favorable supply of plankton life than Heckman Lake. In this connection it must also be noted that yearlings leaving the Naha in 1903 averaged about 65 mm. in length. In the following year there appeared a considerable reduction in the size, the average being under 60 mm. This difference in the figures, however, might be due in slight part to the greater number measured in 1904.

The size of the yearlings at the time of their movement varies more or less in different localities. In the Naha, in 1903, 943 specimens averaged 65 mm., with extremes of 48 and 100 mm.; in 1904, 2,714 specimens averaged 59 mm., extremes 47 to 115. (See diagram A[a].) In the Fraser River, as reported by Babcock, the average is 76 mm. Fifty-seven examples from the Wallowa River, Oregon, taken April 20, averaged 100 mm., with extremes of 99 and 132 mm. Besides these, in the same lot, were 6 females averaging 163 mm. (extremes 155 and 178 mm.), which were distinct in size and did not intergrade with the remainder. That they were not the dwarf form is shown by the large number of eggs in the ovaries, the large sockeye bearing always far more than the dwarf is known to contain.

The presence of these large individuals raises the question of a possible second winter's residence in the fresh water. Young sockeyes were found in the Wannuck up to 150 mm. and in the Karluk up to 221 mm., with the spring migrants. The Karluk fish intergrade with the smaller, indicating merely unusual growth. The only disturbing factor in the Karluk data is the fact that some of the larger of these young fish, taken June 25 at the mouth of the lake going up stream, show such enlargement of the testes as to indicate approaching sexual maturity. The largest male and the two females taken in the same lot show no unusual precocity and the ovaries indicate the large form. The maturing males may be the dwarf form, but it is more probable that they are precocious individuals of the ordinary type.

In the yearling sockeye the sexes run approximately equal. Of 1,550 of the 1904 catch examined, 51 per cent were males and averaged 0.2 mm. greater than the females in length, the sexes standing, respectively, 59.7 to 59.5 mm. It appears that the greater size of the male becomes early characteristic.

MIGRATION OF YEARLINGS.

The migration of the yearlings seems to be wholly a matter of instinct. In 1903 the Naha reached a temperature of 40° F. about the middle of April. By the end of that month most of the ice was out of the lakes, but the temperature had not risen further. By

[a] On diagram read "yearlings" for "fingerlings."

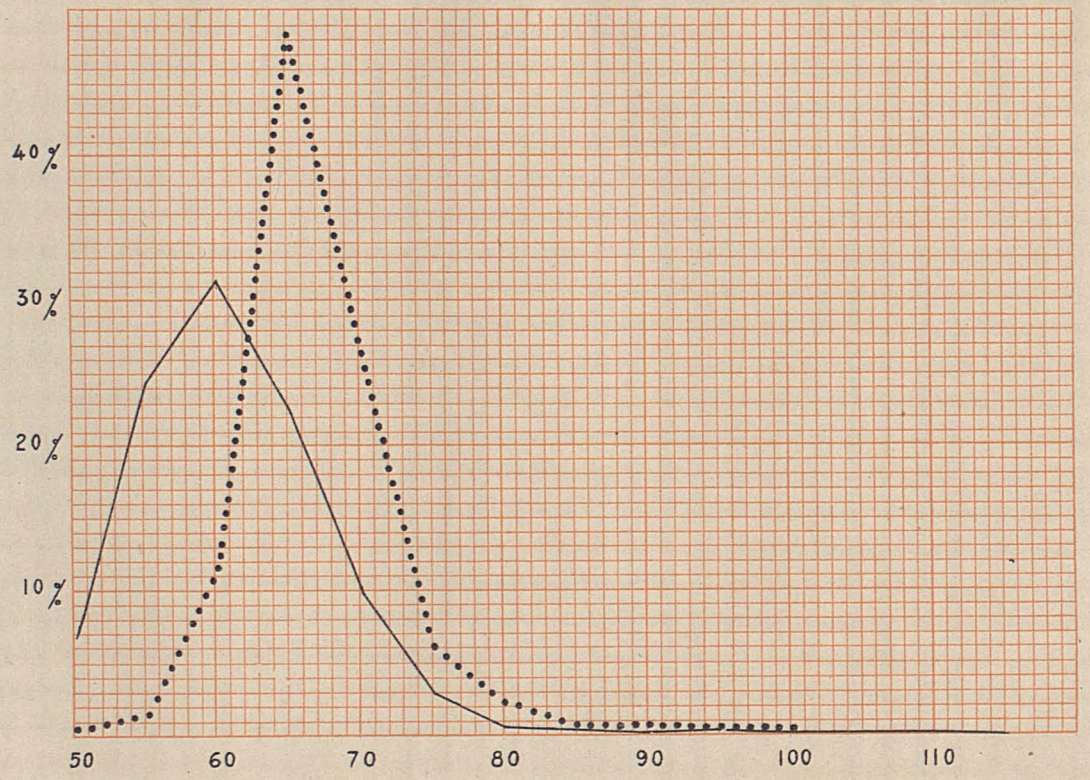


DIAGRAM A.—SHOWING LENGTHS OF SOCKEYE FINGERLINGS MIGRATING FROM THE NAHA IN 1903 AND 1904.

1903 — 1904

e middle of May, when the temperature of the lagoon had reached ° F., though the upper river was still about 40°, the young fish gan leaving in large numbers. The run, however, after lasting out two weeks, fell off abruptly, before any marked rise in temrature had occurred. In 1904 ice had left the lakes very much rlier, but the temperatures were not notably higher the middle of ay than in the previous year; yet on May 17 the movement was full height and continued so till the end of the first week in June, ıen the water had reached a surface temperature of over 50°. It en fell away little less abruptly than in the previous year. During is period the fish showed no corresponding increase in size as the ason advanced, i. e., they maintained about the same average for e four weeks covering the main run, only the remnant stragglers te in June having increased in average length.

In natural spawning the first deposited spawn must be in nō small ırt destroyed by the activities of late-coming fish. Of the eggs posited after low temperatures obtain, the product of the earlier ll perhaps to a certain extent be evened with the later hatching that it will not develop rapidly during the winter, and with the pidly warming water of spring the incubation value of each day ıgments to lessen the total number of days required in the develop-ent of the fry from the egg. Hence, while some fry may be ready move with the opening of the river from ice, the maximum num-r will accrue gradually and fall away abruptly even though the awning be more or less evenly distributed over a greater period, appears to be the case in species migrating as fry. When the ıung feed for a period or season before migrating this effect will obliterated by the superior ability of the larger of them to obtain od and hasten their growth.

That the migration of yearlings takes place in such manner that e average size of the migrants is about the same throughout the ason is shown in the following table:

ENGTHS OF MIGRATING YEARLING SOCKEYES AT STATION 2, NAHA RIVER, 1904.

Date.	Number of specimens.	Average length.	Extremes.	Date.	Number of specimens.	Average length.	Extremes.
		mm.	*mm.*			*mm.*	*mm.*
y 17–18	22	54.4	49–102	June 1	147	57.4	48–75
y 19	347	58.8	47–106	June 4	45	62.5	57–105
y 21	422	60.4	47–115	June 8	81	59.7	49–71
y 23	245	60.5	47–93	June 10	48	58.3	51–67
y 24	244	58.3	49–96	June 13	48	59.5	51–68
y 25–27	318	64.4	48–85	June 18	39	63.2	53–84
y 28–29	190	55.3	50–107	June 22–30	17	72.7	57–115
y 31	491	55.3	47–78				

During the month occupied in the migratory movement there ıould have occurred a growth of some 4 mm. in average length, ıt this in nowise appears, and it may be that the late-hatched

vigorous fish whose superior feeding and digestive powers must have advanced them beyond less thrifty earlier-hatched are among the first to reach salt water.

In the British Columbia work it was shown that the movement took place in the Thompson between the first of April and the middle of July, the run of fry being largest in April, with a temperature of 41°, whereas in the Fraser, with an April average of 36°, both fry and yearlings ran about one month later. The May temperatures of the two streams are about equal—46° for the Thompson and 45° for the Fraser. In June they reached, respectively, 53° and 51°. In the Wallowa River the movement apparently takes place in April; temperature unknown.

It would seem from these observations that migration begins when the water has reached a temperature of about 40°. At this time surface food begins to be plentiful, hence the necessity of seeking new feeding grounds would appear to be less than it is earlier in the season. But before any definite statement can be made regarding food influences it will be necessary to become familiar with the crustacean life of the lakes. In the fall, at least some of the principal crustacean forms are multiplying, yielding an increased food supply which might account for the continuance of crustacean feeders in the lakes. Surface food at that season decreases, hence the tarriers in the streams, as coho and king, must move on as winter approaches. That scarcity of food has some influence might be supposed from the usual paucity of aliment in the stomachs of moving fish. Occasionally there will be found a stomach partially filled, but they seldom contain more than a small part of the quantity ordinarily found in examples taken from the resident individuals in any waters. It is probable that the fish take only what presents itself without any searching on their part.

Floods seem to have little influence on the movement of yearlings beyond the possible temperature influence. Fry are apparently swept out by high water, movement near the mouth of the streams inclining to be heaviest on falling water. No catch of yearlings was made in daylight in the Naha where the water is clear, and though the catch was uninterrupted during the night it appeared to be heaviest in the evening, daybreak seeming again to accentuate the movement slightly. In the muddy waters of the Fraser the catch was continuous through the day. The apparatus used, however, would not be effective in clear water in daylight, and its results can not be taken as a sure indication of the time of movement. That there is little movement in day in clear water is highly probable, since none has been directly observed.

The exact behavior of the large schools of yearlings has been fully described by Mr. Babcock in the report for British Columbia, 1903. They were observed to move down the lake in the afternoons, running

headfirst from the quiet waters of the lake into the current of the outlet. Seton Lake is 17 miles in length and about 1 mile in width. In this body of water there can be no perceptible current setting down the lake, since the winds would produce more tide than gravity; temperatures, while higher at the head than at the foot, will exhibit no sensible gradual increase after a short distance from the inflow of the cold streams. Yet these schools, apparently guided by instinct alone, approach the outlet directly. Were not the same phenomenon exhibited by migrating fry, as humpback, for example, it might be supposed that the year's residence in the lake has familiarized them with its geography.

Upon reaching a pronounced riffle they "turn en masse and head upstream, circling and moving more or less rapidly in the more quiet stretches before venturing to approach the dam," i. e., the main fall. Their timidity in approaching swift water was notable. Only with the waning light would the first few allow the current to carry them down, the movement, or rather passivity, gradually becoming more and more general. It will be remarked that in heavy runs the average size is slightly smaller. This would seem to indicate that fishes not otherwise quite ready to migrate are drawn out by the general movement. The hesitancy to encounter swift water is noticeable in the adult as well. Spaulding at Karluk remarked it as a prominent feature of the movement of spawners in the small streams, and schools often are noted standing in a swift current, seeming to hesitate to ascend or descend as the case may be. It would appear that this trait may have had no small influence in producing a resident form, though there is no reason to believe that the dwarf sockeyes as now known (*O. nerka kennerlyi*) are the product of the regular form, i. e., only tardy young that have failed to migrate with their fellows, and thereby remained to reach sexual maturity in fresh waters. Their distinctive size, varying with waters inhabited, and the small number of eggs present in the ovary when yet little developed, mark them as at least a distinct race.

It has been reported[a] that by the damming of streams for producing reservoirs to supply San Francisco and Oakland with water, the salmon then in those streams were landlocked. As a result they remained in the reservoirs and reproduced. Ultimately, by reason of the confinement and its effects, they became dwarfed, decreasing from their original weight of 12 to 14 pounds to less than 1 pound at maturity.[b] The continual breeding of this species (*O. tschawytscha*), in confinement in fresh water seems to produce dwarfing, even with abundance of food. At the Trocadero Aquarium, where they have

[a] Report Commissioner of Fisheries, California, 1876–77, p. 5 and 6.

[b] See report by W. N. Lockington, in Report Commissioner of Fisheries, California, 1878–79, p. 50.

been bred in fresh water for several generations, the 4-year fish weigh from 2 to 4½ pounds. These are from the Sacramento fish which average between 15 and 20 pounds. At the same time the number of eggs has diminished from a normal number of about 6,000 to only 1,300 to 1,400.

These examples demonstrate a possible effect of fresh-water residence. Dwarf sockeyes occur in such lakes as Alturas, Wallowa, Seton, Ozette, etc., in all of which fish may come and go at will. No other species of the genus breeds in lakes or exclusively in lake tributaries. It may be that the sockeye is in process of evolution from an anadromous form to a permanent fresh-water resident. Part of the young apparently possess the primal instinct to return to sea at once the first year, another and greater part have changed to become one-year residents, and the smallest part have lost the to-ocean instinct entirely and remain to reach maturity in the lakes. Experiments as to the action of artificially reared young of the two races would be of the utmost interest and no little value to fish-culturists. The existence of marine and fresh-water forms of the same species is well known in Atlantic Salmonidæ, and as well in other families. The effect of change of habitat in the two forms respectively has in no instance been worked out, and remains for solution, one of the most interesting and important problems in ichthyology and fish-culture.

KING SALMON.

AGE AND SEASON OF MIGRATION.

The observations on the Sacramento River have demonstrated that the king salmon young in that stream for the most part leave the fresh water as soon as they are able to swim and feed. All the spawning occurs in the upper parts of the river and its tributaries, yet fry with unabsorbed yolk were sometimes taken only a short distance above tidal influence.[a] This same action was noted in the Karluk. On July 3 a trap which had been set overnight at the mouth of that river just above the lagoon took 1,300 fry, nearly all of which were king; there were only 4 humpback and 7 sockeye fry among the examples saved. As the collector did not differentiate species it is impossible to say whether 7 were all of the sockeye fry in the 1,300, or whether that number was only the natural proportion among the 180-odd specimens saved. The humpback being of striking appearance, however, it is probable the 4 saved were the entire catch of that haul. It should be stated that the haul also contained 5 sockeye yearlings, 25 coho fingerlings, a few sticklebacks, flounders, and young trout. No other sets of this trap were made; hence it is impossible to state

[a] Rutter, Natural history of the quinnat salmon. Bulletin U. S. Fish Commission, vol. xxii, 1902, p. 92.

what period the run of king fry occupied, but inasmuch as a few were taken in daylight, and the total number taken was so large, it would seem probable that the migration at that time was near its height. No fry of this species were taken in seine hauls made in the river May 22.

On the lower Sacramento the principal migration of the king fry occurs in March and April. Ice never forms on their breeding grounds, and they are free to travel as soon as they are able, which the temperature of the water and consequent time of hatching make possible at the above date. The adults reach the river in April, May, and June, and in August and September. They spawn in numbers from the middle of August to the end of September, and from the beginning of October until in December. The first eggs deposited begin to hatch about September, and fry begin to migrate about October, or even earlier, and continue throughout the winter, since no obstacle is offered by ice, and the fall and winter rains put the stream into the most favorable condition. The run is practically over by April 1 on the lower river. From that date on it will be noted that the examples taken gradually increase in size, showing them to be in a manner summer residents.[a]

In the Karluk the adults first appear about the mouth of the river in May and continue in small numbers into August. They are known to spawn in the river below the lake late in August, or at approximately the same season as in California. The different time of migration of the fry is accounted for by the difference in average water temperature. In the Sacramento the eggs are deposited in water of a temperature of 56° to 46° F., the winter temperature rarely reaching as low as 40°. In the Karluk the lake surface in August varies between 40° and 50°, or slightly above, and as the spawn of this species is deposited in the stream below the lake this may be taken to be the approximate temperature of the spawning beds. It is improbable that any great number enter the lake as adults to spawn in the lake tributaries. At an average temperature of 45° (it is probably less) during August and September eggs deposited in the latter part of August could not hatch before the middle of November. By this time it is probable that the temperature has dropped to freezing, and it is doubtful whether even the earliest eggs hatch before the advent of spring. The lake probably clears of ice and the water begins to warm up late in April or early in May. With the increased warmth, due to the long periods of day in that latitude, the fry would have developed at about the date noted, namely, late in June and early in July. As there is little rain at that season, there would seem to be no cause for the downstream movement except age (development) and instinct.

[a] Rutter, op. cit., p. 93.

As in the Sacramento, it was found that a small number of young king salmon remain in the river until they reach the size of fingerlings. Five yearlings averaging 111 mm. total length were taken in Karluk Lake June 5; 2 females slightly smaller, June 23 and 30; 2 males, 115 mm., were taken in an upstream trap at the mouth of the river July 3, and 2 slightly smaller examples on the 5th. This would indicate that they were feeding in the river at this date. In a seine haul on the lagoon 4 males averaging 130 mm. and 4 females averaging 135 mm. were taken July 24, in company with large numbers of sockeye and king fry and a few coho and sockeye fingerlings (or yearlings) and small trout. It has not been noted that these feeding fingerlings migrate in schools, but Rutter has shown that in the Sacramento, with the growing scarcity of food in the fall and the opportunity offered by fall freshets, they gradually forsake their summer quarters.

The "summer residents" were also found in abundance in the Columbia River work of 1895. The altitude of these breeding waters and the proximity of snow tends to reduce the temperatures below those of the Sacramento, altitude doubtless effecting for them what latitude does for the Karluk. The bottom temperatures given for Alturas Lake [a] can not be relied on, owing to the character of the instrument with which they were taken. It is probable that the bottom temperature at 150 feet is little over 40° F., as shown by later observations in Wallowa and other lakes. The falling air temperatures of the autumn must be closely followed by the water. The circulation in these lakes must be comparatively small and the cooling of the waters rapid.

Dr. Evermann's researches show that the lake temperatures, and consequently those of the spawning waters, fall rapidly after August. Since the king salmon deposits its eggs late in August and early in September, it is likely that the early freezing of the water arrests the development of the fry, so that they can not arrive at the migrating stage until some time in the spring. But, in so far as the temperatures taken in Idaho are somewhat above the corresponding observations in Karluk Lake, it is probable that the downstream migration of the main schools would have been completed before the arrival of the investigating party in July. The size and growth of the fingerlings found exhibit a condition exactly analogous to that described by Rutter for the Sacramento and observed in a less degree for the Karluk.

EFFECT OF CHANGE FROM FRESH TO SALT WATER.

Rutter demonstrated that the king salmon fry is unable to sustain immediate transfer from fresh water to sea water. In addition to his experiments on the California salmon, he made a test at Karluk.

[a] Evermann, Bulletin U. S. Fish Commission, vol. xvi, 1896, p. 157.

August 2 about 600 fry and fingerlings were placed in a live-box 3 by 3 by 7 feet and towed from the river through the lagoon to the sea, a trip of 5 hours. About 50 died en route, 150 died during the following night, and all but 70 in the next 24 hours. These were probably all king salmon. The totals show that all under 2 inches died; 6 per cent of the fingerlings up to 2¼ inches lived; 94 per cent of the larger fingerlings lived. This result is singular enough when it is noted that the king salmon young migrating out of the river are but 1⅝ inches in average length. It is inconceivable that they remain in the fresh-water end of the lagoon until they have added 50 per cent to their size. Two-inch fish were taken by Eigenmann in 1890 at Mare Island; 2½-inch examples were taken by the writer in 1898 in San Pablo Bay in brackish water. There is every reason to believe that fingerlings of the latter length under natural conditions are perfectly able to endure a standard salinity. The fact that this species breeds only in rivers of considerable volume insures to the young the opportunity of making the transition with the necessary gradualness. In this they differ from the frequenters of short streams, the fry of which species are doubtless able to endure a sudden entry into salt water.[a]

The tendency of the resident king fingerlings to advance upstream has been pointed out by Evermann in the report of the Columbia River inquiry. The same habit was noted by Rutter, and the presence of king salmon in the catches at Karluk Lake verifies the earlier observations, showing that the location of the breeding ground is not closely indicated by the presence of the young.

FOOD.

The food of this species is almost wholly insects, in large part from the surface. The yearlings mentioned above, taken in Karluk Lake, contained only insects, as did also the young taken at the mouth of the river; but the 8 taken in the lagoon contained amphipods in addition. These large fish must be yearlings. Their presence in the lake can be accounted for only on the assumption that the fry or fingerlings migrated into the lake the previous season, or that the yearlings ascend the stream in the spring and summer. Since their natural food would become scarce early in the fall it would seem to be improbable that they would remain in the fresh water, whereas the length of the river and the unnaturalness of an instinct that would impel female yearlings to ascend it from salt water lay that supposition open to serious question. They remain to be accounted aberrant individuals

[a] Questions regarding the change from fresh to salt water, and vice versa, made by all the salmon, have been discussed in detail by Sumner (Bulletin U. S. Bureau of Fisheries, vol. xxv, 1905, p. 53–108) and by Greene (Bulletin U. S. Bureau of Fisheries, vol. xxiv, 1904, p. 429–456).

that have obeyed neither the instinct to descend as fry nor that to seek the sea in self-preservation upon the approach of winter.

Migrating fry at the river mouth were largely empty, but a few contained insect remains. The small fingerlings taken in a seine haul in the lagoon also showed a purely insect diet. The lot taken by the trap at the river's mouth averaged about 42 mm. (37–53); those seined in the lagoon averaged 47 mm. (40–62), showing a growth of about 5 mm. since reaching brackish water perhaps not over a month previously. It was noted that late in July the number of these small fish seen about the margins of Karluk Lagoon had greatly decreased, indicating that the stay of the main body in brackish water is short.

COHO SALMON.

EARLIEST MIGRATIONS.

As in case of the king salmon, a considerable number of coho young remain as summer residents in the streams of their birth or in the connecting lakes; but the greater part seek the sea as soon as they become free-swimming. In the trap at station 2, on the Naha, the fingerlings and yearlings taken largely exceeded the fry in number. Both were taken from the middle of May until in June—the migration period coinciding with that of the sockeye. It is possible that this migration is in large part influenced by the sockeye movement. When yearlings of the latter species travel at the surface the cohos of similar size may be impelled, to some extent, to school with them; but the general absence of yearlings in the lakes early in the summer indicates that the spring migration is instinctive and general for the species.

The fry reach the swimming stage somewhat later in the season than the sockeye. The eggs, though requiring a slightly shorter incubation period than those of the sockeye, are deposited much later in the fall. By means of a trap which was set in Steelhead Creek on Naha Bay in 1904 the migration was found to be heavy as early as May 19, water at 48°. On this date over 1,100 fry were taken, the net spanning the entire stream. This run reached its maximum ten days later, when over 3,000 fry were taken in a single night. It continued, however, until sometime in July, when the temperature had reached 54°. In this creek the humpback and the dog fry left in May, the coho from the middle of May through June, and the steelhead in July. These dates are approximate for these species in the Loring district.

FOOD AND HABITS.

The fry taken in the trap during the time from May to July 9 showed no appreciable increase in size, the catch average varying irregularly between 37 and 40 mm. Of 600 measured, 85 per cent were

between 36 and 40—extremes 33 and 43 mm. A few fingerlings, less than 1 per cent, were taken at the same time. The food at that time, in the few that contained any, was insects. The main movement was early in the evening, the lifting of the trap at 1.30 a. m. and 9.30 a. m. of the same day showing a catch of 2,015 between dusk (about 10 p. m.) and 1.30 a. m. and 50 during the morning twilight.

In the Karluk in 1903 the first specimens of coho fry were obtained May 22. At that time salmon fry and small fingerlings were said to be numerous in the little sloughs at the edge of grassy marshes where the current was slight. Over 1,000 were taken in a single haul of the seine. Of the 42 examples preserved from this haul only 2 were cohos, about 38 mm. long, 1 with insect food. Of the 17 fingerlings saved from the same haul 15 were cohos, 12 males averaging 68 mm. and 3 females averaging 52 mm., all feeding on insects and larvæ. It should be noted that the small fingerling sockeyes taken in this haul contained crustaceans, some also insects and insect larvæ, while the 2 yearling sockeyes contained only insects and larvæ. Small fingerlings were taken in Karluk Lake July 27, 30, and 31, and as late as August 22. In all but 2 examples examined, which contained crustacea, the food was insects and insect larvæ.

Coho young may be found in almost every brook of Alaska throughout the summer. They linger along the margins and in the pools, with no apparent seaward movement. As the adults penetrate all these small streams to spawn, the upstream movement of the young, if there be any, does not excite attention. They are resident in the lakes as well as in the tributary streams. With the fall rains these residents are swept out of the streams into the lakes or the sea in the same manner as the king.

In the summer of 1905 many coho fingerlings were taken in Yes Lake. August 22, 15, averaging 95 mm. in length (63–122 mm.), were taken in a night haul. Two of these (13 per cent) contained sticklebacks, one having eaten 12, all less than 20 mm. in length; 66 per cent were feeding on flies, etc.; 13 per cent contained beetles, and 26 per cent snails; 13 per cent had eaten caddis larvæ, and a like number other larvæ. August 24, 55 were taken in night hauls of a shore seine, average length 85.6 mm., extremes 53–130. Of these, 91 per cent contained winged insects, as flies and ants; 42 per cent beetles; 14 per cent mites, eggs, etc.; 7 per cent sticklebacks; 7 per cent snails; and 5 per cent caddis larvæ. September 10, 88 were secured in the same manner, average length 83 mm., extremes 51–120. Of these, 44 per cent contained winged insects and the same number caddis larvæ, 20 per cent beetles, 11 per cent mites, etc., about 2 per cent sticklebacks, 5 per cent snails, and 7 per cent other larvæ than caddis. It will be noted that the average size of

the latter lot is slightly smaller, but the decrease is not sufficient to indicate a movement of the larger individuals out of the lake. A more significant fact is the growing scarcity of surface food and greater amount of bottom material—the caddis found in their stomachs.

As early as April 6 (1903) coho yearlings of 145 to 165 mm. were gilled at the Fortmann Hatchery in Heckman Lake at the mouth of the river. They were attracted by the waste eggs thrown in the river.

May 17, 1903, 11 males taken at station 2 averaged 119 mm., and 8 females 112; May 24 of the following year 12 males averaged 125 and 18 females 123. If these may be regarded as typical there appears to be a growth of about 50 per cent between September and May, or about twice that which from similar data was estimated for the sockeye. The yearling cohos taken in the Naha were found to eat the young salmon fry whenever taken with them in the nets. That they sometimes were able to prey upon them in a natural state was evidenced by the presence of digested fry in some examples that were seined in Roosevelt Lagoon in May.

September 12, 1897, the writer seined a number of young cohos at the mouth of Klawak River. No other fish except sticklebacks were noted. Of the 71 cohos saved the 37 males averaged 85 mm. in length (50–125); the 34 females averaged a small fraction of a millimeter greater (47–135). At this time the hatchery was operating and sockeyes were spawning in the lake tributaries above. Many of these young cohos contained salmon eggs. A more common food was a large maggot, probably the blowfly larvæ from dead fish along the stream. One stomach contained 2 leeches, and many of the smaller had insects. Examples taken with a hook in brackish water at the Klawak cannery wharf contained insects and a few beach crustaceans; 50 examples from the lake, October 14, 1905, averaged about 75 mm. These were taken with a dip net and do not give the average size of lake residents of that date. (See also record in salt water, p. 53.) Like the king fingerling the coho is readily taken with a hook, either with a fly or bait, salmon spawn being especially attractive in season. During the spawning season the coho in a few places may do some damage to the sockeye eggs. Large numbers are attracted to the scene of the hatchery work at Loring by the washings from the freshly spawned eggs. They were nowhere noted in any number on the natural beds.

As the result of the wide diversity of spawning regions, the coho may be said to possess three movements seaward, first as fry, second as fall fingerlings in the same manner as the king, and third as yearlings, lake winter residents leaving in the spring with the sockeyes. This

may be true also of the king salmon, but it is not believed, from the observations on the Columbia, that the king spawns above the lakes ordinarily, hence only the wandering young would winter in them.

DOG SALMON.

The dog-salmon young, so far as known, all leave the fresh water as soon as they are able to swim. The records of the occurrence of larger individuals in streams have not been authenticated. The dog-salmon fingerlings reported in the rivers of Washington by Gilbert and Evermann[a] on later examination were found to be cohos. A similar find by Davis[b] likewise proved erroneous.

This species breeds in the Naha in too limited numbers to permit observations of value. Fry were taken in only two instances at station 2. A few were taken at station 1 the middle of April, and again in Gibson and Emma creeks the middle of May. They were found in abundance, however, running out of the creeks of Deep (Moser) Bay, April 30, temperature 37°, many of them still with remnants of yolk. A few were found in Steelhead Creek after May 7 and up to June 6. In the main their fresh-water habit seems identical with that of the humpback.

Early in June, 1903, immense schools of small fingerling dog salmon were seen leaving the Karta River. Examples taken on the 8th of that month about the margins of the upper Kasaan Bay average about 40 mm. They were feeding on insects. It was reported by the workmen building the Alaska Packers' Association trap at that point that shoals of these young could be seen at times well out in the bay, where they were pursued by larger fish, apparently Dolly Varden trout. The great number of adult dog salmon spawning in the Karta River makes this easily credible.

In the Karluk lagoon, 1903, fry and small fingerlings were observed in large numbers May 12–14. They lay close inshore by the spit, moving about in schools, but not going out with the tide. Some of these still contained yolk, others were feeding on insect larvæ, amphipods, and surface material. Slightly larger young were taken in the lagoon June 9–12, feeding on crustaceans and insects. June 18 they were noted as abundant outside on Karluk Beach, 6 taken averaging 50 mm. in length; they were feeding on insects, crustaceans, and small cottoids. July 24 neither dog nor humpback young were present among the examples taken in a seine haul in the lagoon, all apparently having sought the sea. (See p. 52.)

---

[a] Gilbert and Evermann, Bulletin U. S. Fish Commission, vol. XIV, 1894, p. 198.
[b] Davis, Pacific Fisherman, vol. I, no. 4, May, 1902, p. 9.

HUMPBACK SALMON.

The fry of the humpback salmon leave the fresh water with the breaking up of ice. In 1903 they were first taken April 12 at station 1 on the Naha, but the number secured, 240, indicates that this was not the beginning of the run, though all the lakes were still covered with ice. The number migrating increased from this date to the end of the month, and they were found leaving the lagoon throughout May. During this time there was no increase in average size, the fry apparently leaving as rapidly as they attained sufficient strength. They traveled almost wholly by night, the heaviest movement apparently being on the first of falling water after a rise. At these times the average size was slightly less than at others. On April 19 a trap set near station 3 took over 1,500 fry. There is but a very small spawning ground below Jordan Lake above the point where this net was set, and it is thought that the larger part of the run indicated by this catch had passed through Jordan Lake under the ice. The average size was a trifle greater than that of the fry taken at the same time at station 1, wholly because of fewer undersized fish.

Very few humpback fry were seen at Karluk, a few were taken at the mouth of the river May 11, and again July 3, but at no time did they appear abundant. One example occurred in an experiment testing for endurance of salt water and was found to survive the test.

While the young humpbacks are in fresh water, feeding is only incidental. A few have been found to contain remains of insects, larvæ, and crustacea. As with the dog salmon and coho, the descent from the small creeks in which many are hatched makes it necessary that they be able to stand a quick change to salt water. In carrying a number from the trap in fresh water to the lower Naha Bay it could not be observed that immediate immersion in salt water caused them the least inconvenience.

TROUT (STEELHEAD?) AND CHARR.

The first trout fry appear in Steelhead Creek about July 1. On that date in 1903, 255 were taken in the trap, and on the following day 295. About the same number were present again in 1904, 283 being taken on July 9. While no further trials of the trap were made in 1903 the fry were noted to continue in the creek in large numbers until swept out by the fall rains about the middle of September. During this period their abundance was almost incredible when viewed with regard to the number of adults seen in the spawning season.

In the lower Karta River July 26, 1903, trout fry were very numerous. At this time the temperature was 64° and the stream very low. Along the sandy bars in places the receding of the water had left

pools in wh ch large numbers of fry were imprisoned. The temperature in these pools was much higher than in the stream, and in many cases the water had evaporated, leaving the fry to die. All of them were swept out by the first rise.

At Karluk, August 29, 1903, in a small stream tributary to the small lake east of the main lake, Spaulding noted the occurrence of fry imprisoned in the same manner. From the date and place it is believed that these were trout fry. No examples were preserved. Small fingerlings and fry of trout may be seen during the late summer almost as widely distributed as the coho.

So far as observed the food of the trout fingerling is insects. The observations were made on July 11 in a pool about 6 to 18 inches deep at the foot of the fall in Flume Creek, where numbers of both trout and coho young fingerlings were resident for several weeks. The coho were schooling near the surface; the trout inclined rather to scatter and occupy the bottom. One trout was observed to take a position on a rock, from which it would dart for food to either side and forward for some 20 inches, returning each time to the same resting place. During the eight or ten minutes it was observed, it made over twenty trips, once attacking and driving away a brother fingerling that tried to take a place upstream and cut off the food supply. The trout rarely came to the surface, striking mostly at submerged drifting particles. Upon return to the pool two hours later the fingerling was found to be gone.

The fry of the charr occur in very much smaller number. A slight migratory movement was noted in Steelhead Creek in 1904. Two were taken in the trap May 29, 16 on June 5, and on the 13th 30, the last observed. Their habit is to burrow in the gravel in the small streams. In these places their protective coloration and agility permit them readily to elude observation. No notes were made on the food of these young.

Fingerlings of all sizes of trout and charr were taken in the trap at various times, but no indication of any migratory movement appeared. Both species pass indifferently to and from salt water. The seaward movement of the fry is unquestionable, but individuals that remain in the streams after the fry period are doubtless governed only by convenience in obtaining protection and food. In the pools called Trout Ponds on Trail Creek only cutthroats and charrs were taken with a hook. These never exceeded a certain size, about 8 inches, though both male and female ripe cutthroats were taken May 30. In the brook below larger individuals were taken, a ripe female cutthroat being secured April 25. No steelheads were noted in Trail Creek, but a few trout fry may be found there. In Steelhead Creek only rainbow and Dolly Varden trout are taken below the falls, but

in the lake above the falls cutthroats are abundant. These falls are probably now impassable at all stages of water, and it is hardly to be believed that fry of the trout in the lakes help to account for the abundance of trout fry in the stream. It is to be observed that their numbers decrease toward the upper reaches, so that for some distance below the falls few are seen, and none in the few yards of the stream between the lake and the head of the falls.

SEA HABITS OF YOUNG SALMON.

NOTES AFFORDED BY COLLECTIONS AND RECORDS.

THE SOCKEYE.

The sea habitat of the young sockeye so far has not been studied. The only observations available are the results of occasional and irregular seine hauls made by the *Albatross* parties at various times, accompanied usually by no notes regarding exact locality or associated forms. These scant collections throw little light upon the sea habits or habitat. The gear used was capable only of taking examples in comparatively shallow water, close inshore, on smooth beaches. Larger examples would scarcely be taken under these conditions even if present in the same waters, and smaller fry would not be held by the web ordinarily used in the vessel's seines.

The smallest specimens in the collection are 8 examples averaging 41 mm., from Sumner Harbor, taken July 2, 1896. This harbor is a small bay northeast of the town of Unalaska. It receives a small creek, the outlet of a lake. The fry were taken in company with coho fry and fingerlings. The sockeyes were feeding on crustacea, the cohos on both crustacea and insects. If they were taken in the bay, they were doubtless recent migrants from the lake. These sockeyes differ somewhat from the more southerly specimens in having shorter and less numerous gillrakers—about 10–17; in coloration they resemble some of the examples from Karluk, the parr marks being longer and more bar-like than in those from Southeast Alaska.

A number of fingerlings from Wood River, Bristol Bay, taken July 23, 1903, averaged about 41 mm. in length. The stomachs were filled with small crustaceans and insects. Wood River has little fall from the lake which it drains, and in spring tides is affected as far as the lake. No notes accompany the specimens, so they are of little biological significance. They seem to differ from the Southeast Alaska examples of similar size in being of less tapering outline and having a smaller eye. Six yearlings, average 98 mm., are in the same lot, with the same food present in the stomachs. The main run from the Kvichak River was reported to Mr. John N. Cobb, of the Bureau of Fisheries, as occurring from the first to the middle of June, fish from

3½ to 4 inches in length. These are taken for eating by the Chinese at the cannery. Some are said to be pink-meated.

The next smallest examples in the salt-water collections are 12 from Alert Bay, British Columbia, taken June 5, 1895, probably from the beach near the cannery. With these are a number of small dog fingerlings of about 40 mm. and possibly a few humpback. Many of the specimens are in poor condition and not positively identifiable. The sockeyes average 62 mm. (53–68). Their food is all pelagic material, small adult copepods, ostracods and amphipods, crab larvæ, and a worm-like marine form—*Sagitta*. The other species were also feeding on crustacea.

From Nikolski, Bering Island (Komandorskis), there are 5 yearlings taken July 3, 1895; 2 males, 121 and 130 mm., 3 females, 133 to 135 mm.; all with amphipods in the stomachs.

From Kiska Island, June 7, 1894, 1 male, 196 mm., containing copepods, and 2 females, 230 and 245 mm., with stomachs empty. These are said to have been taken in a small lake, but data for this are incomplete. They are apparently not dwarfs.

From Isanotski Straits, at the extremity of the Peninsula of Alaska, 5 examples were obtained July 15, 1894; 3 males, 123 to 135 mm., and 2 females, 132 and 143 mm. The only stomach left in the specimens by the collector contained small crustacea, schizopods, and amphipods. These fishes were all infested with a parasitic roundworm occurring in masses in the region of the air-bladder. They are also noteworthy for the shortness of the gillrakers. These (on the right side) average less than 33 in number, the longest equal to about the distance between 6, or spanning 5 interspaces. The specimens from Nikolski average 34, with a length equal to about 5½ interspaces. Those from Kiska run high, averaging 36 in the 3 examples at hand. Dundas Bay specimens, in a count of 12 somewhat smaller individuals, give an average number of 33+ with average length a little less than 5 interspaces, whereas Karluk fish, in 10 examples taken June 8, 1903, show an average number of 35+ and a length equal to nearly 9½ interspaces.

The examples from Dundas Bay were taken July 24, 1903, in a seine haul on the tide flats with mud and sand bottom. With them occurred dog and humpback fingerlings of about the same size, perhaps in the same school. The individuals saved are 6 males, average 80.6 mm. (71–91), and 6 females, average 77.7 (73–85). They were feeding on crustaceans, insects, and insect larvæ.

At Uganuk young salmon are taken in large numbers in seine hauls for sand launces. Of 25 pounds of these small fishes taken in this manner June 15, 1903, 36 per cent were young salmon, mainly sockeyes, but in addition some cohos; 4 per cent were young herrings; the remaining 60 per cent were sand launces, or, as they are known

locally, candlefish (*Ammodytes*). The sockeyes of this lot whose stomachs were examined contained crustaceans, a few with fragments of insects also; several had small herring fry. Seventy-two males averaged 82.1 mm. in length (47–105); 70 females averaged 81.3 mm. (48–110).

It is a curious fact that in these collections, where there are large numbers of apparently regular-sized examples, usually the males are found to average slightly the larger, whereas in cases of only a few large examples the females almost always exceed the males in size.

At Karluk young salmon are found abundantly in the waters in which seining for the cannery is carried on. It is said these yearlings sometimes rush through the seines in clouds, and even in the large-meshed seines numbers are drawn ashore with the adults. From the catch on June 8, 1903, were saved 67 sockeyes, averaging 181 mm. (123–207). These were feeding on small crustacea; of 20 examined none had fry of any sort in the stomach. The distribution of food was peculiar in that individuals were feeding almost exclusively on a given form. For example, one was filled with ostracods, others had but few; some had almost nothing but copepods, others as exclusively amphipods; many, however, had such a mixture as would be expected. This seems to indicate that the crustaceans form schools to a certain extent, either in zones or otherwise, which enables the fish, acting as a tow-net, to obtain more or less nearly pure masses of a given form. Among the specimens saved from this haul other than sockeyes were only 2 cohos. One of these had eaten a young cottoid of 18 mm. length.

On July 3 from a similar haul were saved 30 specimens; 12 males averaging 136 mm. (122–156), and 18 females averaging 139 mm. (125–164). Some of these were empty, most had been feeding on small crustaceans, several contained in addition small coiled shells (pteropods), and 2 had small blennies and sticklebacks in some number. One coho occurred in this lot.

July 24 young salmon were very abundant in Karluk Lagoon. A seine haul, with a 75-foot seine, covering about 250 square yards, took over 2,000 salmon, 30 to 150 mm. in length, and a few small trout and charrs. It is noteworthy that in this lot there seem to have been no humpbacks or dogs, whereas among specimens taken at the same time on the outer side of the spit, in the cannery seine, no sockeyes were saved. Whether this was a peculiarity of the distribution at that time or whether it arose from some other reason it is impossible to state. It is known that the collector did not closely differentiate the various species. The young sockeyes taken in the lagoon varied from 80 to 145 mm. in length. The smaller are doubtless from the hatchery, the yearlings may be from the lake; all were feeding on crustacea and insects, the smaller fish more on insects

and their larvæ, the larger on crustacea, mainly an amphipod. In several of each size were masses of intestinal worms.

It is stated that small salmon are seen in the seines throughout the canning season, but mainly in the earlier part. It will be noted that the larger specimens were obtained in June, and that after July 3 no collection of sockeyes was made from the cannery seines. It may be that the continual hauling in time frightens them away; but it seems more reasonable to believe that with increasing age they move farther out from shore. The vast numbers observed in June must be the yearling migrants from the lake. As to what becomes of the fry of the same season after reaching salt water, there is no clue, and can be none until search is made for them with small-meshed nets.

The only other specimens in the collection of interest in this connection are 2 males of 91 mm. and 5 females 84 to 104 mm., average 92.4 mm., taken in Karta Bay June 26, 1897. These contained mainly insects; some had also crustacea, and one had a few young flatfish.

THE KING SALMON.

It is a significant fact that in the collections at hand there occurs but one young king salmon taken in salt water. It would seem there should have been some in the Karluk Beach collections if the species is accustomed to tarry near its parent stream. They are sometimes taken in San Francisco Bay and the region outside the straits, but none of these examples have become part of the Bureau's collection. They have been reported also from the region of Killisnoo, Alaska. The example mentioned is a 215 mm. male, which was taken with the cohos (see below) at the Loring cannery wharf August 2, 1904. As this was preserved for a coho, it is possible that others of the 45 mentioned below were of this species.

THE COHO.

The young coho in salt water is more easily observed than the other species. It readily takes the hook, and apparently is less timid than the others in approaching surface and shore. In 1904 45 were taken at the Loring cannery wharf August 2. They averaged 190 mm. (158–226). On July 10 at the same place about 30 were taken. No measurements were made except of the largest, which was 138 mm. On August 2, 1905, a scattered school came about the *Albatross* while anchored at the extreme head of Yes Bay; 26, averaging 202 mm. (152–237), were taken with a hook over the ship's side. Only a few, 6 or 8, would appear at once, and they took the hook baited with bits of meat, etc., very shyly in the perfectly clear water. Most of the stomachs contained offal from the ship's messes; 5 contained fishes up to 65 mm. in length, all that

could be identified being sand launces; 2 contained young sticklebacks, one of them 10 individuals; 2 had isopods, and only 3 had taken insects from the surface. Another example taken later, a male of 265 mm., contained 4 small herring.

At Karluk young cohos are occasionally taken in the cannery seines; two, 180 mm. long, preserved from the catch of June 8, contained 2 species of amphipods and one a young cottoid; one, 158 mm., preserved from the seine July 3, was an empty female; July 24, another, 175 mm. long, contained *Ammodytes*. As will be seen, these records indicate the presence of very few young cohos about Karluk Beach.

The general collections of the *Albatross* afford the following data:

A number of cohos were taken at Karta Bay with larger sockeyes and smaller dog salmon on June 26, 1897. Of the specimens preserved 8 males average about 80 mm. (56–100), and 14 females average nearly 100 mm. (80–140). They were feeding mainly on insects and crustacea.

At Thorne Bay, July 5, of a number of small cohos together with a few dog salmon, seined probably at the mouth of the river, 24 males averaged about 55 mm. and 50 females about 56 mm., the high average of the latter being due to the presence of a few slightly larger individuals (extremes, males 45–65 mm., females 45–78 mm.). The stomachs examined contained insects for the most part; a few had small crustaceans and 2 had flatfishes.

At Port Alexander, July 3, 1903, many young cohos were taken in the seine; 4 males and 2 females were preserved; average about 150 mm. They were feeding on young herring and sand launces, also larval crabs and amphipods.

Of the specimens saved from Uganuk, June 15, 1903, 5 are males, averaging 138 mm., and 8 females, 130 mm. All but 3, which were empty, were feeding on young herring, each containing from 1 to 5 individuals. (See p. 51–52.)

At Unalaska 6 examples, taken July 23, 1888, average 148 mm., contained insects, crustaceans, grubs, and in one case a small fish like a salmon fry. One humpback fingerling was in this lot.

Twelve examples, taken at Sumner Harbor July 2, 1896, averaged about 60 mm. and were feeding on insects and crustacea. They were in company with the smaller sockeyes. (See p. 50.)

Isolated examples in the collection, not worthy of fuller notice, are: 1, Kilisut Harbor, July 1, 1903; 5, Tribune Bay, May 17, 1894; 3, Union Bay, British Columbia, June 22, 1903; 3, Cleveland Passage, July 13, 1903; 1, Pavlof Harbor, July 25, 1903; 1, Humboldt Harbor, Shumagin Islands, July 31, 1888; 3, New Morzhovoi, July 17, 1894, and 2, Kiska Island, June 7, 1894.

From the above data it is seen that the cohos remain for some months about the shores near the streams whence they issue. They

may be found about the mouths of the streams in brackish water perhaps soon after their descent of the stream. It may be they remain about the streams for a time to accustom themselves to the salt water, but this is not evident in case of the fry. The sea-run examples are readily distinguished by the silvery appearance and usually by the greater depth of body which follows habitual distension of the stomach. In some cases, while near in shore, insects appear to continue a staple article of diet, as in the fresh water. The cohos feed less on crustacea than the sockeyes, perhaps inhabiting slighter depths; correlated to this is the abundance of small fishes found in their stomachs—sticklebacks in brackish water and herring and sand launces in more open regions.

From the catches at Naha and Yes bays it would seem that the cohos continue to school after reaching salt water. The results of the seine hauls indicate that the different species of salmon school together, or at least in the same waters.

DOG AND HUMPBACK SALMON.

On May 29, 1903, a small school of salmon, about 50 individuals, was seen along the shore about 1 mile below Naha Bay. Seven of these were secured—5 humpbacks 42 mm., and 2 dog slightly larger. The former were feeding on small crustacea and pteropods, the latter on crustacea and insect larvæ.

On July 1 and 2 a few dog salmon fingerlings were taken in the net at station 2. These may have been either fishes that had remained in Roosevelt Lagoon since early spring, or stragglers from the bay coming in on high tide. Ten were males, averaging 56 mm., and 4 females, averaging 62. Those with food had been taking insects. (See also p. 47.)

At Karluk June 18 the fry of both dog and humpback salmon were abundant along the beach. Six preserved examples of the dog average about 50 mm., and contained insects, crustaceans, and small cottoid fry. Thirteen humpbacks saved average about 47 mm.; of the 6 larger ones examined 4 contained crustaceans, the other 2 nothing.

July 24 there were saved from the cannery seines 5 dog-salmon young, averaging 83 mm. (70–100), which contained a few insects and small fishes (blennies), but mainly crustaceans. Also 47 humpback young, averaging 77 mm. (60–95), the main food in which was copepods, but in addition were found flies, insect larvæ, amphipods, and in a few cases small fry, probably *Lumpenus*, up to 18 mm. in length; 1 stomach contained 22 of these. Only the following collections were made by the *Albatross:*

In Alert Bay, British Columbia, June 5, 1895, about 50 dog salmon small fingerlings were taken, along with a number of small sockeyes; these averaged about 40 mm. and contained only small crustacea.

In Admiralty Inlet, Whidby Island, on June 30, 1903, many young dog salmon were taken in a shore seine on gravel bottom. Of these 13 of each sex were preserved, the males averaging 99 mm. (83–117), females, 98 mm. (78–122). In none of the 9 examined were any fry found. They were feeding wholly on plankton material, crustacea, principally amphipods, and *Sagitta*. They appear to have been schooling alone.

In Otter Bay, Pender Island, British Columbia, 11 dog salmon were preserved from the collection of May 31, 1895. These averaged a little over 70 mm. and contained crustacea.

June 29, 1897, 4 dog salmon, 2 of each sex, averaging about 56 mm., were taken at Loring, it is believed in a seine haul on the seining beach of Roosevelt Lagoon. They contained only insects. These specimens, considered in connection with those obtained at station 2, noted above, point toward a continuance of some of the young of the dog salmon in brackish water for a period and suggest the desirability of investigating such waters with suitable gear. A haul was made in Roosevelt Lagoon on the night of October 1, 1905, but no salmon were obtained.

At Thorne Bay, July 5, 1897, many dog-salmon young were taken in seine hauls on the beach just below the river; 64 of the specimens are males, averaging about 65 mm. (42–82), and 84 are females about 2 mm. longer (44–83). The food in those examined was crustacea, mainly ostracods. A few smaller ones taken in the river mouth were feeding on insects. In Karta Bay, June 26, 1897, dog, coho, and sockeye young were taken in the same hauls. Of the first, 19 males, about 60 mm. average, and 10 females, about 53 mm., were preserved. They were feeding mainly on insects and amphipods; a few contained small flatfish, 1 being filled with them.

In Dundas Bay, July 24, 1903, many young salmon—sockeye, dog, and humpback—were seined on the tide flats. The specimens of dog salmon are 4 males, about 75 mm., and 5 females, 82 mm. long. They were feeding on crustacea; a few had eaten insects and larvæ in addition. The 3 humpback, 2 males and 1 female, average about 80 mm.; food the same as the other species. The 3 species were apparently schooling and feeding together.

In Pavlof Harbor, July 25, 1903, the seine was hauled at the mouth of a small stream in deep water, gravel beach. Many young dog salmon, a few cohos, sand launces, and other small fish were taken. The specimens of the first preserved are 4 males, about 100 mm. long, and 7 females, slightly smaller. Their food was crustacea, except, in one instance, a few flies.

At New Morzhovoi, July 17, 1894, 34 dog salmon young were preserved. These average about 80 mm. in length. The stomachs contain crustacea and gastropods; only 1 had insects. These specimens show the peculiar segregation of food noted in some sockeyes at

Karluk (p. 52); some had eaten almost exclusively large copepods, others ostracods, and yet others a peculiar *Caprella*-like form.

Four specimens from Isanotski Straits, July 15, 1894, show no peculiar features.

At Sucia Island, May 6, 1894, 3 humpbacks and 1 dog salmon were taken, the former 47 mm. and the latter 54; food, crustacea.

At Metlakatla, July 10, 1903, 2 humpbacks were taken, 64 mm. in length. One was empty, the other contained flies.

Single specimens of humpback fingerling are recorded from Kodiak, August 14, 1888, and Unalaska, July 23 of the same year. The first, a female 113 mm. long, contained small fry and a few flies; the last, a male slightly larger, crustaceans.

CONCLUSIONS FROM AVAILABLE DATA.

From the above notes it may be concluded that many young sockeyes, after reaching salt water as yearlings early in the spring, remain, in company with other young salmon, for a few months about the shores near the mouths of the streams from which they are derived; that during this time they feed principally upon the small crustaceans which are found from the surface to an unknown depth and, like the crustacean forms found in the lakes, have a diurnal movement from and to the surface. In tows made by the *Albatross* in the open ocean it has been found that many of these forms tend to be most abundant at the surface about dark, again decreasing in number within an hour or so. Whether the period repeats again at daylight was not tested. Surface tows in daylight made in Yes Bay and Behm Canal during July, August, and September, 1905, showed an almost entire absence of food material. At the same time it was found at depths of 20 to 75 fathoms and greater, the deeper the more abundant. It is known that this pelagic life is ultimately dependent upon the shore for food supply. The open sea far distant from land contains little life, unless it be conveyed by currents originating near land. The narrow and deep channels of Southeast Alaska furnish a superior environment for plankton life; to the wholly free-swimming forms, such as copepods, ostracods, etc., there is added the innumerable progeny of the littoral forms, such as crabs, worms, mollusks, and shore-spawning fishes.

ABUNDANCE OF FOOD.

As a test of the abundance of this salmon food material, during the summer of 1905 numerous hauls were made throughout Yes Bay and into Behm Canal. Yes Bay is a long, narrow inlet less than one-half mile in width and over 4 miles in length, the depth varying from 50 feet at the head to over 50 fathoms at the mouth. It receives several small creeks at the head and the main stream from Yes Lake, about midway between the two extremities. During the summer

months the surface temperatures vary between 55° and 60°, the lower nearer the mouth. The surface densities depend almost wholly upon the precipitation. During ordinary weather the head of the bay, from the pushing up of the dense bottom layers of water by the tides, acquires about half the density of sea water; midway, on account of the volume from the main stream from Yes Lake, the density is reduced to about one-fourth that of sea water, increasing to one-third or more as the mouth of the bay is approached. During freshets the surface density is much reduced, the water becoming practically fresh at times. The bottom temperatures vary from about 50° at the head in 50 feet of water to 44° in 330 feet at the mouth, with corresponding densities of about 1.018—or nearly three-fourths the density of sea water—to 1.0235, or closely approximating standard density. The tows exhibit a very scant population of food forms in the upper bay, with a gradual increase as the mouth is approached and a sudden rise upon entrance to the main channel outside. In the fresher waters jellyfishes predominate; with increasing density and depth the crustaceans increase in number.

This whole subject of the distribution of pelagic forms is of fundamental importance in the study of the sea habits of the salmon. With the pelagic forms, of course, must be considered also the shore forms, such, for instance, as the common amphipods (beach lice), which may be found under stones at low water; perhaps, also, certain mollusks, etc. The factors of temperature, density, light, depth of bottom, proximity of shore, set and velocity of currents, influence of land drainage, etc., require to be carefully studied. As yet nothing has been attempted in Alaskan waters toward the solution of these problems.

It will be noted that the Karluk sockeyes taken in salt water in June are of greater average size than those taken on subsequent dates at the same place. Further, that the average size of the June specimens is about twice that of the migrants from the Naha taken only a few weeks earlier at Loring. If these Karluk sockeyes are accounted yearlings of average size for the locality, which have left the lake not earlier than April, more likely in May, they either have increased very rapidly in size since reaching salt water or were much larger than Naha yearlings at the time of migration. But for the uniformity of size it would seem more probable that the specimens procured are the selected larger examples, the smaller escaping through the meshes of the seine. There is the possibility that these larger individuals were fry that reached salt water the previous summer, and that the absence of smaller specimens in the collections is due merely to the escape of the fry and fingerling migrants of the same season through the large meshes of the seine. That yearlings from Karluk Lake are larger than those of the same age from the small lakes of Southeast Alaska may well be believed in view of

the larger size of examples noted in Wallowa and Alturas lakes and the Fraser River.

The dog-salmon young, cited above, vary from a little over 40 mm. to 120 mm.; the humpback show approximately the same figures. These are unquestionably of the fry that reached salt water in March and April just previous. The catches date about three months later. This indicates an increase of about 100 per cent in that length of time, or about twice the rate of growth of the sockeyes that remain in fresh water. In other words, the species (or individuals) that reach salt water as fry make about the same growth in the first three months that the lake residents (sockeyes) make in twelve. The comparison of fall catches of cohos and sockeyes in the lakes shows the former to exceed the latter greatly in size, but this is only a natural result of the coho's greater size from the fry stage to the adult. In the case of the humpback, however, the fry is scarcely larger than that of the sockeye, and the adult somewhat smaller. Its more rapid growth can be attributed only to the abundance of food in salt water and the nature of the fish. The sockeye young which were taken in salt water must be yearlings. Owing to the lateness of the migration of that species it is impossible for them to have attained such size in the time since they could have reached salt water as fry of that same season.

It will be seen that in general the four species of salmon are closely associated in sea habit. While small they remain much of the time close inshore, to some extent feeding on the insects that fall on the water or are carried down by the streams. The greater part of the food, however, is the various crustacean forms, though the small fry of marine species make up no small part, particularly of the coho's food. With increasing age the salmon doubtless move into deeper water. If the habit of preying on small fishes continues and grows with the increase of size, it would seem that the young salmon would be remarked in pursuit of the schools of young herring, sand launces, and such forms that abound in the bays and coast waters. No note of this has been recorded. Occasional catches of slightly larger fish are made from time to time, possibly fish of the second year. Such cohos are well known in Puget Sound, and a run of some small salmon was observed in Naha Bay during the winter of 1896–97. But unless such fish in large numbers approached the surface of some small body of water near a settlement, they would scarcely attract attention though the channels were teeming with them.

The salt-water habits of young trout and charrs are entirely unknown.

RETURN OF ADULTS TO FRESH WATER.

From the yearling stage to the adult little is known of any of the salmons, and nothing of the sockeye. There are reports of grown fish of that species taken in the winter in various places, as in the

vicinity of Karluk and near Union Bay, Cleveland Peninsula; but the identification of these catches has not been authenticated. The only pertinent fact regarding their place of residence after leaving the vicinity of the parent streams, if they leave it, is that the presence of adult fish is first noted at the time when they are apparently rounding some point in their progress from more open water. Such places are Point Higgins, at the entrance to Behm Canal; Cape Chacon, at the lower end of Clarence Straits, and Otter and Sheringham points, on Juan de Fuca Straits. Karluk River is apparently approached directly from the open straits.

APPROACH OF SCHOOLS.

The presence of salmon can be noted only by their habit of leaping from the water as they approach the land. It is often possible by this means not only to recognize the presence of a school, but also to distinguish the species. In jumping, salmon do not leave the water with their ventral surface downward, as do flying-fishes. They always jump sidewise with one side at an acute angle to the water surface. Sockeyes seldom entirely clear the water, but let the tail drag for some distance, fall on the side, and then perhaps skim the water for a short space. They may make two or three successive jumps, apparently at random and in varying directions. Cohos usually leave the water entirely, falling back on the caudal peduncle held rigid with the fin directed upward. The tail may then drag through the water a short distance till the fish falls on its side and disappears. The humpbacks jump very agilely and characteristically. They leap clear of the water, shaking the tails vigorously while in the air, sometimes turning completely with a corkscrew motion. On falling they strike on the side.

The cause of this jumping has been much discussed. It was noted that a school of kings feeding in Naha Bay in December, 1903, jumped in much the same manner as fish on the way to the spawning grounds, but apparently not so frequently, probably because of the small number of individuals under observation. The sockeye travels in large and compact schools when approaching the spawning regions, and the jumping should be easily accounted for in the natural playfulness of groups of animals or the struggle for preferred position. Stomachs of netted fish often contain salmon scales and teeth, the latter frequently the individual's own. But these are doubtless swallowed during the struggles in the net and not by reason of previous combats.

Under certain conditions the schools exhibit little tendency to jump. In 1903 large numbers of sockeyes entered Karluk River without such announcement. Of course it is not known whether this species feeds in schools in salt water, or whether it is only the approach of sex maturity that impels the gathering into schools. From the

arrangement of the gillrakers, and the few observations made on feeding fish, it may be surmised that the larger part of their nutriment is derived from pelagic crustacea and associated forms. They are known to feed at times on small fishes. In striking into a school of small fish from below they might be led to broach the surface. In towing for plankton food there would be no such occasion. No authentic observation of sockeyes in open ocean has been reported, but inasmuch as no search has been made for them the matter remains without evidence. It is probable that they do not jump in feeding, and thus they are unobserved up to the time they start for the spawning beds.

FOOD AND FEEDING.

THE SOCKEYE.

It is reported that the Fraser River schools, even before leaving Juan de Fuca Strait, have ceased to feed. In Southeast Alaska it was found that a certain percentage of the earlier catches, even at the mouths of the rivers they were presumed to be entering, were still feeding. This is shown in the following table:

FOOD OF ADULT SOCKEYES.

Locality and date.	Total number examined.	Number having eaten fish.			Number having eaten crustacea.			Number having eaten worms.			Total with food.	Per cent of total with food.
		Male.	Female.	Total.	Male.	Female.	Total.	Male.	Female.	Total.		
Karta Bay:												
July 1–4, 1903	120	4	2	6							[a] 6	5.0
July 23–26, 1903	300	1		1		1	1				2	.6
July 1–6, 1904	512	3	3	6							[b] 6	1.1
Yes Bay:												
July 17–20, 1903	400				1		1				1	.2
Aug. 16–21, 1904	[c] 510				3	3	6	1		1	7	1.3
July 26 to Aug. 14, 1905	692				112	85	197	16	6	32	[d] 197	28.4
Boca de Quadra:												
July 30 to Aug. 5, 1903	500				100	83	183	1		1	[e] 184	36.8
Aug. 24–29, 1904	[f] 512				7	6	13				13	2.5
Kegan, Moira Sound:												
Aug. 14, 1903	100				12	11	23				[g] 23	23.0
July 24–29, 1904	511	13	8	21	32	52	74		1	1	[h] 93	18.2
Nowiskay, Moira Sound:												
Aug. 17–19, 1903	100										0	.0
July 14 to Aug. 12, 1904	[a] 514	59	60	119	5	2	7				126	24.5
Dolomi, Moira Sound:												
Aug. 21 and 23, 1903	[i] 200	2	1	3	1	5	6				9	4.5
Aug. 4–11, 1904	511										0	.0
Total	5,482										648	

[a] *Ammodytes.*
[b] *Ammodytes*, except 1 with herring.
[c] In the last 111 examined, Aug. 20 and 21, the stomachs were all empty.
[d] Many stomachs with medusæ, some with purple ctenophores (?), which occur in about 50 fathoms of water in daylight.
[e] Mostly larval crabs; also some small schizopod (?) forms.
[f] In the 57 examined on Aug. 29, all stomachs empty.
[g] Mostly a small shrimp-like form.
[h] *Ammodytes*, crustacea, mostly as above, but also crab larvæ. No food in stomachs of the 69 examined on July 24.
[i] The 100 examined Aug. 21 were empty.

Stomachs of adult sockeyes, as the fish are taken for commercial uses, are commonly empty. In many cases the shrinkage which follows the termination of feeding is pronounced, but usually the upper limb is still lax, with only that degree of contraction due to its emptiness, and the pyloric limb and coeca are still undiminished in size. On the other hand, schools are sometimes taken in which the shrinkage of all parts of the digestive tract is pronounced and the characteristic yellow slimy or curdy secretion fills the canal. The stomachs not infrequently contain scales, teeth, bits of vegetable débris, etc., all of which is probably incident to the pursing of large numbers in the nets and consequent struggles of the fish. In many cases the esophageal cavity is filled with a clear viscid liquid, which appears to be largely dissolved jellyfish.

In the examples examined at Yes Bay in 1905, undissolved portions of the common globular ctenophore frequently occurred. This same form was taken in great abundance in the surface and subsurface towings in the bay and in Behm Canal just off the bay. In addition, fragments were found of what seemed to be the larger ellipsoidal, purple ctenophore taken in towings in Behm Canal and elsewhere only in depths of 50 fathoms or more. It is not known whether this form rises at night, hence its presence indicates nothing as to the depth at which the salmon feeds. Much the greater part of the food observed is crustacean. In the examples from Boca de Quadra, 1903, which have the highest percentage (36.8) of food-containing individuals of any lot examined, the material is almost wholly larval crabs, a few of the macruran forms also occurring. In Kegan examples the common crustacean form is a small macruran, though a few crab larvæ also were noted. In Yes Bay the most widely distributed form is a macruran, but crab larvæ are present in great quantity. Yes Bay salmon stomachs showed much the same aggregation of forms that the tow net developed, which indicates that the food is taken by "towing."

Among the stomachs of sockeye salmon taken at Karta Bay, in Moira Sound, and at Hetta, were found some containing sand launces (*Ammodytes alascanus*), in instances as high as 83 individuals in a single stomach. In these waters large schools of sand launces somewhat more than half grown are numerous during July and August. Schools of young herring occur earlier and during the same period, but in only one instance was a herring found in an adult sockeye stomach. In Yes Bay a small clam worm, identified by Dr. J. Percy Moore as *Callizona angelini* (Kinberg) Apstein, was found in 32 stomachs, or over 4 per cent of those examined. Several of these worms were sometimes found in a single stomach, as if they had been assembled by selective feeding. A very few were noted at Boca de Quadra and at Kegan. These worms were taken only in the sub-

surface towings at Yes Bay, but they probably came to the surface in the evening at that season.

It is remarked, in general, that the earlier runs of fish contain a higher percentage of feeding individuals than the later. Much depends also on the locality. At Dolomi practically all the fishing is done in a small bay almost at the river's mouth. It is improbable that the fish enter this bay in great numbers until ready to ascend the stream. Of 511 examples opened August 4 to 11, 1904, none contained food; many of these stomachs were shrunken, but some were still lax. Of 200 examined August 21 to 23, 1903, none of the first hundred contained food. These fish were of a distinctive type, more or less characteristic, long, slender, and dark in color. Of the second hundred, taken two days later, 9 were feeding on sand launces and crustaceans. These were brighter fish of a different type—deeper and more resembling the fish of other localities.

The fishing at Nowiskay was done by a single crew, hence ordinarily all or nearly all were taken near the mouth of the river. In 1904, owing to the scarcity of fish, the crew sometimes hauled in the lower end of the arm, which may help to account for the larger number of feeding fish taken that season. This same circumstance has a bearing on the fish examined at Yes Bay in 1905. A greater part of the fishing was done in Behm Canal than in former seasons. The paucity of food material in the bays may sufficiently explain why the salmon do not approach the rivers until about ready to make the ascent.

Digestion in fishes is ordinarily quite rapid, and for this reason we may be sure that food found has been recently ingested; but the fishing crews are out with the daylight, and our knowledge of the distribution of forms at that hour is too limited to permit any conclusions as to the depth at which salmon feed.

The presence of such large percentages of feeding fish might lead to the supposition that the fish were still on the natural feeding grounds and had not yet been made subject to the changed instincts of approaching maturity. This view is somewhat supported by the absence of food as reported in the large schools of the greater rivers at relatively earlier dates. On the other hand may be noted the fact that the Alaskan schools are much smaller, hence the opportunity to feed, if the instinct to do so still remains, is much better. A salmon stomach at any time, if empty for a period, becomes contracted and gives the appearance of being shrunken. This perhaps is due to the lack of blood in the tissues and the action of the contractile fibers. It is noted in migrating fingerlings as well as in adult fish. With the presence of food and excitation of secretion, blood will return to the tissues, the bulk of the ingested mass will stretch

the fibers, and the feeding appearance will return.[a] It is probable that the sea habitat of salmon will be ultimately disclosed, if at all, by a study of their food and its distribution.

KING SALMON.

In recent years it has been learned that schools of king salmon feed in the channels and bays of Alaska during the winter. In 1903 they were first observed off Naha Bay late in December. Their presence was apparently due to the presence of a large shoal of herring, upon which they were feeding. The stomachs contained only herring, in one case 9 full-sized fish being counted in the stomach of a salmon that was still hungry enough to take the troll. Since the above date a valuable winter fishery for king salmon has been established.[b] Previously they had been taken only at the time the herring were approaching their spawning beaches, about April and May, continuing to a greater or less extent throughout the summer in various regions. Their movement apparently depends entirely on that of the herring, which in turn may be supposed to be governed at other times than its spawning season by the abundance of its food; it is well known to be erratic in its appearance. The problems of the food supply of the herring in Alaska have not been considered.

The appearance of the salmon in Monterey Bay in the spring has been taken to be of the same character, i. e., a moving inshore with their food, which here consists of sardines, anchovies, smelts, and other small fishes, squid, and crustacea.[c] It has been assumed incidentally that these fish are also on their way to the Sacramento to spawn. It does not appear that any careful study of their food, condition of maturity, or even species has been made.

The facility with which the king salmon is taken with a troll, and the consequent interest of anglers, may account for the fuller knowledge of the winter habits of this species. Of the other four species, only one takes a troll, namely, the coho.

THE COHO.

Little is known of the food of the adult coho. Its habit of approaching the rivers late, when almost sexually mature, and running at once into the stream, makes it difficult to study in this regard. The food contents of the immature cohos taken in Puget Sound have not been reported. The adults are known to take the troll readily, which indicates that they feed on small fishes.[d] Their early exhibition of this

[a] Rutter, Bulletin U. S. Fish Commission, vol. XXII, 1902, p. 126.

[b] See footnote *d* below.

[c] Annual Report of the Department of Fisheries of Oregon for 1902, p. 69–78.

[d] "Since 1904 during the winter fishing for king salmon numbers of cohos also have been taken. Up to 1907 only troll lines have been used, but traps have been prepared for use during 1907–8." (Fassett.)

instinct supports the inference, as does also the character of the mouth parts, teeth, and gillrakers. Two examples were seen at Karta Bay the first of August filled with sand launces; another contained a herring. One example, a female, taken at Quadra early in August, was filled with crab larvæ, the same material upon which sockeyes were feeding at the time.

HUMPBACK AND DOG SALMON.

The humpback is ordinarily not feeding at the time it is taken in the cannery seines. Of a number examined at Karta Bay early in August, some of the males contained crustaceans and in one instance a sand launce; none of the females had food. At this time the males exceeded the females in number in the ratio of 50 to 15. At Kegan early in August a few humpbacks were found containing the macruran from that locality. At Karluk, July 30, they were found to be feeding about equally on sand launces and crustacea.

The dog salmon has not been examined for feeding habits. Like the coho, it approaches the streams late, and as a rule the stomachs are then empty.

RELATION OF FOOD SUPPLY TO NUMBER OF ADULT SALMON.

The abundance of food has a direct relation to the number of adult salmon that may be produced. The propagation of countless myriads of fry can result only in their cannibalism if the supply of other food is lacking. The dependence of the different species of salmon upon other fishes is probably about in the same ratio as their average size. The largest, the king, is largely dependent on the herring, sand launce, cod, etc., for its subsistence, as are, doubtless, also the coho and dog. The two smaller species, humpback and sockeye, are better adapted to live on the more minute life. They are not known to take a troll at any time. Their food is, at least largely, the food of the species which in turn support the king salmon. The interrelation has reached a nice adjustment in nature which, while not understood in detail, is known to exist. The extinction of the herring might lead to increased food supply for the growing sockeye. At the same time it would deprive the dogfish and king salmon of their natural aliment and cause them to become a menace to the otherwise favored species. Only upon complete knowledge of the various elements of animal life can recommendations be safely made regarding more obvious matters. Empirical regulations may be successful, but rational legislation must ultimately rest upon results from the bolting-silk tow nets and the microscope.

AGE OF ADULT SALMON.

The age of the sockeye at maturity is yet not absolutely determined. It is unnecessary to do more than refer to the four-year theory based on the quadrennial increase in the Fraser River run. There seems to be sufficient reason for believing four years to be the usual term of life for the sockeye and the king salmon, but experiment has pretty conclusively shown that they may mature in less time or may be retarded beyond that term.

It is possible that the humpback reaches maturity in less time. The rapid growth of the young and the biennial occurrence of the species in Puget Sound may be noted in support of this belief. The small size and irregular number in certain localities may be adduced also. A fish of a short growth-period would be more apt to show rapid fluctuation in numbers than a form overlapping a variable series of years. At Yes Bay in 1903 many very large males occurred, in some cases reaching a weight of 11½ pounds. These were already much "humped" and advanced in sex maturity, whereas the main body of fish were still bright. Their occurrence was unusual and the size extraordinary. The fishermen believed them survivors of a previous season. The grilse form has not been noted among the humpbacks or dogs.[a] It has been reported for the coho by Mr. Patching, but not seen by the writer.

SALMON-MARKING EXPERIMENTS.

Methods.—In an effort to determine the exact age of maturity, fish have been variously marked. As against the results thus obtained it has been asserted that any mutilations can be of no value, since the mutilated part will regenerate. There have been a number of trials of marks. Hubbard, experimenting in the Clackamas River, by removal of the adipose fin is supposed to have determined maturity to arrive in the king salmon at three, four, and five years—mainly at three. Richardson, at Karluk, by removing the dorsal fin in the same manner, arrived at four years as the average age of the sockeye. In August, 1903, 1,600 sockeye fry, reared for the purpose at the Fortmann Hatchery from the 1902 eggs, were marked by excising both ventrals with fine curved scissors. The fry were released at a point in the Naha just above Heckman Lake as soon as marked, at which time they were about 3 months old. In 1906 between 50 and 100 adult sockeyes with ventral fins missing were reported by the superintendent of the hatchery at Yes Lake from the spawning beds there. Some had also the adipose fin removed; this mark in addition had been used on some of the fry mentioned above. At the Fort-

[a] See p. 9.

mann Hatchery, where they were marked, only 2 of these fish were obtained in 1906.[a] There is no doubt that these fish noted at the hatcheries were identical with the fry so marked. In careful measurements of over 7,000 sockeyes during two summers and casual inspection of many thousands during five seasons in Alaska, the writer has seen but one example of a salmon without ventrals, and in that case the fish was entirely without any indication that fins had ever begun to develop and was doubtless a monstrosity. The 2 samples sent in from Loring show the stubs of the fins just as would be expected from an amputation performed in the manner stated. This experiment, so far, supports the four-year theory.

In the spring of 1904 several thousand of the yearlings trapped at the head of Naha Bay were marked by the complete amputation of both dorsals. These fish were the same age as the fry mentioned above as marked the previous summer. There has been no record of the return of any of these latter. It is believed that the handling resulted in great loss and the percentage of survivors was too small to obtain notice even if, as is probable, the complete regeneration of the fin did not make the marking useless. A similar experiment at the Clackamas hatchery in the summer of 1904 has so far produced no result.

Mr. Rutter made several experiments in branding fingerlings, and reached the conclusion that it can be successfully done. Unfamiliarity with methods ordinarily used in branding led him first to try a five-pointed star. As was to be expected, when the fish survived the severe burn of the iron, which was seldom, the scar rapidly became formless by obliteration of the points. Subsequent experiments developed that a wire is a better instrument, the heat being applied wholly on fine lines, burning the skin but not injuring adjoining tissue. Any design with lines which do not cross, and which will not resemble in sharp angles or parallels the wounds of the teeth of predatory animals, will answer.

It is believed that if fin amputation is demonstrated as a feasible mark it should be performed on the small fingerlings. Fish under 2 inches are less susceptible to injury by handling. The fingerlings, after the formation of scales, are very easily injured, the scales parting from the skin upon the least touch. Their struggles when handled will almost infallibly produce abrasions. The experiment of anæsthetizing has not been made.

Regeneration of lost parts.—Regarding reproduction of lost parts, authorities differ. It was believed by Günther[b] that "the power of reproduction of lost parts in Teleosteous fishes is limited to the delicate terminations of the fin rays," etc.

---

[a] Seven more of these marked fish have been reported taken at the Fortmann Hatchery during the fall of 1907 up to September 29.

[b] Günther, Introduction to the study of fishes, p. 188.

Jordan[a] reiterates essentially the same statement, and this belief was held also by Weismann. Thomas Hunt Morgan has by experiment demonstrated a slightly greater power of regeneration of lost extremities of fins than had previously been held to exist. After amputation of the distal portions of the caudal in the mudfish (*Fundulus heteroclitus*) regeneration was distinctly marked in from seven to twelve days, indicating the ultimate reproduction of a perfect fin. In further experiments both the paired and median fins of this fish were found to possess the power of reproducing the distal portions after amputation. Similar regeneration in the caudal was demonstrated in the common scup (*Stenotomus chrysops*) and the mackerel shad (*Decapterus macarellus*). The presence of this fin-regenerative potency was also noted in the kingfish (*Menticirrhus saxatilis*(?)), the goldfish (*Carassius auratus*), a minnow (probably a *Leuciscus*), the stone cat (*Noturus* sp.), and others. In a spiny-rayed labroid (*Ctenolabrus*) a pectoral fin cut off *at the middle* regenerated completely, and a pelvic (ventral) fin had partially regenerated when the fish was killed. In the toadfish (*Opsanus tau*) the pectoral fins regenerated only very slowly. In none of these experiments is it stated that a fin was cut away closely at its base. There seems to be no evidence that Günther's original statement is incorrect. It was shown that in ordinary temperatures the beginning of regeneration is almost immediate where it does occur; hence it is perfectly safe to assume that in the removal of the adipose dorsal in the salmon no regeneration occurs, since no beginning of a new growth is evident several months after its excision. Nor do these experiments militate against the results of the Loring experiment of entire amputation of the ventrals, cited above. It is probable that in very cold water the beginning of regeneration will be much delayed.

SALMON IN THE TROCADERO, AT PARIS.

The most unassailable evidence of the age of king salmon adults has been rendered by the aquarium of the Trocadero[b], in France. At that institution king salmon from eggs obtained in California have been reared for some twenty-five years, generation after generation. It has been found that four years is the usual age, but that females may mature in three and in some cases not until five years. The males are found to be more precocious, some maturing in their second year. This precocity is noted in nature in the "grilse" of the Sacramento and the "Arctic salmon" of the Alaskan sockeye. The occurrence of abnormally large fishes may be due to the delay of maturity until the fifth year. It was found at the aquarium that fish invariably died soon after completion of spawning.

[a] Jordan, Guide to the study of fishes, vol. I, p. 150.

[b] Bulletin de la Société Nationale d'Acclimatation de France, October, 1905.

The New Zealand experiment in acclimatizing salmon indicates that both the sockeye and the king reach maturity at the age of 4 years. These two species have been successfully transplanted to New Zealand waters, and runs of mature well-developed fish returned in 1906 to the respective streams in which they were placed. An account of the results will appear in the Proceedings of the American Fisheries Society for 1907.

FACTORS INFLUENCING RETURN TO FRESH WATER.

SEX INSTINCTS VERSUS CONDITION OF NUTRITION.

The stimulus which it is assumed impels the salmon to seek again the fresh water is approaching maturity. Many known facts bring this assumption into question. The study of the Atlantic salmon by the Fishery Board for Scotland led to the conclusion that in that species the state of nutrition is the factor determining migration toward the river; that when the fish has accumulated the necessary supply of material it tends to return to its original habitat. In this conclusion it is assumed that the present sea-running race has been derived from a permanent freshwater-residing form. On the other hand it has been assumed for the Pacific salmon that at the time of separation of the early run to begin its travel into the stream, all of that school of salmon—both those that are to leave the sea at once and cease to feed and those that are to remain and continue to feed—are equally well nourished and equally developed. It is known that heavy floods in the springtime bring heavy spring runs, and correspondingly poor fall runs, and it will be shown that the early arrivals in Alaskan short streams are not so heavy in proportion to length as late arrivals. In all salmon the cessation of feeding upon or just previous to entering the fresh water brings a peculiar factor into the problem. When they start for the spawning beds the fish have two demands upon their supply of energy-producing stores, i. e., energy for the work of ascending the rivers, and material for the growth and development of the sex product—spawn and milt. In the case of fish entering long rivers, such as the Columbia and Fraser, the early run enters with a slightly developed generative product to build up and the entire trip to the headwaters to perform. The late run arrives with more fully developed sex organs and a much shorter journey to make.

Since no fish known to enter the streams fail to become sexually mature the same season, and since fish retained permanently in fresh water do not mature the sex product until they have reached the appropriate age[a], it must still remain as the most reasonable con-

[a] See Rutter, Bulletin U. S. Fish Commission, vol. XXII, 1902, p. 109. This can not be cited as an exception to the above statement, since the assumption that the precocious maturation is *due to* residence in fresh water has no other support, and, moreover, sea-run males are known to return as sexually mature grilse.

clusion that the reproductive purpose is mainly instrumental in bringing them into the streams. Correlated with this in determining the particular time of year for the entrance into fresh water are seasonal influences, temperature, density, currents, character of the river, etc. There may be sufficient explanation of the variation in time of runs in the proposition advanced by Moser, viz, that in streams where the run is large both the precocious arrivals and the stragglers are in sufficient number to be noted and recorded. But this can scarcely account for the distinctly double maxima noted in the runs of the Columbia and Sacramento rivers. The sockeye is said to "run" earliest in the Aleutian Islands, where it arrives in May. It is said to be found in the vicinity of Umnak Island all the year, in which case it must be feeding. In Bristol Bay the middle of June is given as the time of arrival, but the run is usually small until in July. At Karluk it is earlier, sometimes the first part of June, while in Southeast Alaska the arrival is delayed in certain streams until the second week in July.

THE DIFFERENT RUNS.

In large rivers different runs of salmon are noted—for example, in the Columbia and Sacramento the king salmon has two runs per year, or two maxima; the early fish are supposed to travel to the headwaters of the various tributaries which they enter, the later run not to ascend so far. The April–June (?) arrivals spawn in July and August; the later fish spawn September to November. The reason for the separation is unknown. A well-marked division appears only in the Columbia and Sacramento. In the former river both king and sockeye are so separated. The Karluk is said similarly to have two runs, one maximum about the last of June and one the first of August, but this was not true in 1903 when the river was under study. A double run might be supposed to bear some relation to the two migration periods of young, i. e., as fry or yearlings, but this is not borne out by the conditions in the Fraser, where such migrations are also known. In the Sacramento, the distance being short and the winters mild, the hatching periods and time of reaching salt water are distinct for each run. In the Columbia the elevation of the headwaters, with attendant low temperatures and distance which the fry must travel to reach the sea, may equalize the time of arrival at salt water.

The question whether an early hatched fry, the offspring of an early run parent, will in turn become an early run adult is of much importance in fish-cultural problems. In the Sacramento both runs receive attention at the propagating stations. On the Columbia it is mainly the late fish that are propagated, with what seems to be the result that early fish are becoming fewer. In the Fraser the early run may escape by reason of the close seasons. In short Alaskan streams

both early and late fish occupy the same grounds. The late comers thus destroy the early eggs to a considerable extent. Partly from this cause, perhaps, double runs are not well established; perhaps the fact that the volume of the streams is insufficient to carry the stimulus of the fresh water to the spring feeding ground permits the fish to remain together until all are induced by approaching maturity to direct their movement toward the coast.

Rutter found that of over 25,000,000 artificially hatched fry placed in the Sacramento in 1897–98, in addition to the product of natural reproduction, less than 1,000,000 remained as summer residents. The following year the stations hatched about 17,000,000 from the two runs, with probably a greater natural production than the previous year. The fry passed the lower river between the middle of January and last of March, with maxima about six weeks separated (January 25–30 and March 8–13), or less than half the interval that separates the adult runs, if we assume that the fry taken in January at Walnut Grove were from the early run eggs, as we must by consideration of temperatures and the observed rate of travel. This does not bear out the opinion that runs remain distinct.

TEMPERATURE.

Adjacent streams may have different seasons, i. e., time of run. The variations in the small streams of the Loring district are of interest. The early streams are the Naha, with dates of June 14–26 for the first fishing; Karta Bay, June 13–26, and with these may be included Klawak, June 16–29. The late streams are Yes Bay, July 11–17; the Moira Sound group (Dolomi, Kegan, and Nowiskay), July 8–25; Quadra, July 13. The streams here listed as early streams all drain lake areas of considerable surface and of a character that would occasion an early rise in temperature. The late streams have lakes of smaller total area or greater elevation and high surrounding ridges. The temperature data at hand are entirely too scant to demonstrate the difference suggested, but the few figures obtained seem to point to such a condition. They indicate that the streams are somewhat warmer than the surface in the adjacent salt water at the time of the run, i. e., that the fish leave the colder for warmer water.

June 30 a line of observations was carried from the Naha to Karta Bay. Off Loring the surface was 57°, density 1.0133. With some variations the temperature reached its maximum, 59.5°, about midway across Behm Canal, with density lowered to 1.0112; from this point both temperature and density decreased until off Cape Caamano, where the temperature had reached 54.5° and the density had fallen to 1.0108–1.0110. Off the cape a momentary rise in density—1.0136—occurred. Crossing Clarence Strait the temperature varied

around 55°—density rising from 1.012 to 1.0216—with which increased density the temperature fell again to 51°, and this, falling in places to 50°, was carried with a density of about 1.020 through Kasaan Bay into Karta Bay, when the density abruptly dropped to about 1.012, with almost no change in temperature.

These figures show a general decrease in temperature corresponding to a rise in density. They show further that the surface density and temperature of Kasaan Bay is little affected by the fresh water from the Karta stream, whereas Behm Canal is markedly affected by its affluents. At this season sockeyes are running into both the colder waters of Karta Bay and the warmer waters of Naha Bay. The Karta Bay fish are reported to be seen first farther south along the west side of Clarence Strait. Hence they may never come in contact with the currents from Behm Canal.

Another series of observations was made July 30 and 31, 1903, from Kegan stream to Dolomi via Old Johnson Stream opposite Kegan. In the Kegan Basin the temperature was 60° and density 1.003; at the Kegan fish scow, anchored just outside the mouth of the stream, the temperature was about 53° and density somewhat over 1.020; in the middle of Moira Sound, between the two streams, the temperature fell to 51° and density rose to near 1.022. In Old Johnson Bay a temperature of 54° and a density of over 1.020 were found. Passing down the sound, the temperature fell gradually, but varying, to 51°, with corresponding rise in density to near 1.022. The inflow from North Arm (Nowiskay) could scarcely be noted. The lowest temperature was found off Point Adams, 48°, with a density of over 1.022. The stream at Dolomi exhibited no influence outside the arm into which it flows. At the fish scow in the inner bay the temperature was 57° and density 1.0032. Five minutes' run of the tug reached water of 52° F. and density of over 1.020.

If the fish travel on the flood tide, it must be necessary for them to approach these small streams very closely in order to feel the influence. The observations recorded above are all surface, where the greatest change would be made by the fresh water. It would seem scarcely possible to detect the river water outside the small basins or estuaries at a few feet below the surface.

It is not impossible that the incoming schools closely follow the coast line. For example, it has been stated[a] that sockeyes enter Uyak Bay, on the east side of Harvester Island, pass to the south and east side of the bay, thence to the mouth of Larsen Bay, after which they follow the west side of the bay at some distance from the shore and pass out again into Shelikof Strait at the point where first seen. Since Uyak Bay contains no sockeye streams, such

[a] A. B. Alexander, ms. notes.

movements of a school, if they occur, can be regarded only as exploration either for food or spawning streams.

Other interesting temperature questions are raised by the sockeyes' selection for spawning of such streams as the one at Bartlett Bay.[a] It may be postulated that streams with lakes at levels accessible to salmon possess a higher summer temperature than streams of similar volume without lakes. There is a class of streams, however, such as that at Bartlett Bay, where the lake outlet furnishes only a small part of the volume of the main stream. In the Bartlett Bay stream a temperature of 46° at the mouth June 26 decreased to 39° before the lake in which the sockeyes spawn was reached. The main volume of the stream is glacial water, and there is nothing at the mouth to intimate to human intelligence the existence of lakes and suitable spawning beds in its course. With even this temperature, however, the river was probably warmer than the surrounding salt water, in which ice was then drifting.

CURRENTS.

The influence of tide or current in salt water apparently varies, for reports are contradictory. The Fraser River sockeyes are said to travel on the flood, i. e., with the current. Salmon enter San Francisco Bay on the ebb. At Karluk they come in on the first of the ebb, or preferably on flood just before the current from the lagoon changes. In the Kvichak the last of the flood and the whole of the ebb are said to be the best fishing. By this they must approach on the flood and take the river on the ebb. It is also claimed that a southwest wind blows the fish inshore in Bristol Bay, whereas a northeast wind at Karluk is alleged to prevent their approach. The value of these observations regarding winds is lessened by the fact that certain winds prevent the operation of gear and perhaps influence the salmon not to expose their presence by jumping. It is believed that many fish, in 1903 estimated at some 2,000,000, reached Karluk Lake in this way by passing the bay and estuary unobserved. A similar instance was noted by Mr. Cobb on the Ugaguk in 1906, when an offshore wind had not prevented the schools from reaching the fishing ground. It seems probable that inshore winds, besides obscuring the presence of fish, will accelerate their movement by assisting the current shoreward, while an opposite wind will retard this.

In such streams as Dolomi it is inconceivable that a current influence can be felt beyond the small bay at its mouth. This may explain why only small fishes reach it, such small fishes perhaps traveling closer to the shore. On the other hand, none of the small salmon streams of that region can maintain the identity of their currents

[a] Moser, Bulletin U. S. Fish Commission, vol. xxi, 1901, p. 374.

far beyond the receiving bays, and if currents are a prominent factor fish entering Behm Canal should all travel to the Unuk.

The influence of flood water on schools near a river's mouth may be due in part to an increased temperature of the water as well as to an augmented volume. It is well known that in dry seasons, when the streams are low, even though a sufficient depth for a practicable ascent may remain, schools tarry in the bays much longer than in rainy seasons. But as this is marked only in the case of small streams, the main factor must be the volume or quantity of water.

ASCENT OF STREAMS.

The speed of the salmons' ascent of rivers is perhaps modified by various conditions. In short streams of Southeast Alaska large fish are not noted in the rivers except while passing difficult falls. In the Naha they seem to make the distance from tide water to the lakes traveling at night, hence not observed. At Dorr Falls, on the Naha, humpbacks which were constantly jumping at the fall throughout the day made no attempts at night. This lack of movement at night can not hold for waters of other character.

Observations on the Karluk indicated that about ten days were consumed in making the ascent there, a rate of 2 to 3 miles per day, the main movement occurring after 4 o'clock p. m.

Rutter estimated that the spring run of king salmon in the Sacramento ascend from the ocean to their spawning beds at the average rate of 10 miles per day. If some of this time is lost in the ebb and flow of tides in the bay, the rate in the river is in excess of this. The fall run, he determined, ascended the river at the rate of 4 or 5 miles per day. Earlier observers supposed the fall fish to travel the faster.[a] Sockeyes are reported to reach the Quesnel Dam, 500 miles up the Fraser, about the middle of August; in 1906 the first arrived July 26. These are perhaps the fish entering the river in May and June, and if so they travel at a rate between 5 and 10 miles per day up a rapid river—ascending in that time to an altitude of 2,250 feet. The run continues at this point until September, perhaps including a part of the heavy July run at the mouth of the river. This would indicate that the rate of ascent is more nearly the higher figure, or that it is about equal to that of the early Sacramento fish. The variation between this movement and that in the Karluk is notable. Does it indicate any knowledge on the part of the fish as to the extent of the journey that is to be performed?

No observations are recorded regarding the movement of the coho or of the steelhead. The coho probably ascends rapidly when traveling for such points as the Wallowa and Baker Lake regions. The time occupied by schools of fish in the brackish water before entering

[a] Report Commissioners of Fisheries, California, 1876–77, p. 10.

the stream proper seems to vary with locality, species, and time of year. In some cases it is perhaps necessary that some time be so spent to inure the fish to the fresh water. Their natural timidity in approaching shallows has been mentioned above. This may be due to the exposure entailed or to recognized dangers in swift water. Adult sockeyes released at the foot of Seton Lake passed through the 17 or 18 miles of that body of water to its upper extremity in from eight and one-half to about eleven hours, presumably in daylight.

INTERVAL BETWEEN ARRIVAL AND SPAWNING.

The early arrivals of salmon spend some time in the region of the spawning beds before depositing any spawn. In the Naha the first sockeyes reach the lakes in June, but none spawn earlier than about the middle of August—after a lake residence of about six weeks. In the Karluk in 1903 the first sockeyes entered the lake about the middle of June; they continued to arrive in numbers until the latter part of July. They spawned during August. The first arrivals, as in the Naha, thus spent about six weeks in the lake and all remained at least four weeks before spawning. In the Fraser basin in 1905 the first fish reached Seton Lake the latter part of July, the run continuing until the latter part of September. The first eggs were spawned the first week of September, and spawning continued until late in October. This was approximately the same length of residence before spawning as in the Naha and the Karluk.

During the residence in the lakes it is improbable that the fish occupy the greater depths, since it has been shown that these are not suitable for fish life. In the evenings salmon may often be seen in numbers "finning," i. e., swimming leisurely at the surface in such manner as to expose the dorsal fin. The sockeye seldom jumps in lakes until about to approach the spawning bed, when there may be a slight demonstration of that habit. Ordinarily a lake may be filled with adult fish and no evidence of their presence noted by the observer.

The early king salmon also reach the beds some time before spawning. They reach the McCloud late in June or early in July, but do not spawn until the middle of August. In the Idaho investigation it was found that they reached the upper Salmon Valley the last half of July, the spawning occurring approximately a month later. All sockeyes had entered Alturas Lake before July 20 and spawned from the 23d until into September, the height of the season being about the last of August. The fish seem to have spent at least a month in the lake.

The late-running species—coho, humpback, and dog—arrive only a short time before maturity.

PARENT STREAMS.

The election by salmon of certain streams as a spawning ground to the exclusion of others has long been noted in the case of the sockeye and king salmon. The choice on the part of the latter seems to be based mainly on the volume, only stragglers of this species entering the smaller streams like the Naha and Yes rivers. The larger streams, such as the Stikine and Unuk, carry large quantities of silt and thereby form extensive mud flats, which, with the drift carried on the strong currents, make fishing difficult. For this reason no adequate idea of the number of king salmon entering these streams has been obtained. The only small stream in the region near Loring which they are known to frequent, one tributary to Carroll Inlet, has not been examined. They are commonly thought to have in Alaska a predilection for streams of glacial origin, but all large rivers of this section have some glacial water.

The sockeye is recognized as exclusively a frequenter of streams with tributary lakes. The only suggestion adverse to this is a report by Mr. Fred Patching, superintendent of the Fortmann Hatchery, regarding a small stream in the vicinity of Wrangell, which Mr. Patching believes to have no lake water. The sockeyes are said to spawn in a somewhat expanded portion of the stream, but this expanse has not the character of a lake. As a converse proposition, not all lake outlets, even of apparently suitable character, attract the sockeye. The Anan stream, tributary to Bradfield Canal, seems to be perfectly adapted to all the sockeye's requirements, but no recognized run enters it.

The dog salmon apparently recognizes some distinctions, though it is much more generally distributed than the two above-mentioned species. For example, comparatively few of this species enter the Naha or Yes rivers, whereas Karta River, on the opposite side of the strait, abounds with it.

The coho is probably less particular in its requirements. The fry were found, without exception, in every stream and brook examined; even a tiny seepage rill entering Naha Bay which would become dry with the first week of fair summer weather contained its little school of coho fry. That some streams are profitably fished for cohos, whereas others apparently as suitable are found not productive, is probably due mainly to the stream character, this in the one case being such as to promote the schooling of the fish at the mouth of the stream, while in the other a greater length of estuary or greater volume permits immediate ascent.

The humpback, like the coho, is found everywhere, and being exceedingly abundant is the more noticeable of the two.

The evidence in the question as to the existence of a homing instinct in the salmon is still lacking in many points. The exposition by

H. S. Davis in the Pacific Fisherman (vol. I, no. 6, July, 1903, p. 6 and 7) summarizes the data as known up to that time. The facts advanced as evidence of the existence of such instinct are: (1) Distinctive and characteristic runs in various streams; (2) return of marked salmon to the stream in which liberated; (3) introduction into streams not previously frequented.

"INTRODUCTION INTO STREAMS NOT PREVIOUSLY FREQUENTED."

On this subject little material data beyond Davis's citations is at hand. There is no report that runs have been established in either Papermill Creek or Chinook River. The release of fry in the Chinook River has been continuous since 1898, with no definite result. The presence of salmon in abundance in Tomales Bay has been reported, but seems to be only a result of their general abundance throughout the streams of northern California, and can not be credited to the plants in Papermill Creek. The introduction of Pacific salmon into streams of the eastern United States or of Europe seems not yet to have been successful. Until complete knowledge of the environmental requisites of the different species is obtained, the failure to establish them in these locations can not be accounted for.

The station at Baird, Cal., was opened in 1872 for the collection of salmon eggs for shipment to other streams, mainly in order to introduce the species into the waters of the Atlantic coast. The experiment was conducted on a scale unprecedented. The first plant was of about 6,000 fingerlings in the Susquehanna at Harrisburg in March, 1873. During the next three years over 640,000 were planted in the Great Lakes system, over 3,250,000 in Atlantic coast streams, over 1,000,000 in tributaries of the Gulf of Mexico, principally in the Mississippi and its branches, and several hundred thousand were scattered about in the lakes of Minnesota, Colorado, and Utah. To these plants 18,250,000 fry were added in the next five years. The last large plant was made in 1881, at which time the result had become less hopeful and the demand for more attention to the California home waters more urgent. This attempt at acclimatization was based entirely on the fact that the salmon is known to leave the cold ocean water and enter the warm rivers for spawning. The Sacramento rises to a temperature of over 80 and the Columbia reaches almost the same. Conditions appeared to be practically equivalent on the opposite coast, so far as temperature, volume, length, source, and nature of the rivers, the presence of food and enemies, etc., are concerned. But the attempt was an absolute failure.

The success recently attained in introducing both sockeyes and king salmon into the streams of New Zealand should supply valuable

data not only on the life history of these species but especially on the physical requisites for practical work. The returning adults in these instances reached only the streams in which the fry had been placed, the two species not commingling. It is yet too early to draw positive conclusions regarding the relative influence of the two factors, natural suitability of the different streams, and a homing instinct.

That any given stream within the natural range of a species is not inhabited would seem to indicate its natural unsuitability. Whether the example of the Chinook River, where the king salmon once placed in the current of the river seems to find the locality at least endurable, can stand as a refutation remains yet to be proved. That it is not naturally populated by this species has been explained by the peculiar nature of its location and the general character of the stream and its bed. At least one of the principal guides directing the salmon to their spawning grounds seems to be the current. That the fish do not enter the Chinook River by choice is thought to be due to the lack of any sensible current from that stream reaching into the path followed by the schools in their movement from the ocean into the Columbia River. Temperatures have not been recorded. This same apparent influence of the current has been noted in many instances. For example, in the Columbia, salmon pass the Willamette during the summer season of flood, when the tributary river has become back water, but enter it before and after that season when the current is perceptible. At the Quesnel Dam in the Fraser system sockeyes died fighting the swift current of the race, while ignoring the feeble flow from the original fishway.

"RETURN OF MARKED SALMON."

The experiment in which the marked Naha fry subsequently appeared as adults at Yes Bay, as noted above, must be again mentioned. This result is a direct refutation of the homing theory. The relative numbers at Yes Bay and the Naha are the more remarkable for the reason that no Naha fish are taken except for breeding, hence almost all the individuals returning to that stream would be discovered, while at Yes Bay many may have been taken in the cannery seines and the record lost. In all experiments based on marking young fish by various mutilations the possibility of regeneration of the lost parts must be fully taken into consideration. In this experiment it is believed the fins were cut much closer than in the laboratory experiments.

"DISTINCTIVE AND CHARACTERISTIC RUNS."

Upon this point some more or less conclusive facts have been determined. The group of streams fished by the Loring Cannery were studied in 1903 and 1904, careful counts and measurements of a num-

ber of fish from each locality being taken at the receiving scows in order to eliminate as far as possible any doubt regarding the region to which the fish belonged.

The localities are rather widely distributed. The most northerly and most distant from the ocean is Yes Bay, on the upper arm of Behm Canal. Opposite the mouth of this arm, and across Clarence Strait, is Karta Bay at the head of Kasaan Bay. The other localities are near the opening of Clarence Strait into Dixon Entrance; on the west side, Kegan and Nowiskay, tributary to Moira Sound, and Dolomi just above it; on the east side, Boca de Quadra, opening into Revillagigedo Channel; Tamgas, on Annette Island, about midway between Moira Sound and Boca de Quadra, and Port Chester, just above Tamgas, off Nichols Passage.

To make these data of decisive value it remains to be proved that fish taken in the receiving bay of a given stream are all destined, if not interfered with, to enter that stream for spawning. It has been suggested that fish may congregate in a given bay for a time and, subsequently scattering, travel to distant streams to spawn. To test this, Rutter in 1903 tagged several hundred fish and released them in Karluk Bay or in the lagoon. But one of these was ever reported in another basin; most of them were retaken in the seines working in the bay at that time. If not taken the same day, they were seldom found, though occasionally a straggler was discovered several days after its release, the latest nine days after tagging. While not at all definite, these results point to the probability that few, if any, fish reach another river after appearing at the mouth of one. (See also p. 106.)

In some instances, in closely adjacent basins, the fishermen in their effort to meet the incoming schools reach the neutral grounds between; for example, at Yes Bay some crews fish Behm Canal and so, perhaps, interrupt schools bound for the Unuk River; Moira Sound fishermen sometimes fish outside the respective arms. But this does not often occur. In general, the figures from a given basin are believed to represent fairly well the fish traveling at the time for that particular stream.

Variations in weights and measurements.—In this inquiry weights were taken on a small spring balance read to the nearest quarter pound. The lengths were taken with a steel tape, the fish lying on a flat table. The points chosen, with the view of later making comparative measurements on spawned fish, were the center of the eye and the extremity of the last caudal vertebra. The reading was made to the nearest half centimeter. The depth was taken at the front of the rayed dorsal by means of dividers, which were read from a scale to millimeters. As all the measurements with the exception of the Port Chester and Tamgas figures were made by the writer, the

personal factor is well guarded against. The exceptions mentioned are measurements made by Fassett after careful observation, and are believed to be closely comparable with the rest. The averages are given in the following table:

TABLE 2.—AVERAGE WEIGHTS AND MEASUREMENTS OF SOCKEYE SALMON FROM DIFFERENT LOCALITIES.

Locality and year.	Date of examination.	Number examined.			Length.			Weight.		
		Male.	Female.	Total.	Male.	Female.	Average of total.	Male.	Female.	Average of total.
					mm.	*mm.*	*mm.*	*Pounds.*	*Pounds.*	*Pounds.*
Yes Bay, 1903	July 16–20	162	135	297	555.3	544.4	549.8	8.294	7.407	7.85
1904	Aug. 16–21	503	504	1,007	524.7	523.0	523.8	7.07	6.547	6.76
1905	July 26 to Aug. 14.	339	353	692	532.1	530.0	531.0	8.158	7.559	7.853
Karta Bay, 1903	July 1, 23–26.	208	213	421	542.6	536.4	539.5	7.088	6.418	6.753
1904	July 1–6	518	507	1,025	537.7	524.1	531.0	6.778	5.947	6.377
Quadra, 1903	July 30 to Aug. 5.	267	236	503	531.6	536.8	534.2	7.087	6.843	6.965
1904	Aug. 24–29	503	509	1,012	512.1	511.5	511.8	6.207	5.813	6.019
Kegan, 1903	Aug. 14	56	44	100	496.3	494.8	495.5	5.826	5.454	5.64
1904	July 24–29	509	507	1,016	515.6	517.2	516.4	6.195	5.835	6.016
Nowiskay, 1903	Aug. 17–19	93	107	200	528.0	519.3	523.6	6.924	6.222	6.523
1904	July 14 to Aug. 31.	512	509	1,021	513.3	500.7	506.8	6.224	5.379	5.803
Dolomi, 1903	Aug. 21–23	122	181	303	488.3	482.7	485.5	5.436	4.874	5.155
1904	Aug. 4–11	505	506	1,011	470.0	471.2	470.7	4.508	4.230	4.369
Port Chester, 1904	Aug. 20 and 23.	150	155	305	498.1	486.2	492.0	4.932	4.274	4.597
Tamgas, 1904	Aug. 19–23	528	512	1,040	466.2	463.6	465.0	3.934	3.625	3.782

Locality and year.	Date of examination.	Depth.			Ratio of depth to length.		
		Male.	Female.	Average of total.	Male.	Female.	Average of total.
		mm.	*mm.*	*mm.*			
Yes Bay, 1903	July 16–20	157.8	148.4	153.1	28+	27+	28−
1904	Aug. 16–21	150.6	140.3	145.9	28+	27−	28+
1905	July 26 to Aug. 14	158.0	149.6	154.0	29+	28+	29
Karta Bay, 1903	July 1, 23–26	144.1	135.1	139.6	26+	25+	26−
1904	July 1–6	146.7	136.9	141.8	27+	26+	26+
Quadra, 1903	July 30 to Aug. 5	144.6	140.0	142.3	27	26	26+
1904	Aug. 24–29	138.5	132.9	135.6	27+	26−	27−
Kegan, 1903	Aug. 14	134.1	127.6	130.8	27	26	26+
1904	July 24–29	141.4	135.6	138.5	27+	26+	27−
Nowiskay, 1903	Aug. 17–19	141.4	132.3	136.8	26+	25+	26+
1904	July 14 to Aug. 31	139.7	130.0	134.9	27+	26−	27−
Dolomi, 1903	Aug. 21–23	124.7	117.7	121.2	25+	24+	25−
1904	Aug. 4–11	120.7	115.8	118.2	25+	24+	25
Port Chester, 1904	Aug. 20 and 23	126.4	117.0	121.6	25+	24	25−
Tamgas, 1904	Aug. 19–23	114.4	109.7	112.6	24+	23+	24+

Of 100 sockeyes, equally divided as to sex, weighed at Karta Bay August 2, 1904, the males averaged 7 pounds and the females 6. Males were very slightly in excess in number at the time.

DIFFERENCES IN AVERAGES OF THE SEXES.

[Except where the minus sign appears, the figures represent excess in average of the males.]

Locality.	Date.	Length.	Weight.	Depth.	Locality.	Date.	Length.	Weight.	Depth.
		mm.	*lb.*	*mm.*			*mm.*	*lb.*	*mm.*
Yes Bay	1903	10.9	0.887	9.4	Nowiskay	1903	8.7	0.708	9.1
	1904	1.7	.523	10.3		1904	13.2	.845	9.7
	1905	2.1	.599	8.4	Dolomi	1903	5.6	.562	7.0
Karta Bay	1903	6.2	.670	9.0		1904	−1.2	.278	4.9
	1904	13.6	.831	9.8	Port Chester	1904	11.9	.658	9.4
Quadra	1903	−5.2	.244	4.6	Tamgas	1904	2.6	.309	4.7
	1904	.6	.394	5.6					
Kegan	1903	1.5	.372	6.5					
	1904	−1.6	.360	5.8					

It will be noted that this table shows a smaller average size for the fish of 1904, except in one instance (Kegan); there the number obtained in 1903 was too small for accurate comparison.

The variation in depth between the two sexes seems to be practically constant, about 1 per cent of the measured length (which measurement is about three-fourths of the total length), or less than 1 per cent of the total length. The dates at which the examinations were made do not alter this ratio, showing that ordinarily there is no great increase of the depth in the male while still in salt water, and that variations of proportionate depth, as shown in the different localities, are not an effect of secondary sex changes. In all instances the males are heavier, although in a few cases slightly shorter than the females. This difference in weight varies from 3.6 per cent in the case of one lot of Quadra fish to over 15 per cent in the case of the Nowiskay fish of 1904. The greater weight is attributable to the greater depth of the males, which exceeds the depth of the females by from 4 to over 7 per cent on the average. In these sex variations there seems to be no marked similarity in the two seasons for a given locality, the resemblance between different localities being greater in some cases than between different years in the same locality. In the few weights of Karta Bay fish taken in August, 1904, the difference in average of the two sexes is remarkable, amounting to over 16 per cent. This is probably due to the increased weight of the later running males. In all questions involving weight, analysis should be made to see what increase is due to mere increase of water in the tissues.

The only spawned sockeyes weighed were at the Fortmann Hatchery. These were apparently a somewhat different fish from those of other localities, so no data as to the loss suffered during migration and spawning could be deduced. Seventy-two males averaging 539 mm. (std.) in length (480–605) averaged 7.4 pounds in weight, or considerably heavier than fresh fish of the same length from other localities. The combined average of green fish of similar lengths

from Yes and Karta bays is but 7.2 pounds. The 128 females measured show an average length (std.) of 532 mm. (465–570) and an average weight of 6 pounds. The combined average of Karta and Yes Bay females of similar length is about 6.3 pounds.

The figures obtained are hardly sufficient to determine the change, if any, incident to the varying periods of the run. Nowiskay is the only locality in which the measurements were carried through a considerable length of time. At this point, owing to the smallness of the early July run, the dates extended from July 14 to 22, and again to August 10, 12, and 31. In summing up these lots as July fish and August fish it is observed that the average length of the July fish is greater. Over 79 per cent of the whole number, 235, measured in July, are over 500 mm. (std.) in length, whereas of the August fish, 277 in number, only 47 per cent exceed 500 mm. The same fact is noticeable in the fish of Karta Bay in 1903. Of 55 measured the first of July nearly 62 per cent are 550 mm. (std.) or over, whereas of 153 measured the latter part of that month only 45 per cent reach these lengths. These figures pertain only to the males, the females showing less variation. At other stations the daily distribution of sizes very closely resembles the totals, and a curve plotted for any one day would not vary materially from the curve for the total.[a]

The fish of Yes Bay are found to be the heaviest and also the deepest, those of Tamgas the lightest and relatively the most slender. The former are about twice the average weight of the latter, one-eighth longer (total), and one-seventh greater in proportionate depth. These are comparatively widely separated localities; but the variation between more adjacent regions, as Boca de Quadra and Tamgas, while less than in the case of Yes Bay and Tamgas, is still marked. A yet more interesting instance is seen in the streams of Moira Sound and Dolomi.

The average weight of fish from Nowiskay is nearly one-third greater than that of the Dolomi fish, and they are nearly one-sixth longer and of somewhat greater proportionate depth. These basins are immediately adjacent and this difference is always well recognized by the fishermen. It indicates one of three things: That the fish exercise some selective instinct in choosing their spawning stream; that they are practically limited in their feeding activity to a radius of less than 10 miles, or that the currents are such that the product of these two streams remain as separate schools in different areas.

[a] At Karluk it is reported (Alexander, ms.) that the earliest-run sockeyes are smallest, averaging 16 to the case when canned. As the season advances the size increases until 11 or 11½ make a case; but again by the middle or latter part of August the size falls to about that of the beginning. This may hold in other localities, the earliest of the run passing unobserved by reason of the small number.

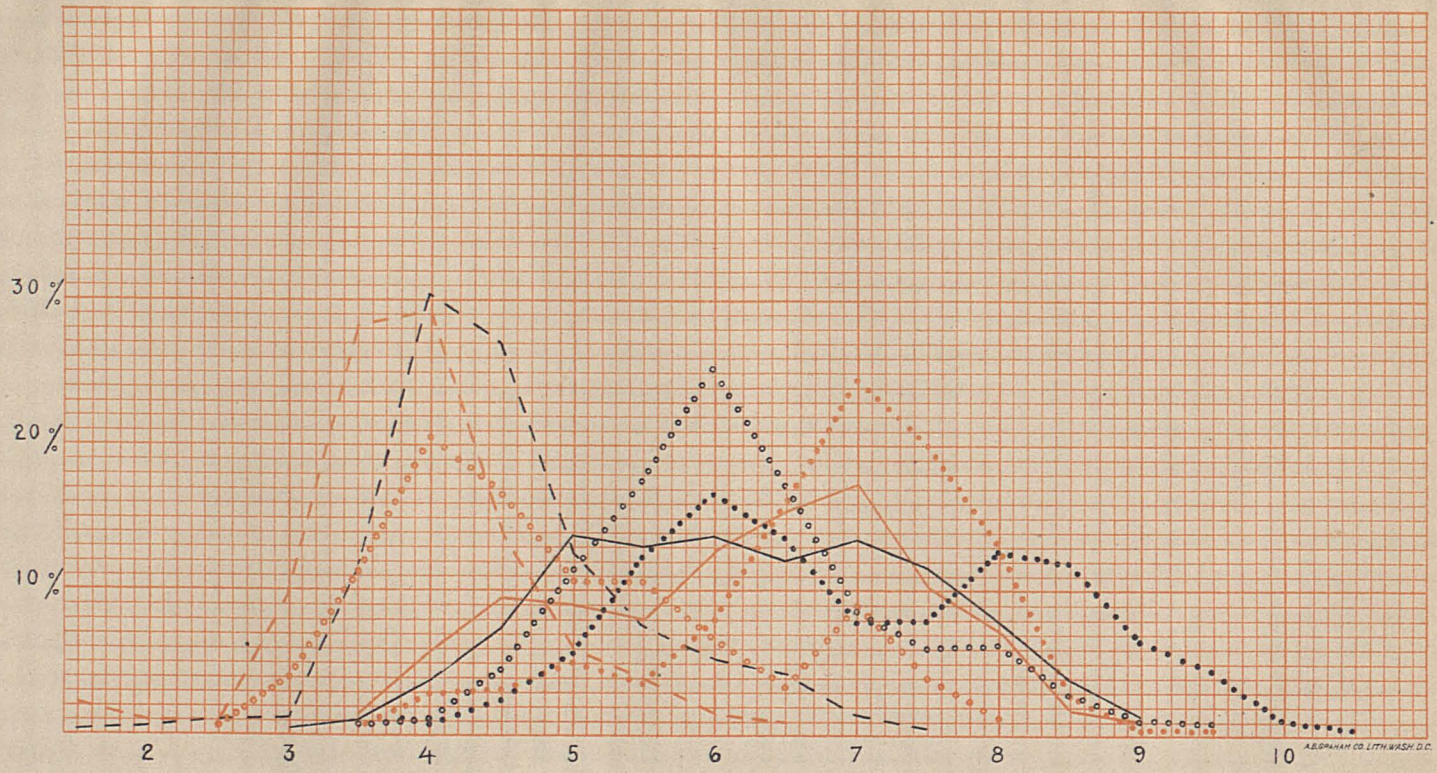


DIAGRAM B.—SHOWING WEIGHTS OF MALE SOCKEYES IN 1904.

KEY TO SYMBOLS

- TAMGAS
- DOLOMI
- NOWISKAY
- KEGAN
- KARTA
- YES BAY 1903-4
- QUADRA
- PORT CHESTER

In table 3 are shown for the males the percentages in which each weight (to the nearest half pound) was found in the respective lots. In diagram B are plotted the curves for each lot for 1904, the weights being marked off in the horizontal axis and the number of examples of each weight, as a percentage of the whole number weighed at a given locality, indicated on the verticals.

TABLE 3.—WEIGHTS OF MALE SOCKEYES, SHOWN AS PERCENTAGES OF THE TOTAL NUMBER OF EXAMPLES EXAMINED FROM EACH LOCALITY.

Weight.	Tamgas.	Doloml.		Port Chester.	Nowlskay.		Kegan.		Quadra.		Karta Bay.		Yes Bay.		
	1904	1904	1903	1904	1904	1903	1904	1903	1904	1903	1904	1903	1904	1903	1905
1½ pounds	2.1	0.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2 pounds	1.0	.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2½ pounds	1.1	1.0	.....	0.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3 pounds	9.9	1.0	0.8	4.0	0.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3½ pounds	28.3	11.4	.8	11.3	.8	.....	1.8	.....	0.4	0.4	0.4	.....	.....	.....	.....
4 pounds	29.4	30.2	10.7	20.6	3.5	.....	5.7	5.4	1.0	.....	2.9	1.0	0.6	.....	0.3
4½ pounds	14.0	26.8	8.2	16.6	7.3	2.1	9.6	5.4	4.2	.....	3.1	1.9	2.2	.....	.6
5 pounds	6.0	12.4	32.2	10.6	13.5	7.6	9.0	10.8	11.0	1.6	5.2	5.8	5.4	0.6	.6
5½ pounds	4.0	7.2	12.4	10.6	12.7	4.3	8.0	28.5	17.4	6.0	3.7	5.8	12.0	2.4	.9
6 pounds	1.6	5.0	14.8	6.6	13.5	8.6	12.7	25.0	25.6	20.8	8.0	9.1	16.6	1.8	2.0
6½ pounds	1.0	4.0	5.0	3.3	11.7	15.2	15.5	12.5	17.0	13.2	16.0	9.6	13.2	1.8	4.7
7 pounds	.4	1.2	7.4	9.0	13.3	20.4	17.4	5.4	8.2	14.4	24.4	17.7	7.6	7.3	5.0
7½ pounds	.2	.2	6.6	4.0	11.3	20.4	10.2	5.4	5.8	10.9	22.0	18.2	7.6	11.5	11.7
8 pounds	.....	.....	.8	1.1	7.4	18.3	7.3	.....	6.0	18.5	13.0	17.0	12.4	25.4	15.3
8½ pounds	.....	.....	.....	.....	3.5	2.1	1.8	.....	2.6	4.5	2.7	6.3	11.4	18.2	18.2
9 pounds	.....	.....	.....	.....	1.0	1.0	1.0	1.7	.8	5.6	.6	4.3	6.2	15.9	14.8
9½ pounds	.....	.....	.....	.....	.....	.....	.....	.....	.6	3.5	.6	2.4	4.2	9.1	13.9
10 pounds	.....	.....	.....	.....	.....	.....	.....	.....	.2	.7	.....	.5	.8	4.2	8.0
10½ pounds	.....	.....	.....	.....	.....	.....	.....	.....	.2	.....	.....	.....	.2	.6	3.2
11 pounds	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.6	.3
11½ pounds	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.6	.3
No. of specimens	528	505	121	150	512	93	509	56	503	264	518	207	501	165	339
Average weight, lbs.	3.9	4.5	5.4	4.9	6.2+	6.9	6.2—	5.8	6.2+	7.1	6.8—	7.1	7.0	8.3	8.2

In table 4 are shown for the males the various lengths tabulated by percentages of the number of fish in the lots measured, in the same manner as in table 3 to show the weights. In diagram C are plotted the curves for each lot measured in 1904; in diagram D the curves for the lots of 1903 and 1905. Table 4a shows in the same manner the lengths of female sockeyes.

TABLE 4.—LENGTHS OF MALE SOCKEYES, SHOWN AS PERCENTAGES OF THE TOTAL NUMBER OF EXAMPLES EXAMINED IN EACH LOCALITY.

Standard lengths.	Tamgas.	Dolomi.		Port Chester.	Nowiskay.		Quadra.		Kegan.		Yes Bay.			Karta Bay.	
	1904	1904	1903	1904	1904	1903	1904	1903	1904	1903	1904	1903	1905	1904	1903
320 mm	0.2														
330 mm	.5	0.2						0.8							
340 mm	1.0	.2													
350 mm	.3														
360 mm	.5	.2													
370 mm	.3		0.8												
380 mm	.2	.2													
390 mm	.3	.4	.8												
400 mm		.4											0.3		
410 mm	.2	.4	.8	0.6	0.2			.4							
420 mm	1.7	1.0											.3		
430 mm	3.8	4.8			.4				1.2				.3	0.2	
440 mm	10.0	7.8	2.5	3.4	.8		0.2		.6	3.6	0.4		.3		0.5
450 mm	11.9	14.8	7.5	6.9	1.1		1.0		2.6	1.8	.6		.9	.9	
460 mm	16.6	16.4	9.0	8.9	4.1	1.7	1.6	.4	5.2	7.1	1.8		.3	2.1	1.0
470 mm	17.5	16.8	9.0	8.9	7.4	5.4	4.0	.8	7.6	7.1	4.0		.9	2.0	1.4
480 mm	11.2	12.2	22.0	13.8	9.2	5.4	8.0	3.6	6.0	14.3	7.6	0.6	3.0	3.3	2.9
490 mm	7.3	7.6	8.0	12.5	9.6	5.4	12.6	5.2	5.1	14.3	12.6	1.2	3.2	3.3	3.8
500 mm	5.0	3.8	9.0	6.1	9.2	4.3	17.4	11.1	5.1	16.1	11.4	1.8	7.1	3.1	4.3
510 mm	3.8	5.0	7.5	3.4	8.0	11.8	16.6	10.0	8.4	10.7	9.4	1.8	7.1	2.0	5.3
520 mm	3.4	3.0	6.5	6.1	8.7	19.2	11.2	11.8	12.1	14.3	4.8	3.7	11.5	3.5	5.8
530 mm	1.3	3.0	9.0	8.2	11.0	18.1	7.8	7.0	12.0	1.8	5.4	6.2	11.5	11.4	9.1
540 mm	1.1	1.4	6.0	6.2	10.4	15.0	5.4	10.8	14.7	5.3	7.4	9.4	14.8	18.5	12.2
550 mm	.5	.8	1.7	9.7	10.0	10.7	4.6	13.0	11.4	1.8	12.0	16.2	14.0	21.6	13.0
560 mm	.5	.4		3.4	6.8	3.2	4.4	8.1	5.6	1.8	9.8	25.6	13.3	14.9	17.0
570 mm				1.3	1.6		3.6	8.9	1.6		8.4	16.8	8.6	8.5	12.7
580 mm	.2			.6	1.0		1.4	5.0	1.6		3.0	10.6	1.5	3.5	6.7
590 mm							.2	2.0			1.6	4.4	.6	.6	2.9
600 mm							.2	.8			.4	1.8		.2	1.9
610 mm							.2					.6		.2	1.0
No. of specimens	528	504	122	146	512	93	502	267	509	56	502	162	338	518	208
Average length, mm	466	470	488	498	513	528	512	531	516	496	525	555	532	538	543

TABLE 4a.—LENGTHS OF FEMALE SOCKEYES, SHOWN AS PERCENTAGES OF THE TOTAL NUMBER OF EXAMPLES EXAMINED FOR EACH LOCALITY.

Standard lengths.	Tamgas.	Dolomi.		Port Chester.	Nowiskay.		Quadra.		Kegan.		Yes Bay.		Karta Bay.		
	1904	1904	1903	1904	1904	1903	1904	1903	1904	1903	1904	1903	1904	1903	1905
380 mm	0.2														
390 mm															
400 mm	.2	0.4													
410 mm	.2	.6													
420 mm	1.9	1.0	0.6	0.6					0.2						
430 mm	4.9	5.0	1.1	2.0	1.1				.4				0.2		
440 mm	11.7	6.8	2.2	5.2	2.9				1.0		0.4		.2		
450 mm	20.0	13.2	5.0	9.7	4.6	1.0	0.6	0.4	1.7	7.0	1.4		1.0	0.5	
460 mm	20.7	17.0	11.1	13.0	7.4	2.8	2.0	.8	2.3	9.0	2.0		.8		
470 mm	16.0	20.2	20.0	11.0	6.0	3.7	5.4	1.2	3.1	15.9	4.8		.8	.5	1.4
480 mm	8.8	14.4	20.5	13.0	8.4	1.0	11.4	2.0	3.5	15.9	7.0	0.7	1.1	2.3	1.4
490 mm	4.3	8.0	18.0	9.7	7.2	2.8	14.2	2.5	3.1	11.5	5.0		1.9	1.4	2.8
500 mm	2.7	5.8	6.0	4.6	10.0	7.5	16.1	5.1	6.9	4.5	4.6		6.7	3.3	4.5
510 mm	4.3	3.6	6.5	5.8	14.9	16.0	11.0	5.5	14.2	4.5	4.8		13.4	4.2	9.3
520 mm	2.9	2.2	3.8	8.5	15.0	24.3	7.6	5.1	18.5	7.0	11.6	9.0	21.9	8.4	15.6
530 mm	1.1	1.8	3.8	9.0	12.7	17.7	7.2	14.6	19.5	13.6	17.4	19.3	21.5	17.8	23.5
540 mm		.6	.5	5.8	4.8	14.0	7.0	21.9	15.9	7.0	18.2	23.7	12.2	27.2	19.0
550 mm	.2	.4	.5	1.2	3.1	5.6	8.6	18.2	7.7	2.3	14.2	22.2	11.6	19.2	15.3
560 mm				.6	.8	3.7	5.6	13.8	1.3	2.3	6.6	12.1	2.7	11.2	6.2
570 mm					.2		2.4	5.1	.2		2.2	10.0	.4	3.0	1.7
580 mm		.2	.5				1.2	1.6			.6	1.5		1.0	
590 mm							.2	1.6				.7			
600 mm							.2								
No. of specimens	512	506	181	154	509	107	508	236	507	44	504	135	506	213	353
Average length, mm	464	471	483	486	519	500	512	537	517	495	523	544	524	536	530

A.H. GRAHAM CO. LITH. WASH. D.C.

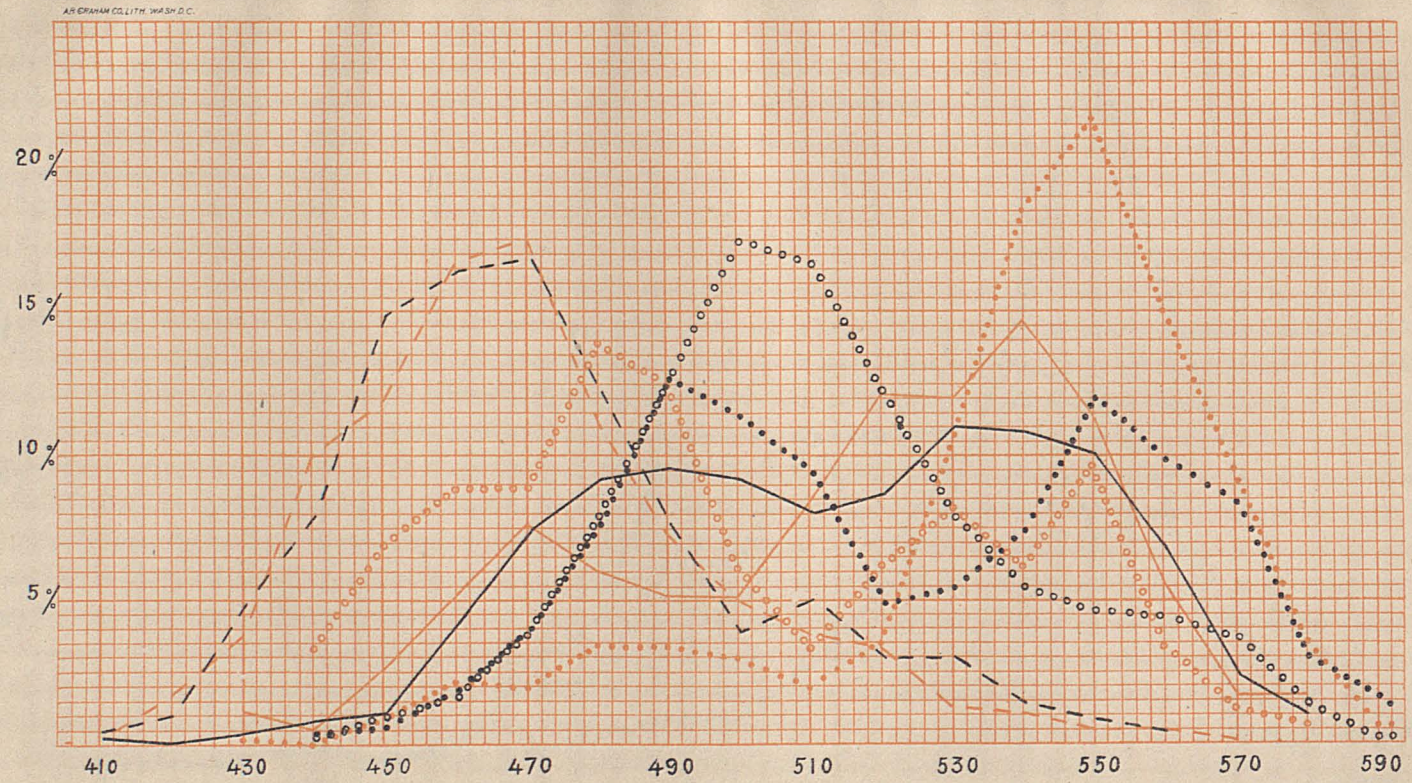


DIAGRAM C.—SHOWING LENGTHS OF MALE SOCKEYES IN 1904.

FOR KEY SEE DIAGRAM B.

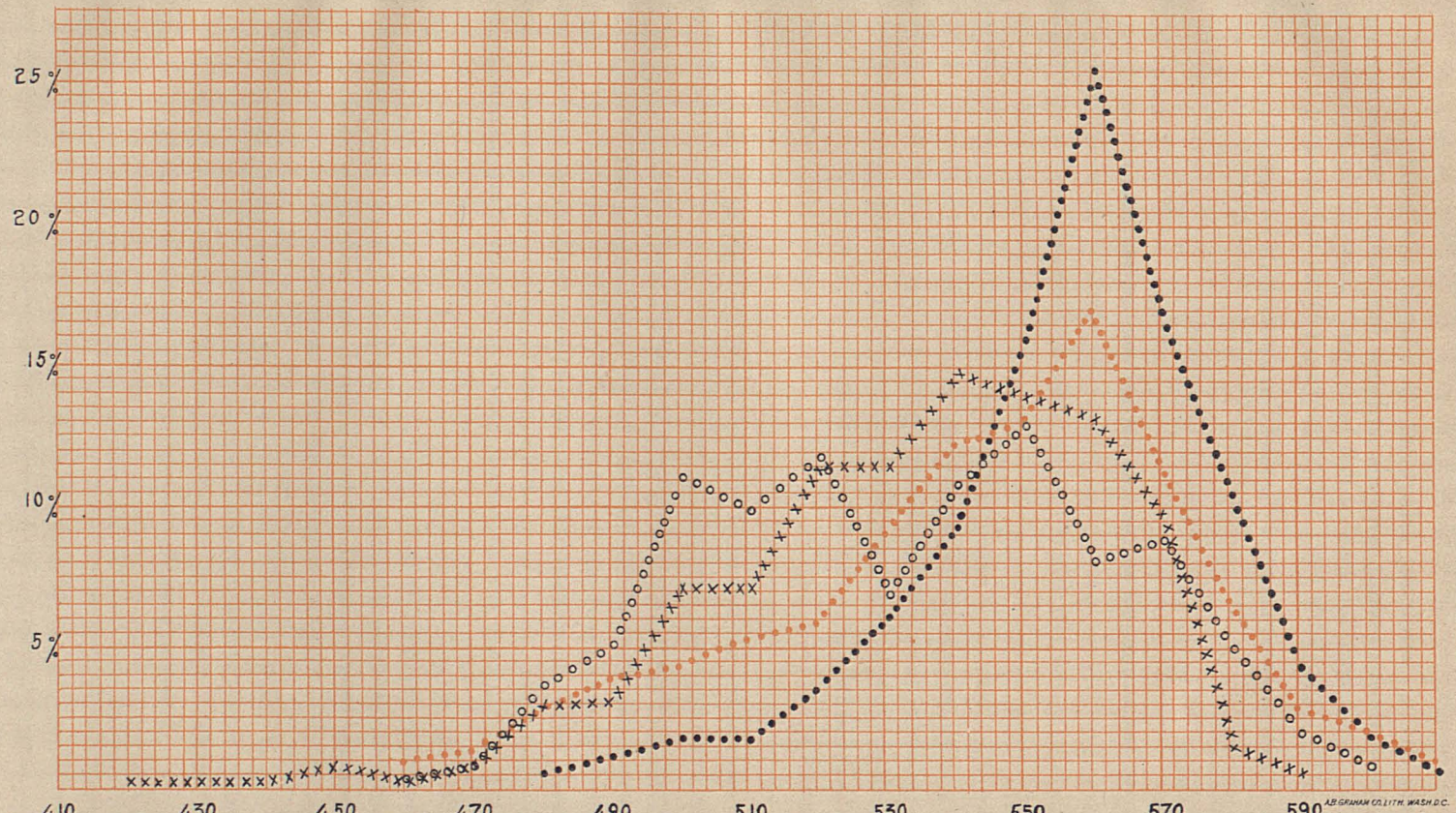


DIAGRAM D.—SHOWING LENGTHS OF MALE SOCKEYES IN 1903 AND 1905

SEE KEY TO DIAGRAM B. XXXXXX YES BAY 1905.

Table 5 shows the depths of the males tabulated in the same manner as the lengths and weights, showing these measurements in percentages of the total number of fish in each lot measured. Diagram E presents the same information for 1904 shown by curves.

TABLE 5.—DEPTHS OF MALE SOCKEYES, SHOWN AS PERCENTAGES OF THE TOTAL NUMBER OF EXAMPLES EXAMINED FOR EACH LOCALITY.

Depth.	Tamgas.	Dolomi.		Port Chester.	Quadra.		Nowiskay.		Kegan.		Karta Bay.		Yes Bay.		
	1904	1904	1903	1904	1904	1903	1904	1903	1904	1903	1904	1903	1904	1903	1905
80 mm	0.6														
85 mm	.6														
90 mm	1.0	0.4													
95 mm	1.2	.4													
100 mm	2.0	.6	0.8	2.6											
105 mm	7.7	.8	4.0	1.3	0.2										
110 mm	16.4	6.1	4.0	7.3	.2		0.4			1.8					
115 mm	24.0	19.0	7.4	10.6	.6		.8		0.4			0.9			
120 mm	19.2	26.3	22.0	15.3	.4		2.3	3.2	2.5	10.7	1.1	1.4			
125 mm	13.2	22.7	18.0	11.3	5.2	0.4	6.5	5.4	5.5	5.3	1.3	1.9	1.4		0.3
130 mm	7.6	12.5	13.0	15.3	13.4	2.9	11.2	8.6	10.7	8.9	4.0	7.7	2.4		.6
135 mm	3.4	7.0	14.0	8.0	19.6	10.6	14.9	10.8	13.5	36.0	4.8	8.2	5.8	1.2	1.8
140 mm	2.0	2.8	6.5	8.0	25.2	19.9	16.0	14.0	12.3	18.0	11.7	11.0	15.4	1.8	2.3
145 mm	.6	1.4	4.8	8.0	16.4	17.0	15.8	16.1	15.1	8.9	14.0	24.0	13.8	6.0	4.7
150 mm		.2	4.0	8.0	9.2	20.1	17.0	24.9	20.6	8.9	28.3	17.3	16.4	12.8	7.4
155 mm	.2	.2	.8	.2	5.0	13.0	8.3	13.0	11.9		20.0	15.4	11.6	20.0	14.5
160 mm					4.0	8.7	6.0	3.2	5.3		10.6	7.7	14.6	25.6	20.9
165 mm					1.0	6.0	1.0		2.5		3.1	3.3	9.6	17.2	21.8
170 mm						2.3					.6	1.9	6.8	10.0	13.0
175 mm					.2								2.6	4.9	7.4
180 mm													.2	.6	4.1
185 mm														.6	.6
No. of specimens	528	505	122	150	503	265	512	93	509	56	518	208	503	164	339
Average depth, mm.	114+	121	125−	126+	138+	145−	140−	140−	141+	134	147−	144+	151−	159	158

A close correspondence will be seen in all the curves for Dolomi and Tamgas.[a] The greatest number of individuals in each are 4-pound fish. The balance of the average weights of the two lots is destroyed by the varying numbers under and over this maximum. The weight curve, however, for Dolomi is very similar to that for Tamgas, though it occupies a place about 0.5 pound higher in the scale, the average weight for Dolomi being 4.5 pounds as compared with 3.9 pounds. An examination of the length curves (diagram E) also shows a very close parallel between these two localities, while the difference between the curves for depths (diagram F) will explain the greater weight of the Dolomi examples, the depth curve for Dolomi standing about 5 mm. higher on the scale than that for Tamgas. Comparing the two lots, it is shown that while the average length is about the same for each locality, and the number of examples of any given length is about the same for each, the Dolomi fish average about 5 mm. greater in depth and therewith 0.5 pound greater in weight. These two localities seem to be set off clearly from all others examined.

[a] In the following discussion of the tabular data reference is to the males only unless otherwise specified.

The Dolomi fish of 1903, only 200 in number, were much heavier than those of 1904, but in this they but follow the rule exhibited by other localities, in almost all of which the 1904 fish are lighter than those of the previous year. It will be noted that in 1904 the examination of Dolomi fish preceded that of Tamgas fish by about two weeks. The latter were reported to be quite immature sexually, apparently more so than the Dolomi fish of the earlier date. This may account in a measure for their slenderness. In both these localities running small fish, two type forms are noted more distinctly than in streams carrying the larger fish, viz, the slender terete form, usually dark, with scales more or less embedded, but not showing the other marks of sex maturity; and the deeper, more compressed form, with scales distinct and brightly colored. Fassett noted at Tamgas that one or the other of these forms predominated on different days, indicating a difference in schools. The dark fish may be fish which have been feeding in the brackish water for some time.

The fish of Karta and Yes bays, the heaviest of all, in 1904 approached one another closely in average weight, varying only 0.3 pound. Examination of the curves for weight, however, shows great difference. The curve for Karta Bay is comparatively simple, rising to over 24 per cent on 7 pounds, extremes falling between 3.5 and 9.5 pounds and showing little tendency to indicate a double node or maximum, while Yes Bay shows 2 maxima, one on 6 pounds and one on 8 pounds, with small numbers on 7 and 7.5; in addition the upper extreme rises to 10.5 pounds. The length curves exhibit this variance increased. In this the line for Karta, showing some tendency to form a double node, rises on the same maxima with Yes Bay, 490 mm. for the lower, and 550 mm. for the upper, but in the case of Yes Bay the percentages on each are about equal (12 per cent), while for Karta they are, respectively, 3+ and 21.5 per cent. This shows that the relatively short fish are found in much greater number among the Yes Bay examples, reducing the total average length (std.) in this locality to 525 mm. as against 538 at Karta, in the face of a slightly higher average weight for Yes Bay. Reference to the depth curve again offers the explanation. The two length types of Yes Bay cause the depth curve for that locality to be somewhat truncated, rising to about equal height (14 to 16 per cent) on 140, 150, 160 mm. and reaching an extreme of 180 mm. This indicates the prevalence of short deep fish in Yes Bay and long slender fish in Karta Bay.

In this year the Karta fish were examined about six weeks earlier than those of Yes Bay. They were noted as nearly all bright, but some were of advanced maturity, with the usual changed form. The Yes Bay fish were noted as being of "advanced" maturity in outward appearance, and it was said they were so from the beginning of the run. The catches made in Behm Canal averaged smaller fish and

A.BORAHAM CO. LITH. WASH. D.C.

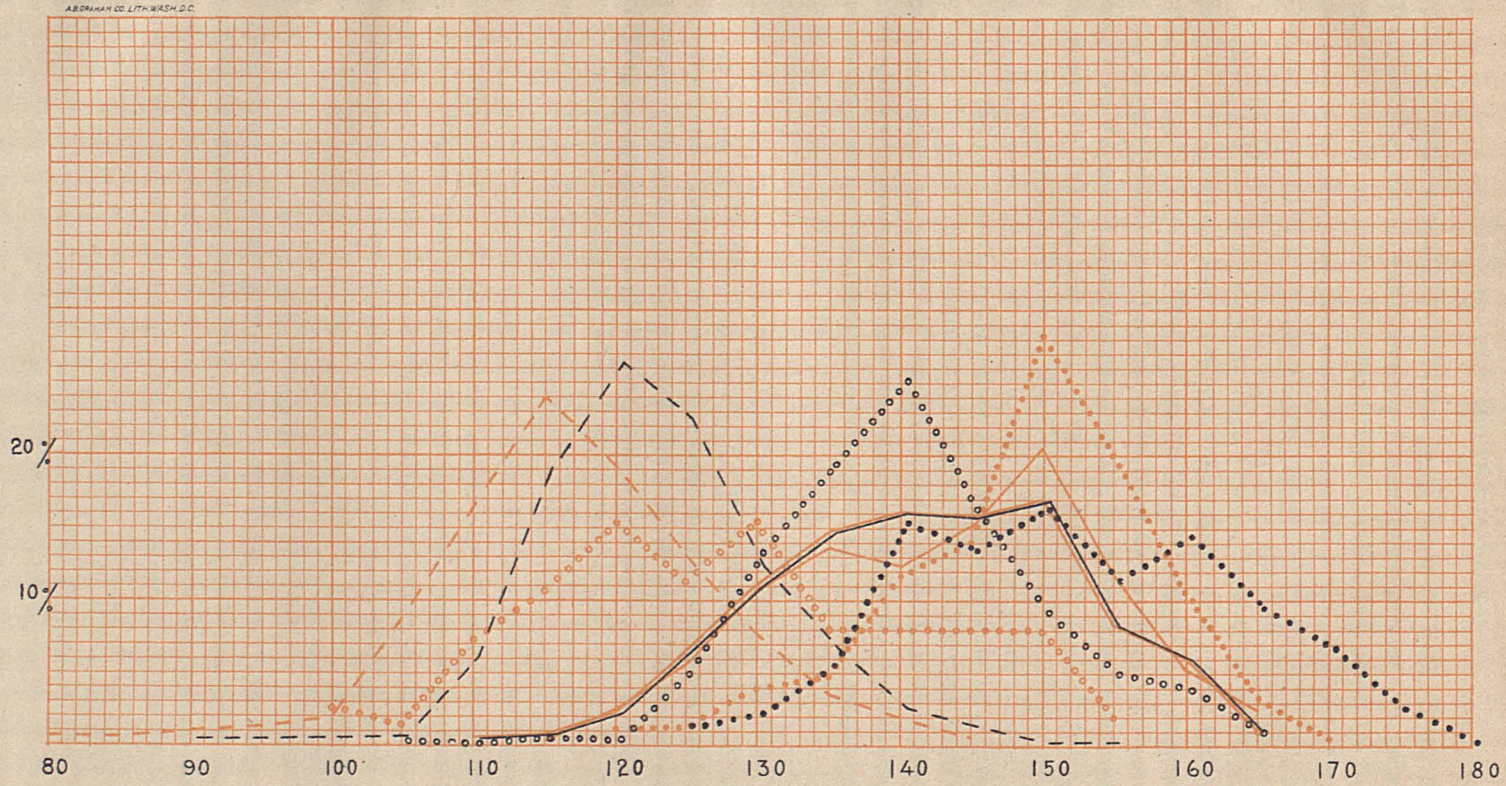


DIAGRAM E.—SHOWING DEPTHS OF MALE SOCKEYES IN 1904.

FOR KEY SEE DIAGRAM B.

brighter. The fishermen thought these were "Unuk River fish." Whether regarded as fish traveling to another basin or as a later run not yet ready to enter the bay, these smaller fish account for the abundance of 6-pound fish and the double node in the curve. In 1903 the fish of these two localities, examined at approximately the same time, differed much more in averages, the Yes Bay fish exceeding those of Karta Bay by more than 1 pound in weight, by 12 mm. in length, and about 15 mm. in depth. In neither is there an indication of more than one type. The curves for length, weight, and depth show a single maximum, that for length in both localities on 560 mm., for weight on 7.5 and 8 pounds, respectively, for Karta and Yes bays, and for depth on 145 and 160 mm. Over 25 per cent of the Yes Bay fish reach the maximum, while of the Karta fish less than 20 per cent are of maximum weight and length and 24 per cent are of maximum depth. This indicates, again, that increased weight is largely due to increased depth. In condition the Karta fish of this year were noted as being quite as much, if not more, advanced than the Yes Bay. This applies rather to the last lot of 153, examined July 23 to 26, in which the shorter fish predominated, only 45 per cent being over 550 mm. in length, while of the first lot of 55, examined July 1, 62 per cent were of that length. In the two lots from Yes Bay the curve for that of 1903, taken earliest—about a month earlier than the 1904 lot—is much more like the curves for Karta than like that of Yes Bay for 1904, rising to over 25 per cent on 560 mm., with extremes between 480 and 610. In 1905 the values are more distributed, varying between 10 and 15 per cent from 520 to 570 mm., with extremes between 420 and 590. The average lengths, respectively, of the 1903 and 1905 examples are 555 and 532 mm., the average depths approximating 158 mm. in both cases, while the weights are 8.3 and 8.2 pounds. This indicates that the fish of 1905 were more of the deep form, while those of 1903 were rather long and comparatively slender. These 1903 fish were from the early part of the run, those of 1905 some weeks later, giving another example of the long slender type form in the early run. On the whole, it seems that Yes Bay fish may be said to be deeper than the Karta fish of corresponding maturity, and that the early fish of both localities are of less depth and weight for corresponding length than later fish.

Quadra and the Moira Sound streams, Kegan and Nowiskay, show an almost exactly equal average weight in the fish examined in 1904, as well as close similarity in the averages of length and depth. Inspection of the curves, however, shows this similarity to be factitious. The Quadra fish are a symmetrical group, while the Moira Sound fish are, like Yes Bay, composite, apparently made of a short deep type, and another correspondingly longer and more slender.

In Quadra fish taken in 1903, about one month earlier than the 1904 lot, the length curve shows much variation (see diagram G). The average length is nearly 20 mm. greater than in 1904, and the curve zigzags between 500 and 570 mm. across the 10 per cent line, while in 1904 it shows a single rise to about 17 per cent on 500 and 510 mm. The difference in average length, weight, and depth of Quadra fish in the two seasons of 1903 and 1904 is very close to that of Yes Bay fish for the same years. The curves, however, are quite unlike, that of Quadra for 1903 being compound, while that for Yes Bay is simple. It was noted that the Quadra fish of 1903, though examined later than those of Yes and Karta bays, were less developed sexually. In almost all cases the curves for the females, though quite similar in general form, exhibit less complexity than the curves for the males. (See tables 4 and 4a, p. 84.) In no case is the curve of such a character as clearly to indicate fish of different ages, though it is possible that such curves as that for Yes Bay in 1904 may be so accounted for. The maxima in this case, separated by 60 mm. (80 total length) and 2 pounds, would seem to be about what might be expected for the difference between a 3-year and a 4-year fish. In the females the maxima of length are separated by the same interval and the much lower percentage of the lower maximum accords with what is known of the development of the king salmon in captivity, in which the males exhibit much the greater precocity.

Of the occurrence of the grilse form, or Arctic salmon, we know little, for the reason that many doubtless pass the meshes of the nets, and many are unreported by the fishermen, since they are not taken as "counts." At Quadra, of the sockeyes delivered at the scow about 1 in 300 were grilse. This is, perhaps, not far from the average ratio in the Loring district. They were not noted in unusual number at Dolomi. The Moira Sound fish examined in 1903 are too few to be of any value in the present comparisons.

The increase of relative depth in the later fish may indicate only the change incident to sex maturation. It carries with it, however, a corresponding increase in weight. If it is not a typical form, but merely a sex character, then the early run ascends the stream with a smaller amount of tissue deposit than later runs, else they do not first enter the bay for the purpose of ascending the stream, but return again, if not hindered, to the feeding grounds.

Such observations as could be made in opening the fish for determination of sex did not indicate that the difference in sex maturity of the different parts (seasons) of the run are material until after the main body has arrived. The late arrivals—the last week or so of the regular run and belated sections—do show marked advance of sex maturity. It is probable that careful measurements would show a gradual increase in relative maturity, but not proportionate

to the difference in time at which the different schools arrive at the breeding stream.

Variations in counts.—For a further test of the similarity of fishes from a given basin, counts were made of the dorsal and anal fin rays, the branchiostegal rays, and of the tubes of the lateral line and number of longitudinal rows of scales. These various counts are tabulated in the same manner as the measurements, except that sexes are not differentiated, percentages being used instead of the number of examples in order to make comparable the results for the different sized lots that were obtained. In the fin-ray counts the totals of rudimentary and branched rays are used, but the terminal half ray, which varies greatly in development, is in all cases omitted.

In table 6, showing the counts for dorsal rays, the similarity of the two years for each of the various localities is striking; Yes Bay, Karta, and Quadra exhibit the maximum on 15 rays, while Dolomi and the two Moira Sound points give it to the next lower number, or 14 rays; 12 and 17 are the extremes. The averages differ very slightly; Karta Bay is highest with 14.7 and Nowiskay lowest with 14.3. It is noteworthy that these two localities were examined in sequence in 1904, and the field notes call attention to the exact identity of method in recording the fin counts.

TABLE 6.—DORSAL FIN-RAY COUNT.

Locality.	Date.	Number examined.	Average number of rays.	Percentage of fish with specified numbers of rays—						
				12	13	14	15	16	17	18
Karta Bay	1904	512	14.7	.....	0.6	31.6	60.9	6.8	.....	.....
	1903	420	14.8	.....	.5	29.0	63.1	7.1	0.2	.....
Yes Bay	1904	509	14.5	.....	1.7	41.5	53.8	2.5	.4	.....
	1903	300	14.6	.....	1.6	36.3	61.0	.6	.3	.....
Quadra	1904	512	14.5	.....	2.3	44.0	51.7	2.1	.2	0.2
	1903	500	14.5	.....	2.6	42.4	51.2	3.8	.....	.0
Kegan	1904	511	14.4	.....	2.5	54.2	41.3	1.9	.....	.....
	1903	100	14.4	.....	2.0	57.0	40.0	1.0	.....	.....
Dolomi	1904	511	14.4	0.2	2.5	53.7	41.2	1.9	.....	.....
	1903	200	14.4	.....	3.0	53.5	41.0	2.5	.....	.....
Nowiskay	1904	513	14.3	.....	5.4	58.2	34.1	1.9	.....	.....
	1903	100	14.3	.....	7.0	61.0	30.0	2.0	.....	.....

In the anals (table 7) the parallel is less sharply defined but still characteristic. All reach the maximum on 18 except Dolomi and Nowiskay in 1904, which rise highest on 17. The extremes are 15 and 20. Quadra shows the lowest percentage on 17 and highest on 19. The averages vary from 18.2 at Quadra to 17.3 at Nowiskay. The order of localities as to number of rays is changed from that of the dorsals, though the Moira Sound streams are still lowest.

TABLE 7.—ANAL FIN-RAY COUNT.

Locality.	Date.	Number examined.	Average number of rays.	Percentages of fish with specified numbers of rays—					
				15	16	17	18	19	20
Quadra	1904	512	18.2	.....	0.4	10.9	54.1	32.6	1.6
	1903	499	18.2	.....	.....	13.0	55.4	29.2	2.0
Yes Bay	1904	508	18.0	.....	.6	16.1	63.4	19.0	1.0
	1903	300	18.0	.....	.3	14.0	69.0	16.3	.3
Karta Bay	1904	512	17.8	.....	.2	25.9	60.0	13.8	.....
	1903	420	17.8	.....	.2	27.1	63.8	8.8	.....
Kegan	1904	510	17.7	0.2	1.1	29.4	61.7	7.4	.....
	1903	100	17.8	.....	2.0	32.0	56.0	8.0	.2
Dolomi	1904	511	17.3	.....	2.0	48.5	46.6	2.9	.....
	1903	200	17.4	.....	6.5	42.5	48.0	3.0	.....
Nowiskay	1904	513	17.3	.2	6.4	50.1	41.3	1.7	.2
	1903	100	17.4	.....	7.0	44.0	46.0	3.0	.....

The branchiostegal rays exhibit little local variation in number. The maximum in practically all cases falls on 14/13, the left overlapping membrane carrying the extra ray; about one-third the total occurs on this maximum. Extremes are 12/11 and 16/15. Quadra and Kegan resemble one another in rising high on 13/13 and falling low on 14/14 and the higher counts. Karta and Dolomi exhibit the highest counts on 14/14. In no instance was a clearly defined case of right overlapping seen, though occasionally the right membrane carries the higher number of rays.

TABLE 8.—BRANCHIOSTEGAL RAY COUNT.

Locality.	Date.	Number examined.	Percentage of fish with specified branchiostegal counts—										
			11/11	11/13	13/15	14/11	12/11	12/14	13/11	12/13	12/12	14/12	13/14
Karta	1904	511	.....	.....	.....	.....	0.2	0.4	0.4	0.4	0.2	1.0	3.1
	1903	420	.....	.....	0.2	.....	.....	.....	.....	1.7	1.1	3.1	1.9
Kegan	1904	511	.....	0.2	.....	0.2	.....	.2	.4	2.5	2.9	3.5	.8
	1903	100	.....	.....	.....	.....	1.0	.....	.....	2.0	2.0	2.0	4.0
Nowiskay	1904	513	.....	.....	.2	.....	.....	.....	.4	1.0	.2	.4	2.1
	1903	100	.....	.....	.....	1.0	.....	.....	.....	.....	1.0	2.0	3.0
Dolomi	1904	511	.....	.....	.....	.....	.2	.....	.....	.2	1.0	.8	1.1
	1903	200	.....	.....	.....	.....	.5	.....	.....	1.5	2.0	.5	3.5
Quadra	1904	512	0.2	.....	.....	.2	.2	.4	.4	.8	2.1	1.7	2.0
	1903	500	.....	.....	.....	.....	.2	.2	.4	2.2	3.4	.8	3.0
Yes Bay	1904	508	.....	.....	.....	.....	.....	.....	.....	.4	.4	2.7	1.7
	1903	300	.....	.....	.....	.....	.....	.6	.3	.6	.3	1.3	2.3

Locality.	Date.	Percentage of fish with specified branchiostegal counts—											
		13/12	13/13	14/13	14/14	15/14	15/13	15/15	16/15	14/15	16/14	15/12	15/16
Karta	1904	5.5	16.8	32.5	26.2	10.0	2.0	0.8	0.2	.....	0.2	0.2	.....
	1903	9.0	21.7	35.0	15.0	7.9	1.4	.7	.....	0.5	.2	.2	.....
Kegan	1904	15.0	22.5	35.2	12.1	2.5	1.3	.2	.....	.....	.....	.2	.....
	1903	17.0	26.0	29.0	11.0	4.0	1.0	.....	.....	1.0	.....	.....	.....
Nowiskay	1904	4.7	15.2	34.3	21.4	14.2	2.5	1.1	1.0	.4	.6	.....	0.2
	1903	4.0	22.0	34.0	18.0	10.0	2.0	3.0	.....	.....	.....	.....	.....
Dolomi	1904	8.8	18.0	30.7	26.2	10.1	1.1	.8	.....	.6	.....	.2	.....
	1903	7.5	15.0	27.0	28.0	8.5	1.0	3.5	.5	1.0	.....	.....	.....
Quadra	1904	11.1	27.3	33.6	13.7	4.5	1.0	.6	.....	.2	.....	.2	.....
	1903	12.0	21.8	30.0	14.6	7.2	1.8	1.2	.....	.....	.2	1.0	.....
Yes Bay	1904	4.7	13.3	37.6	19.7	12.6	3.1	2.0	.8	.4	.4	.....	.....
	1903	5.3	15.0	32.3	21.6	13.3	3.6	1.6	.....	.6	.....	.6	.....

In the number of tubes in the lateral line (table 9) no great local variation was found, the averages varying from 132.1 to 135, with extremes 126 and 143. The value of this count is somewhat lessened by the varying degree to which the tubes extend on the caudal. This does not imply that all the high counts are due to this; in some instances high counts are due to the finer scaling. In other cases even low counts continued well on to caudal. The averages for the different years, however, show a striking similarity. The maxima vary from 132 for Karta in 1904 to 135 for Dolomi in 1903, but mostly fall on 133.

TABLE 9.—TUBES OF LATERAL LINE.

Locality.	Date.	Number.	Average.	Percentage of fish with specified numbers of lateral line tubes—																
				126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
Karta	1904	512	132.1	0.2	0.4	1.4	3.2	12.7	17.5	23.4	20.5	12.7	5.0	2.5	0.2	0.2	...	...	...	...	...
	1903	419	132.5	...	.5	1.1	1.7	9.3	18.6	19.3	20.0	15.0	9.3	3.3	.7	1.4	...	...	...	...	...
Nowiskay	1904	513	133.1	.2	...	.8	1.1	5.6	11.3	17.7	23.0	15.8	13.6	6.2	3.1	.4	0.8	...	...	...	...
	1903	100	132.9	...	...	.1	.1	9.0	11.0	15.0	24.0	21.0	13.0	4.0	...	...	...	1.0	...	...	...
Yes Bay	1904	509	133.0	...	...	.6	2.0	4.9	11.2	20.8	21.6	20.2	11.8	3.7	2.0	.6	...	...	...	...	0.2
	1903	208	132.9	...	.3	...	2.6	7.6	13.3	19.0	21.4	13.3	12.3	5.0	2.6	1.3	.3	...	...	...	...
Quadra	1904	512	134.0	...	...	.4	.2	1.9	5.2	14.6	15.2	22.0	19.5	11.5	6.2	1.7	.8	.4	...	...	...
	1903	496	133.6	...	.4	1.4	.6	2.2	7.2	15.2	20.0	21.8	14.6	9.2	4.4	2.2	.2	...	...	...	...
Kegan	1904	511	132.9	...	...	.6	2.1	5.4	11.1	21.0	22.9	19.5	9.7	4.9	1.3	.7	...	...	0.2	...	...
	1903	99	133.0	...	...	...	1.0	9.0	6.0	19.0	23.0	17.0	13.0	8.0	2.0	1.0	...	...	...	...	...
Dolomi	1904	511	134.1	...	...	...	.4	.9	6.2	12.5	15.6	23.5	18.6	12.5	5.6	1.7	.7	.6	.4	0.2	...
	1903	200	135.0	...	...	...	...	.5	1.5	9.5	9.0	13.0	25.0	20.0	11.0	6.5	2.0	.5	.5	...	...

In table 10, showing rows of scales, it will be seen that the counts for 1903 regularly fall below those for 1904. This is due to the varying procedure regarding the fine rows in front of dorsal and ventral fins, where the counts were initiated. A considerable variance is thus introduced. The branching of the rows under the front of the dorsal also affected the accuracy of the count. In some specimens a few scales' difference in the point at which this branching occurs adds or excludes a row in the count, which was made for the top rows from front of rayed dorsal down to lateral line, and for lower rows from front of ventrals up to lateral line, the lateral row being included in the total.

TABLE 10.—ROWS OF SCALES.

Locality.	Date.	Number examined.	Average.	Percentage of fish with specified numbers of rows of scales—														
				38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Dolomi	1904	511	44.0	0.2	0.4	1.3	6.6	11.5	18.5	21.1	20.5	11.3	5.6	1.9	0.6	...	...	...
	1903	200	43.0	...	2.5	3.5	16.0	21.5	24.0	18.5	9.0	3.5	1.0	.5	...	...	...	...
Kegan	1904	511	44.5	...	.6	.6	3.5	10.0	14.0	18.7	22.5	16.4	8.5	3.5	.6	0.8	...	...
	1903	100	44.1	...	...	2.0	1.0	13.0	21.0	20.0	23.0	15.0	3.0	1.0	1.0	...	...	...
Karta	1904	512	45.0	...	...	.4	1.1	4.3	9.7	18.1	25.0	24.0	12.3	3.9	.2	.4	0.2	...
	1903	420	44.0	...	.2	.2	3.3	13.3	19.3	17.1	20.9	14.8	7.1	3.3	.2	...	...	...
Quadra	1904	512	45.2	...	...	...	1.5	6.2	10.3	16.2	22.1	19.3	13.1	7.5	2.5	.8	.2	...
	1903	496	44.9	...	...	.6	.8	6.0	11.3	20.8	24.4	20.4	9.3	5.2	.8	.4	.2	...
Yes Bay	1904	509	45.5	...	...	.2	1.2	3.9	10.6	15.5	17.4	21.2	16.6	8.4	3.1	1.2	.6	...
	1903	300	44.3	...	.3	1.3	2.0	10.3	17.6	21.3	23.6	12.6	6.6	3.0	.6	...	.3	...
Nowiskay	1904	513	45.8	...	...	...	.8	3.3	8.7	11.3	19.3	18.9	19.1	11.1	4.7	1.9	.4	0.2
	1903	100	43.8	...	...	1.0	6.0	9.0	27.0	26.0	17.0	9.0	2.0	3.0	...	...	...	...

The average number of rows of scales varies from 43 to nearly 46, with extremes 38 and 52. It was noted that the slender type form usually showed a slightly smaller number of rows.

In conclusion, it may be stated that the various counts, while not amounting to demonstration, point to similarity in fishes from a given basin rather than to a heterogeneous mixture of schools. In general the environment at any one locality is very like that at any other; hence if the output of each stream were entirely segregated there would scarcely arise great differences of character among the different lots. The range of variation is, in fact, so small that it appears to fall within the possible effect of the personal factor if the counts were made by different individuals; or of changing schools in any given stream if made by the same individual in sequence. With measurements, however, there is a difference. A sufficient number of fish for the purpose can be measured in a few days spent at any one locality, and the time element may be controlled by frequent change of place and renewed examinations at each. The remarkable difference found between the fish of such adjacent localities as Dolomi and the Moira Sound streams clearly proves the value of such data.[a]

STREAMS NOT UTILIZED BY SOCKEYES.

It is unfortunate in the study of Alaska salmon that almost no streams not known to be frequented by sockeyes have been examined. The only exception of importance is the Anan of Bradfield Canal, which was visited on August 31, 1905. This stream is noted as the earliest and most productive humpback stream in Southeast Alaska. It is slightly less than the Naha in volume and about 3 miles in length below the first lake. Nowhere in the course are any impediments to salmon at ordinary stages of water. The lake has about 160 feet of elevation, and on the above date had a surface temperature of 59.5°, about 1 degree higher than the stream. A tributary of the stream was 54°. At that time humpback and king salmon in small numbers were seen, and there were a few scattering red fish which were thought to be sockeyes. Two humpbacks were seen to jump in the lake. There is no apparent reason why sockeyes should not ascend this stream in numbers equal to the runs in such streams as those of Moira Sound. An examination of the lake might reveal some obstacle to their natural propagation. There was nothing at that season apparent in the surface densities or temperatures to deflect a run entering Clarence Strait. From this strait through Ernest Sound and into Bradfield Canal the temperatures were in general increasing, 54° to 58°, and densities decreasing, 1.020 to about 1.010. In Behm

[a] For a similar study of the winter flatfish (*Pleuronectes americanus*), see Hermon C. Bumpus, On the identification of fish artificially hatched. American Naturalist, vol. XXXII, June, 1898, p. 407–412.

Canal at the same time temperatures rose from 55° at the head of Tongass Narrows to 58° off Spacious Bay, densities falling from 1.0188 to 1.0124 at the same time. Subsurface tows demonstrated an abundance of plankton food throughout all the channels.

Ketchikan Creek is a larger stream than Helm Bay Creek, which carries a few thousand sockeyes. It drains a lake and is frequented by humpbacks and cohos. No sockeyes are known to enter it. They could not reach the lake owing to falls about a mile from the mouth, but a school of fish looking for a suitable stream would learn this fact only after ascending the river.

A few hundred yards below its head Naha Bay receives a small creek known as Steelhead Creek. This creek drains lakes of considerable size, and should carry water suitable for sockeyes, though they could not enter the lakes on account of an intercepting fall. The volume is small, but during the rainy season is ample for the ascent of fish, and many coho, dog, and humpback salmon, as well as steelheads, spawn there. No sockeyes are known to enter it, nor were any sockeye fry seen among the thousands of salmon fry taken there.

It is probable that examination of the unstocked streams of Alaska would disclose others of interest in the question of stream selection.

RELATION OF SIZE OF RUN TO SPAWNING AREA.

There seems to be no relation between the size of the run at any given stream and the extent of spawning ground. Hetta, considered good for from 50,000 to 150,000 fish, has comparatively little area of beds. The fish spawn mainly in one small creek about a mile in length, and along the lake shores. The Naha, as noted above, has a small area compared to its natural productiveness. Kegan has almost no spawning bed—only about a hundred yards of the main stream. At Nowiskay the borders of the lake are used almost entirely, none of the entering streams being suitable. Yes Bay and Karta streams both have excellent and extensive beds. On the other hand, the stream at Ward Cove has a greater area of good spawning ground than any of these streams except Karta and Yes bays, yet it yields too few sockeyes to pay for fishing. Karluk Lake has many tributary creeks that are used by spawning fish, but the total area seems scarcely commensurate with the enormous productiveness.

With the exception of the few streams just mentioned, little is known of the spawning grounds of the Alaskan sockeye. Up to 1903 no attempt was made to arrive at the natural fecundity of the spawning beds; hence the investigator is absolutely without standard or means of accurate comparison.

SELECTION OF SPAWNING GROUND.

CONDITIONS REQUIRED BY THE SOCKEYE.

Interesting preferences are shown by the mature salmon on coming out of the lakes to spawn. The first run of sockeyes at Fortmann Hatchery (usually of somewhat smaller fish) enters McCune Creek. This creek is a mile or so in length and drains a slope to the southeastward of the lake, the mouth, as will be seen from the map, being but a few yards from the entrance of the main stream. The lower course is over fine gravel and has but a moderate fall.

On July 28, 1903, Heckman Lake at the surface was 64°, Naha River at the hatchery 60°, McCune Creek 53°. There were no spawners in sight. August 27 the river was 61° and the creek 52½°, and fish had been spawning a week. At this time some fish were showing a preference for the creek, which was fenced. Considerable numbers of ripe fish were in the river. October 15 the river was about 46°; November 17, 36½°.

Selective discrimination is also shown in Jordan Lake. Emma Creek, tributary to that lake, has a small lake near its source in which its water is somewhat warmed. Gibson Creek, a larger stream, evidently has no expansion in its course, for its waters are always cold. Sockeyes are never known to spawn in Gibson Creek, which carries a temperature of 48° or less, while Emma Creek, between 50° and 60°, is to a small extent made use of.

August 18, at Nowiskay, North Arm of Moira Sound, the main stream above was 51°, the lake over the spawning beds 62½°. A few fish were in sight, but none spawning. This stream is 44° and the lake 46° to 45° during the spawning season. No sockeyes enter the stream, though dog and humpback salmon do. The sockeyes spawn about the lake shores.

At Karta Lake, September 11, Willow Creek was 50½°; Alder Creek, 47½°. Sockeyes were spawning in both in about equal numbers, or slightly preferring Willow Creek, perhaps for its greater size. The main river below the lake was 53½° and full of dog and humpback salmon.

At Yes Bay, September 19, 1903, the river above was full of spawning sockeyes, temperature 50°; sockeyes were also entering the flooded creeks at 70°. September 14, 1904, the surface of the lake was 52°, the water over the beds, 49.5°; in the pool above, 48.5°; a feeder of this pool, 46°. May 2, 1905, the temperature of the main stream had reached 49°. Early in September of that year salmon were spawning in water of 51°.

At Quadra, August 1, 1903, the lake surface was 63° to 65°. Osten Creek, at the head of the lake, in which the fish spawn, 51° at 3 p. m.; the sockeyes had just begun to appear at this stream. A fine creek

farther down the lake was 57°; it is said few sockeyes enter this. The hatchery brook was 46°. The bay just off the stream August 5 was 64° at 6 p. m., or practically the same as the outflow from the lake.

At Kegan, October 3, fish were spawning in the main stream above at 47° and refusing a smaller stream at 43° flowing through the same mouth; later they were reported to be spawning in both, temperatures unknown, but doubtless equalized to a degree.

At Ward Cove, September 6, a few sockeyes were spawning in the stream at 55½°, but this is not a sockeye stream, properly speaking, though it has the required lake and an extensive stretch of good spawning bed.

In the Wallowa Dr. Kendall observed that the dwarf sockeye preferred the warmer water after temperatures fell below 45°, though spawning continued until the temperature had dropped to 40°.

These observations indicate that the natural spawning temperature for the sockeye is between 47° and 55°, probably not over 50° by preference. (See p. 97.) The natural fall temperature for creeks not draining lakes or extensive swamps is about 45° to 48°, lake outlets 55° to 60°. The presence in a stream's course of a lake of any large size and a low altitude may usually be at once discovered by temperature, except, of course, when the lake outflow is mingled with another stream of low temperature, as from a glacier. Ordinary springs have a summer temperature of 44° to 48°, winter around 40°. Creeks, of course, fall with the air temperature to freezing.

In the same manner in which they approach the ascent of a river from the sea, the sockeyes school about the spawning stream a short time before entering, and after entering the current proceed by easy stages to the bed finally occupied. Frequently they are seen to drift back over a riffle they had almost surmounted, and appear in most cases to enter swift water with hesitation and caution. It was noted at the Fortmann Hatchery when high water prevented the usual seining of ripe fish that the natural spawning did not commence for a day or so after the fish covered the beds. A short time seems to be spent in selecting nests.

The sexes of the Alaska sockeyes as found during the fishing season are approximately equal, or perhaps there is more commonly a slight excess of males. Of 1,025 examined at Karta Bay June 24 to July 8, 1904, the sexes were equal; 548 of the first arrivals at Nowiskay July 14–22 had an excess of 12 males, while of 551 at this same place August 10–31 males were still in excess by 19. At Kegan from July 24–29, 988 examples showed 28 in favor of the females; Yes Bay July 26–28, 1905, had an excess of males by 10 in 510, while on August 14 among 172 fish the females exceeded by 24; August 16–20, 1904, in 976 examples there were 31 more males

than females. Dolomi August 4–11 showed a surplus of 21 males in 990; at Quadra August 24–29, 967 examples had an excess of 45 males. These figures show an average preponderance of males by 1.3 per cent. There seems to be no difference in the time of arrival of the two sexes. One sex may be more numerous on one day's fishing and the other on the following day.

It is stated that in the Fraser during the first of the run, the males are greatly in excess. The presence of unmated males is to a certain extent damaging, since they go through the spawning movements alone, and thus disturb the beds. Under wholly natural conditions there should be practical equality in numbers of the two sexes.

PREFERENCES OF THE KING SALMON.

The king salmon spawns in higher temperatures than the sockeye. On the McCloud River it begins spawning at a temperature of about 56°, the summer run completing the season within 3° or 4° of that temperature. In Battle Creek the fall run spawns in practically the same range. That they habitually seek a less depressed temperature than the sockeye is shown by their spawning below the lakes into or beyond which the latter species invariably continues. This has been noted at Karluk, on the Wallowa, and on the Salmon and Payette rivers in Idaho, though in short streams like the Yes Bay Stream the straggling king salmon may also go above the first lake. But while this temperature is suitable a higher can not be endured. It has been found that the summer run can not be successfully confined in lower Battle Creek. These fish naturally travel to the cooler upper reaches, and retention in the warmer water of the lower course causes their death.

At the Trocadero Aquarium it was found that fish of 3 and 4 years can not endure a summer and fall temperature of more than 61°; an addition of 3 or 4 degrees is fatal. Moreover, at that period an abundance of water is essential. This latter condition, perhaps, enables the fish safely to make the ascent of the heated waters of the Sacramento. During May, when the height of the summer run is passing, the river temperatures range closely about 60°, at which temperature the fish are able to move at the rate of 10 miles per day. In August, when the fall run is traveling up the river, the temperatures are decreasing from about 80° to 74°. At this temperature they travel but half as fast, though at a more advanced stage of maturity. During October and November the temperatures continue to fall, varying at Sacramento City from 70° to 60°, and 60° to 50° during the respective months. At this time the spawning temperatures of 50° to 55° are found in the middle course of the river, and in seasons when the depth of water is suitable it is found that the salmon spawn largely on the shallows below Tehama, thus withdrawing large num-

bers from the propagation stations of the upper river. A careful study of the king salmon's movements on the Columbia is much to be desired. The greater length of the river, more numerous branches, and higher latitude and altitudes make that basin an extraordinary field for research, and its very great economic value demands the results.

SPAWNING STREAMS CHOSEN BY THE COHO, DOG, AND HUMPBACK SALMON.

The coho apparently demands a yet lower temperature for spawning than the sockeye. Where it enters lake outlets early, it presses into the higher waters in much the same manner. It differs in that it often selects streams not connected with lakes, but in all cases its later arrival from the sea finds the temperature low. While the most active of any species, long journeys do not find favor with it. Wallowa and Baker lakes seem to be at about the limit to which it travels.

In the Naha in 1903 the cohos were spawning October 27 in a temperature of 46°. This is probably about the temperature at which they begin. During October and later the small streams fall rapidly in temperature, so that scarcely any running water after that date would be too warm for spawning purposes. Since in favorable places the coho continues spawning throughout most of the winter, any temperature above freezing does not seem to be prohibitive. At Hetta it is reported that the cohos sometimes spawn in small numbers throughout the winter, even as late as March. This lake is said to have areas of open water, perhaps due to warm springs, about which sockeyes spawn until February. Alexander (ms. notes) states that in the winter of 1902–3, while the lakes and stream were frozen over, one of the lakes of South Olga stream, Kadiak Island, was visited by a party of white men and Indians who found a large number of sockeyes and cohos frozen in the ice. These were thought to be late-run fish entering after the canneries had closed. Many carcasses of salmon that had been frozen in the ice were seen by Rutter at Karluk Lake in the spring of 1903. In that stream the occurrence at times of late runs arriving after the usual closing time of the cannery early in September is well known. They more frequently occur in seasons of a small early run, and at such times the cannery is held open for them. The carcasses of winter spawners were still to be seen on Trail Creek the last of May, 1904.

The dog and humpback salmons apparently exercise less discrimination than other species. The humpback was noted as working upstream in the Naha at 61° August 25, 1903, and in the Anan at 58° August 30, 1904; yet it had completed spawning in the outlet of Yes Lake September 11, 1905, in temperatures around 56°. Karta River, September 12, 1903, was full of both dog and humpback sal-

mon spawning at a temperature of 54°, and Steelhead Creek contained many spawning humpbacks August 25, 1903, at about the same temperature. It is probable that the optimum temperature for the humpback is about the same as for the king. The dog salmon seems to accept a slightly lower degree; a few were spawning in a creek of Moira Sound as early as August 18 in 48°.

NATURE OF SPAWNING BEDS SELECTED.

With the exception of the coho, the salmons appear to require a depth of water and a fineness of bed material somewhat in correspondence with their relative size. The king salmon spawns in water of a depth up to 2 or 3 feet, with a bottom of gravel and coarse sand. No exact conditions seem to be required. In the Salmon River, Idaho, the kings are reported to avoid the coarser gravel and swift currents; in the Sacramento they will spawn on bowldery rapids.

The sockeye affects shallower water for spawning than the king. On most Alaskan beds many occupy water which does not completely cover the male fish. In the selection of spawning beds this species is unique in requiring the adjacency of a lake; also it is the only species of the genus that ever spawns in still water. The lake shores chosen are more frequently portions through which a small rill flows or where seepage comes through, but sockeyes are known to spawn where no inflow of any kind is apparent.

In the streams the beds chosen are similar to those well known for various species, but, as mentioned above, in water of less depth than is usual for the king. Sometimes bottoms of fine gravel are occupied, sometimes bottoms of larger bowlders where the current is so swift as to make the holding of position precarious. No observations are recorded as to whether the first comers occupy the more accessible grounds. They apparently distribute from the beginning, and there is no evidence that a spawner ever recedes from a position once chosen and occupied. Unless carried out by the current, even the spawned-out fish remain until they die about the pool where they have spawned. At Yes Bay stream in 1903 fish could be found throughout the stream as far as the falls, but strikingly few examples were attempting to pass higher. The writer has seen no fish attempt the dam on the Naha just above the spawning beds, though cohos are said to do so. A few individuals usually enter all the small unsuitable brooks during times of freshets, apparently returning with the subsidence of the water.

In the Karluk tributaries many fish occupy beds where none of the material is of a size they can move, hence the naked eggs are swept down the current and doubtless most of them lost. In bottoms of finer material occupied by many fish dead eggs in abundance are usually to be seen in the eddies behind the hillocks formed by the spawners working up the gravel.

The coho, perhaps in its effort to reach low temperatures, frequently continues up the small streams to a point where the bottom material is coarse. In Steelhead Creek it passes humpbacks and dogs on the gravelly lower part of the stream and spawns in the rough upper portions. In all the small Alaskan streams it doubtless occupies the sockeye beds later in the season and perhaps does some damage, but the greater part of the run spawns below those beds and in creeks not entered by the sockeyes. Cohos, like the smaller species, while making their way upstream or when frightened out of the "nest," may frequently be seen in water too shallow to cover them. Whether these "nests" are excavated in shallows where the original depth is less than that of the fish, or whether the small amount of water is not more usually due to a fall in the stream subsequent to the fish's entry, has not been fully ascertained.

Humpback and dog salmon may often be seen spawning on the same beds, but in general the former is more frequently seen on finer bottoms and in shallower water, while the more powerful dog salmon sometimes occupies bottoms of coarse gravel in some depth of water. The humpback is said sometimes to fail to get beyond the reach of high tide in the selection of its spawning place.

DEPOSIT OF EGGS.

The deposit of spawn on riffles and in small streams, where it is most subject to the action of floods and frost, at first sight seems to be poor economy. But the necessities are twofold, first, aeration, and second, protection from light and enemies. In water of much depth relative to volume the bottom current is retarded, with the result that fine sediment is deposited and the circulation through the gravel or other material is impeded if not entirely cut off. If the eggs were placed in such a region of little current, they would not be carried from under the mother fish and the material for covering and protecting them would not be carried down over them, hence any such movement as the spawning fish now makes would only lead to stirring up eggs and gravel, with the result of destroying the first spawn within a few days after its deposit. For this reason the lake spawning of the sockeye must be of less proportionate value.

The action of the spawning fish in breaking away the gravel by means of forcing the body and tail against it achieves the double purpose of working the sex product down to the genital opening and of setting the fine gravel and sand in motion to cover the eggs. When first extruded the contents of the egg envelope do not quite fill it, the egg is soft and will bear considerable rough handling. Its specific gravity, only slightly greater than the water, holds it to the bottom, but allows it readily to drift along with the current. Upon finding an early lodgment the osmotic absorption of water "freezes" it to the object against which it rests, and any drifting particles of sand not heavy

enough to dislodge it readily cover and conceal it from the light. It is probable that the dead eggs referred to above as seen in abundance about a well-covered ground are as often the earlier deposits dug up by later arrivals as eggs that have failed to be covered. Live eggs are almost never seen among these, as should be the case if they are of recent deposit. Uncovered eggs must eventually perish by the light even if not consumed by egg-eating fishes and birds. In ordinary currents the eggs drift perhaps but a few feet. Very early the ridge below the "nest" rises to a height that creates a bottom eddy, causing the downward motion of the eggs to cease on its lower slope. For this reason when one of these ridges is opened the greater number of eggs ordinarily is found in its lower portion.

During the season of spawning a well-covered ground becomes thrown, through the joint action of the fish and the current, into high ridges, or hillocks, sometimes as much as 2½ feet above the corresponding depressions or holes. Eggs may usually be found buried in these ridges, but their semibuoyancy and spherical form make it quite difficult in a current to recover them without a screen. The abundance of dead eggs which at times collects in the eddies below these ridges has been mentioned above. On Karluk Lake in 1903, in the creek on which the spawners were counted, these beds were examined by digging in the gravel to find the condition of the deposited eggs. Between August 5 and September 2, 58 "nests" were so examined. In these were found 4,005 good eggs and 2,022 dead ones, or, in other words, about two-thirds of the buried eggs were found to be in good condition. On the latter date 587 eyed eggs were found under about 10 inches of gravel, with only 13 dead ones. This demonstrates that eggs will live and develop under proper conditions when deeply buried. In another stream, in the center of a nest, under 6 inches of gravel, only 29 of 620 eggs recovered were living. In a third bed of 1,140 eggs taken from the lower half of the nest, in a light current and from under 7 inches of gravel, only 28 were dead. In general, the observer records few eggs from locations in strong current; this was possibly in part from failure to find the eggs as well as from their scarcity. Most beds show a decided balance in favor of the good eggs. In two examinations of the connecting stream from one of the tributary lakes less than 4 per cent of the eggs were dead.

COMPLETENESS OF SPAWNING.

In 1903 a careful count was kept of the sockeyes spawning in one stream of Karluk Lake, the second from the outlet on the right or east side. This is a small creek, averaging some 10 feet in width, about 1 mile of which is used for spawning beds. From August 5 to September 5 of that year, 21,756 spawned fish were examined in this creek, presumably the total number spawning there in that time and practically the total for the season. Of these, males were in excess by

about 3 per cent, the numbers being 10,723 females and 11,033 males. But one unspawned female was found dead. Dead unspawned males are more common. Of 636 females opened, about 80 per cent were entirely spawned out, i. e., with no loose eggs in the abdominal cavity; the remaining 20 per cent had an average of 97 eggs unspawned, with the most in any instance noted 1,246. The sockeye carries between 2,500 and 4,000 eggs, an average, perhaps, of about 3,500. This remnant, then, amounts to about one-half of 1 per cent of the total number of eggs matured. The product of this one stream on the same basis of estimate is 37,000,000 eggs. It is believed that less than one-tenth the number of fish entering the lake spawned in the above-mentioned creek. Thus approximately 400,000,000 sockeye eggs were spawned in Karluk Lake basin in 1903. Sockeyes are reported by natives to spawn late in the winter, even under the ice, but it is doubtful whether it is usual for any noteworthy number to occur as a fall run, as with other species and in more southerly streams.

In 1903 the spawning season was practically over early in September. Since the fishing continues ordinarily into that month, the spawning should last much later. The double operation of cannery and hatchery, perhaps, accounts for its early close. On the Naha the season continues into November. At Hetta the fish are reported to spawn in small numbers until later in the winter.

PERCENTAGE OF NATURAL PRODUCTION.

The percentage of natural production of fry is a matter of the utmost interest. In daylight observation of a well-populated spawning ground one is sometimes struck by the absence of factors to cause damage. At Yes Bay, Karta Bay, Kegan, the Naha, Wards Cove, and other places one may see hundreds of various species spawning uninterruptedly. At times on the humpback beds where fish are numerous the dead eggs lie in numbers in the eddies for days and even weeks untouched, not a trout or sculpin in sight—though it is certain that at least a few are in protected places near by. The ducks arrive late after most of the spawning in that region is over. It is believed by the writer that the natural loss of spawn has been overestimated.

In Steelhead Creek in 1903 comparatively few cohos were noted—it is believed not more than 50 pairs; yet over 3,000 fry of that species were sometimes taken in a single night as they were leaving for the sea. The run begins early in May and lasts until July. In six sets of the net in May and June an average of about 1,300 of these fry were taken, which indicates a run of between 50,000 and 75,000 for the season, or a product of at least 30 per cent. Similar facts regarding steelheads were noted in the same creek, which was observed carefully in both 1903 and 1904 for spawning steelheads in an effort to take sufficient eggs for an experiment. Not over a dozen pairs could

be seen either season, yet early in July the fry were migrating at the rate of 200 to 300 per night and the creek was full of them till the fall rains swept them out.

Regarding the migration of sockeye young from Seton Lake in 1903, Babcock states: "The sight was amazing, and impressed one with the fact that the percentage of natural fertilization of ova and the survival of the resulting fry was greater than has been generally believed by the authorities."

It will be noted that eyed eggs were found in the Karluk creeks on September 2. On this date the lake surface was 44°, having fallen about 10° in as many days. With the shortening of the days and prevalent cloudy weather the temperatures must fall rapidly from this date, and it is questionable whether any but the earliest deposited and hence most advanced eggs hatch before the onset of freezing weather.

Fry were found as late as August 1 in the stream just below the lake; species unidentified. It is improbable that any considerable number of sockeye eggs hatch in time for the young to seek the shelter of the lake for the winter. With the congealing of the waters in the mountains the streams will become reduced in volume and the entire bed must at times become frozen over, part by its exposure and the remainder by the formation of anchor ice. The habit of the fish of spawning on the shallow riffles must unfailingly subject the spawn to this influence. That it is not an exterminating influence is due to the covering of gravel which the eggs have received. The depth to which the bared beds freeze in winter has not been ascertained. At points where a constant current percolates through, such as must occur on the spawning riffles, it is improbable that this depth is so great as might be suspected in view of the low air temperatures.

The effects of freshets are largely nullified by the season at which they occur. Late fall rains produce comparatively small floods for the reason that the precipitation in the hills falls as snow. The spring floods which come with the melting snows will find the eggs in great part hatched, and fry are largely able to rise above the deposit.

RELATION OF SPAWNING HABITS TO NUMBER OF FISH.

The spawning habits of a species bear a suggestive relation to its abundance. The humpback in Southeast Alaska far outnumbers all others. This is a region of small streams, and practically all that have a suitable bed and are accessible from the sea are utilized by this salmon. The small size of the adult humpback makes spawning possible in even shallower water than the sockeye or coho requires. The number of eggs, about 2,000, is perhaps less than in other species. The incubation period is less than that of the sock-

eye or king. This, with the early arrival on the beds and consequent high temperature of the incubating water, brings the humpback egg to a hardy stage early in the season and the fry to a stage of development that sends them seaward with the opening of spring. The small size and light color of the egg also may be advantageous. In regions of larger rivers, such as Bristol Bay, the number of humpbacks is much less in proportion to other species. The same is true for more southerly regions. In the Bristol Bay region the average size of humpbacks is considerably less than in Southeast Alaska. Whether these facts are due to the character of the streams can only be surmised.

The limited number of cohos can not be attributed to scarcity of spawning beds of the nature required. These are scarcely less widely distributed than those suitable for the humpback. The spawn incubates in about the same time, but is somewhat larger and more brightly colored. The increased number of eggs, about 3,000, should offset the disadvantage of size. The cohos coming last to the beds, their eggs are undisturbed by other fishes, but since much of the spawning is late the loss from physical causes may be greater. The fry are probably less active, reach the sea later in the season, and perhaps suffer greater loss from predatory enemies.

The dog salmon, while widely scattered, occurs in numbers only in selected streams. The eggs are very large, rather light colored, and run about 3,000 to the fish. The incubation period probably differs little from that of the humpback. The fry reach the sea early, and there is no obvious reason why this should be one of the scarcer species.

The spawning habits of both king and sockeye are obviously advantageous. The king, resorting to large rivers, is able by its strength to reach waters where the conditions are most favorable. Other species do not work over its beds; and though limited in the main trunks entered, the king secures extent of territory in the numerous branches; the habits of the young permit them to obtain the necessary food in the streams, and the distance of the trip to be performed insures their sufficient age and size for adequate protection upon reaching the sea and its rapacious inhabitants. The summer residence conserves the species to an extent, while the migration of the main body as fry prevents overpopulation of the limited freshwater area. In this connection it is of interest to note that the fish found in the Columbia headwaters in 1895 were of less than the average size for that stream, weighing only 10 to 14 pounds. Even allowing for tissue expenditure during the ascent of the stream this does not indicate that the stronger fish travel farthest, but rather the contrary. It seems possible that at a certain point the beds are occupied by the stronger fish and that the less powerful go beyond in search of unpreempted grounds.

The sockeye profits by its lake habit. An unoccupied food supply is thus made available, and protection for the immature young is obtained in waters not naturally inhabited by many predaceous animals. In basins of large productiveness the overflow of fry, migrating as such, conserves the lake food supply. In the main the species secures immunity from disturbance on the spawning beds, passing beyond all but coho and king and avoiding the latter by selection of colder water.

CHANGES INCIDENT TO MATURATION.

The changes that are associated with maturation of the reproductive element vary in extent in the sexes, in the species, and with the age. The production of the jaws and growth of canine teeth that is more or less characteristic of all male salmons is seen also in the trout and the charr. The change in body form—the increase in depth by the ridging of the back—is much more developed in the salmon. The changes seem to be greater in the larger, and presumably older, fish. The grilse of the king show very little of it, scarcely more than the female, and in the case of fingerlings in the Sacramento which develop mature spermatozoa there is no evident external change.

In the trout and charr the upper jaw elongates somewhat but does not become hooked. The lower jaw elongates and becomes knobbed or hooked; this swelling is usually received in a corresponding recess or notch in the upper jaw, but sometimes is sufficiently large to prevent complete closure of the mouth. After the spawning season is over these growths are to an extent resorbed, but the jaws never fully recover their original shape.

In the Sacramento the king salmon of the spring run show none of these characters until some time after entering the fresh water. The late runs, being more developed, show some changes by the time they have reached the mouth of the river in Suisun Bay. The various changes, which have been fully described by Rutter, are progressive with the development of the reproductive elements. Little of the red color is shown by this species except in the large (old?) males, and even in these never approaches the brilliancy of the sockeye or coho. Neither do they as fully develop the body depth as species which frequent shallower waters.

The Alaskan sockeye at the time it is first taken in the fisheries has already begun to show the hooked jaw, so that with care one can distinguish the sexes in the larger fish. Cases will occur, however, in which the female has jaws somewhat prolonged, and there are corresponding cases of males with neat heads, so that in statistical work it is essential that the fish be opened to make sure of the sex. Late in the season, or in occasional schools at any time, the males are more readily distinguishable.

When the sockeyes emerge from the lake en route to the spawning beds the change has become complete. The entire fish, except the head and fins, has changed from its original green and silver to a brilliant vermilion or maroon. The head retains its bright green color and the fins become variously dark. At this time the sockeye rivals the tropical fishes in beauty of coloration. The elongation of jaws and development of depth are extreme in large males; the females show little of it and acquire less brilliance of color, in some cases scarcely any.

The grilse (Arctic salmon) exhibit less change than the large fish, but show all the characters to a degree.

The dwarf sockeye exhibits very little change; sex of ripe fish taken in Wallowa Lake can not be distinguished by external appearance. At the time of entering streams for spawning they are thus described by Kendall:

> Back olive green, more or less spotted with black; dorsal and caudal somewhat spotted; sides dusky metallic blue or smoky with faint marks like parr marks; belly white or slightly dusky. Pectorals, ventrals, and anal black, tipped with white; outer ray of pectorals white; a general brassy luster after the fish has been out of water some time.

Colors, spotting, etc., vary in different individuals, but there is never any red. In Alturas Lake in larger examples of the dwarf the red is sometimes present and the other changes are somewhat more marked.

The coho shows more change in the female than any other species, and the jaw develops more knob, as in the trout. It is sometimes difficult to distinguish the sexes among spawning fishes in the Naha. Both may acquire a red almost as brilliant as the sockeye's, so that in the water it is easy to mistake either species for the other.

The extreme height of the back in the male of the humpback and the characteristic color blotching of it and of the dog salmon are well known. The females of the two species, particularly the latter, retain silvery colors and neat forms more fully than other species.

The useful purpose, if any, which these changes subserve is difficult to surmise. It may easily be believed that the development of teeth, and of jaws to render them effective, is a matter of defense with the male. It does not hesitate to make use of the weapon to drive away intruders, but its awkward and slow movements render its armature of no avail so far as trout and other egg-eating fish are concerned. The only service is in preventing other males of the same species from mating with the female, and even in this the ability is not always equal to the emergency. A small active male has been seen to slip alongside a spawning female during the absence of her consort in pursuit of another interloper and administer all the attention shown by her regular attendant. In general it may be assumed that in this man-

ner nature secures the offspring of the well-developed mature males, which offspring is known to be stronger and more thrifty than that of the younger fish.

The exhibition of beauty in color and form in the male, which has been thought to be the result of sex selection, can hardly be so considered in the case of these fish. The female apparently has no option in the matter. The larger male will drive away the smaller and take possession. The peculiar compression of the male, with the flattening of the ventral aspect, increases its ability to work through the shallow water, which the small size of the female, without such change, allows it to enter.

RETURN OF ADULTS TO SALT WATER.

To test the question of the return of salmon to salt water after once entering a river system, Rutter, in 1903, made two experiments. Eight hundred salmon (species not noted, but probably mainly if not all sockeyes) were tagged and released in Karluk Lagoon (brackish water) 1 mile from the sea. Four hundred of these were released June 12 and 15. One was retaken outside in a cannery seine 1 hour after release, 3 were retaken entering Karluk Lake after 11, 13, and 34 days, respectively; 2 were retaken by seines in the lagoon, and 1 died in the lagoon. Doubtless many of the tags were lost, and perhaps many fish entered the lakes or were retaken outside and unobserved.

Five hundred and fourteen were tagged and released on June 30. One of these was retaken in New Red (Ayakulik) River, 40 miles down the coast, 3 days later. One reached the lake in 10 days; another was found spawning there August 2; one was seined in the lagoon 2 days after release; and another, a green female somewhat fungused and worn, 27 days after. No others were reported.

This experiment is very incomplete and most desirable data are lacking, especially as to whether the fish were taken into the lagoon in a live car or were seined in the lagoon after voluntary entrance. The influence of the tag, clamped to the lower jaw by a strong ring, in irritating the fish and stimulating unnatural action can not be estimated. The results point to the probability that some fish remain in the lagoon for several days, some reenter the ocean, and others spend varying times somewhere between the lagoon and lake.

Another experiment was the tagging of 255 individuals at the mouth of the lake, from July 3 to 25. Of these, 123 were males, 64 of which were ripe and 66 showing more or less of decay, fungus, etc.; 132 were females, 23 ripe, and 70 in poor condition. These fish were taken in a trap built at the outlet of the lake, but on the shallow or small current side. This location unfortunately led to the securing of a large percentage of weak fish, and made the results less valuable. In general, fish reach the lakes in sound condition. Of these tagged

fish, 3 females and 1 male were retaken in the ocean by the cannery seines in from three to eleven days after tagging, 1 was retaken in the trap the following day, and 2 males were found in the spawning creeks.

The main interest attaching to this result is in the number of ripe fish obtained at the entrance to the lake. The percentage of ripe fish in the number trapped is of no point, since the strong green fish entered in the heavy current beyond the trap. It may be that these fish were hindered from making an early ascent of the river by the seining carried on for the cannery, and that such a condition of ripeness is unnatural. If there is no purpose in a lake residence of about one month it is difficult to see how it should have been brought to be the normal habit. That these exceptions were abnormalities is shown by the failure to find any of these tagged fish in the nearly 22,000 spawned fish examined at a creek which these ripe fish would most naturally seek, the nearest good ground about the lake.

The main body of fish entering Karluk Lake came in against the stronger current and in the deeper water. During the day they entered in small schools of 20 to 60 or more, at intervals of a minute or less. They seemed to linger about the foot of the lake some days.

ENEMIES OF YOUNG SALMON.

In the trap at the mouth of Karluk Lake in 1903, 190 charrs were taken between June 5 and July 25. The biggest catch (20) was made on June 5, after which the number fell off rapidly. The next highest catch was made June 26, about ten days after the arrival of the first salmon. On the 27th a charr of 535 mm. length was taken with salmon eggs in its stomach. On July 1 a steelhead, also containing salmon eggs, was taken. One hundred and fifty-seven, or about 82 per cent, of the stomachs were empty; 14, or 7½ per cent, contained remains of fish, mostly cottoids; 13, or 7 per cent, contained insects or their larvæ; 6, or over 3 per cent, contained mollusks, snails, and clams; 3 in addition had eaten eggs, 2 salmon eggs, and the third those of some small fish.

It will be observed that these fish were taken in an "upstream" trap into which the fish would come from the river. In the river at this time were numerous schools of salmon fry and small fingerlings, yet there is no record that any stomach contained a single identifiable young salmon.

During May and June many of these trout (?) were seen jumping near the foot of the lake. On the first day the trap was installed, May 29, 10 were taken; on the 31st, 9, etc. No young salmon are reported in these. Upon the occupation of the spawning beds by the salmon the trout follow to feed on their spawn. This probably forms a large part of their food until late in the season, when the maggots from the flies breeding in the dead salmon become more common.

On August 19, 131 charrs were taken in a seine haul in a spawning creek. One hundred and twenty-eight of these were feeding on maggots; 3 contained insects, and 1 a cottoid; 54 were without salmon eggs; but the remaining 77 contained from 1 to 110 eggs each, an average of 16. At this time there were few live spawning salmon in the creek, and few dead eggs in sight in the eddies, where earlier there had been an abundance. The trout were more numerous than at any previous time, in schools of 30 to 50 as well as many isolated individuals.

In the salt water about Karluk Beach they were even more abundant than in the lake. Sometimes as many as 2,000 are taken in a single haul, and ordinarily at least 500. No effort is made to destroy them. July 20, 220 of these were examined for stomach contents. The most common food was small crustaceans of several species, next in abundance sand launces, both adult and half grown being quite common; young cod were found in many, 40 being taken from one stomach. No other fish were found. July 25, of 22 examples, 7 to 18 inches in length, from the hatchery corral (fresh water), 17 were feeding; 2 had salmon eggs, 1 had 5 2-inch salmon fingerlings, others had various crustaceans. Of 19 examples, 10 to 20 inches in length, from the lagoon, examined July 28, only 4 were feeding. One had eggs, 1 maggots, 1 young sand launces, and the other some unidentifiable fish. No rainbow or cutthroat trout were seen in Karluk Lake.

July 14, 1903, the stomachs of 28 rainbow trout, 2 cutthroat, and 2 charrs, taken in the Naha, were examined. None contained young salmon; 1 contained small eggs like herring eggs, and all the rest contained only caddis larvæ. The fish ranged from 2 feet to about 8 inches in length. At that time of year many coho young are resident in the river.

During the summer of 1905 many trout of the three species from Yes River were examined. No record was kept of the number, but it amounts to at least a hundred. In these the food was mainly caddis and insects from the surface. No young salmon were found, though coho young were present in the stream.

Trout and charrs have been taken near the hatchery at the head of Heckman Lake with numbers of fry in their stomachs. The exact conditions are not known. In the planting of large numbers of fry or small fingerlings, some are sure to be at least for a time disabled and numbers can readily be captured by an active fish. The loss is apt to be especially large if the plant is made in a vicinity where bad eggs have been dumped, and the waters thus "baited."

The sculpin or bullhead would seem to be a more dangerous enemy to the salmon fry than is the trout. It lurks under the stones in just such places as the fry will seek for shelter. Its movements are extremely rapid and its appetite insatiable.

Ducks are perhaps the most active enemy of the salmon in Alaska, especially the sawbill (*Merganser*) and golden eye (*Clangula*). All ducks will doubtless root up the beds in low water, but those just mentioned, as well as the harlequin (*Histrionicus*) and the gulls and terns, will dive for eggs. The sawbill is resident in Southeast Alaska, where the young arrive in time to feed on the coho fry but rather too late for others. In the fall the birds work with the spawning salmon, diving for the eggs as they are extruded or exposed by the shifting of the gravel. Mallards feed more on the blowfly maggots in the dead fish, but apparently find a sufficient number of eggs to ruin the flavor of their flesh for the table. The larger flocks of ducks arrive rather late in the season in the Loring district, doing greatest damage to the coho in large streams, but a considerable number arrive in time for the earlier species of salmon. They do not seem to frequent the small streams, except those tributary to lakes. The grebe family does not seem ordinarily to take young salmon.

GEOGRAPHICAL GLOSSARY.

Following is a list of the geographical names used in this report, with approximate position of the places. The astronomical position is given of rivers and bays for their mouths, of islands for the center, of straits for the center or the more prominent mouth or connecting end.

Admiralty Inlet, waters between Whidby Island and the mainland to the westward. 48° N., 122° 40′ W.

Alder Creek, one of two main tributaries entering at the head of upper Karta Lake.

Alert Bay, small bight on south side of Cormorant Island north of Vancouver Island 50° 35′ N., 126° 57′ W.

Aleutian Islands, chain of islands on the south of Bering Sea.

Alturas Lake, small lake of the Columbia Basin, tributary to Salmon River, central Idaho. 43° 55′ N., 114° 51′ W.

Anan Stream, stream emptying into Bradfield Canal from the south. 56° 12′ N., 131° 49′ W.

Annette Island, small island south of Revillagigedo Island. 55° 08′ N., 131° 30′ W.

Baird, U. S. hatchery on the McCloud River, northern California.

Baker Lake, small lake in northern Washington, tributary to the Skagit River. Location of United States hatchery. 48° 44′ N., 121° 37′ W.

Bartlett Bay, small bight off east side of Glacier Bay. 58° 27′ N., 135° 53′ W.

Battle Creek, tributary of the Sacramento River, northern California.

Behm Canal, channel separating Revillagigedo Island from Cleveland Peninsula on the west and the mainland on the east.

Bering Island, largest of the Komandorski group.

Boca de Quadra, long, narrow fiord in the mainland south of Revillagigedo Island. 55° 05′ N., 131° W.

Bradfield Canal, deep fiord in the mainland above Cleveland Peninsula. 55° 11′ N., 132° W.

Bristol Bay, large bay north of Alaska Peninsula. 58° N., 159° W.

Cape Caamano, south point of Cleveland Peninsula. 55° 30′ N., 131° 58′ W.

Cape Chacon, south point of Prince of Wales Island. 54° 42′ N., 132° 01′ W.

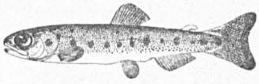
Carroll Inlet, long, narrow inlet in southern part of Revillagigedo Island. 55° 20′ N., 131° 128′ W.

Chinook River, small tributary of the Columbia near its mouth. 46° 18′ N., 123° 58′ W.

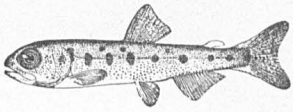
Clackamas River, tributary of the Willamette, Oregon; site of United States hatchery.
Clarence Strait, main channel east of Prince of Wales Island.
Cleveland Passage, small strait separated from east side of Frederick Sound by Whitney Island. 57° 14′ N., 133° 30′ W.
Cleveland Peninsula, extension of the mainland northwest of Revillagigedo Island. 55° 45′ N., 132° W.
Columbia River, large river between Washington and Oregon.
Deep (Moser) Bay, small bight on west side of Revillagigedo Island below Naha Bay. 55° 34′ N., 131° 39′ W.
Dixon Entrance, waters between Queen Charlotte Islands and Alaska. 54° 30′ N., 133° W.
Dolomi, village on east side of Prince of Wales Island just north of Moira Sound. 55° 08′ N., 132′ 03′ W.
Dorr Falls, falls on the Naha above Roosevelt Lagoon. See map.
Dundas Bay, small bay off Cross Sound to the northward. 58° 25′ N., 136° 12′ W.
Emma Creek, small creek falling into Jordan Lake. See map.
Ernest Sound, waters northwest of Cleveland Peninsula, opening into Clarence Strait. 55° 50′ N., 132° 15′ W.
Flume Creek, small creek near Loring. See map.
Fortmann Hatchery, Alaska Packers' Association hatchery on Heckman Lake. See map.
Fraser River, largest river of British Columbia. 49° 06′ N., 123° 08′ W.
Gibson Creek, small creek falling into Jordan Lake. See map.
Harvester Island, island in mouth of Uyak Bay, Kodiak Island.
Heckman Lake, second fresh-water lake of the Naha system. See map.
Helm Bay Creek, stream in southern part of Cleveland Peninsula. 55° 38′ N., 131° 58′ W.
Hetta, an inlet, lake, and stream on west side of Prince of Wales Island. 55° 08′ N., 132° 36′ W.
Hirsch Rapids, tidal rapids at head of Naha Bay. See map.
Humboldt Harbor, small bight on west side of Popof Island, Shumagin group. 55° 20′ N., 160° 32′ W.
Isanotski Strait, water separating Unimak Island from Alaska Peninsula. 54° 53′ N., 163° 23′ W.
Jordan Lake, first fresh-water lake of the Naha system. See map.
Juan de Fuca Strait, waters between Vancouver Island and Washington, connecting Puget Sound with the Pacific Ocean. 48° 30′ N., 124° 40′ W.
Juneau, town on mainland, northern part of Southeast Alaska. 58° 18′ N., 134° 24′ W.
Karluk, village on west side Kodiak Island. 57° 35′ N., 154° 18′ W. The bay, lagoon, river, and lake adjacent of same name.
Karta Bay, small bight at head of Kasaan Bay. 55° 35′ N., 132° 34′ W. River and lakes of same name.
Kasaan Bay, inlet on east side of Prince of Wales Island. 55° 25′ N., 132° 10′ W.
Kegan, small stream, lake, and bight opening into Moira Sound. 55° 01′ N., 132° 10′ W.
Ketchikan Creek, small stream on west side of Revillagigedo Island, falling into Tongass Narrows. 55° 21′ N., 131° 38′ W. Town of same name.
Kilisut Harbor, long, narrow, shallow inlet opposite town of Port Townsend, Wash. 48° 04′ N., 122° 43′ W.
Killisnoo, village on west side of Admiralty Island. 57° 28′ N., 134° 34′ W.
Kiska Island, one of the Aleutian Islands. 52° N., 178° 30′ W.
Klawak, village, stream, and lake on west side Prince of Wales Island. 55° 33′ N., 133° 07′ W.
Kodiak, village on east side of Kodiak Island. 57° 48′ N., 152° 24′ W.
Kodiak Island, large island on west side of the Gulf of Alaska. 57° 30′ N., 153° 30′ W.
Komandorskis, group of islands east of Kamchatka. 55° N., 174° W.
Kvichak River, main stream at the head of Bristol Bay. 58° 55′ N., 157° W.

Lake Creek, the outlet of Seaton Lake, British Columbia.
Larsen Cove (or Bay), bight off west side of Uyak Bay. 57° 33′ N., 153° 53′ W.
Loring, village on Naha Bay, Revillagigedo Island. 55° 36′ N., 131° 38′ W. See map.
Lytton, town of British Columbia at the junction of the Thompson with the Fraser.
Mare Island, island in north part of San Pablo Bay, California. 38° 04′ N., 122° 16′ W.
McCloud River, tributary of the Sacramento (Pit) in northern California. 40° 45′ N., 122° 20′ W.
McCune Creek, small stream falling into head of Heckman Lake. See map.
Metlakatla, village on west side of Annette Island. 55° 08′ N., 131° 34′ W.
Moira Sound, branching inlet on east side of southern end of Prince of Wales Island. 55° 05′ N., 132° W.
Monterey Bay, bay in central part of California coast. 36° 45′ N., 122° W.
Naha Bay, bight on west side of Revillagigedo Island. 55° 36′ N., 131° 40′ W. River of same name.
New Morzhovoi, village on east side Isanotski Strait. 54° 54′ N., 163° 18′ W.
New Red (Ayakulik) River, stream of the southwestern part of Kodiak Island. 57° 11′ N., 154° 30′ W.
Nichols Passage, water west of Annette Island, between Clarence Strait and Tongass Narrows.
Nicolai's barabara, an old barabara in Karluk River below the lake.
Nikolski, anchorage at Bering Island.
North Arm, northern arm of Moira Sound. 55° 05′ N., 132° 04′ W.
Nowiskay, lake and stream emptying into North Arm. 55° 07′ N., 132° 08′ W.
Oakland, city on San Francisco Bay, California.
Old Johnson, lake and stream emptying into Moira Sound from the south. 54° 59′ N., 132° 06′ W.
Osten Creek, main stream at head of Quadra Lake.
Otter Bay, small bight on west side of Pender Island. 48° 48′ N., 123° 18′ W.
Otter Point, projection of Vancouver Island into Juan de Fuca Strait. 48° 21′ N., 123° 49′ W.
Ozette Lake, small lake in northwestern part of Washington. 48° 05′ N., 124° 40′ W.
Papermill Creek, small creek tributary to Tomales Bay, California, just above San Francisco. 38° 10′ N., 122° 50′ W.
Patching Lake, third fresh-water lake of the Naha system. See map.
Pavlof Harbor, small bight off Freshwater Bay, Chicagof Island, Southeast Alaska. 57° 41′ N., 135° 01′ W.
Payette River, tributary of the Snake River in western Idaho. 44° 05′ N., 116° 58′ W.
Pender Island, small island north of Haro Strait. 48° 47′ N., 123° 16′ W.
Peninsula of Alaska, the long peninsula in the southwest of Alaska.
Point Adams, point of Prince of Wales Island north of Moira Sound. 55° 07′ N., 132° W.
Point Higgins, westernmost point of Revillagigedo Island. 55° 27′ N., 131° 50′ W.
Port Alexander, bay on east side Nigei Island, southern part of Queen Charlotte Sound. 50° 50′ N., 127° 40′ W.
Port Chester, bay indenting Annette Island on the west.
Prince of Wales Island, largest island of Alexander Archipelago, Southeast Alaska. 55° 30′ N., 133° W.
Puget Sound, large sound in northwestern Washington.
Quadra. (See Boca de Quadra.)
Quesnel Dam, a point on the Fraser River.
Revillagigedo Island, large island in the southern part of Alexander Archipelago. 55° 30′ N., 131° 30′ W.
Rivers Inlet, inlet of British Columbia, south end of Hecate Strait. 51° 26′ N., 127° 40′ W.
Roosevelt Lagoon, body of brackish water at mouth of the Naha River. See map.

Sacramento, river and city of California.
Salmon River, tributary of Snake River, western Idaho. 45° 50′ N., 116° 50′ W.
San Pablo Bay, bay above San Francisco Bay. 38° 05′ N., 122° 23′ W.
Seton Lake, large lake of the Fraser system, British Columbia.
Shelikof Strait, waters between Kodiak Island and Alaska Peninsula.
Shelter Island, island at the head of Stephens Passage. 58° 26′ N., 134° 51′ W.
Sherringham Point, projection of Vancouver Island into Strait of Juan de Fuca. 48° 23′ N., 123° 55′ W.
Shumagin Islands, group south of Alaska Peninsula. 55° N., 160° W.
South Olga Stream, stream entering southern end of Olga Bay, southern part of Kodiak Island. 57° 06′ N., 154° 20′ W.
Spacious Bay, bay on east side of neck of Cleveland Peninsula. 55° 51′ N., 131° 46′ W.
Steelhead Creek, small creek falling into Naha Bay. See map.
Stikine River, large river from mainland in Southeast Alaska. 55° 36′ N., 132° 22′ W.
Sucia Islands, small group just south of Georgia Strait. 48° 46′ N., 122° 54′ W.
Suisun Bay, bay above San Pablo Bay, receiving the Sacramento River. 38° 07′ N., 122° W.
Sumner Harbor (Bay), small bay northeast of town of Unalaska. 53° 54′ N., 166° 27′ W.
Susquehanna River, river in eastern Pennsylvania.
Tamgas, inlet in the southern part of Annette Island. 55° 01′ N., 131° 32′ W.
Tehama, town on the Sacramento River, California, near head of steamboat navigation.
Thompson River, tributary of the Fraser from the east, in British Columbia. 50° 03′ N., 120° 10′ W.
Thorne Bay, small inlet on east side of Prince of Wales Island, north of Kasaan Bay. 55° 40′ N., 132° 27′ W.
Tongass Narrows, reach on southwest side of Revillagigedo Island connecting Behm Canal with Revillagigedo channel.
Trail Creek, small creek connecting Trout Ponds with Roosevelt Lagoon. See map.
Tribune Bay, small bight on south side of Hornby Island. 49° 31′ N., 124° 38′ W.
Trocadero, aquarium at Paris, France.
Trout Ponds, two small lakes near Loring. See map.
Ugaguk, large stream falling into Bristol Bay from the east. 58° 14′ N., 157° 34′ W.
Uganuk, bay in the north side of Kodiak Island. 57° 54′ N., 153° 30′ W.
Umnak Island, one of the Aleutian Islands, lying about 53° 15′ N., 168° 15′ W.
Unalaska, town on the north side of Unalaska Island. 53° 52′ N., 166° 32′ W.
Union Bay, small bight off Baynes Sound, east side of Vancouver Island. 49° 35′ N., 124° 54′ W.
Unuk River, large river falling into Burroughs Bay at head of Revillagigedo Island. 56° 03′ N., 131° 07′ W.
Uyak Bay, deep inlet on west side of Kodiak Island. 57° 45′ N., 153° 53′ W.
Wallowa River, river in northeastern Oregon, tributary to the Grande Ronde. 46° 03′ N., 40° 03′ W.
Walnut Grove, village on the Sacramento River, between Sacramento and Suisun Bay.
Wannuk River, tributary of Rivers Inlet, British Columbia.
Ward Cove, small bay on west side of Revillagigedo Island, between Point Higgins and Ketchikan.
Whidby Island, large island in the northern part of Puget Sound. 48° 09′ N., 122° 34′ W.
Willamette River, large river of western Oregon, tributary to the Columbia.
Willow Creek, one of two main tributaries entering head of upper Karta Lake.
Wood River, large river emptying into Bristol Bay from the north. 59° N., 158° 23′ W.
Wrangell, town in north end of Wrangell Island. 56° 28′ N., 132° 22′ W.
Yes Bay, narrow inlet on east side of neck of Cleveland Peninsula opening into Behm Canal. 55° 53′ N., 131° 42′ W. Lake and stream of same name. Site of United States hatchery



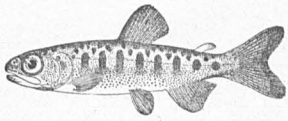
1. Sockeye fry.



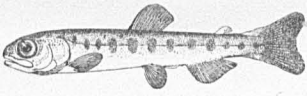
2. Sockeye no. 1 fingerling.



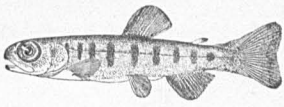
3. Humpback salmon fry.



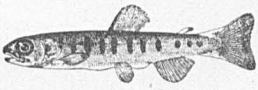
4. King salmon no. 1 fingerling.



5. Dog salmon fry.



6. Coho fry.



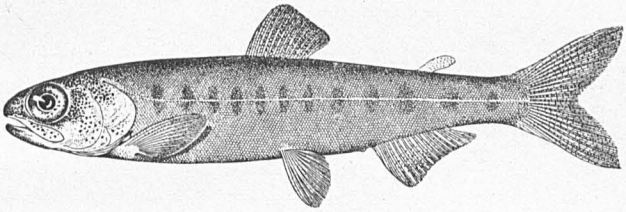
7. Trout fry.



8. Charr fry.

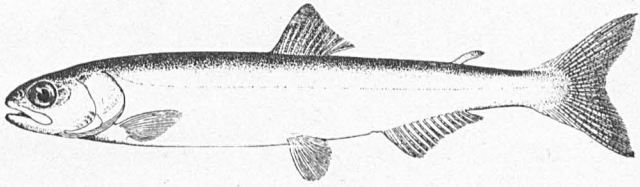
MIGRATING YOUNG OF ALASKA SALMON AND TROUT.

(Natural size.)



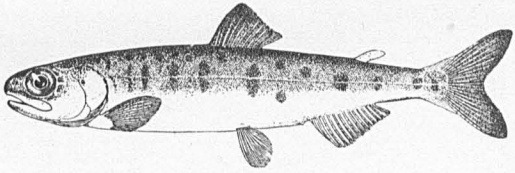
1. SOCKEYE FINGERLING.

(Natural size.)



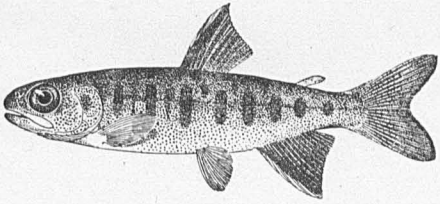
2. HUMPBACK SALMON FINGERLING.

(Natural size.)



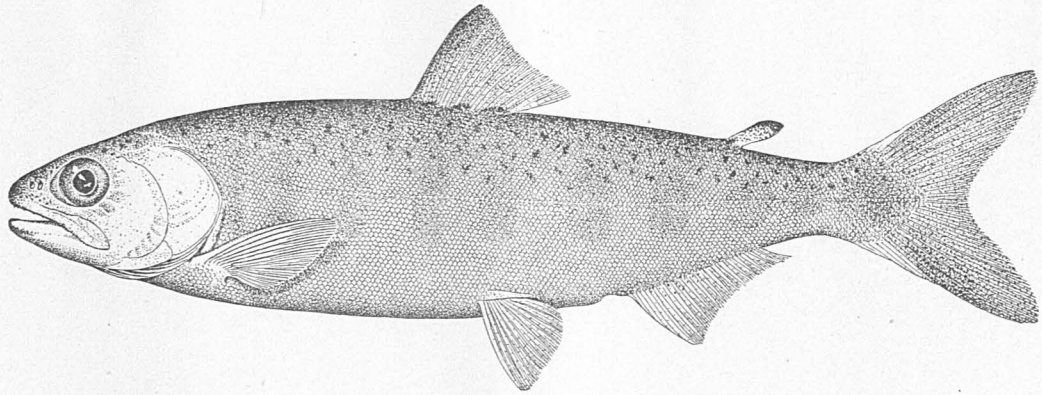
3. DOG SALMON FINGERLING.

(Natural size.)



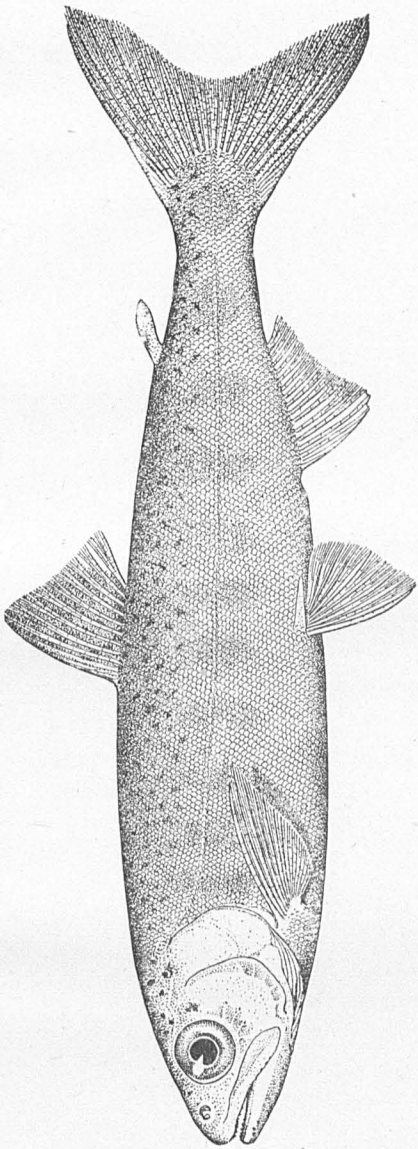
4. COHO NO. 2 FINGERLING.

(Natural size.)

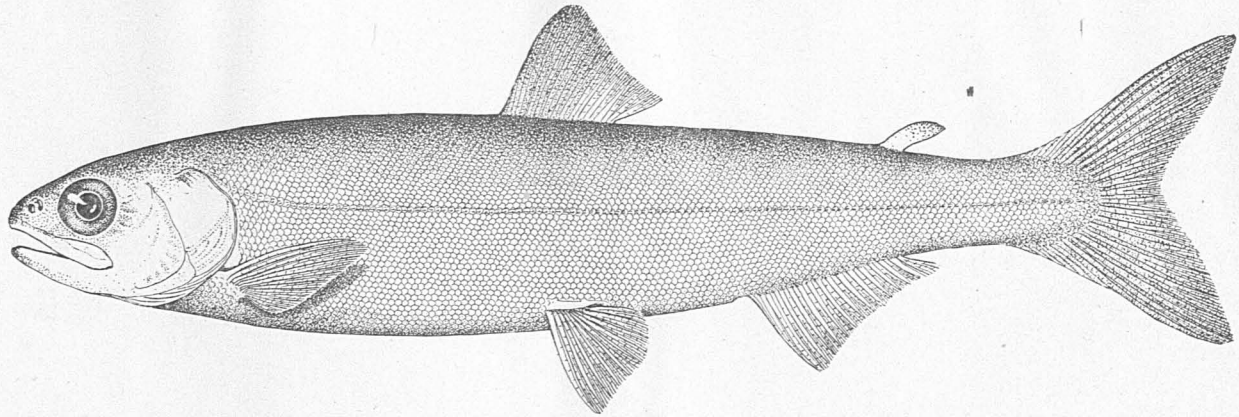


KING SALMON YEARLING.

(Natural size.)



COHO YEARLING.
(Natural size.)



SOCKEYE YEARLING.

(Natural size.)

CULTURE OF THE MONTANA GRAYLING

By JAMES A. HENSHALL

Superintendent U. S. Fisheries Station at Bozeman, Montana

Bureau of Fisheries Document No. 628

Blank page retained for pagination

CULTURE OF THE MONTANA GRAYLING.

By James Alexander Henshall,
Superintendent U. S. Fisheries Station at Bozeman, Mont.

CHARACTERIZATION OF THE SPECIES.

The Montana grayling originally existed only in the tributaries of the Missouri River above Great Falls, and was first noticed by Lewis and Clark, during their remarkable journey to the Pacific coast. They described it from fish taken near the headwaters of the Jefferson River, but did not name it, alluding to it as a new kind of white or silvery trout. It was rediscovered by James W. Milner, of the U. S. Fish Commission, in 1872, in a tributary of the Missouri near Camp Baker, Montana. He described it, and named it *Thymallus montanus*. At first it was said to be a variety of the Michigan grayling, but it is now given specific rank. In its affinities it is really more nearly related to the Arctic grayling (*T. signifer*), as may be seen from the following characterizations:

Specific Characters of the Graylings.

Species.	Head in length.	Depth in length.	Eye in head.	Maxillary in head.	Scales.	Gill rakers.	Dorsal rays.	Height of dorsal fin in length.	Spots on body.
T. signifer	5½	4½	3	2½	8-88 to 90-11	12 below angle	20-24	3½	Anterior.
T. tricolor	5	5½	4	2½	93-98	7+12	21-22	5½	Posterior.
T. montanus	5	4½	3½	3	8-82 to 85-10	5+12	18-21	4½	Anterior.

[a] To orbit.

Description.—From the examination of a large series of fresh specimens the following detailed description of the Montana grayling may be given:

Head moderate, subconic, its length contained 5 times in length of body, curving regularly from snout to dorsal line, and continuous with it. Mouth moderate, oblique, terminal, the maxillary extending to the anterior border of the eye, its length 3 times in head; jaws equal. Eye large, 3½ in head, nearly equal to interorbital space, and longer than snout, the pupil pyriform or pear-shaped, with the apex anterior. Teeth feeble, sparse, and uniform in size; on jaws,

vomer, and palatines; none on tongue. Gill rakers 5+12. Scales moderate, 82 to 85 along lateral line, with 8 rows above and 10 rows below; lateral line nearly straight, curving upward slightly toward the head. Dorsal fin long and high, the height greater than depth of body; 18 to 21 rays. Caudal fin strongly forked. Coloration: Back bluish-gray with purplish reflections; sides and gill-covers lighter, with purple and silvery reflections, beautifully iridescent; scales with a pearly luster; belly pure white; a few V-shaped black spots between the head and middle of dorsal fin, but none posteriorly; two oblong, bluish black blotches in cleft between opercle and branchiostegals, more pronounced in the male; a line on upper border of belly from ventral to pectoral fins, dark and heavy in the male, very faint in female. Dorsal fin edged with a red or rosy border; four to seven vertical rows of red or rosy roundish spots, ocellated with white between the dorsal rays; dark blotches forming lines between the rows of red spots. Ventral fins with three rose-colored, branching stripes along the rays, darker between. Pectoral and anal fins plain, with dark border.

Origin.—It is very probable that the Arctic grayling was the parent stock from which the Michigan and Montana graylings descended; and from the fact that the habitats of the three species are so widely separated, it is not unreasonable to suppose that the Michigan and Montana forms were conveyed thence from the Arctic regions during the Glacial period. This theory is strengthened by the fact that Elk Lake, a half mile from the Montana grayling station, is abundantly inhabited by both grayling and the lake trout (*Cristivomer namaycush*), which latter fish is found nowhere else west of Lake Michigan.

Game and food qualities.—The Montana grayling is a most graceful and beautiful fish, whose dainty and lovely proportions and exquisite coloration must be viewed fresh from its native waters to be appreciated properly. As a food fish it is fully as good as the trout, and to my taste better. Its flesh is firm and flaky, very white, and of a delicate flavor, as might be expected. As a game fish it is the equal of its congener, the red-throat trout, and when hooked breaks water repeatedly in its efforts to escape, which the trout seldom does. It takes the artificial fly eagerly, and if missed at the first cast will rise again and again from the depths of the pool, whereas the trout will seldom rise the second time to the same fly without a rest.

Habits.—The Montana grayling prefers swift, clear streams of pure water, with gravelly or sandy bottom. It is quite gregarious, lying in schools in the deeper pools, in plain sight, and not, like the trout, concealed under bushes or overhanging banks. In search of food, which consists principally of insects and their larvæ, it occasionally

extends its range to streams strewn with bowlders and broken rocks. The fry subsists on minute crustaceans, as Entomostraca, and for seizing the minute organisms is furnished, like the lake whitefish fry, with two sharp, retrorse teeth in the upper jaw.

Unlike the Rocky Mountain trout (*Salmo clarkii*), but like the salmon, the grayling will go long distances, if necessary, to find suitable spawning grounds. The auxiliary grayling station of the Bureau of Fisheries is on Elk Creek, one of the feeders of Red Rock Lake, at the head of the Jefferson River. At the beginning of the breeding season many grayling go up the Jefferson, through Beaverhead and Red Rock rivers, to Red Rock Lake, 14 miles in length, and through the lake to the inlets at its head. After spawning they return through the lake to the streams below, none stopping in the lake, as it is unsuitable, being shallow and with an alkali bottom. At spawning time Elk Creek is fairly alive with grayling on the gravelly shallows, where their large and beautiful dorsal fins are to be seen waving like so many banners, clear of the water, in the manner of shark fins on a flood tide. In the North Fork of the Madison River, where the water is comparatively warm, coming from the Firehole River in Yellowstone Park, the grayling spawns a month earlier than in other waters of Montana.

METHOD OF ARTIFICIAL PROPAGATION.

Stripping and incubation.—One fish produces from 2,000 to 4,000 eggs, which are about one-seventh of an inch in diameter, running from 750 to 850 in number to a fluid ounce. The eggs in the ripe fish lie loose in the abdominal cavity, as in the trout, and the fish is quite as easily stripped—the eggs perhaps a little harder to start, but afterward flowing freely. They are fertilized by the dry process, and fully 95 per cent are fecundated. They require much more washing than trout eggs, to free them of a glutinous substance that otherwise would cause them to bunch.

When first extruded the eggs are of a rich amber color, owing to the presence of a large oil drop, which renders them almost semibuoyant; but after a few days of incubation they become hyaline or glass color, and as clear as crystal. It is imperative that they be eyed in hatching jars with a good pressure of water, to obviate all danger from bunching and fungus. If they are placed on ordinary flat trays, touching each other, and exposed to a lateral current of water, they adhere in bunches, fungus appears, and much labor is entailed in picking, ending in a great loss of eggs. After the eye-spots show the eggs may be placed on the ordinary hatching tray, being then much heavier and not likely to float off. The embryo becomes very active before the eye-spot appears, which occurs in about a week or ten days at a temperature of 50° F. Incubation

is then complete within two weeks. If the water is much colder the period will be several days longer.

The fry is hatched with a very small yolk sac, smaller than the egg, and this sac is absorbed in a week or ten days, the fry then becoming a free swimming animal about half an inch long, quite slender and delicate, resembling somewhat the fry of whitefish or shad.

Transportation of eggs.—The usual method of packing and shipping salmon and trout eggs will not answer for grayling eggs. They will not bear crowding or pressure, and must be kept at a very low temperature. The period of incubation being so brief, there is a possibility of their hatching in transit if they are several days en route and the temperature rises above 42°. This was demonstrated the first season at the Bozeman station, when the eggs were shipped in ordinary trout-egg cases, and even with the precaution of packing ice with the moss about the stack of egg trays. Before the next season I devised the refrigerator case, with double wall, by means of which the temperature can be kept at 40° or below for any length of time if properly re-iced, and the eggs will reach their destination in excellent condition.

For the better aeration of the eggs was devised also a special egg tray but one-half inch in depth, with cheese-cloth bottom. No moss is placed over the eggs on the tray, for, as before stated, they will not bear any pressure, and a piece of mosquito netting is all that is required to keep them in position. A space of 2½ to 3 inches is left between the inner wall of the refrigerator case and the stack of egg trays, and this, as well as the hopper on top of the trays, should be kept constantly filled with ice. The hopper has perpendicular sides instead of the flaring sides usual in trout-egg cases, to facilitate re-icing of the space surrounding the stack of trays during transportation. The frames of the egg trays are 1 inch wide, so that when placed in a stack they form a wall 1 inch thick to separate the eggs from the ice, and there is no possible danger of freezing the eggs; this was demonstrated by experiment. For grayling egg-case labels the precaution "Do not expose to freezing temperature" is always erased, as unnecessary, and moreover, useless when considered in connection with the notice to express messengers to re-ice en route and to keep as cold as possible.

Feeding the fry.—If stream water containing the minute crustaceans that furnish suitable food for the fry, as most streams do, can be supplied to the fry in the hatchery from the first, no artificial feeding will be necessary for a month or six weeks. If, however, only spring water can be had, great care must be exercised and the ingenuity and intelligence of the fish-culturist brought into requisition to discover the best means of feeding. It was found that fresh blood supplied

before the yolk sac is entirely absorbed answers a good purpose. Liver emulsion rendered as fluid as possible, and then strained through ordinary muslin, will serve to tide the fry over the precarious stage until they are a month or six weeks old, when they can be fed the same as trout fry; but during the first stages they must be watched closely and fed much more frequently than trout fry. If fresh blood can be procured and stirred until it becomes a homogeneous fluid, free from clots, it can advantageously be supplied either straight or mixed with the strained liver emulsion. But, owing to the very small size of the grayling fry, artificial feeding is under all circumstances quite a problem. At the Bozeman station they have been reared to maturity in the manner mentioned with a loss of from 50 to 70 per cent; and the mature fish have been stripped and the eggs hatched and fry planted. This has been done several seasons, though only a portion of the females yielded good eggs and many males were not in good breeding condition, possibly from a lack of their natural food and from being kept in spring water.

The fry should be transferred to shallow, sunny nursery ponds with a good current of stream water, of a higher temperature than spring water, if possible—say from 55° to 60°. They begin to forage for their natural food as soon as placed in the pond, and are exceedingly active and industrious. If the water is found to contain an abundance of their natural food, which can be determined by examination with the microscope, they will do well. In addition, however, it is well to feed the fry at least six times a day for several weeks; otherwise they may begin to eat each other, being very cannibalistic. Owing to this tendency it is, moreover, advisable to begin with two or three times as many fry as it is desired to rear.

Output of the government grayling hatchery.—The following table is a statistical résumé of the results of grayling propagation by the U. S. Bureau of Fisheries in the last decade.

OUTPUT OF GRAYLING FROM THE U. S. FISHERIES STATION AT BOZEMAN, MONT., 1898–1907.

Year.	Eggs collected.	Eggs shipped to other stations.	Fry and fingerlings distributed.	Adults and yearlings distributed.
1898	2,506,200	115,000	1,500,000	.....
1899	5,735,000	380,000	4,567,000	.....
1900	3,687,000	814,000	2,449,718	10,000
1901	2,400,000	390,000	1,453,461	11,721
1902	4,463,000	1,455,000	1,130,333	18,000
1903	3,045,000	645,000	974,114	368
1904	3,247,800	491,000	2,692,200	225
1905	1,010,000	400,000	400,000	.....
1906	1,650,000	642,000	800,000	70
1907	2,370,000	250,000	1,376,200	.....
Total	30,114,000	5,585,000	17,343,026	40,384

O