DEPARTMENT OF COMMERCE
BUREAU OF FISHERIES

REPORT

OF THE

UNITED STATES COMMISSIONER OF FISHERIES

FOR THE FISCAL YEAR 1924

WITH

APPENDIXES

HENRY O'MALLEY
Commissioner

WASHINGTON
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Report of the United States Commissioner of Fisheries

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DEPARTMENT OF COMMERCE

BUREAU OF FISHERIES

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Bureau of Fisheries Document No. 966.

REPORT OF THE COMMISSIONER OF FISHERIES

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DEPARTMENT OF COMMERCE,
BUREAU OF FISHERIES,
Washington, July 1, 1924.

SIR: I have the honor to submit a résumé of the major operations of the Bureau of Fisheries during the fiscal year ended June 30, 1924.

The discussions of the work of the several divisions of the bureau, as treated herein, disclose the critical condition of many of our important fisheries, the inability of these branches to meet the heavily increased demands for service, and the interest of our people in having these fisheries rehabilitated that they may serve to the fullest extent as a source of food and recreation without endangering the future supply.

Pollution, deforestation, reclamation and irrigation projects, power dams and other obstructions to the free movement of fish to the spawning areas, and other factors have seriously depleted the supply of aquatic life, especially in our interior and coastal waters, and created conditions that make it extremely difficult for the natural supply to be properly maintained. The evident depletion of such of the older sea fishing areas as the North Sea and the waters around Iceland emphasizes the necessity of properly safeguarding our marine resources as well.

Improved methods of handling and merchandising have enabled larger numbers of our people to obtain and enjoy fish as food. This has led to more intensive fishing operations and has increased the strain on some of the more highly prized forms. Good-roads construction and the increased use of the automobile have served to greatly augment the number of anglers. One State alone now issues nearly 200,000 angling licenses annually. The catch made by anglers has therefore become an important factor in the depletion of the supply of many water areas.

Conditions such as these have contributed to the creation of a demand for a greatly enlarged program for supplementing the natural supply of aquatic forms by artificial means, and for the accumulation of more biological data as the basis for sane conservation laws. It is just and proper that our fisheries should afford recreation and food to large numbers of our people, but in so doing we must also provide for the perpetuation of these resources, that we may not deprive our children of this heritage.

The current program of activities of the bureau has been developed to render the fisheries a larger measure of practical service than at any time in its history. Yet neither it nor the States are able to cope with present-day demands. Anglers, commercial fishermen, and conservationists evidence a greater appreciation of the need for developing a more comprehensive policy and an increasing discontent with the progress that is being made. It is important that Federal and State authorities cooperating with private agencies develop a national fisheries program that will coordinate and develop a plan of action commensurate with the needs of to-day. You have recently directed attention to the fact that the Constitution of the United States provides for interstate cooperation through the rights of the States to make treaties between themselves, which become statutory law. I am convinced that the solution of some of our most difficult problems may be found in this manner if the States will earnestly attempt such a procedure.

The growing interest of our people in these problems of the fisheries is reflected in the increasing attention given to them by Congress. During the last session of Congress four major measures were enacted into law. In each case these had the support of the Department of Commerce. The first of these—the new Alaska fisheries law—is a very important conservation measure, necessary to the rehabilitation of the salmon fishery of the Territory. The North Pacific halibut treaty was ratified and the necessary legislation to make it effective passed. An oil-pollution bill was passed to prevent the dumping of oil in navigable waters of the United States by oil-burning or oil-carrying vessels in quantities deleterious to health or sea food or a menace to navigation, under regulations as may be prescribed by the Secretary of War. The Secretary of War is also authorized and directed to make such investigations as may be necessary to ascertain what polluting substances are being deposited in navigable or nonnavigable waters connected therewith. The fourth measure passed by Congress is the act establishing the upper Mississippi River wild-life and fish refuge, which will preserve some of the finest fish nurseries in inland waters.

INQUIRY RESPECTING FOOD FISHES

INTRODUCTION

The growth of our population and improvements in methods of preserving, transporting, and marketing fishery products have during the past few years greatly increased the demand for such products. To supply this demand improvements have been made in the methods used for capturing fish, and the fisheries have increased both in extent and intensity. An increased strain has thus been placed on the resources. At the same time our rapid industrial development and the increased use of oil-burning vessels are rapidly polluting many inland and coastal waters, making them unfit to support life and thus cutting down the available supply of fish and other aquatic forms, upon the abundance of which the maintenance of our fisheries depends. Again, the erection of dams and other obstructions in many of our streams prevents access of fish to their spawning grounds, and thus cuts off the supply at its source. With this increased demand for fishery products, accompanied as it is by a decreasing supply, many new and complex problems are presented to those who are concerned with the conservation of our fishery resources. Declining fisheries are frequently overexploited to supply the increasing demand, and the problems of restoration or.

indeed, of mere maintenance become more difficult and require additional investigations if they are to be adequately and scientifically met.

If economic losses due to depletion of the fisheries are to be prevented—and this, in the last analysis, is the primary function of the Bureau of Fisheries—it is essential that information be secured which will provide a measure of the condition of a fishery, particularly with respect to its depletion. It is important that this information be secured before depletion has gone far. If it is delayed until the diminution in the supply has become apparent to the casual observer, it may be too late to prevent serious depletion or even commercial extinction. The statistics of the fisheries are not alone adequate for this purpose, important though they be; but these must be interpreted in the light of a knowledge of the life history of the various species on which the fisheries depend—particularly such matters as the rate of growth, age of the breeding fish and of those usually taken for commercial purposes, migrations, etc. Such data as these, and many other, are needed even more urgently if depletion, once discovered, is to be remedied. The scientific investigation of the fisheries provides data that are essential to the proper conservation of these resources.

A knowledge of the condition of a fishery may be applied not only to the purposes of preventing and remedying depletion, however, but also to directing the expansion of a fishery. Not all of our fishery resources show depletion or appear to be in danger of overexploitation. With adequate data it would be possible to direct fishing effort from a depleted resource to one capable of withstanding additional exploitation. The true conservation of our fishery resources is conceived to include not the mere saving of these resources, but their utilization to the fullest possible extent compatible with their perpetuation. The conservation of the fisheries should partake more of the nature of husbandry than of mere saving, and the husbandry of fisheries is no less an art than the husbandry of the plants and animals reared on our farms. The care of the fisheries has not been developed to the stage of perfection reached in the care of the important agricultural products, but advances have been made and are being made in spite of the fact that, in many ways, the problems are more difficult. The factors involved are more complex and obscure, and most fishes are for most of their lives beyond the control or even the observation of man. Such comparatively simple and essential items as their rate of growth and age can frequently be obtained only by indirect methods, which must be applied in the light of accurate biological information and which often require the use of careful methods and long-continued and often arduous and monotonous work on the part of the investigators.

New methods for investigating fishery problems have been developed in recent years. In this newer line of fishery research emphasis is placed not so much on a study of the individual fish as upon the study of the species as a unit, the factors that affect the survival of the race, and the general relationship of the species as a whole to the physico-chemical and biological elements in its environment. The problems in this new line of fishery research are so complex that they may demand years for solution and require investigators of unusual training, ability, and perseverance. In this work the bureau is handicapped not a little by the difficulty of obtaining men properly trained and interested in fishery research. Moreover, such investigations as these require a greater expenditure of funds than do many other types of fishery investigation, an expenditure which is, however, fully justified by the practical importance of the information secured. In spite of difficulties an effort is being made to take up such studies wherever possible, and it is hoped that this development of our scientific investigations may receive the more adequate financial support which its importance warrants.

During the past year a large measure of the efforts of the division of scientific inquiry has been devoted to researches of this nature. Other investigations bearing on special problems of the fisheries and for the purpose of improving fish-cultural methods have been carried on. Following is a brief outline of the results obtained from these efforts.

ATLANTIC COAST FISHERIES

The study of the life histories of the important food fishes of the North Atlantic, such as the cod, pollock, and haddock, which was begun in April, 1923, has been continued. Seven cruises were made by the United States Bureau of Fisheries steamer *Halcyon* to the fishing grounds off the coast of Massachusetts for the purpose of tagging fish. This work was undertaken in order to discover the facts as to the migrations of these important food fishes. Over 10,000 fish were tagged, the greater number on Nantucket Shoals, some near No Man's Land, some off Chatham, and others in Massachusetts Bay. Two hundred and eighteen tags had been returned at the close of the fiscal year, and the results have proved of considerable value and interest. It has been shown that many of the cod found during the summer on Nantucket Shoals remain there until late in the fall; then a definite migration takes place to the southward and westward to points between Rhode Island and New Jersey, and probably still farther south. During the spring the reverse migration occurs, and the fish return to Nantucket Shoals. There is no evidence to indicate that the fish on their return go to other banks than those on which they were tagged, but later returns may not support this tentative conclusion.

In connection with this study of the migration of the cod, pollock, and haddock, extensive scale collections have been made. The scales are being examined carefully and important data bearing on the age and rate of growth secured. Scale studies have been used extensively and with great success in determining the age and rate of growth of many fishes, in this country notably the salmon, and it is believed that the application of this method to the study of cod and similar fishes of the New England coast will provide information of the greatest value.

Such investigations as these provide information relative to the biology of the adult fish only. However, the abundance of fish depends not alone upon the survival of the adults, but perhaps to an even greater extent upon the survival of the eggs and young fish before they have assumed the adult characteristics and habits. During the year the investigation of the larval fishes of the Woods Hole region was continued. Closely coordinated with this work has been an investigation of the minute animals and plants, collectively known as plankton, which are found everywhere, but in varying abundance, in the sea water. Larval fish feed exclusively on these planktonic forms, and the larger fishes and other aquatic animals depend either directly or indirectly on the plankton for their nourishment. A study of the food and feeding habits of the larval fish was begun during the latter part of the fiscal year. This investigation will be extended to include a study of the young fish during the postlarval stages, between the larval stages and the time the fish first appear in the commercial catch. In these investigations special attention is being given to the cod, and when completed this study of the early history of the cod will supplement the study of the migrations and growth of the adult and provide a fairly complete life history of the species.

The abundance and distribution of the plankton on which all other animal life in the sea depends are profoundly influenced by such physical and chemical factors as currents and the temperature and salinity of the sea water. The study of these factors constitutes the science of oceanography, and oceanographic studies are of the greatest importance if we are to understand fully the fluctuations in abundance of our food fishes. Slight changes in temperature or shifts in the oceanic currents may cause extensive migrations, or may spell destruction to an entire brood of young fish. During the year oceanographic studies have been made in the region of Woods Hole, Long Island Sound, Chesapeake Bay, and the Gulf of Maine. In each case special attention has been given to the bearing of the oceanographic data upon fishery problems.

During the past year a report on the fisheries of Key West, Fla., was prepared and published as Bureau of Fisheries Document No. 962. It describes the various fisheries of the Florida Keys and includes a detailed account of the clam industry of southwest Florida. An annotated list is given of all the known commercial food fishes of the region, a total of 83 species.

The study of the salmon, trout, and smelts of the New England coast has been continued throughout the year, and has yielded additional data bearing on the biology of these species.

For a number of years past the bureau has enjoyed the association of Dr. H. B. Bigelow, of the Museum of Comparative Zoology, Harvard University. Recently he has been concerned with a complete oceanographic and biological survey of the Gulf of Maine, a body of water that supports some of our most valuable fisheries. A report dealing with the fishes of this region is now in press. It includes a complete account of the distribution of the fish and as much as is now known of their life histories. Another report, dealing with the plankton, is in an advanced stage of preparation, and progress has been made with the preparation of a paper dealing with the oceanography of the Gulf of Maine. When completed these three reports will provide a comprehensive survey of what is at present known of the physical and biological factors influencing the distribution and abundance of the food fishes of this region, and will form a contribution of first importance to our knowledge of the fisheries.

A comprehensive hydrographic and biological survey of Chesapeake Bay was undertaken several years ago and field observations completed. The work of analyzing the data has been undertaken by a number of specialists, including two of the bureau's scientific staff. This investigation of Chesapeake Bay forms an integral part in the general program for a survey of the entire coast and will provide information of the greatest value in the care of the important oyster and fishery resources of this body of water.

PACIFIC COAST FISHES

The investigation of the salmon of the Columbia River has been continued. A report has been completed dealing with the degree of maturity of the chinook salmon taken by trolling and purse seining off the mouth of the Columbia River and in Monterey Bay and other points along the northern coast of California. The results of this investigation show that this fishery is unduly destructive, since a large percentage of the fish taken are small and immature, producing an inferior product.

A series of extensive experiments was inaugurated on the Columbia River a number of years ago in which young salmon, on liberation from the hatcheries, were marked by the removal of various fins. The primary object of these experiments has been to test the relative and absolute efficiency of various hatchery procedures in caring for and planting the young fish. In the eight years during which these experiments have been running nearly a million fish have been marked, and hundreds have been retaken as adult fish upon their return to the river after a sojourn of from one to four years in the sea. During the past year approximately 500 marked adult fish were reported. These resulted from four experiments started in 1920 and 1921. Four new marking experiments were begun, in two of which chinook salmon were marked and in the other two Alaska sockeyes that had been transplanted to the Columbia River. In this experimental work the bureau has received the active support and cooperation of the Oregon Fish Commission.

As for a number of years past, special attention has been directed to the study of the salmon fisheries of Alaska. These fisheries, representing about 90 per cent in value of Alaska fishery products, together with the salmon fisheries of the west coast, constitute our most valuable aquatic resource, and since their administration is vested in the Department of Commerce it is imperative that adequate information be available on which to base regulations. The efficient aid of Dr. C. H. Gilbert, of Stanford University, California, has been available for this work, and his intimate acquaintance with the salmon problems and with the life histories of these fish has been of the greatest value.

It has been a matter of no little importance to determine the character of the migrations of red salmon in the region of Bristol Bay and the Alaska Peninsula. During the season of 1923, 10,000 salmon were tagged near the extremity of the peninsula. This was a repetition on a larger scale of the tagging experiments carried on during 1922 and corroborated in every important respect the results obtained the previous year. Much additional information was secured, and it is likely that the oceanic migrations of the red salmon of Alaska are now better known than those of any other important food fish.

FISHES OF INLAND WATERS

The whitefish and cisco fisheries represent the most important fisheries of the Great Lakes. In 1922 the catch exceeded 40,000,000 pounds, or 40 per cent of the entire catch, and more than $2,000,000, or 31 per cent, in value. These fisheries have shown marked depletion in recent years. It is therefore highly important that adequate information be provided as a basis for proper conservation measures.

Important advances have been made in the investigation of the whitefishes of the Great Lakes, and a report dealing with these fisheries, which are supported largely by the whitefishes and related species, has been submitted for publication. Detailed studies of the systematic relationships and the natural history of the whitefishes and ciscoes are being conducted. One fact of importance that has been disclosed in this investigation is that the herring of Saginaw Bay suddenly increased their rate of growth in 1919, and that this increased growth has been maintained since that date. This sudden acceleration in growth is apparently correlated with improvements in the environmental conditions in Saginaw Bay due to decreased pollution.

Investigations of the natural food of certain fresh-water fishes and of their ecological relationships have been carried on with the efficient cooperation of the faculty of the department of zoology of the University of Wisconsin. Other important studies relating to the nutrition and physiology of fishes and other cold-blooded aquatic animals have been carried on. Work of this character has a direct bearing on fish-cultural methods.

OYSTERS

The oyster industry of the Atlantic coast, with an annual yield of about 20,000,000 bushels, is one of the most valuable of our aquatic resources. At one time our most valuable fishery, it has suffered serious depletion in recent years. Production has been reduced by as much as 50 per cent in some important areas. During the past fiscal year investigations have been conducted into the causes for this depletion and means whereby it might be remedied.

A hydrographic and biological survey of Long Island Sound, where the situation as regards the oyster industry is especially acute, has been completed, and a report is nearly ready for publication. This survey was undertaken in order to supply data regarding conditions having an immediate bearing on the problems of oyster culture. The results indicate that the difficulties of oyster culture in Long Island Sound are due primarily to (1) the pollution of the best spawning beds by sewage and trade wastes, (2) the overfishing of such spawning beds as remain unpolluted, and (3) the exposure of these unpolluted spawning beds to the attacks of starfish and oyster drills.

The oyster studies that have been in progress for some years in Long Island Sound and in Great South Bay were continued. In Great South Bay attention was directed to the discovery of the cause of the heavy mortality among young oysters, and to the development of additional knowledge of the early life history of the oyster and of the factors affecting spawning. Additional evidence was secured which indicates that hydrogen sulphide (H_2S) generated by a deposit at the bottom of the bay was an important factor in causing the death of young oysters. Valuable data bearing on the larval history and the effects of temperature on spawning were also obtained. At Milford, Conn., during the summer of 1923, the work of testing the effect of materials occurring as pollutants, and experiments in a new method of artificial oyster propagation, were carried on. Encouraging results were obtained in the experiments with artificial propagation, and it is hoped that in time the methods devised may be developed to a stage where they may be made an important adjunct to commercial oyster culture. It is of interest that the oysters artificially propagated during the season of 1923 and placed in the harbor survived the winter and attained considerable growth. An account of these experiments has been published as Bureau of Fisheries Document No. 961, for the benefit of practical oyster growers and biologists. The work will be continued during the coming fiscal year.

FRESH-WATER MUSSELS

Fresh-water mussels form the basis for the most important fishery in the Mississippi drainage. In 1922 the take of shells alone amounted to nearly 52,000,000 pounds, with a value to the fishermen in excess of $1,000,000. The manufactured products, including pearl buttons, poultry grit, lime, etc., had a value of about $7,000,000.

The investigation of the fresh-water mussels of the Mississippi Valley has been carried on as usual from the Fairport (Iowa) biological station. Mussel surveys were made in Lake Pepin, on the Mississippi River between Dubuque and Keokuk, Iowa, and in Arkansas on the White, Black, and St. Francis Rivers. The Lake Pepin survey was one of a series of annual surveys that are being made in order to determine the effect of the propagation of the fat mucket (*Lampsilis luteola*) and the alternate closure, for four-year periods, of various sections of the lake, and the results thus far attained are most promising. In Arkansas the survey was made for the purpose of assisting that State in establishing areas that should be closed for a period of years in order to restore the depleted mussel beds.

The experiment, started during the previous fiscal year, in the rearing of mussels in troughs through their early life did not prove as successful as was anticipated. It is believed that this method for propagating mussels will prove to be of great importance if it can be perfected, and special attention is being given to this work.

A special investigation of the parasitic stage of the mussel was continued by Dr. L. B. Arey, of Northwestern University. Attention was given to a study of the normal cyst and the relationship existing between the mussel embryo and the host fish. The immunity to repeated inoculations developed by the host fish was also studied.

The adult mussels retained at the Fairport biological station have been found to be infected with a ciliate parasite, which invades the brood pouches and destroys numbers of young larval mussels (glochidia) before they are liberated by the parent. It is believed that this condition is dependent upon a polluted condition of the water, due, perhaps, to the increasing amount of sewage entering the Mississippi River from the cities located just above Fairport. If this is true, it may be expected that increased difficulty will be experienced in handling mussels at this station.

ALASKA CLAMS

The investigation of the clams in the region of Cordova and Cook Inlet, Alaska, begun in the latter part of the fiscal year 1923, was continued during the summer of 1923. Data were obtained for the determination of the age, growth, and size at sexual maturity, and the date of the breeding season. Subsequently data for comparison were obtained from the Washington coast. Among other interesting facts it has been shown that the growth of clams on the Washington coast is much more rapid than in Alaska and that a marketable size is reached in one-half to two-thirds the time. A preliminary survey of the density of population on the beds in the older regions and their history indicates that these have about reached their full commercial development, and that more intensive fishing is unwise. If, however, the intensity of the fishing is wisely regulated and a breeding reserve assured by a proper size limit, there is no reason why clam canning should not be a permanent and valuable industry on many Alaskan beaches.

There has been a marked development of the clam canning industry of Alaska, the pack in 1923 amounting to 77,283 cases with a value of $541,139. Because of this development and the slow rate of growth of clams in the territory, it is important that we guard against overexploitation.

INVESTIGATIONS RELATING TO FISH CULTURE

The importance of fish culture in the husbandry of our fisheries lies primarily in the increased protection of the eggs and young. In a state of nature the mortality during the early stages is extremely high, as it is among all animals that give little or no care to their young. By protecting the eggs and young from unfavorable environmental conditions and enemies a much larger percentage may be carried through this critical period in their life history. Present procedures in fish culture are largely empirical and are based upon the practical experience of fish-culturists. With an increased knowledge, gained through scientific researches, of the life histories and ecological relations of the various fishes and of their physiology and pathology, the art of fish culture will doubtless make rapid advances. It is one of the most important functions of the division of inquiry to make the necessary investigations into the physiology and pathology of fishes which are required for the proper regulation of hatchery procedure.

A number of the researches mentioned above bear directly upon fish-cultural problems. The marking experiments conducted on the Columbia River were designed primarily to test the relative efficiency of various practices, particularly as to the length of time the young salmon should be retained before planting, the relative influence of heredity and environment in producing fish of high quality, and the time and manner of liberation most productive of results in the way of commercially valuable fish. All of the investigations bearing on the life histories of fish are of importance from the standpoint of fish culture, since they make it possible to adjust artificial propagation closely to the normal life history. The more closely normal conditions can be provided, the greater the chances will be for success. The study of the physiology and natural food of fresh-water fishes provides data which will aid materially in improving the care given both brood fish and young at the various stations.

Special investigations have been carried on by the fish pathologist dealing with the causes of and remedies for certain diseases that are frequently responsible for heavy mortality at the hatcheries. The life history of a parasitic flagellate (*Octomitus salmonis*) has been almost completely worked out, and it is believed that methods of caring for the fish will be devised which will materially reduce, if not entirely eliminate, the loss from this source. Very encouraging results have been obtained in preventing thyroid tumor in trout by the administration of iodine. In one lot of over 1,200 fish infected with this disease, no new cases appeared after the beginning of the treatment.

During the past year, experiments have been conducted at the Fairport biological station and at several of the fish-cultural stations to determine the effects of vitamin deficiency on fish. It has been shown that vitamins are just as essential to fish as to higher vertebrates, and it is believed that it will soon be possible to prescribe a diet that will be distinctly superior to those now in common use.

Experiments in the culture of several species of fresh-water fishes of commercial importance have been conducted at Fairport during the year. These included the lake and shovel-nosed sturgeons, paddlefish, buffalofish, sheepshead, channel catfish, and bluegill sunfish. In 1922 the take of buffalofish in the Mississippi drainage exceeded 17,000,000 pounds, with a value to the fishermen in excess of $1,000,000, being the most valuable and important species of food fish. Catfishes ranked third in quantity and value, with a catch exceeding 8,000,000 pounds, valued at $713,461. The most successful results were obtained in the case of the buffalofish, channel catfish, and bluegill sunfish. The bluegills have been propagated for a number of years, and it appears probable that the propagation of buffalo and channel cat may be developed to the point where it can be made successful on a larger scale. The so-called "farm pond" has been conducted as usual. The purpose of this work has been to develop methods whereby ponds may be utilized for the production of fish as a part of the regular farming activities. The same pond has been used each year, and no artificial fish food has been added to the natural supply in the pond. The bluegill sunfish has been used in these experiments, and during the past year a production of 304 pounds per acre was secured.

MOSQUITO CONTROL BY MEANS OF FISH

The experiments and investigations relating to mosquito control were mainly a repetition of the previous year's work, and were continued in cooperation with the United States Public Health

Service and the Board of Health of Augusta, Ga. Special attention was given to the effects upon mosquito control of seasonal variations in temperature and rainfall. It has been shown that the top minnow (Gambusia) is not uniformly effective as an agent for mosquito control. Under certain conditions it has been found to give an almost perfect control of mosquito production, and it is of prime importance to discover just what factors contribute to this efficiency. It is dificult to estimate the importance of mosquito control in the Southern States where malaria is prevalent and causes much distress and inefficiency. An adequate control of mosquito production is a pressing need of sanitarians, and it is felt that the work done to develop the use of fish for this purpose is of great importance.

In addition to a study of the effects of variations in temperature and rainfall, experiments have been conducted to determine the relative effectiveness of Gambusia in waters containing growths of various aquatic plants. Similar experiments have been conducted in previous years, and it is expected that this work, when summarized and analyzed, will do much toward establishing the value of the top minnow as an agent for mosquito control under a variety of conditions.

FOULING OF SHIPS' BOTTOMS

The investigation of the fouling of ships' bottoms, begun in September, 1922, in cooperation with the Bureau of Construction and Repair of the Navy Department, has been continued, and observations made during the winter of 1922–23 were further confirmed. During the year examinations were made of over 100 ships, representing approximately equal numbers of naval and commercial vessels. It has been shown that fouling occurs almost entirely while the vessels are in port, those which are seldom in port and which spend considerable time at sea accumulating little fouling. Fouling is caused primarily by barnacles, with hydroids, algæ, bryozoa, and ascidians next in the order of their relative importance. It has been shown that light bears an important relation to the extent of fouling, and experiments were conducted to determine the reactions to light of the organisms commonly involved. These show that for certain species of barnacles, bryozoa, and tunicates the larvæ have a tendency to avoid the source of light at the time of attachment.

Collections of adult barnacles and of data regarding breeding habits at various stations on the Atlantic coast and at different periods throughout the year have been made to determine the seasonal occurrence and distribution of the "infective stages" of the barnacles. Studies of the life histories and of the factors determining distribution of several species of barnacles have also been made.

INVESTIGATIONS IN EL SALVADOR

At the request of the Minister of Agriculture and Education of El Salvador, Central America, the ichthyologist, accompanied by a representative of the division of fish culture, undertook a study of the fish and fisheries of that country. The survey was made for the purpose of determining the condition of the fisheries of that country and the measures necessary for their conservation and development.

It was found that food fishes were comparatively scarce. This, however, is not surprising, since the country is densely populated and no measures for conservation have ever been enacted. Fishing is carried on at all seasons, frequently by destructive methods, including the use of a powerful plant poison, as well as dynamite when that is obtainable. Neither is there any limit to the size of the fish that may be taken; fish as small as 2 inches in length are seen in the markets daily, both in the dried and fresh state. Recommendations were made for the protection of the fresh-water fishes and for the development of the salt-water fisheries.

NORTH AMERICAN COMMITTEE ON FISHERY INVESTIGATION

Two meetings of the North American Committee on Fishery Investigation were held during the year. At these the bureau was represented by Commissioner O'Malley, Dr. H. B. Bigelow, and Dr. W. H. Rich. Various matters of general interest were discussed, including provision for the collection of more adequate statistics of the bank fisheries, the tagging of cod and the study of its life history, oceanographic and plankton studies, and the development of a definite program of fishery research. Through this committee it has been possible to coordinate the work of the several governments represented at the meeting to the best advantage and to prevent duplication of effort.

PROPAGATION AND DISTRIBUTION OF FOOD FISHES

NEED FOR FISH-CULTURAL OPERATIONS

Almost from the inception of the work of the bureau the need for the propagation of food fishes was felt, but at no stage in the bureau's history has the demand for larger scale operations been so keenly felt as at the present time. Deforestation, pollution of waterways, construction of power dams especially affecting the runs of anadromous fishes, reduction of fish-nursery areas through the reclamation of bottom lands, destruction of the young in improperly screened irrigation ditches, land improvement, and many other factors have contributed to the difficulty of keeping our waters adequately stocked with fish by natural means. The construction of good roads and mountain trails and the increased use of the automobile have made it possible for a much larger number of persons to seek recreation in the open country and more remote places. As a result the number of anglers has been greatly augmented. California alone issues nearly 200,000 angling licenses, a number equal to the number of persons engaged in the commercial fisheries of the entire United States and Alaska. Organizations interested in fish and game are increasing in numbers and membership. Although accurate data are lacking, it may be said that the annual catch by anglers alone now reaches a very high figure. In the commercial fisheries improved methods of merchandising and an increased appreciation of the value of fish in the diet is tending to increase production.

This combination of factors has caused a very heavy strain on our fishery resources, resulting in the serious depletion of some forms and greatly endangering others. The effect on the runs of anadromous fishes, such as shad, salmon, and sturgeon, and on the fishes of interior waters has been especially serious. Forms having a fixed abode or restricted movement, such as oysters, mussels, clams, crabs, and lobsters, also are suffering depletion wherever they are not afforded adequate conservation and conditions suitable for their existence. Commercial fishing for salmon on the Atlantic coast is practically nonexistent, and the future of the salmon fishery on the Pacific coast is in jeopardy. The catch of shad has decreased by 70 per cent, and the lobster catch is less than one-third that of 30 years ago.

Under these conditions the need for supplementing the natural supply of food fish by cultural methods is felt as never before, and the bureau has striven to keep pace with the increasing demands made upon this branch of its service. Production in 1924 was four times as great as in 1904, and was accomplished at considerably less than double the cost of operations then. The bureau's inability to keep pace with the demands made upon it in 1923 is illustrated by the fact that it had on file about 13,000 applications for fish, including about 2,000 carried over from the previous year; in 1924 it had on file 16,000, including more than 3,000 carried over from 1923. The number of applications for 1925 is estimated at 21,000, including about 5,000 that have been carried over.

For the current year the bureau's output exceeds 5,300,000,000 eggs, fry, and fingerlings. Approximately three-fourths of this output represents the salvage of fishes from overflowed regions and of eggs from the catches of commercial fishermen that would otherwise be lost in the course of merchandising. The bureau recognizes the need for economy in Government expenditures and has greatly increased its output with a lowered cost of production per million, thus enabling it to meet in part the increased demands made upon it without an increase in appropriation. The bureau is developing certain new fields that will enable it to greatly increase its output as soon as it is practicable to provide a reasonable increase in its appropriation. For example, under this program the bureau believes it will be possible to raise its quota of distribution of black basses by 500 per cent, and such commercial species as the salmon, lake trout, whitefish, pike perch, cod, haddock, pollock, and flounder by 50 to 100 per cent.

REVIEW OF OPERATIONS

During the fiscal year 1924 new fish-cultural methods of proved efficiency were adopted. The limited appropriations, however, have compelled close adherence to the previously established scope of operations in the main without as large an expansion of operations as the demands on the service require. In so far as facilities would permit, however, every energy was bent toward increasing the output of the marine and coastal species, as well as of the basses, trouts, and other fishes of commercial and recreational importance in the interior waters of the country.

Summary, by species, of the output of fish and fish eggs during the fiscal year ended June 30, 1924

Species	Eggs	Fry	Fingerlings	Total
Catfish			30,245,755	30,245,755
Buffalofish	281,728,500		23,706,323	305,434,823
Carp	13,500,000	28,875,000	36,693,618	79,068,618
Shad		15,033,000		15,033,000
Glut herring		95,000,000		95,000,000
Whitefish	73,560,000	299,220,000		372,780,000
Cisco	10,000,000	128,360,000		138,360,000
Chinook salmon	12,785,100	1,801,000	41,526,405	56,112,505
Chum salmon		23,512,320	765,600	24,277,920
Silver salmon		11,419,990	11,430,150	22,850,140
Sockeye salmon	3,320,000	8,819,840	30,168,545	42,308,385
Humpback salmon		1,260,000	11,580	1,271,580
Steelhead salmon	2,180,000	383,685	4,927,290	7,490,975
Atlantic salmon		494,000	7,000	501,000
Landlocked salmon	90,500	752,350	155,360	998,210
Rainbow trout	1,360,611	1,261,000	3,075,513	5,697,124
Blackspotted trout	13,332,000	6,314,900	2,710,000	22,356,900
Loch Leven trout	2,178,000		2,095,800	4,273,800
Lake trout	1,839,646	34,286,710	313,296	36,439,652
Brook trout	17,857	3,052,089	9,569,385	12,639,331
Smelt	8,000,000	9,300,000		17,300,000
Pike and pickerel		7,392,000	784,027	8,176,027
Crappie			22,575,531	22,575,531
Largemouth black bass		710,950	1,675,724	2,386,674
Smallmouth black bass		596,300	69,500	665,800
Rock bass			100,800	100,800
Warmouth bass			4,519	4,519
Sunfish			27,552,589	27,552,589
Pike perch	97,005,000	71,250,000		168,255,000
Yellow perch		212,009,400	630,452	212,639,852
White bass			714,447	714,447
Fresh-water drum			230,566	230,566
Cod	481,355,000	392,423,000		873,778,000
Haddock	235,330,000	2,590,000		237,920,000
Pollock		263,440,000		263,440,000
Winter flounder		2,244,290,000		2,244,290,000
Miscellaneous fishes			8,641,131	8,641,131
Total	1,237,582,214	3,863,847,534	260,380,906	5,361,810,654

In some fields unfavorable weather conditions interfered with the output of the Pacific salmons. The propagation of the marine species of the Atlantic coast assumed very large proportions, and a record was established in the egg collections of one species—the winter flounder—of which 2,404,887,000 were secured by the three stations engaged in the work. With the exception of two species—whitefish and carp—the egg collections and output of the various commercial species of the Great Lakes were increased slightly over the corresponding figures for 1923. A comparison of trout egg collections with those of the preceding year shows a decrease in numbers for certain species. The most noticeable increases over last year's record occur in the collections of blackspotted trout eggs in the Yellowstone Park, and of Loch Leven trout eggs, as a result of the first year's operations of a new field station in the Madison Valley in Montana.

The most important fish-cultural operations of the bureau are those relating to the maintenance of the commercial fisheries, the welfare of which must be considered of paramount value, because they have a direct bearing on the extent of the country's food supply. In this branch of its activities the bureau's sole source of egg supply is the fish that are taken for the markets, and as such eggs would otherwise be an entire loss it can be readily seen that a vast economic saving is accomplished. At fishing centers too remote from hatching facilities to permit of incubating the eggs it has been the bureau's policy to fertilize and immediately return them to the local spawning grounds. This has been the method of procedure in the Georges Bank cod and haddock fisheries off the New England coast, where immense numbers of eggs are available during the spawning season.

In no case does the large output of practically every species propagated exceed the requirements, and in most instances it is inadequate. This is especially true of such pondfishes as the black basses and the crappies. It is the policy of the bureau to use a large percentage of the output of certain interior hatcheries for stocking the lakes and streams in publicly owned lands. In arranging for such plants the fish are delivered at the shipping point nearest the waters and are transported thereto and liberated through the cooperation of forest rangers and other Government representatives.

The salvage of food fishes stranded on overflowed lands along the Mississippi River continues to be one of the most important branches of the bureau's fish-cultural work. These fish usually spawn when the river is at flood stage, and the high waters allow the adult fish to seek sheltered nesting places on the overflowed lands. With the recession of the waters the adults return to the river, but the young fish resulting from their eggs are imprisoned in temporary waters where, if allowed to remain, they would be killed by drought or the freezing of the pools later in the year.

Another important activity is the inoculation of these salvaged fishes with the glochidia of fresh-water mussels. This work has proved to be of material assistance in maintaining the supply of fresh-water mussels, which furnish the raw material used in the highly important pearl-button industry. In 1922 the take of mussel shells approximated 26,000 tons, valued at more than $1,000,000 to the fishermen. During the past season the number of glochidia attached to the gills of living fishes prior to their liberation is estimated to have reached a total of 1,335,000,000.

RELATIONS WITH STATES AND FOREIGN GOVERNMENTS

There is a growing appreciation of the need for increased fish-cultural operations in the several States. This is evidenced by an expansion of State operations and an enlargement of their cooperative relations with the bureau.

In past years much duplication of effort occurred in the work of distributing fish. Cooperation with State officials has now been brought to the point where it effects a material saving of funds and efficiency of operation. Each year frequent exchanges of surplus eggs are made between Federal and State hatcheries, and profitable results are being attained in the conduct of cooperative egg collections under the direction of representatives of the bureau or under the supervision of State officers. During the past year the services of several of the bureau's employees were loaned to assist State authorities in fish-cultural work, including the location and construction of hatcheries, or to give expert fish-cultural advice. The authorities of the States bordering the upper Mississippi River have rendered valuable assistance in transferring fish from temporary waters to the main channel of the river, and also in making distributions to applicants, thus aiding in the rescue work.

The bureau is frequently called upon to give advice and suggestions to State authorities desirous of securing more adequate fish and game legislation, and some of the State organizations have taken decisive action in an effort to secure better protective legislation. The interchange of eggs with foreign governments has been of great value to this country, since it has enabled the bureau to make larger plants of fish of certain species than would otherwise have been possible.

During the fiscal year 1924 the fisheries authorities of States and of foreign governments were supplied with fish or fish eggs as follows:

Assignments of fish and fish eggs to State and Territorial fish commissions, fiscal year 1924

[Asterisk (*) denotes eggs; dagger (†) fry; all others are fingerlings]

State and species	Number
California:	
Blackspotted trout	*100,000
Lake trout	*75,000
Colorado: Steelhead salmon	*75,000
Connecticut:	
Lake trout	*50,000
Pike perch	*5,180,000
Hawaii: Steelhead salmon	*25,000
Idaho: Chinook salmon	*140,000
Illinois:	
Brook trout	*2,500
Do	1,000
Chinook salmon	*10,000
Loch Leven trout	*20,000
Rainbow trout	*55,000
Do	20
Steelhead salmon	130
Whitefish	*6,560,000
Iowa:	
Brook trout	*9,000
Do	10,250
Rainbow trout	*152,220
Do	12,900
Pike perch	*13,825,000
Maine: Lake trout	75,000
Maryland:	
Black bass	1,740
Chinook salmon	†6,000
Crappie	2,500
Rainbow trout	*30,066
Yellow perch	110
Massachusetts: Lake trout	*3,000
Michigan:	
Cisco	*10,000,000
Whitefish	*3,000,000
Minnesota:	
Catfish	3,000
Crappie	5,000
Lake trout	*250,000
Sunfish	7,950
Yellow perch	245
Missouri: Rainbow trout	*11,000
Montana:	
Blackspotted trout	*8,872,000
Chinook salmon	*200,000
Loch Leven trout	*1,500,000
Nebraska:	
Brook trout	800
Loch Leven trout	4,000
Rainbow trout	*148,000
Steelhead salmon	6,000
Nevada: Steelhead salmon	*25,000
New Hampshire:	
Brook trout	43,200
Lake trout	*75,000
Rainbow trout	6,000
New Mexico:	
Black bass	200
Steelhead salmon	*25,000
New York:	
Blackspotted trout	*10,000
Lake trout	*320,000
Rainbow trout	*10,000
Steelhead salmon	*100,000
North Dakota:	
Black bass	1,950
Catfish	6,000
Crappie	2,000
Steelhead salmon	*50,000
Sunfish	9,450
Yellow perch	900
Oregon:	
Blackspotted trout	*1,000,000
Chinook salmon	*10,880,000
Rainbow trout	*323,010
Sockeye salmon	*3,120,000
Pennsylvania:	
Landlocked salmon	*20,000
Loch Leven trout	*108,000
Pike perch	*78,000,000
Whitefish	*16,680,000
South Dakota:	
Brook trout	1,500
Loch Leven trout	*250,000
Utah:	
Brook trout	22,000
Lake trout	*250,000
Landlocked salmon	*20,000
Steelhead salmon	*100,000
Vermont:	
Lake trout	*291,646
Landlocked salmon	*20,000
Steelhead salmon	*75,000
Yellow perch	†8,500,000
Washington:	
Brook trout	†477,930
Rainbow trout	195,000
Silver salmon	†904,990
Steelhead salmon	†298,685
West Virginia:	
Brook trout	367,000
Loch Leven trout	75,000
Rainbow trout	300,000
Wisconsin:	
Black bass	19,055
Catfish	33,800
Crappie	10,265
Lake trout	*450,000
Sunfish	77,000
Yellow perch	835
Wyoming:	
Blackspotted trout	*723,000
Loch Leven trout	*100,000
Total	*158,406,042 †10,277,605 1,226,860

Shipments of eggs to foreign countries, fiscal year 1924

Country and species	Number of eggs shipped
Canada: Blackspotted trout	250,000
Chile: Sockeye salmon	200,000
Czechoslovakia: Steelhead salmon	50,000
France:	
Blackspotted trout	50,000
Rainbow trout	50,000
Netherlands: Chinook salmon	200,000
Poland: Rainbow trout	50,000
Total	850,000

PROPAGATION OF PACIFIC SALMONS

The fishery for salmon is one of the most important commercially, with an annual catch averaging about 475,000,000 pounds. The need for preventing further depletion of this fish is keenly felt by conservationists, commercial fishermen, and others interested in the perpetuation of our aquatic resources.

The run of sockeye salmon to the spawning grounds in Letnik Lake, in the vicinity of the Afognak (Alaska) station, was the smallest in years, the total escapement amounting to only 8,025.

Fish-cultural work in the Washington field was conducted at the Baker Lake station and six auxiliaries, five of which were in operation throughout the year. The species handled comprised all of the Pacific salmons, including the steelhead, and the aggregate egg collections of the group amounted to 50,545,000, or 1,296,000 less than were obtained in the fiscal year 1923.

A total of 62,043,500 eggs was collected in the Oregon field during the year, most of them being chinook salmon eggs. The station's activities were confined chiefly to the propagation of species of greater commercial importance. At the Snake River (Idaho) substation the experiment was recently undertaken of marking considerable numbers of young chinook salmon of the fall run in an effort to determine the possibility of inducing fall-spawning fish to enter the Columbia River earlier in the year. The financial assistance rendered by the State of Oregon enabled this group of stations to rear a much larger number of fingerling salmon during the year than would otherwise have been possible.

The unusually warm, dry weather which has prevailed for the past two years in the California field interfered seriously with the propagation of chinook salmon, and, working under the handicap of low water, only 6,078,000 eggs of this species were collected. From this stock 1,050,000 advanced fry and 4,486,000 fingerlings No. 1½ were produced and liberated on the spawning grounds in the vicinity.

COMMERCIAL FISHES OF THE GREAT LAKES

In 1922 the commercial fisheries of the Great Lakes yielded in excess of 100,000,000 pounds of products valued at more than $6,450,000. About 85 per cent of this catch, in quantity, consisted of ciscoes (35 per cent), pike perches (24 per cent), lake trout (13.5

per cent), carp (8 per cent), and whitefishes (4.5 per cent). The importance of maintaining these fisheries will be apparent from these figures. During the fiscal year 1924 the bureau propagated these species on as large a scale as was practicable. A very satisfactory collection of whitefish eggs for stocking the Put In Bay station was secured in Lake Erie, the total being in excess of 313,000,000. The field in the vicinity of Toledo, Ohio, has heretofore been considered the most prolific collecting ground for these eggs, but last season only a comparatively small number was secured there.

In view of the improved water conditions at Alpena, Mich., the bureau's hatchery at that point was opened and stocked with whitefish and lake trout eggs collected in local fields.

The collection of lake trout eggs at all points slightly exceeded that of the preceding year, and their quality was about the same.

There was a very satisfactory collection of cisco eggs, the total amounting to 200,790,000, or nearly 134,000,000 more than were obtained in the preceding year.

After being closed for a year the Swanton (Vt.) auxiliary station was reopened for the conduct of pike-perch propagation, cooperative arrangements for the work having been entered into with the fisheries authorities of Pennsylvania, Vermont, and Connecticut.

Owing to the intensely cold weather and the strong easterly winds, pike-perch operations on the spawning grounds in Lake Erie were conducted under difficult conditions, it being impossible at times for the fishermen to lift their nets. Adverse weather conditions also hindered the prosecution of carp propagation in the Put in Bay (Ohio) field. Rather an important addition to the work of this station was the propagation of sauger, 8,400,000 eggs of which species were collected and incubated, producing 7,392,000 fry for distribution.

MARINE SPECIES OF THE NORTH ATLANTIC

Among the most important species taken in our North Atlantic waters are the cod, haddock, pollock, and flounders. The annual catch of cod in these waters approximates 90,000,000 pounds; of haddock, about 80,000,000 pounds; pollock, 25,000,000 pounds, and flounders, 15,000,000 pounds. Improvements in merchandising have greatly increased the demand for these fishes and the importance of maintaining an adequate supply.

A very successful year's work is to be recorded in the collection of eggs of the marine stations in New England, the aggregate collections of all species amounting to 4,046,991,000, or an excess of 843,000,000 over the corresponding figures for 1923. The increase was composed entirely of eggs of the winter flounder, all three of the marine stations securing much larger numbers than last year. On the other hand, there was a falling off of about 277,000,000 in the take of cod eggs.

The Boothbay Harbor (Me.) station concentrated its energies on the propagation of the winter flounder.

The Gloucester (Mass.) station was especially successful in the collection of cod eggs, of which 802,000,000, in round numbers, were secured, establishing a new record with that species. The haddock spawning season came on unusually late, no ripe fish appearing on the inshore grounds until late in March, fully a month after the usual time.

The Woods Hole (Mass.) station accomplished very good work in propagating winter flounder from brood fish captured in nets set by the station employees in Waquoi Bay and in the vicinity of Wickford, R. I.

MIGRATORY FISHES OF ATLANTIC RIVERS

Largely through extensive fish-cultural operations, the runs of shad in the Potomac River have been maintained at a higher level than for any other Atlantic coast stream. The catch in that river for the five-year period, 1919 to 1923, averaged nearly 680,000 fish per annum. The results of the fishing operations in the vicinity of the spawning areas were the smallest in many years. Eggs were taken from April 23 to May 11, on which date the work was brought to an abrupt close by a severe storm.

The reopening of the Capehart fishery in Albemarle Sound after a lapse of several years was the means of effecting considerable improvement in the shad situation at the Edenton (N. C.) station.

No eggs of the Atlantic salmon were collected at the Craig Brook (Me.) station, and the only fish of that species produced were the result of approximately half a million eyed eggs supplied by one of the Canadian Government hatcheries in exchange for an equal number of blackspotted-trout eggs.

Between September 21 and October 5, 1923, 593,000 humpback-salmon eggs were collected from brood fish captured in the Dennys River near Dennysville, Me., the run of that species being the outcome of past efforts of the bureau to acclimatize the humpback salmon in the coastal waters of New England. The fry hatched from these eggs were liberated in the Dennys and Pembroke Rivers.

SALVAGE OF FOOD FISHES FROM OVERFLOWED LANDS

In 1922 the catch of fishery products in the Mississippi River and its tributaries exceeded 105,700,000 pounds, valued at more than $4,500,000 to the fishermen. In addition large numbers of anglers engaged in this recreation, whose combined catch would add materially to the above total. The species of commercial importance are buffalofish, carp, catfish, fresh-water drum, and spoonbill catfish. The catch of fresh-water mussels represents nearly one-half of the total take for these waters. It is highly important that these fisheries be maintained as a source of food and recreation and as a basis for the important pearl-button industry. As the water stages were lower than usual during the period when the river fishes spawn many of the adjoining ponds and sloughs were not flooded. This restricted the field of operations to some extent, but such lowlands as were flooded were found to contain more than the average numbers of young fish. The field of activity extended from Prescott, Wis., on the north, to Andalusia, Ill., on the south, and the season's results were 148,486,316 rescued fishes of various species. All of these were released in the Mississippi River with the exception of 937,814, which were reserved for distribution to applicants.

The total number of larval mussels released in a state of parasitism on living fishes amounted to 1,335,595,300 for the season, as compared with a total of 2,048,977,910 for last year.

PROPAGATION OF FISHES OF INTERIOR WATERS

Collections of eggs at stations where brook, rainbow, blackspotted, and Loch Leven trout and the landlocked salmon are propagated amounted to 78,849,670, or nearly 31,000,000 in excess of the corresponding figures for 1923. This large percentage of gain is attributable to the greatly increased collections of blackspotted-trout eggs in the Yellowstone Park and to the heavy yield of Loch Leven trout eggs in the newly opened field in Madison Valley, Mont.

As in the past, brook and rainbow trout eggs were collected in Utah fields in cooperation with and under the direction of the Utah fisheries department. The stock of rainbow-trout eggs was augmented by the collection of 1,121,700 eggs.

During the entire season of 1923 fish-cultural work in the Yellowstone Park was directed by the district supervisor of the Mississippi River Rescue Station. The field of operations was widened to include practically all streams flowing into Yellowstone Lake, and as a result of such extension and of some improvements effected in the method of capturing brood fish, egg collections of the blackspotted trout amounted to 31,570,000. In view of the difficulty of transporting fry for stocking many of the mountain streams of the park, eyed eggs were planted in the more inaccessible waters. Careful observation of plants of this character, which has been made from time to time, has demonstrated that the results are practically as good as where fry are planted, and the saving in distribution costs by this method amounts to considerable.

Very satisfactory results attended the initial season's operation of a field station in Meadow Creek, a tributary of the Madison River, in Montana, where Loch Leven trout eggs were secured during October and November, 1923.

About the usual numbers of brook trout and rainbow trout were produced at the stations located at White Sulphur Springs, W. Va., Erwin, Tenn., and Wytheville, Va., and the Neosho (Mo.) station was able to augment its collections of rainbow-trout eggs considerably through the operation of the substation established last year at Bourbon, Mo. The outcome of the year's work at this auxiliary exceeded that of 1923 by more than 100 per cent.

Notable results in pondfish culture were attained at the Louisville (Ky.) station; at Lakeland, Md., near Washington, D. C.; and at the Langdon (Kans.) auxiliary of the Neosho (Mo.) station. The Louisville station exceeded its record output of smallmouth black bass in 1923 by over 100,000; the outcome of the initial year's work at Lakeland was remarkably good, while approximately 100,000 bass, crappie, and sunfish fingerlings were distributed as the result of the first year's operations at the Langdon substation under Government auspices.

During the period from March 6 to 29, inclusive, buffalofish eggs approximating 277,000,000 were collected in the Atchafalaya (La.) field.

During May eggs of the buffalofish and carp to the number of 99,-266,000 and 13,500,000, respectively, were salvaged by the bureau's men from fish caught for the market in the Marquette (Iowa) field and returned as fertilized eggs to local spawning grounds.

FISHERY INDUSTRIES

REVIEW

The fishing industry in 1923 to a large extent recovered from the severe depression that existed in 1920 and 1921. The landings of fish by vessels at the principal New England ports substantially exceeded those of immediately previous years. The average price paid the fisherman at Boston for fresh fish was 4.37 cents per pound in 1923 as compared with 3.78 cents in 1922. Although this was a substantial increase, the prices of fish relative to other commodities are still below the pre-war level, though nearly approaching it. The production of canned fishery products and by-products in the United States and Alaska shows increases both in amount and value as compared with the previous year. Particularly notable is the increase in the salmon and tuna packs. The amount of fish frozen during 1923 was greater than in 1922, and the landings of fresh fish in California exceeded those of the previous year. Thus the comparison of the year 1923 with 1922 and previous years indicates, in general, a substantially greater volume of business at improved prices.

In view of the high cost of labor and materials the increased prices do not indicate any extraordinary prosperity. They do, however, relieve the precarious situation of recent years. It is in the nature of the case difficult to assign this recovery to any particular cause, but it should be pointed out that the bureau has in recent years been particularly active in endeavors to improve the condition of the fisheries, with the result that the last few years have been marked by improvements in the handling of fish, such as filleting and brine freezing, country-wide demonstrations in fish cookery, and dissemination of information concerning the health properties of food fish. Some of these activities were actually carried on by the bureau through its division of fishery industries; others were encouraged and largely made possible by the advice and support of the bureau.

The following statistics on the fisheries were taken: Landings of fish by vessels at Boston and Gloucester, Mass., and Portland, Me., published monthly with an annual summary; landings of fish at Seattle, Wash., by fishing and collecting vessels, published monthly with annual summary; canvass of the shad and alewife fisheries of the Potomac River; canvasses of the Pacific Coast States, Mississippi River and tributaries, and the Great Lakes, for the calendar year 1922; quarterly collection of production, holdings, and consumption of animal and vegetable oils in fish canneries and factories; and monthly publication of the cold-storage holdings of frozen fish.

Technological investigations were continued on sardine canning, copper oleate as a net preservative, and determination of the iodine content of fishes. Methods and demonstrations of fish cookery were carried on by the bureau's specialist, and important service was rendered the industry by supplying information on the condition of the fisheries and markets in foreign countries to producers who compete in the foreign market. Attention was directed to both the technological and economic phases of the salt-fish trade, and constructive suggestions were provided for the solution of its problems.

TECHNOLOGICAL INVESTIGATIONS

Fishery technology as practiced by the bureau has to do with improvement of existing and the development of new equipment, methods, products, and practices within the different branches of the fishing industry, and with the proper utilization of its wastes and by-products. The accomplishment of these ends calls for the application of science in many forms and the carrying out of quite widely diversified research, both as to type and purpose. Knowledge of practices thus gained is then presented to the industry, and the application of such practices thereto directed and pushed until they become integral parts of it.

The fishery industries offer almost a virgin field for work of this nature, and a large amount of it must be done before these industries can be placed in the same class as others that supply the Nation with food. Well-directed efforts along these lines may be expected to and do yield large returns. The success that is now being attained with the bureau's net-preservative and sardine-canning investigations bears out this statement.

The policy of the bureau is to carry on such technological investigations as are possible with the limited funds and personnel available for this purpose. The endeavor is made to select broad fundamental studies, which are urgent, which promise to be of the greatest value to the largest number, and which the industry itself is least capable of undertaking. In this work the direct results are not the only ones obtained. A successful investigation gives general confidence in what science can do for the fishery industries and leads to independent initiative in fishery technology.

CANNING SARDINES

In the bureau's experimental laboratory at San Pedro, Calif., continued attention has been given to the technology of sardine canning. This investigation has been yielding excellent results of evident value to the industry. The observations on the keeping and shipping qualities of packs put up according to the methods mentioned in the last report have been completed. The prevalent opinion that the method of preparing the fish for canning is an important factor in the ability of the canned product to withstand storage and transportation does not seem to be true. It was shown by the laboratory that the physical condition of the prepared fish themselves and not the method of preparation is the determining factor. Since the preparation of fish for canning as sardines is essentially a process of removing excess water from them, any procedure that effectively accomplishes the removal of sufficient moisture without adding any foreign product to the fish, and at the same time leaves them in good physical condition, gives a good final product.

Partial drying by moving warm air has so far been an essential step in all successful commercial methods of preparing fish for canning as sardines. Fundamental knowledge of this procedure was needed to make possible further effective work upon the development of a new method. This information was therefore obtained. Now for the first time data are at hand which will enable drying equipment used in the sardine-canning industry to be designed upon a scientific basis. Advantage has already been taken of this fact within the industry, with very good results, in the building of new equipment and the improvement of old. It has been shown that fish may be dried for frying in from one-third to one-fifth the time formerly required. The size of the equipment may also be decreased correspondingly.

The real outcome of the drying research and the studies which preceded it has been the development of a new process of preparing fish for canning. This process depends upon rapidly moving hot air to cook and dry the fish simultaneously, followed by cooling in a blast of cold air so that they may be packed immediately. The time required for carrying out this process has been reduced to about 40 minutes for the largest California pilchards, and operation can be continuous. In the frying-in-oil method now in use the fish are dried at least 30 minutes, fried 7 to 10 minutes, and allowed to drain and cool overnight before being packed. Fish prepared in the new manner are not open to the objections raised against fried fish.

Experiments with the process have successfully passed through small and semilarge scale operation, and plans are now being made by the industry in California for the first large-size installations. It is believed, and this view is generally shared by the packers, that in time this process, or some modification thereof, will be the one in common use.

PRESERVATION OF NETS

With the publication, during the last fiscal year, of the results obtained in the bureau's experiments with copper oleate as a net preservative, the point was reached where commercial fishermen could take advantage of this information. The manufacturers promptly took up its manufacture and were able to meet the large demand created by the adoption of copper oleate as a net preservative by commercial fishermen. Its use has already passed beyond our own borders into other countries.

A recent survey of the New England and Middle Atlantic States showed that copper oleate is being used on a commercial scale with very satisfactory results on the whole. There still remains some difficulty in certain localities in satisfactorily checking the deterioration of nets. Experiments to obviate these difficulties have been continued. It has been found that the excessive solubility of copper oleate in the water is effectively prevented by a combination with tar, and where a stiffness in the net is not objectionable, this preservative is highly satisfactory. Experiments showed further that re-treating lines in fresh water at 30-day intervals more than doubled their life. Most users of copper oleate found that in applying copper oleate better results were obtained when the net was soaked in a solution for several hours instead of dipping it in the solution for a shorter interval.

IODINE CONTENT OF SEA FOODS

In recent years a lack of iodine in food and drinking water has been recognized as one of the most important causes of endemic goiter, cretinism, and other disorders of the thyroid gland. Thyroxin, the active principle of the thyroid gland, has been shown to be an iodine compound. Various observers have shown that it is only necessary to have small amounts of iodine in the food or drinking water to enable the thyroid gland to function properly.

Physiologists and physicians recently have called attention to the probability that sea foods might constitute an agreeable and convenient source of iodine for the public at large. In order to supply exact information on this subject, an investigation of the iodine content of sea foods was made in the fishery products laboratory. The iodine content of a large number of fresh and salt water fish and shellfish was determined. The work showed that oysters, clams, and lobsters are unusually rich in iodine, containing about 200 times as much as such common foods as beefsteak, milk, eggs, etc. Shrimp contain about 100 times as much and crabs and most marine fish an average of about 50 times as much. Fresh-water fishes were found to contain very small amounts of iodine, the quantity being about the same as that found in milk, eggs, beefsteak, etc. The results of these determinations have been published in Bureau of Fisheries Document No. 967.

EDUCATIONAL WORK

The educational work carried on under the auspices of the bureau is probably one of the most effective agencies in relieving postwar depression in the fishing industry. In the past difficulty has been experienced in marketing the catch of abundant well-known food fishes. American housewives, as a rule, lack specific knowledge of the delectable qualities of many of our abundant fishes and are not skilled in the many attractive ways of preparing fish, nor are they acquainted with many of the nutritive and health properties of fish as food. In an attempt to remove these obstacles to a more general consumption of fish special attention was given, through lectures, demonstrations, and the dissemination of informative matter, to better acquaint housewives with this valuable food. Most of this work was carried on by an expert in fish cookery, working under the auspices of the Bureau of Fisheries. Especially successful work was conducted in Boston, New York, and Chicago.

FOREIGN TRADE INFORMATION

The United States is both a large importer and an exporter of fishery products. Information on the condition of the fisheries and markets in foreign countries, including domestic products, is of special interest to our producers. The bureau has an especially close contact with the fishing industry and has lists of firms engaged in the various manufacturing phases, and for these reasons is able to establish direct contact with the different groups and supply the specific valuable information direct to those most concerned. Over 3,500 individual market letters have been mailed to the salt-fish trade, sardine and salmon canners, and producers of fisheries by-products. That this information is of value to the industry is evinced by the many expressions of appreciation that have been received since its inception.

SALT-FISH TRADE

An important fisheries conference held in New York on October 2, 1923, marked the beginning of intensive efforts to properly diagnose the problems of the salt-fish trade. It was successful in bringing about a clearer understanding of the difficulties to which the salt-fish trade is subjected, and a means by which these difficulties might be obviated. Since then the bureau has materially aided the salt-fish trade by the dissemination of foreign-trade information, as mentioned previously. It also directed attention to the study of the utilization of salt fish through its expert in fish cookery. Experiments were conducted and recipes for the attractive preparation of salt fish were evolved. A demonstration in the production of a better grade of salt fish by the bureau's methods clearly pointed the way for the production of salt fish which more nearly retained the desirable qualities of fresh fish, principally in the prevention of toughness without impairing the keeping qualities.

CANNED FISHERY PRODUCTS AND BY-PRODUCTS

The annual canvass of fishery products and by-products of the United States and Alaska was made for 1923 as in previous years. The total value of canned products amounted to $72,445,205, as compared with $60,464,947 in 1922, and the by-products, such as fish oil, fertilizer, fish meal, liquid glue, poultry grit and lime from shell, were valued at $12,702,861, as compared with $11,390,693 in 1922. The results of the canvass were published and distributed to the trade as Statistical Bulletin No. 608.

The salmon pack in Alaska amounted to 5,035,697 cases, valued at $32,873,007, and in the Pacific Coast States the pack amounted to 1,367,263 cases, valued at $12,660,566. This is a substantial increase over 1922. The prices, however, were somewhat lower.

The pack of sardines in Maine, including one plant in Massachusetts, amounted to 1,219,675 cases, valued at $5,288,865 in 1923. This is less than the pack of the previous year, due to a scarcity of fish, and is well below the prewar level. The California sardine pack of 1,115,422 cases, valued at $4,607,931 in 1923, marks an increase in amount which has been continuous since 1921. The prices commanded by this product have suffered a decline during the past three years and have reached a seriously low level.

The tuna pack in California has continued to increase, the pack of all tunas in 1923 amounting to 788,611 cases, valued at $6,914,760. Of this, only 295,546 cases, valued at $3,106,329, were albacore, the highly prized white-meated tuna. The pack of this fish has declined considerably in recent years, its place being taken by related species, a large portion of which have been caught in Mexican waters. A development worthy of note is the "tonno" pack. This is made from several of the tunas, but principally the striped tuna or skipjack, and consists of a highly seasoned pack in oil prepared after the

Italian method. The first appearance in appreciable amount of this style of pack was in 1921, when 1,953 cases, valued at $12,715, were packed. In 1923 this pack totaled 131,745 cases, valued at $1,136,814.

In 1923 the shrimp pack in the South Atlantic and Gulf States amounted to 691,339 cases, valued at $4,256,379. This is a gain of 18 per cent in amount and 39 per cent in value over 1922. As in former years, Louisiana and Mississippi were the leading producers. The crab pack in Alaska, Maine, Maryland, Mississippi, and Virginia was less than half that of the previous year, amounting to 4,138 cases, valued at $47,023. The production of canned oysters in 1923 showed an increase of 3 per cent in amount and 12 per cent in value over that of 1922. The actual pack in 1923 was 537,549 cases, valued at $2,720,073. The pack of razor, hard, and soft clams in 1923 totaled 328,229 cases, valued at $1,710,616. This is somewhat greater in amount and smaller in value than the 1922 pack.

In 1923, 52 plants were engaged in the manufacture of products from menhaden, as compared with 45 plants in 1922. These produced 88,387 tons of fish meal and scrap, valued at $3,094,276, and 7,461,365 gallons of oil, valued at $3,316,277. This is a slight decrease in scrap and meal production and an increase in oil production as compared with 1922. In addition to this there was produced in 1923 from other fish and shellfish, fish scrap, meal, and shrimp bran to the amount of 25,498 tons, valued at $1,319,109, and various fish oils, glue, and miscellaneous by-products to the value of $2,543,793.

The shell products from oyster, mussel, and clam shells included crushed shells for poultry, lime dust, lime, and stucco, amounting to 317,765 tons and valued at $2,429,406. Of this, 308,791 tons, valued at $2,358,535, were from oyster shells.

FROZEN-FISH TRADE

Statistics of the cold-storage holdings of frozen fish and the quantity of fish frozen are collected by the Bureau of Agricultural Economics, Department of Agriculture. These statistics were collected by the Bureau of Markets, Department of Agriculture, from October, 1916, to June, 1922. The reports give the holdings on the 15th of each month. Through the courtesy of that bureau arrangements were made in December, 1921, for the Bureau of Fisheries to publish and disseminate this information, beginning with the returns for January 15, 1922, in the form of a monthly statistical bulletin. This bulletin gives the holdings by species and sections, total holdings for the current month and for the same month of the previous year, the five-year average, holdings for the previous month, and the quantity of each species frozen during the month and during the same month the previous year.

In 1923 the cold-storage holdings of fish, as compared with 1922, were smaller from January to June and larger from July to December. The holdings were smallest in April and largest in December.

The total quantity of fish frozen during the year ending December 15, 1923, was 91,548,643 pounds, which was an increase of 16,094,969 pounds, or 21.3 per cent, over the previous year. The principal species frozen during the year were ciscoes, 16,101,224 pounds; salmon, 11,043,424 pounds; halibut, 10,211,251 pounds; whiting, 8,664,680 pounds; mackerel, 7,248,381 pounds; herring 5,748,228 pounds; and pike perch and pike or pickerel, 4,283,697 pounds.

NEW ENGLAND VESSEL FISHERIES

Statistics of the vessel fisheries at Boston and Gloucester, Mass., and Portland, Me., were collected by the bureau's local agents and published monthly. Two annual bulletins were issued, one showing the catch by fishing grounds and the other by months.

The total landings of vessels at these ports during 1923 amounted to 174,941,469 pounds, valued at $7,051,154, an increase over 1922 of 9.4 per cent in amount and 29 per cent in value. The product was caught by 9.5 per cent fewer vessels and on 2.9 per cent more trips than in 1922. Of the total amount 71 per cent was landed at Boston, while Gloucester received 20 and Portland 9 per cent. Compared with previous years this registers a tendency of the landings to be diverted from Gloucester and Portland to Boston. These fish were taken chiefly from fishing grounds off the coast of the United States, about 77 per cent of them coming from these waters and 3 per cent and 20 per cent being taken from fishing banks off the coasts of Newfoundland and the Canadian Provinces, respectively.

The catch of cod and related fishes amounted to 150,557,106 pounds, valued at $4,963,602. Of these the haddock ranked first in both quantity and value, with cod next. The combined catch of these two species comprises 91 per cent of this category of fish. The catch of halibut, amounting to 4,874,504 pounds valued at $922,654, registers a decline in amount and an increase in value over 1922.

The total catch of fresh mackerel taken by the American fishing fleet in 1923 was 121,982 barrels, as compared with 53,708 barrels in 1922, and of salted mackerel 18,864 barrels, as compared with 2,749 barrels in 1922. Of the total quantity in 1923 there were landed by vessels at Boston and Gloucester, Mass., and Portland, Me., 11,565,228 pounds, valued at $487,637. In 1924 the total catch of mackerel up to July 3 was 38,916 barrels fresh and 860 barrels salted, compared with 25,879 barrels fresh and 346 barrels salted for the same period in 1923.

FISHERIES AT SEATTLE, WASH.

Statistics of the fish landed at Seattle, Wash., were collected by the local agent and published as monthly and annual statistical bulletins, giving the quantity and value of fishery products landed by fishing and collecting vessels during the year at that port. In 1923 this fleet landed 27,625,068 pounds, valued at $2,630,318. The catch by fishing vessels, which consisted largely of halibut, amounted to 10,237,590 pounds, valued at $1,321,587. This registers a decrease in the catch at Seattle, which has been continuous since 1920, and is due largely to the failing supply of halibut. The amount of this fish landed in 1923 was 7,805,000 pounds, as compared with the average for the previous seven years of 12,104,000 pounds. The fish landed by collecting vessels amounted to 17,387,478 pounds, valued at $1,308,731, showing an increase of about 2,000,000 pounds over last year. The catch consisted largely of salmon, 15,711,200 pounds, valued at $1,209,855, being landed in 1923. The king or spring salmon furnished nearly half of this amount, coho or silver salmon about one-third, and the remainder was divided between humpback or pink, chum or Keta, and sockeye or red salmon. The king or spring salmon has increased continuously since 1920, when the catch amounted to 3,269,670 pounds, as compared with the 7,363,900 pounds in 1923.

FISHERIES OF CALIFORNIA

Through the courtesy of the California Fish and Game Commission the bureau has received statistics of the catch of fish, by species, for California, and also the quantity of fish imported into California from Mexico during the calendar year 1923. The catch of fish taken in the waters of California in 1923 amounted to 230,830,942 pounds, as compared with 168,969,733 pounds the previous year, an increase of 61,861,209 pounds, or 37 per cent. The species taken in the largest quantities were California sardines or pilchards, 159,197,006 pounds; albacore and tuna, 16,562,351 pounds; flounders, 10,485,431 pounds; barracuda, 5,135,824 pounds; salmon, 7,090,260 pounds; and bonito or skipjack, 5,057,848 pounds.

The imports of fish from Mexico in 1923 amounted to 23,956,962 pounds, as compared with 12,146,066 pounds in 1922 and 6,699,817 pounds in 1921. These products are caught by fishermen having their home ports in California and fishing in Mexican waters during a portion of the year. The growth of this fishery is due largely to the increased catches of albacore and tuna, which in 1923 amounted to 10,752,864 pounds, as compared with 6,179,754 pounds the previous year, and bonito or skipjack, which in 1923 amounted to 7,519,191 pounds, as compared with 1,792,592 pounds the previous year.

SHAD AND ALEWIFE FISHERY OF THE POTOMAC RIVER

The shad and alewife fishery of the Potomac River was canvassed for the calendar years 1922 and 1923. The statistics show that in 1922 it employed 832 fishermen, with a total investment of $190,532, and produced 884,176 shad weighing 3,115,571 pounds, valued at $420,022, and 11,367,000 alewives weighing 4,546,800 pounds, valued at $38,342.

The same fishery in 1923 employed 888 fishermen, with an investment of $240,832, and produced 351,546 shad weighing 1,187,382 pounds, valued at $198,619, and 11,428,569 alewives weighing 4,570,-828 pounds, valued at $49,421.

Comparing these data with those of recent years, we find that the number of fishermen has remained almost constant, while the catch in 1922 was vastly greater and in 1923 was substantially smaller than heretofore.

FISHERIES OF THE MISSISSIPPI RIVER AND TRIBUTARIES

A canvass of the fisheries of the Mississippi River and tributaries was made for the calendar year 1922, and the summary of the results was published as Statistical Bulletin No. 607. The results of this canvass show that there were 19,122 persons engaged, an investment of $7,345,034, and a production of 105,733,734 pounds of fishery products valued at $4,503,521 in the Mississippi River and tributaries. The principal products taken, in the order of their value, were: Mussel shells, 51,768,173 pounds, valued at $1,050,592; buffalofish, 17,267,177 pounds, valued at $1,013,692; carp, 18,338,371 pounds, valued at $872,128; catfish and bullheads, 8,092,690 pounds, valued at $713,461; fresh-water drum, 5,260,892 pounds, valued at $290,480; paddlefish, or spoonbill cat, 1,398,991 pounds, valued at $132,545; suckers, 699,539 pounds, valued at $63,028.

A comparison of the statistics for 1922 with previous statistics ranging back as far as 1894 shows some very interesting facts concerning the increase and decrease of the catch of certain of our species. The mussel-shell fishery, which in 1894 was hardly touched, only 195,500 pounds having been taken that year, grew to 76,000,000 pounds in 1908, but in 1922 the catch of this product was less than 52,000,000 pounds. It is evident that this industry has reached its maximum development and only the most careful administration will guarantee its perpetuation.

The carp fishery is one based wholly upon a species introduced from Europe. In 1894 about 1,250,000 pounds of this fish were taken. This grew to nearly 31,000,000 pounds in 1908, but in 1922 dwindled almost to 18,000,000 pounds. The catch of buffalofish has been remarkably constant throughout the period mentioned, being between 11,000,000 and 16,000,000 pounds in each of the five canvasses taken during this period. The catches of catfish and bullheads and the fresh-water drum, like that of the buffalofish, have been fairly well maintained. Although decided fluctuations have been indicated in the statistics, no decided trend can be detected.

The story of some of our game fishes is somewhat different. The catch of black bass, for instance, in 1908 amounted to 1,500,000 pounds. In 1922 the catch of this fish had decreased to 73,554 pounds. When the white, rock, and yellow basses are considered we find there has been a continuous decline since 1894. The catches of these fishes in the years in which canvasses were taken were as follows: 1894, 511,000 pounds; 1899, 278,000 pounds; 1903, 105,000 pounds; 1908, 83,000 pounds; 1922, 75,000 pounds. A large part of the decline may be attributed to the fact that the basses are being protected from commercial fishing and reserved for sporting purposes. This action, however, is more likely the result than the cause of depletion.

FISHERIES OF THE GREAT LAKES

A canvass of the fisheries of the Great Lakes, Lake of the Woods, and Rainy Lake was made for the calendar year 1922, and the results were published in condensed form as Statistical Bulletin No. 618. The results of this canvass show that there were 8,162 persons engaged in the fisheries, an investment of $12,186,413, and a production of 110,410,442 pounds of fishery products, valued at $6,799,633.

These totals, when compared with such previous statistics as are available, show that the catch of fish as a whole is being well maintained. On Lake Superior, however, the catch in 1922 was over

4,000,000 pounds less than in 1917; the 1922 catch in Lake Michigan, exclusive of mussels, was less than two-thirds that of 1917 and only slightly above half the 1908 catch; in Lake Huron there was an increase of 500,000 pounds over the 1917 catch, while Lake Erie yielded a catch over 16,000,000 pounds in excess of that of 1917, and Lake Ontario's 1922 catch almost equaled that of 1917.

The yield of some of the more important species in 1922 was: Lake trout, 13,726,959 pounds, valued at $1,647,662; pike perch (three species), 24,798,644 pounds, valued at $1,588,093; ciscoes, 36,161,642 pounds, valued at $1,380,327; whitefish, 4,519,672 pounds, valued at $718,648; carp, 8,129,337 pounds, valued at $331,144; yellow perch, 4,915,454 pounds, valued at $315,919; and suckers, 5,491,916 pounds, valued at $265,075.

Compared with 1917, the catch, in pounds, of lake trout increased by 3 per cent; pike perch increased 169 per cent; ciscoes decreased 33 per cent; whitefish decreased 30 per cent; carp increased 13 per cent; yellow perch increased 17 per cent; and suckers decreased 2 per cent.

FLORIDA SPONGE FISHERY

The quantity of sponges sold at the Tarpon Springs Exchange in Florida in 1923 was 490,200 pounds, valued at $734,391. This total included large wool sponges, 243,230 pounds, valued at $604,343; small wool, 54,292 pounds, valued at $59,721; yellow, 87,878 pounds, valued at $46,868; grass, 88,772 pounds, valued at $15,979; wire, 16,028 pounds, valued at $7,480. It was estimated that sponges to the value of $50,000 were sold at Tarpon Springs outside of the exchange.

ALASKA SERVICE

The work of the Alaska service falls naturally into two broad divisions: (*a*) The protection and conservation of the salmon and other fisheries, and (*b*) the development and utilization of the fur-seal herd of the Pribilof Islands. In the exercise of the duties thus fixed by law it is constantly the aim and objective of the bureau to bring about the greatest possible use of these highly valuable natural resources and at the same time to insure their perpetuation. Within the past year there has been marked achievement in conserving the salmon fisheries, and the development in fur-seal activities has been very satisfactory. The seal herd has been increased from approximately 140,000 animals in 1911 to about 700,000 in 1924, and more than 200,000 skins were taken during that period, while the fisheries of Alaska have grown in value from less than $17,000,000 in 1911 to more than $38,000,000 in 1924.

EXTENT OF THE ALASKA FISHERIES

In 1923 the Alaska salmon industry showed an increase over 1922 in the catch, product, investment, and number of persons employed. Striking fluctuations, due to increased or decreased runs of salmon and the effect of regulations promulgated by the department, were noted in the take of salmon as compared with 1922. In southeast

Alaska the take increased 51 per cent, due chiefly to the larger run and increased pack of humpbacks, while in central Alaska there was a decline of 32 per cent and in western Alaska of 22 per cent.

A comparison of Alaska salmon canning operations in 1922 and 1923 is as follows:

Item	1922	1923	Percentage of increase (+) or decrease (−)
Canneries operated	123	130	+5.7
Cases of salmon packed	4,501,652	5,035,697	+11.9
Value	$29,787,193	$32,873,007	+10.4
Persons employed	17,697	19,439	+9.9
Cases of salmon packed, by species:			
Coho	175,993	164,107	−6.8
Chum	565,918	525,622	−7.1
Humpback	1,658,423	2,448,129	+47.6
King	30,660	38,343	+25.1
Red	2,070,658	1,859,496	−10.2
Number of salmon caught	72,370,400	77,422,311	+7.0

Other salmon products were: Mild cured, 3,372,250 pounds, valued at $726,622; pickled, 2,332,844 pounds, valued at $186,790; frozen, 1,765,289 pounds, valued at $132,522; fresh, 2,926,257 pounds, valued at $244,838; dried and smoked, 778,412 pounds, valued at $39,328; fertilizer, 888,220 pounds, valued at $22,409; and oil, 29,031 gallons, valued at $13,247. The total value of these minor salmon products in 1923 was $1,365,756. The value of similar products in 1922 was $1,779,064.

The products of the herring fishery were as follows: Bait, 5,234,525 pounds, valued at $43,927; Scotch cured, 13,047,433 pounds, valued at $966,025; Norwegian cured, 453,450 pounds, valued at $29,268; roused for food, 50,200 pounds, valued at $2,510; bloaters, 64,222 pounds, valued at $1,939; fertilizer, 6,382,445 pounds, valued at $194,081; and oil, 886,112 gallons, valued at $364,821. The total value of the herring fishery products in 1923 was $1,602,571, as compared with $2,329,116 in 1922.

The halibut industry produced 3,959,105 pounds of fresh fish, valued at $449,638, and 8,214,169 pounds of frozen fish, valued at $804,313, a total of 12,173,274 pounds, valued at $1,253,951.

The cod fishery yielded 5,747,671 pounds of products, valued at $406,932. The whaling industry produced oil, fertilizer, whalebone, and pickled meat valued at $388,681.

The pack of clams amounted to 77,283 cases, valued at $541,139. The output of shrimps was 460,560 pounds, valued at $178,474. Crab products were valued at $14,590. The output of trout products, including 77 cases of canned trout, was valued at $4,122. There were also produced 849,585 pounds of sablefish, chiefly frozen, valued at $49,172; 6,691 pounds of frozen flounders, valued at $190; 7,035 pounds of frozen rockfish, valued at $140; and 1,063 pounds of smelts, valued at $100.

The total value of the manufactured fishery products of Alaska in 1923 is estimated at $38,678,825. The value of the catch to the fishermen was approximately $10,700,000.

The entire Alaska fishery industry gave employment to 25,246 persons and represented an investment of $60,039,677.

A detailed account of the extent and condition of the Alaska fisheries in 1923 and of the activities of the bureau under the laws and regulations for the protection of the fisheries is embodied in the annual report of the Alaska service for that year.[1]

VISIT TO ALASKA BY PRESIDENT HARDING AND OTHER OFFICIALS

An event of importance was the trip of President Harding and his official party to Alaska in July, 1923. Members of the party included the Secretary of Commerce, the Secretary of the Interior, the Secretary of Agriculture, and the Speaker of the House of Representatives. Close attention was given to the fishery resources of the Territory, and as a result a much better understanding was derived of their importance and of matters affecting their conservation.

Another important official visit to Alaska was made by Senator Wesley L. Jones and Representative Lindley H. Hadley, of Washington, accompanied by the Commissioner of Fisheries, who spent about two months in the Territory in 1923. While attention was devoted to various matters of public interest, special consideration was directed to fishery problems. Southeastern, central, and western Alaska, including Bristol Bay, all were included in the itinerary. A trip was also made to the Pribilof Islands to observe fur-seal activities there.

NEW ALASKA FISHERY LEGISLATION AND REGULATIONS

For years attention has been directed to the necessity of securing further legislation for the protection of the highly important salmon and other fisheries of Alaska, which had suffered serious depletion as a result of overfishing primarily through the lack of authority to properly control the situation. The Alaska fisheries act, approved June 6, 1924, represents a distinct advance in providing means for the proper conservation of this our greatest domestic fishery. The broad power lodged in the Secretary of Commerce to indicate the time, place, and manner of taking all fisheries products from the waters of Alaska is the outstanding feature of the act. The act provides for the promulgation of regulations of general application, within each area, and also declares it to be the intent and policy of Congress that there shall be an escapement of at least 50 per cent of the salmon to the spawning grounds. There is an extension also of the 36-hour closed period to Bristol Bay, Cook Inlet, and the Copper River Delta, thus making this prohibition apply to all waters in the Territory. Powers of arrest and seizure are also lodged in designated employees of the bureau.

On June 21, 1924, the Secretary of Commerce promulgated regulations modifying very extensively the fishery privileges previously enjoyed in Alaska. These regulations created eight fishing areas, to which was added one more area later in the season, in all of which distinct limitations were imposed on fishing. Chief among these were the creation of 20-day closed seasons in southeastern Alaska, the extension of the 36-hour weekly closed period in other sections to periods varying from 48 to 84 hours, the fixing of the size

[1] Alaska Fishery and Fur-seal Industries in 1923. By Ward T. Bower. (Bureau of Fisheries Document No. 973.)

of mesh of certain forms of fishing apparatus, the prohibition of specified kinds of fishing gear in designated districts, and the creation of 12 areas in which fishing was entirely prohibited. During the progress of the fishing season of 1924 a number of additional regulations were promulgated by the Secretary of Commerce upon recommendation of the Commissioner of Fisheries, who spent the active salmon-fishing season in Alaska in order to study the effect of the regulations and the need for additional restrictions to fulfill the requirements of the law.

The beneficial effects of the new law and regulations have been self-evident. There has been a far greater escapement of salmon to the spawning grounds in proportion to the size of the runs than for many years past in practically every section of Alaska. Definite results in the increased returns of salmon can not be expected within a period of from two to five years, depending upon the place and species, as it takes this length of time for salmon to mature.

Obviously laws and regulations indifferently or inadequately enforced are of but little value. In the season of 1924, however, there was the most vigorous and complete enforcement of the fisheries law and regulations in Alaska ever undertaken. More than 100 special stream guards and a number of chartered boats in addition to the bureau's regular force of employees and its fleet of 10 patrol vessels were used in the accomplishment of this work. It must be pointed out, however, that a further material expansion in succeeding seasons will be necessary in order to rehabilitate the salmon fishery in accordance with the terms of the law.

The Alaska Fisheries Advisory Committee, appointed in the summer of 1924 by the Secretary of Commerce, will be an adjunct in developing the best methods of controlling and conserving the fisheries of Alaska under the broad authority conveyed by the act of June 6, 1924. The personnel of this committee, which includes both representatives of the Alaska Territorial Fish Commission and commercial fishery interests, is as follows: Gov. Scott C. Bone, chairman, Juneau; Anthony J. Dimond, Valdez; Carl A. Sutter, Ketchikan; Samuel Butts, Sitka; J. R. Heckman, Ketchikan; Calvin C. Hazelet, Cordova; and Harry E. Ellsworth, Seward.

In the season of 1923 fishing within the Alaska Peninsula Fisheries Reservation and the Southwestern Alaska Fisheries Reservation was in accordance with regulations promulgated by the Secretary of Commerce. Fishing in the former was authorized by 15 formal permits, and in addition 28 permits for minor operations were issued by local representatives of the bureau. For fishing in the Southwestern Alaska Fisheries Reservation, 71 formal permits were issued by the Secretary of Commerce, and in addition 292 permits for minor operations were issued locally. The Executive orders creating the Alaska Peninsula Fisheries Reservation and the Southwestern Alaska Fisheries Reservation were revoked by the President under date of June 7, 1924.

In the season of 1923, 17 statutory employees were engaged in fishery protective work. The bureau also employed 46 men as stream guards, of whom 25 were in southeast Alaska, 15 in central, and 6 in western Alaska. The vessels used for the work included 9 owned by the bureau and 14 small power boats chartered for brief periods. The *Kittiwake*, a 70-foot boat acquired by the bureau from the Navy Department, was used for the first time in the patrol work. In 1924 the *Blue Wing* was purchased and added to the fleet.

Violations of the fisheries laws and regulations when detected were vigorously followed by prosecutions. Fines, exclusive of costs, paid in the calendar year 1923 amounted to $4,880. The increased force employed by the bureau in patrolling fishing grounds has greatly reduced illegal fishing, and at the same time has resulted in the detection of a larger percentage of the violations that occur.

ALASKA SALMON HATCHERIES

In the fiscal year 1924 two private salmon hatcheries were operated in Alaska under the provisions of the act of June 26, 1906, and 17,234,000 red-salmon fry were liberated.

The Alaska Territorial Fish Commission has transferred its fish-cultural operations in southeast Alaska from Juneau to Ketchikan, and a permanent hatchery has been constructed at the latter place. The hatcheries at Ketchikan and on Eyak Lake were operated in 1923, but the one on Bear River was not completed in time for fish-cultural work in that year.

The operations of Federal fish hatcheries are discussed in another section of this report.

SPECIAL STUDIES AND INVESTIGATIONS

In 1923 counts of red salmon ascending streams to spawn were made in two streams at Olga Bay, near Alitak, Kodiak Island, and in the Chignik and Karluk Rivers. The counts at the Olga Bay streams together with the commercial catch showed that slightly over half the red salmon entering the waters of Alitak and Olga Bays reached their spawning grounds. At Chignik the commercial take of red salmon was so large in proportion to the escapement that commercial fishing was ordered discontinued at the close of August 21, 1923. At the Karluk River it appeared that a little less than half the run of red salmon was taken commercially.

The study of the migration routes of salmon was continued in 1923 under the direction of Dr. C. H. Gilbert. Ten thousand salmon taken south of the Alaska Peninsula between the Shumagin Islands and Isanotski Strait were tagged and released. Some of these tagged fish were recaptured in Bristol Bay, at Chignik, Alitak, Karluk, Afognak, and in Cook Inlet: also some were recaptured locally on both sides of the Alaska Peninsula. The percentage of the tagged fish retaken in Bristol Bay indicates clearly that a large portion of the run of salmon along the south side of the Alaska Peninsula is bound for Bristol Bay. Most of the fish tagged were red salmon.

The counts of salmon on waters tributary to Olga Bay and at Chignik and Karluk were continued in 1924, and salmon-tagging operations in southeastern Alaska were also inaugurated. Full reports in regard to these activities are not yet available.

ALASKA FUR-SEAL SERVICE

GENERAL ACTIVITIES AT THE PRIBILOF ISLANDS

A resource of great value is the fur-seal herd, now numbering nearly 700,000 animals, which annually resorts to the Pribilof Islands in Bering Sea for breeding purposes. This herd contains more than 90 per cent of the fur seals of the world, and is therefore of great importance in supplying a valuable product of trade.

The protection of the fur-seal herd, the taking of sealskins, the care of the blue-fox herds and the taking of fox pelts, and the support of the native inhabitants constitute the chief features of the work at the Pribilof Islands. The 325 native residents are virtual wards of the Government, and their maintenance is a unique governmental activity, involving as it does the furnishing of all necessaries of life, including educational and medical facilities. In return they conduct most of the sealing, foxing, and other work at these islands, under the supervision of a staff of about 15 white employees of the bureau.

The bulk of the annual supplies required for the islands was transported from Seattle by the U. S. S. *Gold Star* through the cooperation of the Navy Department. A number of employees were also afforded transportation by the same vessel. Valuable assistance in the matter of transportation of employees, mail, and freight was also given by vessels of the United States Coast Guard. Some service was obtained from the privately owned steamship *Buford*.

The new method of stripping skins from seals was extended to cover practically all the skins taken on St. Paul Island during the regular sealing season, and all the skins so taken were washed and blubbered at the island before being cured. Improvements and additions were made to the washing and blubbering plant, thereby completing this equipment. Buildings were constructed on St. George Island with a view to taking up similar work there ultimately.

A number of additional buildings for the use of employees and natives were erected on both islands, and on St. Paul Island considerable time was devoted to the construction of a road to the sealing grounds.

SEAL HERD

Computations showed a total of 653,008 fur seals in the herd on August 10, 1923. This is an increase of 48,046 over the figures for the corresponding date in 1922, and is regarded as showing a satisfactory increase in numbers.

TAKE OF SEALSKINS

In the calendar year 1923 there were secured on the Pribilof Islands 15,920 sealskins, of which 12,841 were taken on St. Paul Island and 3,079 on St. George Island. The smaller take as compared with the past few years was for the purpose of increasing the breeding reserve.

MARKING OF RESERVED SEALS

As stated in the last annual report, the marking of 3-year-old reserved male seals was undertaken in the season of 1923. About 5,000 were marked by a permanent brand and 5,000 by shearing a patch of fur from the head. The marking of seals removes any question that might be raised as to compliance with the law which requires the reservation of not less than 5,000 3-year-old male seals each year.

In the season of 1924 it was decided that the shearing method would answer all requirements in the marking of a reserve. A total of 8,572 3-year-old males has been so marked and will thus be set aside for the establishment of a sufficient breeding reserve.

SALES OF SEALSKINS

In the fiscal year 1924 there were held two public auction sales of fur-seal skins taken at the Pribilof Islands. The first sale was at St. Louis on October 8, 1923, when 2,736 skins, all dressed, dyed, and machined, were sold at a gross price of $66,911, and 30 confiscated skins brought $292.50. At this sale only 2,736 skins of the 14,756 offered were permitted to be sold, owing to the low bids made. The second sale was held at New York on March 24, 1924, at which time 19,804 dressed, dyed, and machined skins and 11 washed and dried skins were sold for $514,518. At this sale there were also sold 3 skins taken from seals shipped in 1923 from the Pribilof Islands to the Steinhart Aquarium and which subsequently died, as well as 35 confiscated skins, the latter bringing $45.50.

The United States Government's share of fur-seal skins taken by the Japanese Government on Robben Island in 1922 was 60 skins. These skins, after having been dressed, dyed, and machined, were sold at public auction as follows: October 8, 1923, 27 skins at $20 each, $540; and March 24, 1924, 33 skins at $17 each, $516.

FOXES

The commercial importance of the blue-fox herds of the Pribilof Islands has long been recognized. It has also been felt that these herds were susceptible of considerable expansion, particularly on St. Paul Island. Early in 1923 the bureau secured the services of a foxing expert who had previously been employed by the United States Bureau of Biological Survey, and detailed him to the Pribilofs for the primary purpose of studying and developing the herds. Particular attention was given to the feeding of foxes on St. Paul Island during the winter season of 1923–24.

The 888 blue and 29 white fox skins taken at the Pribilof Islands in the season of 1922–23 were sold at public auction at St. Louis on October 8, 1923, the former bringing $91,382 and the latter $1,334, a total of $92,716.

In the season of 1923–24, 802 fox skins were secured, of which 46 blue and 14 white skins came from St. Paul Island and 741 blue skins and 1 white skin were taken on St. George Island. The take on St. Paul Island was intentionally limited in order to provide a larger breeding stock, which it is felt can now be maintained because of feeding operations through the winter and early spring.

Forty-eight blue foxes were sold for breeding purposes on Alaskan fox farms at $175 each. It has been decided to limit the sales of foxes from the Pribilof Islands hereafter to possibly a few to natives engaged in fox farming in the Aleutian Islands.

FUR-SEAL SKINS TAKEN BY NATIVES

It is reported that in the spring of 1924 Indians secured 1,029 fur-seal skins in the waters off the coast of Washington. These skins were authenticated for the bureau by the superintendent of the Neah Bay Indian Agency, Department of the Interior. Only 8 skins were authenticated in southeast Alaska in the season of 1924. The latest report at hand states that 2,162 fur-seal skins were taken by natives of British Columbia in 1924.

FUR-SEAL PATROL

A patrol of that portion of Bering Sea frequented by the Pribilof Islands fur-seal herd was maintained in the season of 1923 by vessels of the United States Coast Guard. During the spring migration of the seals in 1924 the herd was protected in the waters off the coasts of Washington and Alaska by vessels of the Coast Guard and the Bureau of Fisheries.

PROTECTION OF WALRUS AND SEA LIONS

In March, 1924, revised regulations for the protection of walruses and sea lions in Alaska were issued. A close season was placed on these animals covering the two-year period from May 1, 1924, to April 30, 1926.

VESSEL SERVICE NOTES

The steamer *Fish Hawk* has completed the hydrographic and biological survey of Long Island Sound made in connection with the oyster investigations, except for two trips deferred for lack of funds and which were planned in order to check up previous observations.

The fishery investigations in the Gulf of Maine were continued with the steamer *Halcyon*. Current observations were made by means of drift bottles on lines running 25 miles offshore—one off Mount Desert, one off Cape Elizabeth, one off Cape Ann, and one off Cape Cod. During the summer of 1923 this vessel was used for the tagging of cod. Two short cruises were made in Massachusetts Bay for temperature observations.

The usual vessels have been utilized for fish-cultural work at the stations on the New England coast and on the Great Lakes.

After completion of the work of installing a new Diesel engine in the *Eider* at Seattle in July, that vessel returned to Alaska and was kept in commission throughout the remainder of the fiscal year. Transportation was furnished to agents engaged in salmon fishery investigations, a number of trips were made to the Pribilof Islands, and considerable assistance was rendered in the spring of 1924 to the round-the-world flight expedition of the Army Air Service.

The *Auklet* and *Murre* were engaged in fishery patrol work in southeast Alaska from July 1 until late in October, 1923. From March 24 to April 5 the *Murre* was loaned to the War Department for use in inspecting structures in navigable waters in southeast Alaska, and from then until the end of the fiscal year she was employed chiefly in protecting the fur-seal herd migrating northward along the Alaska coast. The *Petrel* was operated in southeast Alaska from July 1 until late in October, 1923, and from the middle of April to the end of June, 1924, and the *Widgeon* was in commission in southeast Alaska throughout the fiscal year except while her 60-horsepower twin engines were practically rebuilt.

Upon the completion of repairs and alterations, including the installation of a 65-horsepower union Diesel engine, the *Kittiwake* left Seattle in August and arrived at Cordova early in September. Throughout the remainder of the fiscal year this vessel was operated in the Prince William Sound and Cook Inlet sections of central Alaska.

The *Merganser* was stationed at Ikatan, the *Ibis* at Chignik, the *Scoter* in the Bristol Bay district, and the *Tern* on the Yukon River. These boats were kept in commission for varying periods of time according to the requirements of the service.

The patrol boats cruise from 4,000 to 7,000 or more miles annually.

The steamer *Albatross* was launched October 19, 1882, having been specially designed and built for deep-sea investigations, and by her means important and valuable work has been conducted and accomplished. Owing to changing conditions and increasing cost of operations, the vessel has not been used to any considerable extent in recent years, and on October 29, 1921, she was decommissioned and laid up at the bureau's station at Woods Hole, Mass. To put the vessel in first-class order would have been very expensive, and even then the bureau would not have had a seagoing vessel suitable for modern requirements. It was therefore decided to dispose of her, and she was sold at auction June 5, 1924.

OFFICE BUILDING

On July 1, 1923, in accordance with an act of Congress, the care and maintenance of the bureau's office building in Washington, including heating and lighting, were assumed by the superintendent of the State, War, and Navy Department buildings. The estimated cost was provided for by a transfer of funds from the bureau's appropriation. The arrangement has proven to be very satisfactory and excellent service has been rendered.

A special appropriation of $10,000 for the purpose becoming available on July 1, the building and premises were given a thorough overhauling and put in excellent repair. This has been badly needed for years. The sanitary and plumbing arrangements have been renewed, a new entrance stairway installed, and the lower floor remodeled by tearing out the old machine shop and using the space for exhibition purposes. The installation of a small fishery exhibit has been begun, which will be added to as circumstances permit. Roofs have been repaired and painted, the yard paved, and the main building painted inside and out.

APPROPRIATIONS

The regular appropriations for the bureau for the fiscal year 1924 aggregated $1,223,490, as follows:

Salaries	$456, 960
Pay, officers and crews of vessels for Alaska service	31, 630
Miscellaneous expenses:	
Administration	11, 900
Propagation of food fishes	375, 000
Maintenance of vessels	110, 000
Inquiry respecting food fishes	40, 000
Statistical inquiry	20, 000
Protecting sponge fisheries	3, 000
Protecting seal and salmon fisheries	165, 000
Repairs to office building	10, 000
Total	1, 223, 490

Respectfully submitted.

HENRY O'MALLEY,
Commissioner of Fisheries.

To Hon. HERBERT HOOVER,
Secretary of Commerce.

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IODINE CONTENT OF SEA FOODS[1]

By DONALD K. TRESSLER, *Assistant for developing fisheries*, and ARTHUR W. WELLS, *Assistant technologist, U. S. Bureau of Fisheries*

Contribution from the Fishery Products Laboratory, Washington, D. C.

CONTENTS

INTRODUCTION

In recent years, since Kendall has shown that the active principle of the thyroid gland is an iodine compound, thyroxin, much interest has been manifested in the iodine content of the dietary. The fact that the active principle of the gland is an iodine compound, has strengthened the theory that goiter is induced by a lack of iodine in the food and drinking water.

For many centuries goiter and other disorders of the thyroid have been recognized as endemic diseases and many theories have been advanced to explain why they are prevalent in certain localities and not in others. Substances containing iodine compounds have been used in the treatment of goiter since time immemorial, but only in recent years have their therapeutic properties been explained. In the United States goiter is most prevalent in the Great Lakes region and in the Pacific Coast States, as is shown by the statistics obtained from the Bureau of the Census and presented in Table 1.

TABLE 1.—*Average deaths per 100,000 in various localities*

Locality	Goiter	Other diseases of thyroid
Great Lakes region	2.5	1.0
South Atlantic States	.5	.6
Middle Atlantic States	1.3	.6
New England States	[a] 1.3	[a] .7
Pacific Northwest	2.3	2.1
Southern Pacific States	2.0	.9
Middle Western States	1.3	1.6
Southern Mid-Western States	1.2	.6
Gulf States	1.3	.9

[a] In making up this average Vermont was not included, as it seemed too high in proportion to the other States in that locality.

[1] Appendix I to the Report of the U. S. Commissioner of Fisheries for 1924. B. F. Doc. No. 967.

McClendon (1923) has pointed out that goiter is most prevalent in regions where there is little iodine in the drinking water. His statistics relative to the prevalence of goiter (obtained from records of the drafted men in the United States Army during the World War) and the iodine content of the water are given in Table 2.

TABLE 2.—*Relation of prevalence of goiter to the iodine content of water*

Zone	Goiter rate per 1,000	Iodine in water, parts per billion
1	15 to 30	0 to 0.5
2	5 to 15	0 to 2
3	1 to 5	2 to 9
4	0 to 1	3 to 20

According to this division, zone 1 is confined to the Great Lakes and St. Lawrence River Basins and the northwestern Pacific region. From this zone of greatest prevalence, goiter gradually diminishes toward the lower Mississippi Valley, where thyroid disorders are least prevalent.

McClendon and Hathaway (1923) have further stated that it would take about 2,000 years for a person to drink enough Lake Superior water to accumulate an amount of iodine equal to that found in the thyroid of a normal adult drinking this or similar water. They conclude, therefore, that there must be iodine in foods. Their analyses of certain foods show that those grown in a nongoiterous region contain more iodine than those from a goiterous region.

Many ways of making up the deficiency of iodine in drinking water have been proposed. Many physicians advocate the administration of small doses of iodides from time to time. Kimball and Marine (1917, 1918, 1920, and 1921) have successfully administered iodides to 1,080 schoolgirls of Akron, Ohio. In Rochester (N. Y.) and other cities small amounts of sodium iodide have been added to the municipal drinking water.

Practically all the common foods have been analyzed to determine their iodine content. The presence of relatively large amounts of iodine in any foods is of considerable importance, for such foods would aid in the prevention of thyroid disorders in regions in which the drinking water and ordinary foods are especially deficient in iodine. Analyses of European fishes, mollusks, and crustaceans have indicated that many of these contained much larger amounts of iodine than the other common European foods. Prior to the work described in this paper, very few analyses of American fishes had been made, and those that had been published were determined by methods that were not accurate enough to be considered of value. This work was undertaken to determine the amount of iodine in the various fishes, mollusks, and crustaceans commonly utilized as food in the United States. It is hoped that the data obtained may be of some value in determining the value of these foods in the dietary.

BIBLIOGRAPHICAL

About 75 years ago Chatin brought forward the theory that endemic thyroid disorders, such as goiter and cretinism, were caused by a lack of iodine in food, drinking water, and air. Chatin distinguished four zones, as follows:

1. Normal zone, goiter and cretinism unknown. In this zone the air, water, and food that a man consumes daily contain a total of 1/100 to 1/200 milligram of iodine.
2. Goiter rare, cretinism unknown. Distinguished from zone No. 1 only by very hard, iodine-free drinking water.
3. Goiter more or less common, cretinism unknown. In these regions the daily ingestion of iodine by man is from 1/500 to 1/1000 milligram of iodine.
4. Goiter prevalent, cretinism common. The daily ingestion of iodine is less than 1/2000 milligram of iodine.

In 1852 the Paris Academy of Sciences appointed a commission to verify Chatin's work. The commission examined foods, water, air, etc. Their results agreed with those of Chatin, and they were convinced that iodine was distributed in nature as Chatin claimed. On the other hand, however, the theory that endemic goiter was caused by a deficiency of iodine in food, water, and air was not acknowledged.

Since Chatin's early work, thousands of investigators have studied the cause and treatment of goiter and cretinism. The ultimate result of the work was the discovery of the active principle, thyroxin, of the thyroid gland by Kendall, who has shown its constitution to be 4, 5, 6 trihydro—4, 5, 6 triodo—2 keto B. indolepropionic acid.

The discovery of the iodine-containing principle, thyroxin, and that most of the disorders of the thyroid can be cured by daily administration of thyroxin gives much ground for the belief that goiter is caused by a deficiency of iodine in food and water. Only recently von Fellenberg (1923) has presented a great deal of evidence to support Chatin's theories that goiter and cretinism are caused by a lack of iodine in foods. Von Fellenberg has compared the iodine content of the foods and water of the people of La Chaux-de-Fonds (a district free from goiter) with that of the foods and water of the people of Signau, where goiter is prevalent. He showed that the average amount of iodine in the food consumed in one day by an inhabitant of La Chaux-de-Fonds was 0.0313 milligram, whereas the iodine found in the average day's food of an inhabitant of Signau was only 0.0130 milligram. It will be seen that, while his figures do not agree with Chatin's zones, it was shown that the foods in normal regions contain much more iodine than those from regions where goiter is endemic. His figures showing the iodine content of foods and water in the two regions are presented in Table 3.

TABLE 3.—*Iodine content of various foods from La Chaux-de-Fonds and Signau*

Kind of food	La Chaux-de-Fonds		Signau	
	Mg. I per kilogram	Parts per billion	Mg. I per kilogram	Parts per billion
Lettuce, head			0.027	27
Lettuce, leaf	0.018	18		
Beets	.015	15	.010	10
Cabbage, crisped			.006	6
Cabbage, white	.020	20		
Green bush beans			.008	8
Beans, ripe			.025	25
Carrots	.007	7	.005	5
"Rublikraut"	.061	61	.021	21
Potatoes, peeled	.007	7	.004	4
Potatoes, whole	.018	18	.011	11
Rhubarb, stalks	.010	10	.003	3
Rhubarb, leaves	.021	21	.028	28
Apple, without core	.006	6	.001	1
Apple, with core	.007	7	.002	2
Apple core	.032	32	.019	19
Wheat	.027	27		
Milk	.009	9	.003	3
Water, drinking	.0014	1.4	.000067	
Hay	.047	47	.080	80

Doctor von Fellenberg, however, came to the conclusion that the iodine content of the atmosphere was of relatively little importance as compared with the iodine of the food and drinking water.

Bourcet (1899) was the first chemist to determine the iodine content of a large number of fishes. His results are given in Table 4.

TABLE 4.—*Iodine content of some European fishes as determined by Bourcet*

Kind of sea food	Mg. I per kilogram	Parts per billion
Mollusks:		
Mussel (*Mytilus edulis*)	1.9	1,900
Periwinkle (*Littorina littorea*)	.75	750
Portuguese oysters (*Gryphea arcuata*)	1.3	1,300
Shrimp (*Crangon vulgaris*)	.7	700
Marine fish:		
Coalfish (*Merlangus corbonarius*)—		
Viscera	2.4	2,400
Flesh	.9	900
Cod (*Gadus morrhua*), salt	1.2	1,200
Gurnard (*Trigla cuculus*)	1.2	1,200
Herring (*Clupea harengus*):		
Smoked, roe	.8	800
Smoked, milt	.6	600
Smoked, entire	1.7	1,700
Do	1.8	1,800
Do	2.0	2,000
Ling (*Molva vulgaris*)	1.2	1,200
Mackerel (*Scomber scombrus*)	.3	300
Ray (*Raja clavata*)	.2	200
Sardines (*Alosa sardina*), salt	.6	600
Whiting (*Merlangus vulgaris*)	.3	300
Anadromus fishes:		
Atlantic salmon (*Salmo salar*), head	1.4	1,400
Salmon trout (*Truita marina*)	.1	100
Fresh-water fishes:		
Bleak (*Alburnus lucidus*)	.6	600
Bream (*Albramis brama*)	1.2	1,200
Burbot (*Lota vulgaris*)	.8	800
Carp (*Cyprinus carpio*)	.6	600
Chevenne (*Leuciscus cephalus*)	.07	70
Eel (*Anguilla vulgaris*)	.8	800
Gudgeon (*Gobio fluviatilis*)	.12	120
Mullet (*Chondostroman nasus*)	.6	600
Pike (*Esox lucius*)	.3	300
Roach (*Leuciscus rutilus*)	1.2	1,200

In the light of the work of later investigators, Bourcet's results seem rather high. Because of this there has been some criticism of his work by reviewers.

Forbes, Beagle, et al. (1916), made iodine estimations on a large number of common foods and feeding stuffs. They concluded that in order of increasing abundance of iodine the groups of food rank as follows: (1) Nuts, (2) spices, condiments, and stimulants, (3) fruits, (4) cereals, (5) hays, silage, and forage crops, (6) garden vegetables and root crops, (7) leguminous seeds, (8) animal products, (9) manufactured foods, and milling and manufactory by-products. They found only "traces" of iodine in some samples of fish and crustaceans and none at all in the remainder. However, the method used (Kendall's) is not suitable for the determination of minute amounts of iodine. Bohn (1917), of the University of Wisconsin, repeated many of the determinations of Forbes, Beagle, and others, and reported that his results checked those obtained by them.

Von Fellenberg (1923) carried out extensive researches, which have been mentioned previously, and proved beyond reasonable doubt that iodine occurs in minute quantities in all foods. Some of his analyses have been given above, others are presented below in Tables 5 and 6.

TABLE 5.—*Iodine content of fresh substance of foods and some other plant and animal products as determined by von Fellenberg*

Kind of food	Source	Mg. I per kilogram	Parts per billion
Fruits and vegetables:			
Lettuce, leaf	Bern	0.006	6
Corn valerian (*Valerianella olitorio*)	do	.020	20
Do	do	.030	30
Apple—			
Without core	Canton Bern	.002	2
With core	do	.002	2
Core	do	.009	9
Tropical fruits:			
Oranges—			
Whole		.015	15
Pulp		.016	16
Mandarin—			
Whole		.007	7
Pulp		.008	8
Lemons—			
Whole		.106	106
Juice		.136	136
Figs, dried		.069	69
Dates, dried, without stones		.005	5
Grains:			
Wheat	Canada	.003	3
Do	La Plata	.002	2
Do	Australia	.019	19
Do	Rumania	.002	2
Wheat bran		.007	7
Milk, eggs, and meat:			
Milk	Bern	.005	5
Butter		.106	106
Skim-milk cheese		.038	38
Eggs	Wengi, Seeland	.022	22
Do	Italy	.012	12
Do	Steiermark	.063	63
Do	Bulgaria	.027	27
Veal	Bern	.022	22
Beef	do	.005	5
Ox liver	do	.019	19
Water plants:			
Water cress (brunnenkreese)	Bern market	.448	448
Water cress (bachkreese)	Vicinity of Freiburg	.190	190
Seaweed (seetang)	Brienzersee	.182	182
Agar (edible)		1.660	1,660
Dried seaweed (meerestang)	Atlantic Ocean	900.000	900,000

TABLE 5.—*Iodine content of fresh substance of foods and some other plant and animal products as determined by von Fellenberg*—Continued

Kind of food	Source	Mg. I per kilogram	Parts per billion
Water animals:			
Trout	Bern market	.036	36
Perch	do	.029	29
Sardines, market "Amieux" headless	Mediterranean	.163	163
Tuna	do	.053	53
Bath sponge	Greece	3,870.000	3,870,000
Fats and oils:			
Peanut oil		.004	4
Lard	America	.017	17
Cod-liver oil—			
Refined	Scandinavia	7.200	7,200
Crude	do	3.370	3,370
Beverages:			
Wine	Canton Tessin	.013	13
Fruit wine, pear and apple	Canton Thurgau	.008	8
Cherry mash		.002	2

TABLE 6.—*Iodine content of parts of fishes, as determined by von Fellenberg*

Parts	River trout		Lake trout	
	Mg. I per kilogram	Parts per billion	Mg. I per kilogram	Parts per billion
Muscle	0.0223	22	0.0204	20
Liver	.866	866	.600	600
Roe	1.030	1,030	.124	124
Thyroid gland	2.000	2,000	(1)	
Head, fins, backbone, and entrails	(2)			

1 Not demonstrable.
2 Not determined.

EXPERIMENTAL

THE METHOD

Von Fellenberg's extraction method (1923) was used in determining the iodine content of fish, mollusks, and crustaceans. The procedure was modified so as to be especially adapted for fish. A detailed description of the procedure follows.

Fifty to 100-gram samples of the finely chopped material were weighed into silica or porcelain evaporating dishes and heated in a drying oven at 105° centigrade to constant weight. The dried samples were ground in a mortar with 3 grams of calcium oxide and returned to the dishes. Three cubic centimeters of a saturated solution of potassium carbonate and sufficient water to make a thick paste were then added. The samples were then heated on a hot plate, slowly at first, and more rapidly after the water had been evaporated. After carbonation was complete, the dishes were heated to dull redness until all the carbon had been oxidized. After cooling, the ignited samples were covered with water and then heated until the water boiled. The resulting solution was decanted through a filter and the residue rubbed to pieces with a stirring rod. The extraction with boiling water was repeated five or six times. The resultant filtrate was evaporated to dryness. In order to separate the bulk of the water-soluble inorganic salts from the iodides, the evaporated water extract was extracted with hot 95 per cent alcohol. The cake was rubbed to pieces with a stirring rod and the alcohol decanted through a filter. The alcohol extraction was repeated until the total volume of the filtrate was about 50 cubic centimeters.

This solution was then evaporated to dryness and the residue taken up in a little water. The resultant solution should be colorless; if it was dark it was transferred to a platinum dish and again evaporated to dryness and again ignited until the residue became light in color, after which it was taken up in water and filtered through a small filter into a 60-cubic centimeter beaker.

The solution was then made slightly acid to litmus with iodine-free hydrochloric acid, and a small crystal of calcspar added. After diluting to about 15 cubic centimeters, 1 cubic centimeter of freshly prepared chlorine water was added and the solution boiled rapidly until its volume had diminished to 2 to 3 cubic centimeters. After cooling, a small crystal of pure potassium iodide was added and a drop of starch solution. Thousandth-normal sodium thiosulphate was then added from a burette until the blue color disappeared. The quantity of iodine in the original sample can be calculated from the following equations:

$$HIO_3 + 5HI = 3I_2 + 3H_2O$$

$$3I_2 + 6Na_2S_2O_3 = 6NaI + 3Na_2S_4O_6$$

Upon the addition of the chlorine water to the acid solution any iodine in the form of iodide is immediately set free. The boiling with the excess of chlorine oxidizes the iodine to iodic acid, and also volatilizes the surplus chlorine. Upon the addition of potassium iodide to the cool acid solution the iodic acid immediately oxidizes five molecules of hydriodic acid to iodine. Each six molecules of thiosulphate required in the final titration indicates the presence of one atom of iodine in the original sample.

Great care was taken to make sure that all chemicals used in the analyses were iodine-free. The alcohol and hydrochloric acid were always purified to remove traces of iodides.

By this method amounts of iodine as small as one-millionth of 1 per cent could be estimated.

The results of the analyses are presented in the following table. Except where noted, the determinations were made on the edible portion of the muscle parts of the fresh fish. The results have been calculated on both the fresh and the water-free basis.

TABLE 7.—*Iodine content of sea foods*

Kind of sea food	Fresh substance		Water-free substance	
	Mg. I per kilogram	Parts per billion	Mg. I per kilogram	Parts per billion
Mollusks:				
Clams, hard (*Venus mercenaria*)	1.37	1,370	6.20	6,200
Oysters (*Ostrea elongata* Solander [1])	1.16	1,160	6.00	6,000
Oyster juice from "selects"	.12	120	3.17	3,170
Scallops, giant (*Pecten grandis*)	.15	150	.81	810
Crustaceans:				
Crabs, blue (*Callinectes sapidus*):				
Soft, whole	.09	90	.49	490
Meat flakes	.18	180	.87	870
Lobster (*Homarus americanus*)	1.38	1,380	11.59	11,590
Shrimp (*Peneus setiferus*), headed	.45	450	2.25	2,250
Marine fish:				
Bluefish (*Pomatomus saltatrix*)	.26	260	1.87	1,870
Cod (*Gadus callarias*)	.24	240	1.00	1,000
Haddock (*Melanogrammus æglefinus*)	.29	290	1.05	1,050
Halibut (*Hippoglossus hippoglossus*)	.25	250	.83	830
Mackerel—				
Common (*Scomber scombrus*)	.14	140	.33	330
Spanish (*Scomberomorus maculatus*)	.40	400	1.41	1,410
Pollock (*Pollachius virens*)	.12	120	.90	900
Pompano (*Trachinotus carolinas*)	.08	80	.25	250
Scup (*Stenotomus chrysops*)	.30	300	.95	950
Spot (*Leiostomus xanthurus*)	.59	590	1.40	1,140
Spotted squeteague (*Cynoscion nebulosus*)	.02	20	.08	80
Squeteague (*Cynoscion regalis*)	.23	230	.85	850
Tautog (*Tautoga onitis*)	.27	270	1.17	1,170
Winter flounder (*Pseudopleuronectes americanus*)	.18	180	.73	730
Anadromous fishes:				
Alewives (*Pomolobus pseudoharengus*), smoked	.26	260	.50	500
Rock (*Roccus lineatus*)	.45	450	2.00	2,000
Smelt (*Osmerus mordax*)	.01	10	.07	70
White perch (*Morone americana*)	.42	420	1.42	1,420
Fresh-water fishes from Lake Erie:				
Cisco, smoked	.24	240	.55	550
Cisco roe, smoked	.27	270	.87	870
Lake trout (*Salvelinus namaycush*)	.01	10	.04	40
Whitefish (*Coregonus clupeiformis*)	.03	30	.11	110
Fresh-water fishes from the Potomac River:				
Bass, largemouth black (*Micropterus salmoides* Lacépède)	.05	50	.19	190
Perch, yellow (*Perca flavescens*)	.02	20	.09	90
Pickerel, eastern (*Lucius reticulatus* LeSueur)	.07	70	.30	300
Fresh-water fishes from the Mississippi River at Fairport, Iowa:				
Bass, largemouth black (*Micropterus salmoides*)	.01	10	.04	40
Black bullhead (*Ameiurus melas*)	.01	10	.04	40
Bluegill (*Lepomis incisor*)	.04	40	.18	180
Bowfin (*Amiatus calva*)	.02	20	.08	80
Buffalofish:				
Bigmouth (*Ictiobus cyprinella*)	.02	20	.08	80
Razorback (*Ictiobus bubalus*)	.02	20	.08	80
Carp (*Cyprinus carpio*)	.01	10	.04	40
Carp sucker (*Carpiodes difformis*)	.03	30	.13	130
Channel catfish (*Ictalurus punctatus*)	.01	10	.04	40
Drum, fresh-water (*Aplodinotus grunniens*)	(2)	(3)	(4)	(5)
Gar pike (*Lepisosteus osseus*)	.01	10	.04	40
Gizzard shad (*Dorosoma cepedianum*)	.01	10	.04	40
Spotted sucker (*Minytrema melanopes*)	(2)	(3)	(4)	(5)
White crappie (*Pomoxis annularis*)	.01	10	.03	30
Marine mammal: Whale steak, canned	(2)	(3)	(4)	(5)

[1] Same as *Ostrea virginica*.
[2] Less than 0.01.
[3] Less than 10.
[4] Less than 0.04.
[5] Less than 40.

CONCLUSIONS

The results of the analyses of fish and fishery products agree in the main with those of von Fellenberg. They are, however, somewhat lower than those obtained by Bourcet, but are of the same order. The results of this work, as well as that of von Fellenberg and Bourcet, tend to show that many of the conclusions of Forbes and Beagle were erroneous. There can be no doubt that iodine is to be found in all fish and fishery products, mollusks, and crustaceans. Moreover, it has been clearly shown that marine fish and shellfish contain much more iodine than fresh-water fishes.

The data indicate that marine fishes, mollusks, and crustaceans contain a higher percentage of iodine than any other common foods. Oysters, clams, and lobsters contain more iodine than any other marine food, with the exception of marine algæ, which, unfortunately, does not enter into the dietary of many Americans. As a matter of comparison, it is shown that oysters, clams, and lobsters contain about 200 times as much iodine as milk, eggs, or beefsteak; shrimp 100 times as much; and crabs and most ocean fishes 50 times as much. In order of decreasing iodine content the more common foodstuffs are divided into the following groups: (1) Marine algæ, (2) oysters, clams, and lobsters, (3) shrimp, (4) crabs and most ocean fishes, (5) freshwater fishes, vegetables, beefsteak, milk, etc.

It is evident that by using marine fish or shellfish in the diet two or three times each week the amount of iodine ingested could be increased considerably. These facts should be of interest to the American people, especially to those living in the so-called goiterous belts in which the iodine content of the water and foods is below normal. This is important in planning the diet of young people living in districts where disorders of the thyroid gland are common.

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PROGRESS IN BIOLOGICAL INQUIRIES, FISCAL YEAR 1924[1]

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CONTENTS

INTRODUCTION

The importance of the part biological investigations play in the work of conserving and developing our fisheries has come to be almost universally recognized. The old idea that the resources of the sea are practically inexhaustible is no longer held by anyone informed on the subject, and the necessity for measures of conservation is admitted.

The rapid growth of our population and improvements in methods of conducting the fisheries and of transporting and marketing fishery products have increased the demand for these products and the strain on the resources, and at the same time have increased the pollution of both coastal and inland waters to such an extent that many regions formerly productive are now barren of aquatic life or show serious depletion attributable solely to this cause. In other regions the erection of dams or other obstructions in streams and the establishment of extensive irrigation systems have shut off important spawning regions or destroyed their value. The present condition of our fisheries is thus the resultant of a large number of interacting forces, and the greatest care must be taken if these resources are to be preserved.

[1] Appendix II to the Report of the Commissioner of Fisheries for 1924, B. F. Doc. No. 971.

Although not all are agreed as to the best methods for providing conservation, it is appreciated that to be effective they must rest on a *firm foundation of scientific information.* Regulatory laws limiting the season in which fishing may be carried on or the type of gear that may be used must be formulated in the light of a *knowledge of the biology of the various species of fish that form the* basis of the fisheries in question. Artificial propagation must also be regulated through a knowledge of these factors, and information must be secured as to the causes affecting, adversely or otherwise, the development, survival, and growth of the eggs and young fish. It is the office of the division of inquiry to provide such data as these, upon which adequate regulations and effective propagation may be based.

It is always difficult to draw the line between scientific investigations of practical application and those of purely academic interest. Probably few investigations in pure science are without their ultimate practical application, and likewise few investigations designed primarily to solve practical problems are without their bearing on the problems of pure science. This applies with peculiar force to fishery problems, and to provide an adequate and comprehensive program for fishery research is a difficult task. In general fishery problems are exceedingly complex. Aside from the influence of man, the relative abundance of fishes depends upon the relative abundance of the smaller aquatic plants and animals that form their food and of the numerous enemies that prey upon them from the time the eggs are laid until maturity. Again, the abundance of these smaller forms is directly dependent upon other factors—temperature, etc.—and in the ocean currents play an extremely important part in the distribution of the eggs and of the very young fish. Yet to the average layman the investigation of such things as oceanic currents, the temperature and salinity of sea water, and the microscopic life of both the sea and fresh-water streams and lakes may seem far removed from the legitimate purposes of fishery investigations. This is far from being the case, however, and any comprehensive plan for fishery investigations must involve studies of this character.

Just what is meant by conservation? This much-abused word does not mean merely saving, although it is probable that to most persons the two words are synonymous, for we might save the fisheries without conserving them in the true sense. They might be saved by prohibiting all fishing, but this would not be conservation. To conserve means rather to guard and protect the resources so that depletion may not occur and that they may continue indefinitely to provide food for man. It may be said that the conservation of a fishery resource involves as much its utilization to the fullest possible extent compatible with its perpetuation as it does the preserving of the resource against undue exploitation. The care of the fisheries has not been developed to the stage of perfection reached in the care of the important agricultural products, but advances have been and are being made in spite of the fact that in many ways the problems are more difficult, since most fish can not possibly be reared to maturity under the control of man. There is no reason to suppose, however, that the husbandry of fishery resources may not some time attain an efficiency far greater than that of to-day. If the fisheries are to be utilized to the fullest extent compatible with their maintenance, it is especially important to understand fully the biology of the fishes, since only in the light of such knowledge can they be given scientific care.

With the comparatively limited funds at its disposal, it has been necessary to plan the work of the division with the greatest care. An effort has been made to attack those problems most likely to prove of value in the work of conservation. A general plan was outlined in the report of the division for the fiscal year 1923, and this plan has been followed as nearly as practicable. A great deal of effort has been devoted to the study of the life histories of the important food fishes, crustaceans, and mollusks. These life-history studies provide such fundamental data as the rate of growth, age at maturity, time and manner of spawning, habits of the young, feeding habits of both young and old, extent and direction of migrations, extent to which various groups of fish mingle, particularly with respect to their interbreeding, and the enemies or other elements in their environment which tend to reduce the abundance of those fish and other forms from which we obtain our fishery products.

In addition to these studies of the adult and young of the food fishes themselves it is important to know the plankton, the minute animals and plants found everywhere but in varying abundance in both fresh and salt water. Very young fish of all species, and the adults of many species, feed directly on the plankton, and their survival in a given locality is dependent upon the presence there of the proper planktonic forms. Moreover adult fish that do not feed directly upon plankton are dependent indirectly upon plankton for their nourishment, since the animals on which they do feed in their turn feed upon plankton. The abundance of food fishes is therefore directly dependent upon the abundance of plankton, and a knowledge of the plankton is as important in the husbandry of fish as is a knowledge of forage plants and grasses in animal husbandry as practiced on our farms and ranges. But even with a knowledge of the plankton there is still left a gap in our information on the causes affecting the abundance of food fishes. Just as the abundance of fish is dependent on the abundance of plankton so is the abundance of plankton dependent upon various physical and chemical factors. Temperature, salinity, and the presence or absence of various substances in solution in the water all affect the abundance of plankton. The oceanic currents, likewise, are important factors in the distribution of both plankton and young fish. These studies of the oceanic currents and of the physical and chemical characteristics of both salt and fresh water constitute the sciences of oceanography and hydrography, and are of the greatest importance if we are fully to understand the fluctuations in abundance of our food fishes. Slight changes in temperature or shifts in the oceanic currents may cause extensive migrations or the destruction of great numbers of young and adult fish.

A comprehensive program of fishery investigations must therefore include three fairly distinct though closely correlated lines of study: First, the study of the biology of the fishes, crustaceans, and mollusks themselves, their life histories and ecological relationships; second, the study of the plankton on which, either directly or indirectly, they depend for their food; and third, the study of those physical and chemical factors that determine the abundance of planktonic forms. In the belief that the first of these has the most immediate application in the solution of fishery problems, special emphasis is being placed on life-history studies. Plankton and oceanographic studies are being carried on, and their fundamental character and importance are such that it is hoped that more adequate provision may be made for them in the near future.

It is felt that the results obtained in many of the researches undertaken have already proved to be of such practical value that the importance of the work of the division should be recognized by increased appropriations. The investigations of the salmon of Alaska, for instance, have made possible the control of this fishery in a most scientific manner. The regulations now in force could not have been outlined without the knowledge of the biology of the fish which has come through intensive study of their life history and migrations. Likewise, the regulations placed on the rapidly developing clam industry in Alaska were based upon the results of biological investigations. The mussel resources of the Mississippi Valley, upon the maintenance of which the important pearl-button industry depends, are being maintained by methods developed through researches conducted by this division, and the improvement of fish-cultural methods is founded largely on the results of various scientific investigations. The value of such investigations as are being made is receiving more recognition than ever before, and it becomes increasingly difficult, with the present appropriations, to meet the demands made on the division.

The recent passage of the reclassification bill has greatly improved the status of the employees and will make the service more attractive to competent workers. However, the service of the division does not depend entirely on having satisfactory salaries for the men engaged in research. Adequate funds for equipment, travel, etc., are required for carrying on the various investigations, and the results of the efforts of the division will doubtless be in proportion to the financial support given. Needed investigations are constantly being postponed for lack of funds, and this delay is certain to prove costly in the long run. Delay in the investigation of the causes of depletion in a declining fishery may result in commercial extinction, entailing an economic loss immeasurably greater than the cost of investigation, and when such delayed investigations are taken up they are almost certain to cost more than if performed at the proper time. Furthermore, the chances for a successful solution of the problem are less, since normal conditions are more and more obscured as the fishery becomes more and more depleted. Efficiency in the conservation and care of our fisheries demands additional investigations, and it is hoped that more adequate support will be given.

The following pages contain an outline of the work conducted by the division in its various investigations during the fiscal year ended June 30, 1924:

INVESTIGATIONS OF FISH AND FISHERIES

ATLANTIC COAST

LIFE HISTORY AND MIGRATIONS OF COD, POLLOCK, AND HADDOCK

This investigation was begun in April, 1923, when the *Halcyon* made its first cruise from Gloucester to Nantucket Shoals. A second cruise followed in May and a third in June.

During the present fiscal year a fourth cruise was made in August, a fifth in September, and the sixth and seventh cruises in October. The tagging was concluded on October 17, 1923, for the present fiscal year. These operations have been conducted by William C. Schroeder, scientific assistant, under the general direction of Dr. H. B. Bigelow, of the Museum of Comparative Zoology of Harvard University. As a result of these seven cruises 10,246 fish were tagged. In addition, 891 fish were injured and retained. From these, scales and data were taken to be used in a study of the age and rate of growth. The tagged fish consisted of about 75 per cent cod, 20 per cent pollock, and 5 per cent haddock. About 98 per cent of the fish were tagged on Nantucket Shoals and the remainder at No Mans Land, off Chatham, and in Massachusetts Bay.

The cooperation of fishermen and those connected with the fishery industry is of prime importance to the success of this investigation. Circulars, posters, and news items were distributed among the fishermen and periodicals along the coast from Maine to North Carolina. In addition, one of the bureau's assistants gave direct information to numerous fishing boats at Portland, Gloucester, Boston, New Bedford, New York, and other points. An exhibit showing methods of fish tagging was placed in the Tercentennial Exposition, which was held at Gloucester, Mass., during August, 1923.

Up until the 30th of June the recapture of 218 tagged fish had been recorded. Although this number is but slightly more than 2 per cent of the total number tagged, the results have proved of considerable value and interest. It was proved that many of the cod that visit Nantucket Shoals during the spring and summer remain until fall, when a migration takes place to points between Rhode Island and New Jersey and probably still farther south.

With the exception of one cod taken off Portland, Me., four off Cape Ann, one off Boston (all during the summer of 1923), and one off Plymouth (the date of which is uncertain), all recaptured fish were taken south of Cape Cod. During the summer numerous tagged cod were recaptured on Nantucket Shoals in practically the same place where they were first marked. To illustrate this tendency for the fish to remain in the region where they were tagged, the records show that of nine tagged fish recaptured by the *Halcyon* on October 15, 1923, one had been tagged in May, six in June, one in September, and one early in October, all on Nantucket Shoals. Of three tagged pollock recaptured the same day, one each had been tagged in June, August, and September, 1923, on Nantucket Shoals.

To show the movements of the tagged cod from October, 1923, to June, 1924, the following statement has been prepared. While in some cases the data are meager, nevertheless the migration of cod from Nantucket Shoals to New Jersey in the fall and the return in the spring can be clearly traced.

	Number of fish retaken
October:	
Nantucket Shoals	54
New Jersey	1
November:	
Nantucket Shoals	2
Rhode Island	6
New York	16
New Jersey	6
December:	
Nantucket Shoals	1
Rhode Island	3
New York	10
New Jersey	13
January:	
Rhode Island	1
New York	4
New Jersey	5
February:	
New York	2
New Jersey	1
March:	
Nantucket Shoals	1
Rhode Island	2
New York	3
New Jersey	2
April:	
Nantucket Shoals	1
No Mans Land	3
New York	2
New Jersey	1
May:	
Nantucket Shoals	2
Rhode Island	5
June: Nantucket Shoals	4

In reviewing this table consideration must be given to the changes in the intensity of fishing along various parts of the North Atlantic coast. The large catch made in October on Nantucket Shoals was due to the fact that the *Halcyon* made most of the recaptures while engaged in tagging. Very little fishing is done on Nantucket Shoals during the winter, and this accounts in part, at least, for the absence of tagged fish taken during this period. On the Long Island and New Jersey coasts there is considerable fishing from April 1 to December 15. Practically no cod are to be found in this region from June until October. Besides commercial fishing with pound nets and hand lines, hundreds of boats engage in sport fishing throughout the spring, summer, and fall. While commercial fishing is almost at a standstill during the winter, many anglers fish for cod at this time whenever the weather permits. This midwinter fishing accounts for the few tags taken in New York and New Jersey during January, February, and March, all by sport fishermen. During April both sport and commercial fishing are revived, but cod are taken in considerably less numbers than during the fall. Only three records of recaptured tagged fish were received from this region during April.

The future movements of the fish tagged during 1923 are awaited with interest. While the data at hand are not sufficient to warrant final conclusions, it has been established without question that a definite migration of codfish occurs in the fall from Nantucket Shoals to points between Rhode Island and New Jersey and probably farther south. Furthermore, it is clear that the great majority of these migrated cod return in the spring to Nantucket Shoals. Whether most of them remain in this vicinity during the summer or scatter to various localities is not yet known. Some of them pass on to Georges Bank, since one tagged fish was caught here on April 15, 1924. It is probable that other tagged fish have been taken on this great fishing bank but have been overlooked by the fishermen.

Although three species were tagged—cod, pollock, and haddock—only the cod has furnished sufficient data for a study of migrations. Of 2,215 pollock tagged, only 12 were reported recaptured, and most of these were taken by the *Halcyon* near the locality where they were tagged. Of 411 haddock tagged only 2 tags were sent in, and both records lack the locality and date of capture.

During the fiscal year 1924–25, commencing in July, it is planned to continue fish-tagging operations, for the most part on fishing grounds in the Gulf of Maine.

Considerable time was devoted to the study of cod scales to determine the age and rate of growth of the fish. For this study the scales of more than 600 cod, caught from April to October on Nantucket Shoals, were examined. In addition, the scales of 60 cod taken in January on Georges Bank were utilized. The results of this investigation were very satisfactory and indicated that with the study of additional material considerable information on the rate of growth and age of the cod would be obtained. During the present year it is planned to obtain scale samples from all fish caught, whether tagged or not. This will add thousands to the few hundreds now at hand, these latter having been taken only from fish that were not tagged.

A study of a small number of pollock and haddock scales indicates that the age and rate of growth may be determined by this means. The data already collected will be considerably amplified during the present year.

FISHES OF THE SOUTH ATLANTIC COAST

Near the close of the fiscal year arrangements were completed for a study of the fish and fisheries of the South Atlantic. The services of Elmer Higgins, formerly of the California Fish and Game Commission, have been secured for this important work. At the close of the fiscal year an investigation of the damage done to the fisheries along the Florida coast by such predatory fish as sharks and rays was under way. Headquarters were established at Big Pine, Fla., at which point there is an established fishery for sharks conducted by the Ocean Leather Co. Detailed measurements were made of about 70 sharks, and examinations made of stomach contents and the condition of the sex organs. The sharks were mainly of four species, namely, tiger, dusky, nurse, and hammerhead. They were mostly large specimens, 8 to 12 feet in length. Although the stomachs of many individuals were empty, some data were obtained bearing on the feeding habits. The observations are being continued, and it is expected that more valuable data will be obtained during the next winter, when food fishes, such as the mullet, kingfish, and mackerel, are present in greater abundance.

It is planned to extend these investigations to include studies of the life histories of the important food fishes. The Board of Fish Commissioners of North Carolina kindly offered to cooperate in this work, and it is expected that this arrangement will aid materially in advancing the investigations.

SALMONIDÆ AND SMELTS

It is a pleasure to record that during the past year Dr. William C. Kendall returned to the service of the bureau after an absence of about two years. During this time he was engaged in investigations of the trout of New York State for the Roosevelt Wild Life

Experiment Station of the New York State College of Forestry, Syracuse, N. Y. Since his return Doctor Kendall has been concerned with the continuation of his former studies of the salmonidæ of the Atlantic coast.

Special attention has been given to a study of the smelts and the smelt fishery. The resulting data have been compiled and a paper is now in course of preparation. This paper discusses the distribution of these important little fishes, angling for them and their importance commercially, and the history, decrease, and present condition of the fishery. Extensive field work has been carried on and additional observations made on the breeding habits. The life histories of these fish are being studied, and extensive scale collections are being utilized in determining age, rate of growth, and certain racial peculiarities.

The trout investigations involved, especially, the analysis of brood stocks of rainbow trout in an effort to determine their compositions. It has become evident that more than one species of trout are propagated under the name of rainbow, and there is some evidence to show that certain difficulties encountered in the propagation of trout are due to this fact. Other data have been secured which add materially to our knowledge concerning favorable pond conditions for trout culture and the rate of growth of trout.

It has been found that adult brook trout (*Salvelinus fontinalis*) naturally inhabiting small bodies of water are usually smaller in size than those of larger lakes and streams. It has also been observed that the headwaters of streams are inhabited by trout smaller than those taken from the lower sections or waters into which they flow, and that the general size increases downstream with the increase in volume of the stream. The usual assumption is that the trout of the upper waters are smaller than those below because they are younger. Observations by Doctor Kendall tend to disprove this assumption. A lot of very small trout—3½ to 5 inches—taken from the upper waters of a stream in Maine were examined and found to be adult and near breeding condition. This observation led to a comparison with larger trout from the lower portions of the stream, and it was found that fish twice as long as those of the upper waters—7 to 10 inches—were immature, and that they would not have spawned that year. An examination of the scales disclosed that both of these lots of trout, despite their extreme variation in size and sexual development, belonged to the same year classes, and that they ranged, approximately, from 2 to 4 years of age.

The possible significance of this variation in the size of trout with relation to fish culture, the restocking of waters, and the protection and conservation of trout has not been given serious consideration. Several problems are immediately suggested—the probable effect of heredity upon subsequent growth in a lake or stream from small stock, the possible overstocking of headwaters with the attendant result of small mature fish, and whether the present general system of protection by size limit is the best available.

Some observations were made upon Atlantic salmon, particularly in the markets of Portland, Me., and interesting and valuable data were obtained. Practically no work has been done on the Atlantic salmon since that of Atkins, many years ago, who stated that grilse were rare in Maine waters, and, so far as the fisheries indicated for many years, this appeared to be true. However, it was learned that during the season of 1923 grilse were common in the region of outer Casco Bay, and considerable numbers were taken in mackerel gill nets and in pounds. Some smolts were also caught. A few specimens were secured and scale readings made to determine the ages of both grilse and smolts, as well as adult salmon.

FISH AND FISHERIES OF KEY WEST

A report on the fisheries of Key West, Fla., by William C. Schroeder, has been published (Bureau of Fisheries Document No. 962). It describes the various fisheries of the Florida Keys and includes a detailed account of the clam industry of southwest Florida. Among the subjects treated are reef fishes, the mullet fishery, Spanish mackerel fishery, kingfish fishery, turtles, spiny lobster, stone crab, sponges, and the hard clam. An annotated list is given of all the known commercial food fishes of Key West, a total of 83 species.

The director of the Key West laboratory, Isaac Ginsberg, has continued the collection of a representative series of the fishes of this region. Data bearing on the life histories of certain fishes have also been secured.

LARVAL FISHES OF THE WOODS HOLE REGION

During the past year the investigation of the larval fish of the Woods Hole region has been continued by Marie D. P. Fish. The purpose of the work has been to study the seasonal distribution of the species occurring in this vicinity in relation to the physical factors of temperature, salinity, etc., and particularly in relation to the other organisms occurring with them in the sea. The material and data will serve also as a basis for a study of the food of larval fish to be carried on later. The collections were made by suspending silk plankton nets from the Bureau of Fisheries' dock for four hours, on the rising tide, daily during the spring and summer months, and three times weekly during the late fall and winter. Drawings were made of developmental stages not already known, and a constant watch is kept for undescribed stages of all species.

A series of cruises was made on the *Phalarope* in Buzzards Bay and Vineyard Sound during the summer and fall of 1923, a 6-foot young-fish trawl being used in addition to the usual small plankton nets. These collections showed the occurrence of larval fish in neighboring localities.

A collection of larval fish made daily at the station in 1921 has been identified and all species recorded. Another large collection made by the late W. W. Welsh has also been transferred from Washington to Woods Hole, and much new material will probably be found among these slides.

An investigation of the early development of the cod, haddock, and pollock, to supplement the tagging investigation now being carried on by the bureau, was begun on May 1 by Dr. Charles J. Fish, assisted by Marie D. P. Fish. The conditions existing during the period of incubation of the eggs, the early larval history, the food during this period, the enemies, and the gradual changes in the feeding habits and migrations during the first year of existence form the basis of the problem.

The work consists of two parts: (*a*) An investigation of the physical conditions, food, and enemies of the larval forms, to be made on the spawning grounds, and (*b*), an investigation of the migrations, feeding habits, and enemies of the young fish after they leave the surface waters and enter the shallow shore zone. The latter work will, for the most part, consist of seining over large areas along the shore to determine the distribution of the young fish. The steamer *Phalarope* is being utilized for weekly seining in the vicinity of Woods Hole and the *Halcyon* and *Gannet* are being outfitted, the former for work in deeper water and the latter to be used north of Cape Cod.

In connection with the cod investigations all young fish taken in seines in the vicinity of Woods Hole have been identified, measured, and recorded. The records of seining collections by the late Vinal N. Edwards, covering a period of 15 years, are now being charted. This data will prove valuable for comparison with results obtained in the present intensive seining program.

CHESAPEAKE BAY

In connection with the hydrographic and biological survey of Chesapeake Bay, which was undertaken several years ago, an extensive collection of fishes was made, and this, together with data bearing on the commercial fisheries, has been studied by S. F. Hildebrand and W. C. Schroeder. Progress in this work has been slow during the past fiscal year, owing largely to the fact that the investigators were engaged in more pressing work. Some time has been devoted to this study, however, and about one-third of the report has been completed. Much of the detail work of the remainder has been finished, leaving only the examination and description of about two-thirds of the specimens to be done. It is expected that all of this work can be completed during the winter of 1924–25.

NORTH AMERICAN COMMITTEE ON FISHERY INVESTIGATIONS

This committee, formerly called the International Committee on Marine Fishery Investigations, met twice during the year. The first meeting was held in Ottawa, Canada, on November 9, 1923, and the second in Boston on May 2, 1924. Commissioner Henry O'Malley was appointed to fill the vacancy left by the resignation of Dr. H. F. Moore. At the close of the fiscal year the committee consisted of the following members: For Newfoundland, D. James Davies; for France, E. Le Danois; for Canada, W. A. Found, Dr. J. P. McMurrich, and Dr. A. G. Huntsman; for the United States, Henry O'Malley, Dr. H. B. Bigelow, and Dr. Willis H. Rich. At the Ottawa meeting Doctor Bigelow was elected permanent chairman to succeed Doctor Moore.

The function of this committee is to provide a means of contact for the various countries interested in those North American marine fisheries that are international in character. Through the meetings of the committee it is possible to coordinate the scientific investigations conducted by the various agencies, to avoid duplication of effort, and to plan for future investigations to the best advantage.

At the two meetings held during the past fiscal year a number of important topics were discussed. The work of the bureau in tagging cod, pollock, haddock, salmon, and other commercial species received attention and favorable comment. The Canadian fisheries authorities plan to undertake similar work, and the hope was expressed that the tagging operations of the bureau would be continued and expanded. The records of current drift bottles released by Canada and the United States on the coast north and east of Sandy Hook were discussed, and arrangements were made for putting out additional lines of these bottles.

The important bearing of oceanographic investigations on fishery problems was brought out and discussed at some length. The committee was unanimously of the opinion that these investigations are of fundamental importance and should receive additional attention.

Steps were taken to secure more uniform statistics of the fisheries. It was decided that each country should issue the statistics on the catch of cod, haddock, etc., at the end of each calendar year instead of for the fiscal year, as formerly. Arrangements were made for an exchange of statistics bearing on the fisheries of the Grand Banks, this exchange to be made as soon as the statistics are compiled, in order that any country so desiring may publish complete statistics as well as the data dealing with the fishing operations of its own citizens.

The desirability of an investigation of the mackerel fishery was again discussed, and it was urged upon the representatives of the United States that this country undertake this work as soon as possible. Plans have been made to do this, but no active work had been done by the close of the fiscal year.

INTERIOR WATERS

COREGONINÆ OF THE GREAT LAKES

The whitefishes and related species form the most important fishery resources of the Great Lakes. The investigation of these fish has been continued by Dr. Walter Koelz and John Van Oosten, scientific assistants. Doctor Koelz has been concerned primarily with a study of the systematic relationships and natural history, and Mr. Van Oosten with the life histories, including age and rate of growth as determined from a study of the scales.

All the collections necessary for a determination of the species of coregonines in the Great Lakes have been made, and it is now possible to state that there occur in the Great Lakes Basin 11 species. In Lakes Nipigon and Superior there are 8 coregonines, in Lake Michigan 10, in Huron 9, in Erie 2, and in Ontario 7. Only two species occur in all six lakes. Three are found in five of the lakes, 3 in four, 2 in two, and 1 species is found in only one lake. Except for the latter, which is a western species and occurs in the east only in Lake Nipigon, the coregonine fauna of the various lakes of the basin is essentially alike, but each species has become more or less differentiated in each of the lakes in which it occurs, and sometimes there are marked racial differentiations within a species in one lake.

A preliminary report dealing with the fishery industry of the Great Lakes, which is supported largely by the coregonines, has been submitted for publication. The first draft of the accounts of the systematic relationships and natural history of 7 of the 11 species, and illustrations of the various forms, have been prepared, and it is hoped that the final report may soon be ready for the press.

The investigation of the life histories of the coregonine fishes of Lake Huron has been continued and extended during the past year. Two investigations have been conducted in the field with the financial support of the department of conservation of the State of Michigan. The first was carried on in the region of Alpena, Mich., with the principal object of obtaining additional material and data on the blackfin, a species gradually undergoing extermination. More than 2,500 coregonine scales were secured, of which 1,250 were taken from blackfins. Many of the bays of Lake Huron were seined for juvenile coregonines, but none were obtained. The second expedition involved a survey of the waters of Grand Traverse Bay, Lake Michigan, and four inland lakes—Elk, Torch, Pine, and Walloon. These waters were studied primarily for the purpose of collecting data on the distribution and ecology of the coregonines, and on the habitat of the juvenile fish. A report of this survey has been prepared.

During the past year the final report covering most of the work of the last two years was completed and is now being prepared for publication. In it the scientific status of scale study, as applied to the lake herring (*Leucicthys artedi*), is critically discussed. By this method a rather detailed and complete life history has been worked out for the herring and a less complete one for the whitefish, blackfin, and pilot.

With regard to the herring it was found, among other things, that from 87 to 97 per cent of the commercial catches of herring consisted of individuals in their third, fourth, and fifth year of life, and that no one year class predominated for more than one year. Another thing of interest is the fact that the herring of Saginaw Bay suddenly increased their rate of growth during and since the year 1919. This sudden acceleration in growth in Saginaw Bay is correlated with improvements in the environmental conditions in the bay. Many historical data on the pollution of Saginaw Bay were obtained, and they showed that the increased growth rate is correlated with decreased pollution. The growth of the Bay City herring was compared with that of herring taken at 11 other localities on Lake Huron.

"A Study of the Scales of Whitefishes of Known Ages," by Mr. Van Oosten, has been published by the New York Zoological Society. It is believed that the results of this scale study will give an added value to future investigations of this kind, for never before has such material been available for study. Scales from whitefish hatched in January, 1913, from eggs from Put in Bay hatchery and reared in the New York aquarium were examined. The scales studied were removed from fish that were in their eighth and ninth year of life. It was found that the annuli in the scales of the aquarium whitefish corresponded in number with the winters of the fishes' lives, not including the first one, in which the fish were hatched. The ages of whitefish may therefore be determined from their scales. These annuli were winter marks, formed on the retardation or cessation of scale growth in late summer and winter and completed on the resumption of scale growth in the spring. The diameter of the scales appeared to be a better basis for the length calculations of whitefish than the anterior radius, which has nearly always been used in the past for many species of fish.

A rather complete life history of the New York aquarium whitefish is given, which includes statements as to the character of the food consumed, the number of feedings, the changes in the amount of food consumed, the temperature of the water in different months of different years, sexual maturity, spawning, and the rate of body growth. The rate of body growth of the aquarium fish is compared with that of Lake Huron whitefish. The significance of each of the above life-history facts, rate of growth excepted, as a factor in the formation of annuli, is discussed.

This work on the corengoninæ of the Great Lakes has been carried on in the laboratories of the department of zoology of the University of Michigan. The aid and advice of Dr. Jacob Reighard has been freely given and, with the cooperation afforded by the State department of conservation, has done much to promote the progress of the investigations.

MISSISSIPPI RIVER FISHES

Investigations into the life histories and migrations of some of the important food fishes of the Mississippi River were conducted by R. L. Barney, director of the Fairport laboratory. Mr. Barney left the service before the investigations were completed, but it is planned to continue the work. Studies were made of the life history and spawning habits of the lake sturgeon (*Acipenser rubicundus*), the shovelnose sturgeon (*Scaphirhynchus platyrhynchus*), and the sheepshead (*Aplodinotus grunniens*). Extensive collections of scales and otoliths from the sheepshead were prepared for examination, to be used in a study of the age, rate of growth, and age at maturity.

Other researches bearing on Mississippi River fishes have been conducted at the Fairport hatchery and will be described in the section dealing with investigations pertaining to fish-cultural operations.

PACIFIC COAST AND ALASKA

ALASKA SALMON

The red-salmon fisheries located in Bristol Bay and along the Alaska Peninsula are among the most valuable of the fishery resources of the United States. On account of extensive exploitation they were in real danger of serious depletion when the Alaska fishery reservations were established. Administration of these reservations was vested in the Department of Commerce, acting through the Bureau of Fisheries. During the past year the reservations have been superseded by legislation which, however, leaves the administration of the fisheries of Alaska in the hands of the Department of Commerce. In order that regulations may be adequately based the bureau has undertaken an extensive investigation of the various phases of the life history of these fish. Of special importance has been the extent, direction, and rate of the oceanic migrations of the fish, with particular reference to the relationship of the fish taken in Bristol Bay to those taken near the extremity of the Alaska Peninsula. In an effort to solve this problem the bureau, during 1922, tagged 4,000 red salmon—mainly in the region south of the peninsula but close to the extremity. The details of this work were given in the last annual report of this division.

These experiments were continued on a larger scale during the summer of 1923. Ten thousand fish were tagged from the large fishing traps located along the south shore of the Alaska Peninsula close to its extremity and from traps in the Shumagin Islands. Scales were taken from each individual as it was tagged and liberated. Most of the fish tagged were red salmon, though a few hundred humpbacks, dog salmon, and silver salmon were also used. The work was conducted by Dr. C. H. Gilbert and W. H. Rich, assisted by W. P. Studdert.

The results confirmed in every important respect those obtained the previous year, and gave much additional information. Again a large proportion of the fish tagged were taken in Bristol Bay, proving beyond doubt that the run of fish, which is of such commercial importance along the southern shore of the Alasaka Peninsula, is composed in large measure of fish bound for Bristol Bay. Their home streams are located in the Bristol Bay district, and they are on their return migration to the streams from which they came at the time they are taken commercially. Apparently the feeding grounds of these salmon during their life in the ocean is along the continental shelf of the North Pacific. Evidence is available which shows that the fish found south of the peninsula pass through Isanotsky Strait on their way to Bristol Bay.

The rate of travel is approximately 20 miles per day during the early part of the season, but this increases during the season until the rate is nearly double this toward the end of the season, the latter part of July. The rate of travel is apparently slower to near-by streams and faster to more distant regions, such as Bristol Bay and Cook Inlet.

In addition to the migration to Bristol Bay, some of the salmon are bound to local streams along the southern shore of the peninsula, and to a less extent to local streams along the northern shore. An interesting feature of this local migration is that the fish bound for these local spawning grounds apparently school separately from those bound for Bristol Bay. This is particularly indicated by the fact that in Morzhovoi Bay, the first large indentation of the southern coast of the peninsula east of Isanotsky Strait, the fish tagged along the western and northern shores of the bay were predominately Bristol Bay fish, while those tagged along the eastern shore during the latter part of the season went mainly to local spawning grounds to the eastward. A few of the fish tagged in the region about the Shumagin Islands went eastward as far as Chignik, Kodiak and Afognak Islands, and Cook Inlet.

In addition to the scales collected from the tagged fish extensive series of scales and measurements were made from fish taken for commercial purposes in Bristol Bay, along the Alaska Peninsula, and on Kodiak and Afognak Islands. Many of these scales have been examined and the results are being correlated with the results of the tagging operations. A report giving a detailed analysis of the data is in an advanced stage of preparation.

A number of the important spawning streams in Bristol Bay, along the Alaska Peninsula, and in southeastern Alaska were visited and observations of value recorded bearing on the life history of the salmon and on the number of spawning adults found in the various streams. In certain cases it was found that the streams were not as heavily populated as in other years. A more accurate census of the spawning population than can be obtained through such observations has been made on several streams. Weirs are erected for this purpose and the number of salmon passing through is accurately recorded by observers stationed at the weirs. Such censuses were conducted in the Karluk and Chignik Rivers and in Letnik Creek (Afognak Island).

SALMON OF THE PACIFIC COAST STATES

These investigations have been continued. The study of the chinook salmon taken by troll and purse seines off the mouth of the Columbia River, in Monterey Bay, and at points along the northern coast of California, which has been carried on for a number of years by Willis H. Rich, has been completed and a report submitted for publication. The results show that a high percentage of the fish taken in the ocean are small and immature and would not have entered the streams for the purpose of spawning for at least one more year. These small fish are known to be of poor quality, and the taking of them results in a serious economic loss. The percentages of mature and immature fish so taken have been worked out for the entire season, and it is shown that there are relatively many more immature fish taken during the early part of the fishing season than later. The relative maturity of the fish was determined by careful measurements of the eggs, and it was found that a differential growth occurs during the spring and summer just preceding the fall in which the fish spawn. This differential growth results in a great increase in the relative size of the eggs, so that quite early in the season females that are due to spawn in the fall may be distinguished from those of the same age and size, but which will not spawn for at least one more year. Recommendations are made for the control of the fishery. This paper also deals with the rate of growth of chinook salmon in the ocean. The capture of fish during their life in the ocean has provided an unusual opportunity for such a study.

The extensive experiments in marking young salmon on their liberation from the various hatcheries on the Columbia River have been continued with gratifying results. This work is being conducted by Harlan B. Holmes, scientific assistant, who has been materially assisted by the fine cooperation afforded by the Oregon Fish Commission. During the commercial fishing season of 1923 and 1924, and the spawning season of 1923, a constant search was made for returning marked fish. As a result of these efforts, records of approximately 500 marked salmon were reported.

Returns from a marking of 65,000 chinook salmon from eggs taken on the Willamette River in 1919 and liberated at Bonneville during October, 1920, are particularly pleasing. Eleven of these fish were reported during the early part of the 1923 season, and over 200 have been reported thus far this season. The capture of 25 four-year-old chinooks marked at the Little White Salmon hatchery were reported last season. Judging from the proportion of four and five year old fish returning from other experiments, very good returns are expected from this experiment during the latter part of the present season. The reported capture during May, 1924, of 16 four-year-old Willamette fish liberated at Bonneville gives promise of good returns from this experiment next season. Over 300 five-year-old marked sockeyes were reported last season. These fish were hatched from eggs brought from Alaska, but reared and liberated in the Columbia. Twelve hundred individuals from this same experiment were reported during the season of 1922. This experiment has been the most successful, in so far as the number of returns secured is concerned, of any of this series of marking experiments.

The following new marking experiments were started during the past year:

1. Alaska sockeyes reared and liberated at Enterprise, Oreg.
2. Alaska sockeyes, second generation in Columbia River, eggs collected and the young reared and liberated at Herman Creek.
3. Fall chinooks from Little White Salmon River, reared and liberated at Salmon, Idaho.
4. McKenzie River chinooks, reared at Bonneville and liberated in the Wallowa River.

FISHERIES OF CALIFORNIA

During the past year arrangements have been made to cooperate with the California Fish and Game Commission in the important studies they are conducting on the fisheries of that State. The scientific work of the California commission has been developed within recent years through the efficient efforts of Norman Scofield and W. F. Thompson. At the present time special attention is being given to the sardine and tuna. Although the aid that can be given this work is not great, it is believed that such cooperation as is planned will lead to more effective work and to a feeling of mutual interest and responsibility in the difficult fishery problems awaiting solution.

FISHERIES OF EL SALVADOR

During the year the Government of El Salvador, Central America, requested that a scientist be loaned for the purpose of studying the fish and fisheries of that Republic. S. F. Hildebrand, ichthyologist, was assigned to the work and spent two months (January and February, 1924) in El Salvador, accompanied by F. J. Foster, of the division of fish culture. The expenses were borne entirely by that country.

The investigators were accorded the most cordial and helpful cooperation by the officials of the El Salvadorian Government, and were provided with facilities that greatly assisted in the work and promoted its success. All of the fresh waters of importance were visited and collections of fishes were made in each. Plankton specimens and crustaceans and some of the more important plants also were taken. The fish collection has been studied and a systematic report concerning these fish will soon be ready to be submitted. The plants were identified by Mr. Stanley, of the United States National Museum, who has collected plants extensively in El Salvador. The plankton specimens were turned over to Dr. C. Dwight Marsh, of the division of animal industry, Department of Agriculture. The crustaceans were identified by Doctors Rathbun and Schmitt, of the United States National Museum.

It was found that food fishes are scarce. This, however, is not to be wondered at, for the country is densely settled and no measures of conservation have ever been enacted. Fishing is carried on at all seasons, frequently by destructive methods, including the use of a very destructive plant poison as well as dynamite when obtainable. Neither is there any limit to the size of the fish which may be taken. Fish 2 inches and upward in length are seen in the markets daily, both in the dried and fresh state.

In a preliminary report concerning the investigation, which was submitted to the Salvadorian Government, recommendations were made for the protection of the fresh-water fishes. It was also suggested that while the fresh waters apparently were greatly overfished the salt waters of the coast and the estuaries were practically untouched.

The top minnows, although used for food and not infrequently present in the markets, are abundant in nearly all the permanent waters visited, and mosquito breeding appears to be reduced to a minimum, while in disconnected pools and cow tracks containing no fish mosquitoes were breeding prolifically. It was recommended that the use of top minnows for food be discouraged as far as possible, and that their sale be prohibited by law. An interesting collection of fishes and other forms was made and transmitted to the United States National Museum. A longer and more complete report is being prepared. This report contains statements in regard to the great scarcity of fish in the Republic, the destructive methods of fishing in use are denounced, and recommendations for regulations that may be helpful in conserving and building up the fisheries are made. The employment of a biologist to study the habits of the local fishes is strongly recommended, as it is impossible to induce sane measures of conservation until more is known about the habits of the fishes. The spawning season of even the commonest food fishes is not now known with any degree of certainty.

INVESTIGATIONS OF SHELLFISH AND TERRAPIN

OYSTERS

J. S. Gutsell, scientific assistant, continued his studies of the oyster-set problems of the Connecticut shore of Long Island Sound and of Great South Bay, Long Island. Investigations were made at Great South Bay chiefly for two reasons: (1) To discover the cause of the heavy mortality of the set or spat which sometimes occurs there, and (2) to add to the knowledge of the early life history of the oyster and of the factors affecting spawning. Because of the excellent survival during the summer of 1923 only negative evidence as to the cause of spat mortality could be obtained. This survival coincided with an absence in the bay of the black muck that generates hydrogen sulphide, and which was so prevalent in 1921, when heavy mortality occurred. This tended to support the hypothesis that the hydrogen sulphide generated on the bottom was a principal cause of spat loss. Valuable data in regard to larval life history and the effects of temperature on spawning were obtained.

About Milford, Conn., a fairly good young set was almost entirely lost while still minute. Search and inquiry in September showed a quite generally distributed but (except in a few favored places) very light set. The increased oyster planting on inshore lots, as advocated by the bureau, is believed to have helped matters. At Milford the work of testing the effect of materials occurring as pollutants was continued. Salts of copper, zinc, and lead were used. As in previous trials, copper proved most deadly. Young oysters placed in a solution containing 1 part of copper per million were killed, so that but 30 per cent survived after 5 days. In a solution containing 2 parts per million all died within 4 days. In the controls nearly complete survival occurred. Solutions of zinc and lead salts of 10 parts of the metal per million exhibited no greater toxicity than did solutions of 1 and 2 parts of the copper per million. In the case of large larvæ solutions of copper salt in strengths varying from 10 to 0.5 parts of copper per million and of zinc and lead in a strength of 10 parts per million proved fatal in less than a day. In the controls the greater portion of the larvæ lived into the second day.

The services of J. W. Sale, chemist in charge Water and Beverage Laboratory, Bureau of Chemistry, were obtained from the Department of Agriculture. Mr. Sale investigated the Housatonic River, New Haven Harbor, and Hammonasset River, principally for heavy metals. Hammonasset River, comparatively free from pollution, showed no trace of copper or zinc, both of which were found in considerable quantities in the other waters. Copper was found in both the Housatonic River and New Haven Harbor in quantities approaching those which experiments indicate are deadly to oyster larvæ.

Experiments in a new method of artificially propagating the oyster were carried on during the summer of 1923 by H. F. Prytherch at the plant of the Connecticut Oyster Farms at Milford, Conn. The objects of this work were (1) to determine by a series of experiments the important environmental conditions required by the oyster larvæ for normal growth and development; (2) to raise a small number of the larvæ under controlled conditions during the free-swimming period until they "set," and (3) to perfect the method so that oysters may be raised from the egg in sufficiently large numbers to make the process one of commercial value.

The new method proved successful in an experimental way from the start, and two batches of oysters were raised from the eggs under artificial conditions. This success was attributed to the close imitation of natural conditions. In the first place, millions of fertilized eggs were obtained by allowing the adult oysters to spawn naturally under favorable conditions and not by cutting them open and stripping the apparently ripe eggs and milt from them. As soon as the eggs developed into tiny swimming oyster larvæ they were reared in tanks of running water for 15 to 20 days until they "set." The greatest problem of artificial propagation has been that of retaining the minute larval oysters when supplying them with running water, as they are so small that they will pass through felt or the finest bolting silk until they are several days old. For this purpose a new material known as "filtros" was tested out under various conditions and proved entirely satisfactory. Although these experiments have proved successful on a small scale, there is still much to be accomplished before the method can take its place as a part of commercial oyster culture.

In order to lay before practical oyster growers and biologists the various problems that have made artificial propagation a difficult task, a report on Experiments in the Artificial Propagation of Oysters has been published (Bureau of Fisheries Document No. 961). This work will be continued at Milford during next summer for the purpose of developing the method to a point where it may be of practical value to the oyster industry.

The regular cruises planned for the hydrographic and biological survey of Long Island Sound were completed in October, 1923. The survey was inaugurated in 1922 in order to obtain fundamental information relative to the hydrographic and biological conditions having immediate bearing on the problems of oyster culture in Long Island Sound waters. It covered a period of over 15 months, beginning on June 30, 1922, and ending on October 10, 1923. During this time the fisheries steamer *Fish Hawk*, employed for the survey, made 410 stations, 111 of which were made during the fiscal year just closed. The hydrographic data obtained in field observations were analyzed, and the biological collections are in process of examination. This work has been conducted by Dr. P. S. Galtsoff, naturalist.

Detailed observations were made on the temperature of the water in the Sound, salinity, dissolved oxygen, acidity (pH), number of bacteria, plankton, spawning of oysters, and sterility of male oysters.

The results of this survey indicate that the difficulties in oyster culture in Long Island Sound may be ascribed to several causes, the following being the most important:

(1) Most of the spawning beds located in shallow water in harbors, bays, and in the mouths of rivers are now exposed to pollution either by sewage or by trade wastes; (2) the beds located in clean waters are greatly overfished and have become exhausted; (3) many of the inshore beds, not exposed to pollution, are attacked by starfishes and drills. In East Haven River, for instance, it is estimated that more than 50 per cent of the young oysters were killed by drills.

To restore the industry it is believed that it will be necessary (1) to protect the beds from pollution, (2) to set aside public spawning beds, (3) to organize methods for the systematic extermination of oyster enemies, and (4) to develop the artificial propagation of oysters.

ALASKA CLAMS

During the summer of 1923 Dr. F. W. Weymouth, of Stanford University, accompanied by H. B. Holmes, scientific assistant, visited the clam canneries and beds in the vicinity of Cordova and in Cook Inlet, Alaska. Surveys of the local conditions were made and data obtained for the determination of age, growth, size at sexual maturity, and the date of the breeding season. Subsequently data for comparison were obtained from the Washington coast. This field work will be continued and extended during the current summer by Doctor Weymouth with the assistance of H. C. McMillin, scientific assistant, who during the past year has been investigating the razor clam for the State of Washington. These investigations have been undertaken for the purpose of securing information on which to base regulations for the conservation of the rapidly expanding fishery. The data already secured have been used in preparing the regulations now in force.

The more important findings and the problems that require solution may be briefly summarized. Preliminary surveys of the density of population on the beds in the older regions and their history indicate that these have about reached their full commercial development and that more intense fishing is unwise. Data from the examination of the shells have made it possible to picture the growth in a number of localities. Among other interesting facts brought out is that growth is much more rapid on the Washington coast, and that therefore a marketable size is reached in one-half to two-thirds the usual time. The set of young on the Alaskan beds was far inferior to that on the Washington coast, and this has apparently been the case in past years. The comparison of growth for many localities in this widely distributed species shows an interesting relation between growth and latitude and will probably throw light on the question of local races.

In consequence of the slower growth and less abundant spawning of the Alaskan clam, the experience on the Washington coast is no safe guide to the intensity of the fishing that the beds of Alaska will endure. If, however, the intensity of the fishing is wisely regulated, and a breeding reserve assured by a proper size limit, there is no reason that clam canning should not be a permanent and valuable industry on many Alaskan beaches.

A preliminary report has been submitted and a more comprehensive report is in course of preparation.

FRESH-WATER MUSSELS

The investigations bearing on the life histories and artificial propagation of fresh-water mussels, have been carried on as usual by the staff of the biological laboratory at Fairport, Iowa. Mussel surveys were made in Lake Pepin, on the Mississippi River between Dubuque and Keokuk, and in Arkansas on the White, Black, and St. Francis Rivers. The Lake Pepin survey was one of a series of annual mussel surveys in that lake, made with the object of determining the effect of the yearly propagation of the fat mucket (*Lampsilis luteola*) upon the mussel population of the lake, and to learn more accurately the effect of the closure of various sections of the lake for four-year periods on the quantity of mussels available for the fishery. It is believed that one or two more surveys will be necessary before conclusions in either case can be reached. In Arkansas the survey was made with the purpose of assisting that

State in establishing in certain rivers areas that should be closed for a period of years in order to restore their mussel life.

The experiments in rearing mussels in troughs was undertaken on a larger scale than previously, and 100 new troughs were added to the 42 already installed. The new troughs were not given the protection of a shed, however, as was the case with the original troughs. The original troughs produced 160,000 young mussels, while, owing apparently to the exposure and consequent overheating in the sun, production in the new troughs was a total failure. This and other defects in the installation of the troughs and the conduct of the experiments have been remedied and the work is being repeated. If this method can be perfected it is believed that it will prove of great importance.

During the summer Dr. L. B. Arey, temporary investigator, continued his study of the normal cyst and of the immune cyst, and the relationship between mussel embryo and host fish.

The mussels retained at the station become infected with a ciliate (Conchopthirius), referred to in the report of last year. This ciliate invades the marsupia of the mussels and destroys numbers of glochidia. It is thought that the presence of this ciliate may be consequent on a polluted condition of the water, due, perhaps, to the increasing amount of sewage entering the Mississippi above Fairport from Davenport, Rock Island, and Moline. If this proves to be the case it may be anticipated that the increasing amount of sewage in the river will mean increasing difficulty in handling mussels at the station. It is quite possible that this ciliate may seriously affect the culture of mussels in troughs at this station by destroying the juveniles as soon as dropped. Owing to these conditions it is believed that the station's contributions to the aid of the mussel industry must come through surveys, with the recommendations resulting therefrom, and the various studies made largely by temporary workers in the ecology and life history of the commercial species.

TERRAPIN

The experiments in the culture and breeding of diamond-back terrapin, which have been conducted at Beaufort, N. C., for a number of years, have been extended. The work has been done under the general direction of S. F. Hildebrand and the immediate supervision of Charles Hatsel, acting director of the Beaufort laboratory.

Thirty lots of diamond-back terrapin are now on hand. These lots represent terrapins of different ages, or terrapins of the same age which have been or are now being treated differently, and each lot in itself or in combination with other lots represents an experiment. All terrapins now on hand, except two lots, have been hatched in captivity, and several of the lots represent terrapins of a second generation that are being grown in confinement.

The experiments under way include tests of the longevity of the diamond-back terrapin, a determination of the age at which reproduction ceases, selective breeding experiments, the results of hybridizing the North Carolina with the Texas terrapin, the value of winter feeding in a hothouse, the natural sex ratio in terrapins, the necessary number of males to a given number of females to produce maximum fertility of the eggs, the necessary space requirements of terrapins in captivity, winter requirements, and food and water requirements.

In the experiments on selective breeding several lots of terrapins were selected when quite young (usually at the age of 1 year) for their large size and generally fine appearance. Other lots, representing the "runts" of the same brood or broods, were set aside for comparison. It is noteworthy that among these early selections of "fast growers" many have not continued the rapid growth, and in several instances the "runts" have overtaken the early fast growers. During the past year new selections have been made from among previously selected terrapins. The terrapins that were further selected had attained sexual maturity. In these new selective breeding experiments three of the very finest females were chosen from a given lot and placed with a single male, which was selected with equal care. Several of these small lots have been set aside, and it is expected that by a comparison of the offspring from different males it will be learned which male is the most desirable. A new and further selection will then be made. It is hoped that in this way a better, larger, and faster-growing terrapin may eventually be developed.

Terrapins hibernate normally during the winter months, and in an effort to produce more rapid growth experiments have been carried on for a number of years in which young terrapin are kept in hothouses during the first winter. Under these circumstances they do not hibernate, but continue to feed and grow.

Diseases are unknown among terrapins 2 years of age or more, but many deaths usually occur among the younger individuals. The deaths among the young up to the age of 1 year may amount to one-third of the total number. This death rate has not differed greatly among those placed in a hothouse for winter feeding and the young that were permitted to hibernate. Advancement, however, has been made in reducing the deaths among the winter-fed young. The simple expedient of scalding the tanks in which the terrapin are held with hot water once a week was employed during the past winter. This treatment apparently was instrumental in reducing the death rate below that of previous years, and it greatly reduced the amount of work necessary to keep down growths of algæ and to keep the tanks clean.

The necessity for daily feeding the young terrapins in the hothouse, as had become the custom, was doubted. Therefore a part of the terrapins were fed only once every other day. The terrapins fed on alternate days gained in growth just as rapidly as those fed every day. Feeding on alternate days was found to save food and to lessen the work required for preparing the food for feeding, and also in keeping the tanks clean.

The diamond-back terrapin cultural work at Beaufort to date has been carried on as experimental work with the view of determining the practicability of growing terrapin in confinement. It has been shown to the entire satisfaction of those who have conducted the experiments that terrapin can be grown in confinement on a commercial scale. The question of the practicability of hatching young in captivity, to be liberated for restocking the depleted natural grounds, has presented itself as a secondary advantage to be gained from this experimental work. During the past several years more young have been produced at the station each year than were desired for experimental purposes. Such young, when about 1 year old, usually were liberated on the marshes in the vicinity of Beaufort. In some years only a few hundred were liberated, but a few times 1,000 or more were liberated. Apparently as a result of these few plantings partly grown diamond-back terrapins have been seen frequently during the past year by fishermen and others, whereas before they were so nearly depleted that such terrapins were seen very rarely or not at all. The apparent results from the limited plantings made are so encouraging that the propagation of diamond-back terrapin for restocking the almost depleted grounds seems highly practicable.

ECOLOGICAL AND OCEANOGRAPHIC STUDIES

CONTROL OF MOSQUITOES BY MEANS OF FISH

Experiments and observations on the use of fish, particularly the top minnow (*Gambusia affinis*), as an agency for the control of mosquitoes have been continued by Samuel F. Hildebrand, ichthyologist, assisted by Irving L. Towers, scientific assistant. This work has been conducted in cooperation with the United States Public Health Service and the Board of Health of Augusta, Ga. During the summer of 1923 a series of experiments was conducted designed to determine the effectiveness of Gambusia as agents for the control of mosquito production in the presence of various types of aquatic vegetation. The experiments were mainly a repetition of the previous year's work, and were continued for the purpose of determining the effects upon mosquito control of seasonal variations in temperature and rainfall. Mosquito production throughout the summer of 1923 appears to have been much less prolific than during the previous year, and the value of the fish, according to the records obtained, was correspondingly smaller. The records, however, have not been critically studied, and it is probable that factors other than seasonal variations in the weather may have contributed to the apparent differences in the effectiveness of Gambusia as agents for mosquito control.

During June, 1924, experiments again were started which, it is believed, will cast further light upon the true value of top minnows as agents for the control of mosquito production under a variety of conditions. It is admitted by practically all officers engaged in malaria control work in the south that Gambusia are, under certain conditions, of great value, but it is also claimed by some that under other circumstances they are valueless. The experiments that are being undertaken are so selected and arranged that one area which, for example, is overgrown with Myriophyllum will contain no Gambusia, while another area similarly overgrown will be stocked with these fish. Weekly dippings will be made in each area, and the number and size of the immature mosquitoes will be tabulated. Similar experiments have been conducted during previous seasons, and the former work, together with the work now under way, when finally summarized, should do much toward establishing the true worth of the top minnow under a number of different conditions.

The impounding of waters for various industrial purposes and the consequent formation of artificial lakes bring about unusual conditions that require special consideration if mosquito production is to be prevented. Several such lakes in Southern States have been examined for the purpose of securing information concerning the effectiveness of Gambusia for mosquito control under the various conditions found in these impounded waters. Conferences were held with public-health officials and recommendations made for the planting and propagation of Gambusia.

OCEANOGRAPHIC WORK

The oceanographic work conducted by the division during the past fiscal year has practically been confined to completing investigations previously begun. Near the close of the fiscal year arrangements were made for hydrographic studies in Great South Bay, Long Island, and for some oceanographic work to be done in the region lying between Woods Hole and Long Island and from the coast out to the Gulf Stream. The last-mentioned region has not been included in other similar work done in recent years, and it is desirable to take this up in order to fill in the gaps in our information.

Rapid progress has been made with the reports dealing with the oceanographic and biological survey of the Gulf of Maine. This work is being done by Dr. H. B. Bigelow, of the Museum of Comparative Zoology of Harvard University. Three reports are planned, which together will cover the work accomplished. The first paper deals with the fishes of the Gulf of Maine, their distribution, relative abundance, and such facts of their life histories as are known. This report was in press at the close of the fiscal year ending June 30, 1924, but has not yet been published. The second report deals with the plankton of this region. The manuscript is practically completed and will be presented for publication in the very near future. The third report deals with the physical oceanography. Considerable progress has been made with this report and it is expected that it will be completed during the present fiscal year. When completed, these three reports will provide a comprehensive survey of what is at present known of the physical and biological factors influencing the distribution and abundance of the food fishes of this region and will form a contribution of first importance to our knowledge of the fisheries.

The hydrographic and biological survey of Long Island Sound has been discussed under the section dealing with oyster investigations, since the survey bore particularly upon conditions as they affected oyster culture.

The work on the survey of Chesapeake Bay is well on its way toward completion. A sufficient number of trips over Chesapeake Bay, covering important stations at definite intervals of time have been made and the results of collections and physical observations are being prepared for publication.

Reports from the following specialists are now in the hands of Dr. R. P. Cowles: Leeches, by Dr. J. P. Moore; ascidians, by Dr. Willard G. Van Name; echinoderms, by Dr. Hubert Lyman Clark; sponges, by Dr. H. V. Wilson; annelids, by Dr. A. L. Treadwell;

hydroids, by Dr. C. W. Hargitt; crabs, by Dr. Mary J. Rathbun; macrura and anomura, by Dr. Waldo L. Schmitt; amphipods, cumacea, schizopods, pycnogonids, and isopods, by C. R. Shoemaker.

Reports on the following are in progress, and it is hoped that they will be completed during the fiscal year: Medusæ, by Dr. Henry B. Bigelow; Sagittae, by Prof. A. G. Huntsman; Bryozoa, by Dr. Raymond C. Osborn; Algæ, excepting diatoms, etc., by Dr. W. H. Hoyt; Mollusca, by Dr. Paul Bartsch; Nudibranchia, by F. N. Balch; plankton, by Dr. Bert Cunningham; Mysis, by Dr. R. P. Cowles and M. Glassman; and fishes, by S. F. Hildebrand and W. C. Schroeder.

The salinity determinations have been completed by Dr. R. C. Wells, and these, together with determinations of densities by Dr. R. P. Cowles, and observations on temperature, wind, tide, character of bottom, and hydrogen-ion concentration, are being studied from a comparative point of view with special reference to the biological data. It is expected that Dr. Cowles will complete the report on this phase of the work during the coming year.

STUDIES OF MARINE PLANKTON IN RELATION TO THE FISHERIES

Young fish feed upon the minute forms of animals and plants, collectively known as plankton, which are found everywhere but in varying abundance in the sea water. Since the survival of the young fish depends upon the presence of the proper plankton forms, it is important to know just which of these forms the young fish feed upon at various stages in their development. The larger adult fish likewise depend either directly or indirectly upon the plankton for their nourishment. They may feed directly upon the larger plankton forms, or their food may consist of other smaller fishes that do feed directly on plankton. The importance of these small marine forms in the economy of fish life is therefore obvious, and no life history of the important food fishes can be complete without taking into consideration the part played by the plankton. The investigation of plankton forms a connecting link between the life-history studies of food fishes on the one hand and the study of physical and chemical oceanography on the other. Only through a study of the plankton is it possible to know how, in general, chemical and physical factors affect the abundance and distribution of the food fishes.

Dr. Charles J. Fish, attached to the Woods Hole laboratory throughout the past year, continued his investigation of the daily and seasonal variation in the plankton of the Woods Hole region. The work, until July, 1923, had consisted of daily observations on physical conditions and collections made from the end of the Bureau of Fisheries' dock. During the summer the work was supplemented by similar observations made throughout Vineyard Sound and Buzzards Bay, the purpose being to determine the horizontal distribution of the various planktonic organisms. Special collections of larval fish were also made, to be used in a future investigation of their feeding habits.

Unusually cold weather prevailing throughout the spring of 1923 had a decided effect on the summer plankton of the region. Almost all of the pelagic forms appeared later than usual, and some comparatively common animals did not appear at all. The diatom maximum, which in 1922 appeared on June 15, did not arrive in Great Harbor until August 9.

A very noticeable factor in the investigation in Vineyard Sound was the direct effect of temperature on the distribution of pelagic animals and on the breeding seasons of benthonic animals having planktonic larvæ. In the deeper waters offshore, temperatures were found in August which compared with the late May and early June temperatures at Woods Hole. The plankton found there also proved to be identical with the May and June plankton of Great Harbor.

The annual distribution of the diatom maximum of the American coast is very similar to that of the eastern Atlantic waters, in that the seasons of the greatest swarms retreat farther and farther from the warmest months as one approaches the Tropics. A similarity in the seasonal variation in European and American waters of the same latitude is particularly noticeable, conditions at Woods Hole corresponding to those in the Adriatic Sea. The great effect of the arm of Cape Cod on the local plankton is again evident, for within 20 miles of Massachusetts Bay, where the seasons of diatom production are similar to those in the Norwegian Sea, conditions comparable to those of the Mediterranean and Adriatic Seas are found in Buzzards Bay.

A report on the plankton of the Woods Hole region for 1922 and 1923, compiled with complete records of plankton collections by the late Vinal N. Edwards covering the years 1893–1907, was submitted for publication during the past year.

Through the courtesy of the Coast Guard, Doctor Fish was able to make a three weeks' cruise off the east coast of Newfoundland on the Coast Guard cutter *Modock*, leaving Halifax on June 2. Collections, which often yielded large numbers of fish eggs and occasionally larval fish, were made over the northern part of the Grand Banks.

ECOLOGY OF FRESH-WATER LAKES

The quantitative studies of the flora and fauna of Green Lake, Wis., which have been in progress since 1921, were completed in 1924. This work has been conducted by Dr. Chancey Juday, of the Department of Zoology of the University of Wisconsin. The survey of the flora showed that the large aquatic plants usually extend down to a depth of 8 meters, but in favorable localities they reach a depth of 10 meters. The average crop of these plants in the 0—8 meter zone amounted to 13,540 pounds per acre, wet weight (1,588 pounds per acre, dry weight). About 49 per cent of the dry material consisted of Chara, and 20 per cent of various species of Potamogeton.

The standing crop of plankton in Green Lake yielded an average of 244 pounds of dry organic matter per acre. The living plankton organisms weigh approximately 10 times as much as the dry organic matter, so that the live weight of this standing crop was substantially 2,440 pounds, or a little more than 1 ton, per acre. The upper 10 meters yielded more than any other 10-meter stratum. The horizontal distribution of the plankton was fairly uniform over the entire lake.

Quantitative studies of the bottom-dwelling animals showed that the greatest variety of forms inhabited the region over which the depth of the water ranged from 1 to 10 meters, while the 0—1 meter zone was second in rank. The maximum number of individuals was found in the 20—40 meter zone (6.765 per square meter), while the minimum number was found in the 0—7 meter zone (1,155 animals per square meter). Five groups of organisms constituted the main element of the population in the deeper zones, namely, Nematoda, Oligochæta, Pontoporeia, Chironomus, and Tanytarsus.

The weight of the bottom animals reached a maximum in the 20—40 meter zone, namely, 155 pounds per acre, live weight (30 pounds, dry weight); the minimum was found in the 0—1 meter zone, 32 pounds per acre, live weight (7.8 pounds, dry weight).

The weight of the dry organic matter in the average standing crop of plankton was a little more than 10 times as large as the dry weight of the entire bottom population; thus the plankton feeders among the latter have an abundant supply of food to draw upon at all times.

A 2-year study of the nitrogen compounds dissolved in lake waters was completed in June, 1924. It was found that the total soluble nitrogen in the surface water of Lake Mendota increases during the winter months and decreases during spring and summer. In the bottom water it increases in summer and in winter, or during the two periods of stratification; the minimum is reached during the vernal and autumnal periods of circulation. The soluble organic nitrogen, both in the surface and in the bottom water, shows the same seasonal variations as the total soluble nitrogen. Proteins, peptides, animo acids, and complex animo acid combinations were found in solution in the various lake waters studied.

FOULING OF SHIPS' BOTTOMS

An investigation into the nature and extent of the fouling on ships' bottoms was begun in September, 1922. This work is carried on by Dr. J. P. Visscher, temporary assistant, in cooperation with the Bureau of Construction and Repair of the Navy Department. The object in view is to secure data that may be applied in preventing the attachment of the fouling organisms to the ships' bottoms, which will show what conditions are most conducive to fouling, and from which proper docking intervals for ships of various kinds and with various histories may be determined.

Examinations regarding the nature and extent of the fouling on the bottoms of 175 vessels have been made since this investigation was begun. Of these, more than 100 were made during the past year, these representing approximately equal numbers of commercial and naval craft. From these data the following conclusions can be drawn:

1. Fouling occurs almost entirely while vessels are in port.
2. Vessels that are never in port for more than a few days at a time, and whose next port of call is at a considerable distance, rarely if ever accumulate much fouling.
3. Fouling in north Atlantic waters is caused, in the order of their importance, by barnacles, hydroids, algæ, bryozoa, ascidians, and by other growths of much less importance.

4. There is an important and specific relation between light and the nature and extent of the fouling of ships' bottoms.

Experiments have been conducted to determine the reactions to light of the organisms commonly causing fouling. These show that for certain species, both of barnacles, bryozoa, and tunicates, the larvæ are negative to light at the time of attachment.

Collections of adult barnacles and of various data regarding breeding habits, at various stations on the Atlantic coast and at different periods throughout the year, have been made to determine the seasonal occurrence and distribution of the " infective stages " of the barnacles.

Studies of the life histories and of the factors determining distribution of several species of barnacles have been made.

INVESTIGATIONS PERTAINING TO FISH-CULTURAL OPERATIONS

PATHOLOGY OF FISHES

Investigations on *Octomitus salmonis*, a parasitic flagellate of trout, were continued during the year by the pathologist, Dr. H. S. Davis, and the life history has now been almost completely worked out. It has been found that this parasite is often associated with a parasitic amœba, and that the cysts of the latter have been mistaken by some investigators for those of Octomitus. The vegetative stages of the amœba are found only in the stomach, and the cysts formed here pass into the intestine, where their common occurrence along with Octomitus has led to their being identified as cysts of the latter. As a matter of fact the cysts of Octomitus have a very different appearance and when once seen can never be confused with those of amœba. After becoming encysted the organism divides into two equal parts, each of which shows the essential features of the flagellated forms except that they lack flagella. The later history of the cysts has not yet been worked out, but there can be little doubt that it is by this means that infection is spread from one fish to another.

The amœba that develops in the stomach, where it is often very abundant, does not appear to appreciably injure the host, but its life history, which has been only partially worked out, exhibits some very remarkable and interesting features.

A severe epidemic among the fish at the Wytheville (Va.) station during March and April, which was accompanied by heavy mortality, was found to be due to Octomitus, the parasites being excessively abundant in the intestines of the infected fish. Ordinarily only fingerlings from about 1½ to 3 inches long appear to be seriously injured by the presence of the flagellate, although they may interfere more or less with the growth of larger fish. While these parasites are undoubtedly present at nearly all trout hatcheries, it is believed that the outlook is distinctly encouraging and that as a result of improved methods of caring for the fish the loss from this source need not be serious.

Very encouraging results have been obtained in preventing thyroid tumor in trout by the administration of iodine. In one lot of over 1,200 rainbow trout at the Wytheville station, which were badly infected with this disease, no new cases have appeared since beginning the iodine treatment in May, 1923. In this case small quantities of iodine were added to the food, which is believed to be more effective than when added to the water.

During the year a brief paper describing a method for controlling a disease common among aquarium fishes caused by Ichthyophthirius was published (Bureau of Fisheries Document No. 959). This was prepared by H. F. Prytherch, scientific assistant. In this paper the author describes two methods of combating the disease, the first by the use of external applications of aluminum sulphate—a 5 per cent solution for dipping and a 3 per cent solution for brushing or rubbing the fish. It also was found that the application of a 3 per cent solution applied to the diseased parts of fish infected with Saprolegnia gave excellent results. The second general method described for combating Ichthyophthirius is entirely mechanical and consists in arrangements for disinfection of the tanks and the removal of the parasites after they have left the fish.

The pathologist has on numerous occasions been called into consultation by fish-culturists and various Federal and State organizations regarding the cause of and remedies for unusual mortalities among fishes.

NEW METHOD OF OXYGEN DETERMINATION

In many biological investigations, particularly in field work, information concerning the dissolved oxygen content of a water sample is essential. Such knowledge is no less valuable to the fish-culturist, since in hatcheries, aquaria, fish cars, and in planting fish the welfare of the specimens is dependent upon a sufficient aeration of the water. Very accurate information on the oxygen content of water can be obtained by analytical methods, but the apparatus is breakable and cumbersome and some knowledge of chemistry is necessary for its manipulation; a simple method for this determination with a minimum of apparatus has hitherto been lacking. M. C. James, scientific assistant, has developed a method that promises in some degree to satisfy such requirements.

PHYSIOLOGY AND NUTRITION OF FISHES

Experiments to determine the effects of vitamin deficiency on fish were carried on under the direction of Dr. H. S. Davis at the Fairport (Iowa) station during July and August, 1923. While these experiments were not entirely successful, owing to the practical impossibility of preventing the fish from getting small quantities of natural food, the results obtained are of considerable interest.

In these experiments young carp, buffalofish, bluegill sunfish, and bullheads were kept on diets that lacked one or more of the various vitamins. In the case of each species the fish were divided into five lots. One lot, the controls, was fed a well-balanced diet, rich in vitamins. A second lot was fed a ration that contained no vitamins, while the remaining three lots were given rations that lacked either the A, B, or C vitamins.

Of the four species of fish used in the experiments, the carp were found to be most satisfactory, and for this reason only the results obtained with this species are given here. However, it should be pointed out that while not as conclusive, the results obtained with the buffalofish, bluegills, and bullheads are, so far as they go, in complete accord with those obtained in the carp experiments.

In all the lots fed vitamin-deficient diets the mortality was very high, ranging from 45 to 67 per cent in the various lots, while in the controls, consisting of 44 fish, there was no loss during the course of the experiment. Strangely enough all of the fish made a good growth. This may possibly be explained by the fact that they all obtained some natural food, which, of course, contained vitamins.

The most characteristic symptoms were produced by the lack of water soluble B. Many of the carp fed on a diet containing no B vitamin developed characteristic convulsions after a time. On being alarmed they would dart rapidly to and fro, dashing their heads against the sides of the trough and leaping from the water. After a short time they would stiffen with convulsive shudders and sink quietly to the bottom. Recovery usually took place within a few minutes, after which the fish appeared perfectly normal for a time. The intensity of the paroxysms increased from day to day until the fish eventually died. At different times several fish that had developed convulsions were removed and given food containing 10 per cent of yeast. The effect was almost immediate, the fish appearing perfectly normal on the following day.

Many of the carp given a diet in which only water soluble C was absent developed white patches on the gills. Such fish invariably died, although there was no evidence of infection by bacteria or other organisms. Although the mortality was high in the case of carp fed on a diet lacking fat-soluble A only, there were no characteristic symptoms and no evidence of infection of the eyes. This is in accord with the experiments on mammals, it being generally conceded that the xerophthalmia which develops is primarily due to failure of the tear glands to function, as a result of the absence of vitamin A.

These experiments demonstrate that vitamins are just as essential to fish as to higher vertebrates, but there is still much to be learned regarding the specific effects of vitamin deficiency. It is planned to carry on similar experiments with fingerling trout at the White Sulphur Springs (W. Va.) station, where the food supply can be more efficiently controlled than at Fairport.

In connection with the investigations at Fairport a series of experiments with fingerling trout was undertaken at the Manchester (Iowa) station. The primary purpose of these experiments, which were carried on by M. C. James, was to develop a more satisfactory diet for use at trout hatcheries. Since the foods usually given trout are believed to be more or less deficient in vitamins, it was felt that possibly much of the mortality at the hatcheries might be primarily due to this cause. The results to date have fully confirmed this view. It has been found that better growth and lower mortality in rainbow fingerlings can be secured by the addition of vitamins A and B to the diet, whether liver or heart. The best sources of these vitamins are cod-liver oil and yeast. Attempts at substitution of other sources were unsatisfactory. Various mixtures were used, but up to the present no diet has been found to surpass beef heart and sheep liver to which a sufficient amount of cod-liver oil and yeast has been added. The former diet (heart) is the most valuable, showing both increased growth and lowered mortality over the liver, oil, and yeast diet.

These experiments, on a more extensive scale, are being continued during the summer of 1924 at the White Sulphur Springs (W. Va.) station, and the results to date are in complete accord with those of the Manchester experiment. Similar experiments with both fingerling and brood fish under ordinary hatchery conditions have also been undertaken at the Erwin (Tenn.) and Wytheville (Va.) stations. As a result of these experiments it is believed that by the end of the season it will be possible to prescribe a diet distinctly superior to those now in use at the various trout hatcheries.

For a number of years investigations in the physiology and nutrition of fishes and other aquatic animals have been carried on in cooperation with the University of Wisconsin. During the year Dr. W. A. Kenyon has completed a study of the digestive enzymes of representative fresh-water fishes. The carp, which has no stomach, shows no evidence of peptic digestion. The enzymes of fishes are found in general to have the greatest digestive action at about the same temperature as in mammals.

Prof. A. S. Pearse and Miss A. L. Hintze have for a year fed turtles on certain natural foods and on synthetic rations of pure foods. Painted turtles, gophers, and terrapins were kept in steam-heated tanks. The foods used were lettuce, egg, meal worms, and mixtures of dextrin, casein, cod-liver oil, yeast, salts, and sand. Each turtle was weighed weekly. Individuals fed on "complete" rations rarely died and showed marked increases in weight. It is believed that satisfactory data on the rate of growth of turtles of different ages has been obtained. The lots fed on rations that were deficient in vitamines showed a higher rate of mortality and did not grow, or lost weight. Dr. S. Lepkovsky is now making chemical analyses of all the turtles that were used during the feeding experiments.

E. S. Hathaway is investigating the relation of temperature to the metabolism of fishes and other aquatic animals. Data have been accumulated on the ability of fishes of various ages to withstand changes in temperature, the amount of food eaten, oxygen consumption, and carbon-dioxide output. Younger fishes are found to possess wider ranges of tolerance and greater powers of adjustment than older individuals. Species that range through a variety of habitats apparently have greater ability to endure extreme variations. In general, the amount of food consumed is greater at higher temperatures, up to about 30° C.

EXPERIMENTAL WORK IN FISH CULTURE

Experiments in the culture of seven species of fish have been conducted at the Fairport station during the year.

Both the lake sturgeon, *Acipenser rubicundus*, and the shovelnose sturgeon, *Scaphirhynchus platyrhynchus*, were given considerable study with the object of developing a method of culture for them. Attempted pond culture of the shovelnose sturgeon in one of the station's ponds did not prove successful, but was considered worth repeating with modifications to more closely approximate natural conditions.

Another fish considered of sufficient importance to warrant culture, if it could be developed, was the sheepshead, *Aplodinotus grunniens.* Pond culture was attempted without success, while in addition a study was made of its life history at Lake Pokegama. Many hundred slides of the scales and carefully ground otoliths of the sheepshead were prepared during the summer season by Mr. Southall and two temporary assistants in order to determine the ages of the fish examined and to compare these ages with the condition of the reproductive organs so that the spawning habits might be more fully understood.

Pond culture of the paddlefish, *Polyodon spathula,* was attempted. As a number of these fish had been in the reservoir for 10 years without any results, some were placed in a pond and various possible spawning conveniences added, such as barrels and sunken tree tops, in the hope that the fish might be induced to spawn. No results were obtained. The work was done rather blindly, as previous attempts by various investigators to become acquainted with the spawning habits of these fish under natural conditions had not been successful. The commercial value of the fish, which is fast being depleted, was considered sufficiently great to warrant the consideration given it.

An effort was made to use channel catfish as pondfish, with the expectation that they might forage successfully for themselves, much as the bluegill has done in the so-called farm pond. A number of channel catfish fingerlings were placed by themselves in certain ponds in the spring and removed in the fall. The available food supply in these ponds was evidently unsatisfactory, for the growth of the fish was insignificant, while one of the two ponds had a very heavy mortality.

Since the buffalofish, once of great commercial importance in the Mississippi and its tributaries, has been greatly depleted within the last few years, it has acquired an increasing interest. An effort was made to determine its value as a pondfish. A bad turn of weather, with a resulting heavy drop of temperature, and certain other difficulties, apparently interfered with the spawning of the fish in the ponds in which they were placed. Under the circumstances the obtaining of over 12,000 young buffalofish from 26 adult *Ictiobus bubalus* may be considered very satisfactory, and excellent future returns are anticipated.

Work with the channel catfish was continued. Twelve pairs of catfish produced an average of 4,000 fingerlings each. It is thought that sufficient work has been done with the channel catfish so that its culture on a large hatchery scale may now be undertaken.

The so-called farm pond was conducted as usual. The purpose of this pond has been explained in detail in previous annual reports. The bluegill sunfish was used as heretofore, and production was at the rate of 304 pounds per acre. This compares with 440 pounds in 1922, 374 pounds in 1921, 333 pounds in 1920, 203 pounds in 1919, and 286 pounds in 1918. The same pond was used each year, and no fish food was added to the natural supply in the pond.

THE BIOLOGICAL LABORATORIES

Work at the Woods Hole (Mass.) biological laboratory was conducted on a somewhat larger scale than at any time since the war. During the summer of 1923, and again in 1924, the laboratory was opened to investigators not in the regular employ of the bureau. Close cooperation has been maintained with the Marine Biological Laboratory.

The facilities of the laboratory were made use of during the entire year by regular employees, including Dr. C. J. Fish and Marie D. P. Fish, working respectively on the plankton and the larval fishes of the Woods Hole region. Dr. P. S. Galtsoff also did here much of the laboratory work in connection with the hydrographic and biological survey of Long Island Sound.

During the summer of 1923 Dr. J. P. Visscher carried on at Woods Hole researches in connection with his study of the fouling of ships' bottoms. Special investigations for the bureau were also conducted by Dr. C. B. Wilson and Dr. R. E. Coker. The other investigators, 13 in all (of which 4 were present for a few days only), were engaged upon independent investigations of more or less direct interest to the bureau.

The laboratory was opened again in June, 1924, with Dr. W. H. Rich acting as director. At the close of the fiscal year 13 independent investigators had availed themselves of the facilities of the laboratory, and applications on hand indicated that all available space would be occupied before the summer was over.

The Woods Hole laboratory is especially well located as a center from which to carry on investigations of the important fisheries of the North Atlantic. This laboratory unquestionably should be the base for studies on the cod, pollock, haddock, mackerel, halibut, flounders, lobsters, oysters, and many other important food fishes. Proximity to the fishing grounds, adequate laboratory, library, and dormitory facilities, and a good harbor for boats needed in these investigations are all prime requisites for efficient work, and the Woods Hole laboratory affords all of these. It is believed that the time has come when the laboratory should be provided with a permanent resident director and kept open the entire year for investigators who are working on fishery problems. This could be done at very little added expense other than the director's salary.

The situation at the Beaufort (N. C.) biological laboratory has remained much the same as last year. Inadequate salaries have made it impossible to secure a competent scientific director, so that the only work of consequence carried on is that of terrapin culture. It is expected that when the reclassification bill passed by Congress is made effective for field employees it will be possible to secure the type of men needed to develop the scientific work in fishery problems of the South Atlantic for which this station is admirably fitted. During the summer of 1923 the facilities of the laboratory were made available to the Navy Department, and several investigators were present who were engaged in work relating to the prevention of the fouling of ships' bottoms. Several independent investigators were also present. The laboratory was reopened near the close of the fiscal year and is being used again by the Navy Department and a few other workers. Dr. J. P. Visscher is conducting here experiments in connection with his study of the nature and extent of the fouling of ships' bottoms.

At the Key West (Fla.) biological station little work of a scientific nature has been possible. The lack of a laboratory building is mainly responsible for this, and it is hoped that adequate facilities for conducting investigations may be provided in the near future. The director, Isaac Ginsberg, has succeeded admirably in improving the condition of the grounds, which are now considered to be the equal of any in Key West. As opportunities were presented, collections of the local aquatic fauna and observations on the fish and fisheries were made.

The work of the biological laboratory at Fairport, Iowa, has been frequently mentioned in the preceding pages. This station is the center from which investigations relating to fresh-water mussels and the fishes of the Mississippi Valley are conducted. During the summer months the laboratory was open to independent workers, and at various times during the year special investigations by regular employees were made here. The director, R. L. Barney, resigned during the year. T. K. Chamberlain has been appointed acting director, and has been materially aided in the work by the advice of Dr. E. P. Churchill, of the University of South Dakota. H. Walton Clark and Chester N. Blystad, scientific assistants connected with the Fairport laboratory, also resigned during the year.

In addition to the regular work of the laboratory, aid and advice has frequently been given by the scientific staff to various governmental and private organizations in matters pertaining to the conservation of the fisheries. Conferences have been attended and surveys made. The work of the station enjoys the confidence of those primarily interested in the commercial fisheries and the aid and support of scientists in the Middle Western States.

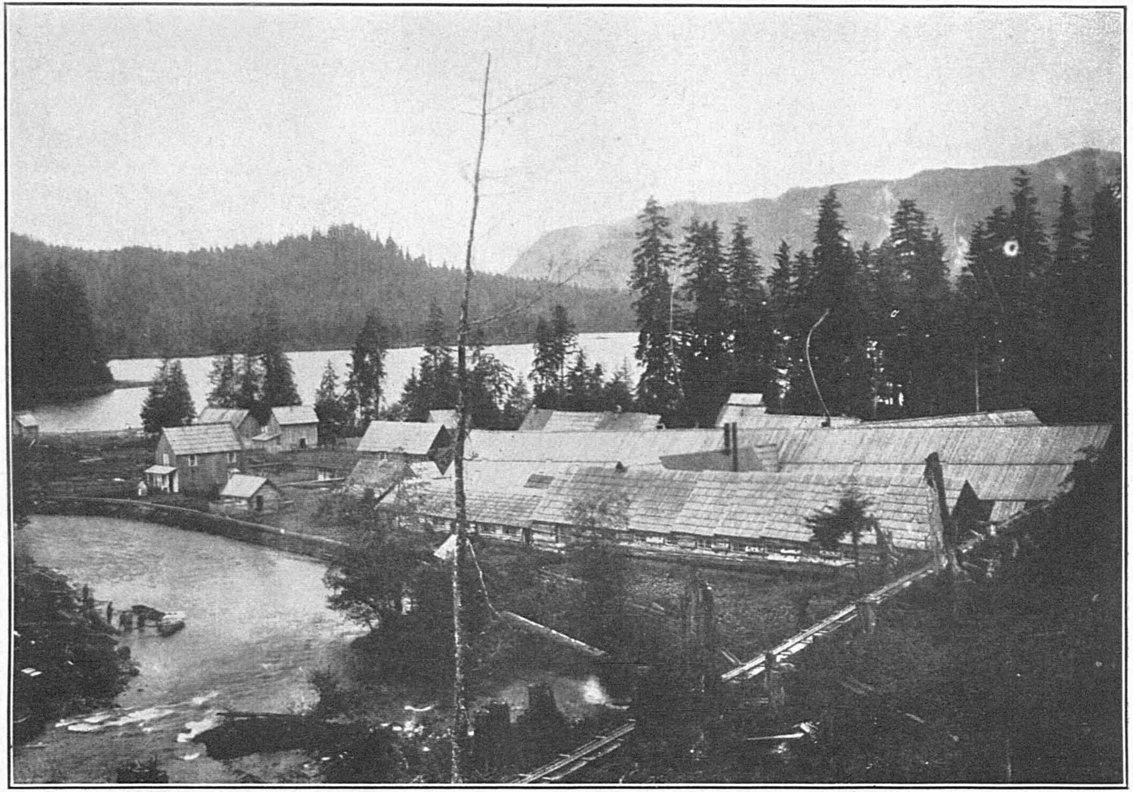

FIG. 1.—Salmon hatchery, Heckman Lake, southeast Alaska

ALASKA FISHERY AND FUR-SEAL INDUSTRIES IN 1923 [1]

By WARD T. BOWER, *Field Assistant*

CONTENTS

[1] Appendix III to the Report of the United States Commissioner of Fisheries for 1924. B. F. Doc. 973.

INTRODUCTION

A highly important event in connection with the Alaska fisheries industry in the year 1923 was the visit to the Territory of President Harding and his official party, on which occasion attention commensurate with their importance was given to the fisheries problems. In addition, the Commissioner of Fisheries, accompanied by Senator Jones and Representative Hadley of Washington, spent about two months in Alaska, making detailed studies of the salmon and fur-seal fisheries.

Fishery operations within the Alaska Peninsula Fisheries Reservation and the Southwestern Alaska Fisheries Reservation were in accordance with the regulations promulgated late in 1922. Counts of spawning salmon were made through weirs at Alitak, Chignik, and Karluk. The special studies begun in previous years on the life history and migration routes of salmon were continued. This work was carried on in the Alaska Peninsula region. Investigations of clam resources were conducted in Central Alaska.

The bureau's regular personnel for the protection of the salmon fisheries was considerably augmented during the active season by temporary employees, mostly stream guards. Nine vessels owned by the bureau were regularly employed on patrol work, and in addition a number of small boats were chartered for brief periods for the same work. Stream markers previously erected were maintained and a number of new ones added.

Transportation of Government employees and supplies for the Pribilof Islands was chiefly by vessels of the Navy and Coast Guard. There was, however, some transportation of employees and freight on commercial vessels. The bureau's power schooner *Eider* rendered supplementary service also.

An important undertaking initiated this season was the marking of about 10,000 of the 3-year-old male seals reserved for future breeding purposes. The work of blubbering fur-seal skins at St. Paul Island was extended to include all the skins taken at that island during the active sealing period. The total take of fur-seal skins at the Pribilof Islands was 15,920, of which 12,841 were secured on St. Paul Island and 3,079 on St. George Island. In the season of 1923-24 there were secured on both islands 787 blue-fox pelts and 15 white-fox pelts, a total of 802. Forty-eight Pribilof Islands blue foxes were sold to fox farmers in Alaska.

Two sales at public auction of sealskins taken on the Pribilof Islands were held at St. Louis in 1923 by the selling agents of the department. The fox skins taken in the season of 1922-23 were disposed of at one of these sales also.

Acknowledgment is made of the invaluable assistance rendered by Edward M. Ball and Henry D. Aller of the Alaska service in the compilation and preparation of much of the material appearing in this document.

TRIP OF PRESIDENT HARDING TO ALASKA

The most notable event of the year in Alaska was the visit of President Harding, who was accompanied by Secretary Hoover, of the Department of Commerce; Secretary Wallace, of the Department of Agriculture; Secretary Work, of the Department of the Interior; Speaker Gillette, of the House of Representatives; and other prominent men. An extended tour of the Territory was made, and numerous hearings on the workings of the various departments of the Federal Government dealing with Alaskan matters were held in an effort to discover any real troubles that might exist. Secretary Hoover conducted public hearings at Juneau on July 10, Fairbanks July 16, Nenana July 16, Anchorage July 17, Seward July 18, and Cordova July 20, with a view to securing first-hand information in regard to fishery conditions in Alaska. These hearings were very valuable in view of the necessity for further fishery protective measures. On July 22 Secretary Hoover made a trip from Sitka to Biorka Island and return on the bureau's patrol boat *Widgeon*. The bureau was represented on the presidential inspection of the fisheries by E. M. Ball, assistant agent.

The last public address made by President Harding in Seattle on July 27 contained the following relating to the fisheries:

The greatest Alaskan industry stands in an entirely different relation than either gold or copper. I refer to the fisheries, which in present wealth-producing potency far exceeds the mines. In fact, the fisheries product is now in value more than double that of all metals and minerals. It is too great for the good of the Territory, for if it shall continue without more general and effective regulation than is now imposed it will presumably exhaust the fish and leave no basis for the industry. .

One must know the natural history of the salmon, the supremely important Alaskan fish, to appraise the fisheries problem. We do not need to enlighten Pacific coast people, who understand the subject, but many others lack understanding. The salmon normally begins and ends his life in fresh water but grows and lives in the ocean. A school of small fish, hatched in a particular stream, go out to sea and are lost for a period of years. In that same time they grow into the magnificent creatures we all know. Then they return, with seemingly unerring instinct, to the very stream in which they were hatched, to reproduce their kind and then to die. They congregate on their way back into great schools, plowing their way up to the streams of their nativity. Full grown and perfectly conditioned, they are now ripe for the enterprise of the fisherman and the canner. Their habit of traveling in schools is their undoing; for the fishermen with their nets and traps literally scoop entire schools into their gear, and thus gradually exterminate the entire fish population of a particular small stream. Thereafter that stream will be barren unless a sufficient proportion of the school is permitted to escape to spawn and perpetuate it. Too often this does not happen, as is proved by the history of both our Atlantic and Pacific coast salmon fisheries and the record of fisheries elsewhere which depend on fish with similar life habits. The progressive disappearance of salmon along our coasts from California northward is a story whose repetition ought to warn us to protect it in Alaska before it is too late. The salmon pack not only represents nine-tenths of the output of Alaska's commercial fisheries, but it is an important contribution to our national food supply.

It is vastly more easy to declare for protection and conservation of such a resource than to formulate a practicable and equitable program. Fish hatcheries have been established to restock streams, but the results are still conjectural and controversial. Argument is advanced for the abolition of one method of fishing in one spot, the condemnation of another type in another, and so on, until there is confusion of local controversies which no specific and exclusive prohibition will solve. Even in his cruder pursuit of the fish industry, the Indian seeks for himself the device which he would have denied to the canner. But there is encouragement in the almost unanimous agreement in Alaska that regulation must and shall be enforced, and we must apply a practical wisdom to the varied situations as the salvage of the industry demands. Against any kind of prohibition it is urged that the immense investment in Alaska's fisheries and canneries would be greatly injured by such a reduction of the catch. To this it may well be replied that the canneries would better have their catches restricted by Government regulation for a time than exterminated in a few years through their own excesses. By the establishment of reserves along sections of the coast we have already accomplished much. More restriction is necessary and urgent. The conservation must be effected. If Congress can not agree upon a program of helpful legislation, the reservations and their regulations will be further extended by Executive order. There is an obligation to the native Alaskan Indian which conscience demands us to fulfill. Moreover, the salvation of the industry is no blow at vested interests; it is a step toward protected investment and promoted public welfare. We have invited cooperation, and in the great majority of cases it has been cordially and intelligently extended. If there is defiance, it is better to destroy the defiant investor than to demolish a national resource, which needs only guarding against greed to remain a permanent asset of incalculable value. Moreover, we have ever to guard against the appeal of the demagogue, whose play on popular prejudice for political advantage has no place in the solution of the great problems of national conservation.

VISIT OF THE COMMISSIONER OF FISHERIES TO ALASKA

The Commissioner of Fisheries spent practically the entire months of July and August on an inspection trip to various parts of Alaska. He was accompanied by Senator W. L. Jones and Representative L. H. Hadley, both of the State of Washington. During a good part of the time while away from Seattle the party traveled on the Coast Guard cutter *Unalga*.

Visits were made to the fisheries of southeastern, central, and western Alaska, including Bristol Bay. From July 15 to 18 the party was at the Pribilof Islands. On the return the week from August 18 to 25 was spent on the bureau's patrol vessel *Widgeon*, thus enabling the party to visit numerous fishing centers and streams in southeastern Alaska.

In view of the serious decline threatening the salmon fishery in various parts of Alaska, it is regarded as extremely fortunate that an inspection of the situation could be made as outlined above. Valuable first-hand information was thus acquired for use in shaping future legislation and determining policies in respect to the administration of the fisheries of Alaska.

FISHERY INDUSTRIES

As in corresponding reports for previous years, the Territory of Alaska is here considered in the three coastal geographic sections generally recognized, as follows: Southeast Alaska, embracing all that narrow strip of mainland and the numerous adjacent islands from Portland Canal northwestward to and including Yakutat Bay; central Alaska, the region on the Pacific from Yakutat Bay westward, including Prince William Sound, Cook Inlet, and the southern coast of Alaska Peninsula, to Unimak Pass; and western Alaska, the north shore of the Alaska Peninsula, including the Aleutian Islands westward from Unimak Pass, Bristol Bay, and the Kuskokwim and Yukon Rivers. These divisions are solely for statistical purposes and do not coincide with districts made under reservations created during the calendar year, which include areas from both the central and western statistical divisions.

Detailed reports and statistical tables dealing with the various fishery industries are presented herewith, and there are also given the important features of certain subjects that were the objects of special investigation or inquiry.

WATERS CLOSED TO COMMERCIAL FISHING

No additional Executive orders were issued during the calendar year 1923 in regard to waters of Alaska. The restrictions and limitations imposed by previous orders of the Department of Commerce prohibited all commercial fishing in the streams and lakes of Alaska and within a zone extending 500 yards off the mouths of all streams, with the exception of the Ugashik and Karluk Rivers, where, owing to peculiar geographic conditions, certain specific districts remained open to fishing. Executive orders previously issued remained in effect with regard to the Afognak Forest and Fish Culture Reserve, Aleutian Islands Reservation, Yes Bay and Stream, Annette Island Fishery Reserve, Alaska Peninsula Fisheries Reservation, including the waters of the Aleutian Islands Reservation, and the Southwestern Alaska Fisheries Reservation.

ALASKA PENINSULA FISHERIES RESERVATION

In the season of 1923 fishery operations in the Alaska Peninsula Fisheries Reservation were carried on under 12 formal permits issued by the Secretary of Commerce, as shown in the table below, which gives also the pack of canned salmon in the reservation. A permit (No. 13) was issued also to George Albert, of Port Heiden, for the salting of not to exceed 700 barrels of all species of salmon. No fishing was done under this permit. Permit No. 70 was issued to the Union Fish Co. for 10 stations and Permit No. 86 to the Brown Fishing Co. for two stations for codfishing operations in the reservation. In addition, 28 permits, of which 3 were for codfishing, were issued by Agent Dennis Winn and Assistant Agent Lemuel G. Wingard for minor fishery operations within the reservation. Most of the permittees sold their catch of salmon to canneries in the respective districts.

Pack of canned salmon under permits in the Alaska Peninsula Fisheries Reservation, Alaska, in 1923

Permit No.	Name of permittee	Location	Allotment	Pack					
				Cohos	Chums	Humpbacks	Kings	Reds	Total
			Cases	*Cases*	*Cases*	*Cases*	*Cases*	*Cases*	*Cases*
1	Alaska Packers Association.	Chignik	50,000	535	1,787	286	15	20,675	23,298
2	Columbia River Packers Association.	do	50,000	510	2,066		2	20,701	23,279
3	Northwestern Fisheries Co.	do	50,000	420	1,896	165	59	20,769	23,309
4	Shumagin Packing Co.	Squaw Harbor	50,000	3,887	15,235	3,511	83	27,284	50,000
5	P. E. Harris & Co.	Isanotski Strait	70,000	600	7,637	294	299	33,498	42,328
6	Pacific American Fisheries.	Ikatan	76,000	924	9,304	1,611	444	49,969	62,252
7	do	King Cove	100,000	704	16,435	900	10	28,782	46,831
8	Everett Packing Co.	Herendeen Bay			408		67	12,406	12,881
9	Fidalgo Island Packing Co.	do							
10	Pacific American Fisheries.	Nelson Lagoon	25,000	10	1,878		1,676	43,906	47,470
11	do	Port Moller							
12	Phoenix Packing Co.	Herendeen Bay							
	Total			7,590	56,646	6,767	2,655	257,990	331,648

Fishery permits issued by local representatives of Bureau of Fisheries in Alaska Peninsula Fisheries Reservation, Alaska, in 1923

SHUMAGIN DISTRICT

Permit No.	Name of permittee	Locality	Operations
1-W	A. Ostermark	Popof Strait, Acheredin Bay, and West Nagai Strait.	Salmon fishing
2-W	Harry Olsen	do	Do.
3-W	N. H. Johnson	Popof Strait and West Nagai Strait	Do.
4-W	S. Brandel	Paul and Jacob Islands	Do.
5-W	Sam Larsen	Popof Strait and West Nagai Strait	Do.
6-W	August Lindquist	Orzenoi Bay	Do.
7-W	Andrew Hanson	Baralof Bay	Do.
8-W	Chas. Christiansen	Sandy Cove and Coal Harbor	Do.
9-W	A. Grosvold	Sand Point and Unga Strait	Do.
10-W	J. Olsen	Nagai Island	Do.
11-W	A. Pedersen and T. Skulstad	Simeonof Island	Do.
12-W	R. Grosvold	Little Koniuji Island	Do.
13-W	R. Reeve	East Nagai Strait	Do.
14-W	Chas. McCallum	do	Do.
16-W	Knut Knutsen	Ivanof Bay	Do.
20-W	Ed Johnson	Barne Cove	Do.
21-W	H. Sharpneck, W. Hubbley, T. Foster, S. Larsen, and H. Olsen.	San Diego, Balboa and Ivanof Bays, and Stepovak Flat.	Do.
25-W	S. Brandel		Cod fishing

IKATAN DISTRICT

Permit No.	Name of permittee	Locality	Operations
15-W	Porter and Wolf	Belkofsky Bay and Deer Island	Salmon fishing.
17-W	Peter E. Nielsen	Cold Bay	Do
18-W	Edward Smith	King Cove	Do.
19-W	Chas. Hansen and Oscar Longsmith	Boiler Point to Whalebone Bay	Do.
23-W	Oscar Vanner	Isanotski Strait	Do.
24-W	Fred Brandel		Cod fishing.

PORT MOLLER DISTRICT

Permit No.	Name of permittee	Locality	Operations
22-W	M. Gunderson, Peterson and Michaelson.	Nelson Lagoon	Salmon fishing.

ALEUTIAN ISLANDS DISTRICT

Permit No.	Name of permittee	Locality	Operations
W-1	San Juan Fishing & Packing Co	Unalaska and Akutan Pass	Cod fishing.
W-2	A. C. Goss	Umnak and Nikolski Bay	Salmon fishing.
	E. H. Larson	Umnak Island	Do.

Revised regulations for the administration of the Alaska Peninsula Fisheries Reservation were issued under date of October 25, 1923, as follows:

By virtue of authority conferred by Executive order of February 17, 1922, creating the Alaska Peninsula Fisheries Reservation, including the waters of the Aleutian Islands Reservation, the following regulations are hereby promulgated:

1. For purposes of administration the following districts are established:

(*a*) *Port Heiden district.*—Extends along the Bering Sea shores of the reservation from its eastern limit to the one hundred and sixtieth meridian of west longitude.

(*b*) *Port Moller district.*—Extends along the Bering Sea shores of the reservation from the one hundred and sixtieth meridian of west longitude to the north entrance of Isanotski Strait (otherwise commonly known as False Pass), which forms its western boundary.

(*c*) *Ikatan district.*—Includes Isanotski Strait south of its northern entrance, the waters surrounding Unimak and the Sannak Islands, and the waters to the eastward along the Pacific shores of the reservation to the one hundred and sixty-first meridian of west longitude.

(*d*) *Shumagin district.*—Includes the Shumagin Islands and the mainland shores and islands of the Pacific side of the reservation from the one hundred and sixty-first to the one hundred and fifty-ninth meridian of west longitude.

(*e*) *Chignik district.*—Extends from the one hundred and fifty-ninth meridian of west longtitude along the Pacific shores of the reservation to its eastern margin.

(*f*) *Aleutian Islands district.*—Waters over which the United States has jurisdiction from Unimak Pass westward throughout the Aleutian Islands Reservation.

2. No corporation, company, or person operating for his own account shall engage in fishing or in the preparation of fishery products of any description, including salmon, clams, crabs, herring, halibut, and cod, except for personal or family use and not for sale or barter, within the above specified districts without first securing a permit from the Secretary of Commerce. Applications for permits covering minor fishery operations by local residents shall be made before the beginning of the fishing season to representatives of the Department of Commerce in Alaska authorized to issue such permits. Applications for all other permits shall be made on or before October 1 of the preceding year to the Secretary of Commerce, Washington, D. C., and shall give full information on the following points:

(*a*) Name and permanent address of person or corporation desiring permit.

(*b*) Character of business proposed, whether fishing, or canning, salting, or otherwise curing fish.

(*c*) Location and capacity of plant. If a cannery, state number of lines of machinery and whether for pound or half-pound cans.

(*d*) Number and kind of each class of fishing gear desired, and location where same is to be operated.

(*e*) The quantity which it is desired to pack. In regard to canned salmon the amount shall be stated upon the basis of 48 one-pound cans per case.

(*f*) If application is for continuance of operations previously conducted, the pack of salmon by species, and of other fishery products, and the amount of each class of gear operated in the next preceding season must be shown.

(*g*) Affidavit as to correctness of facts set forth in the application must be made by competent authority.

3. Permits will specify the amount of pack allowed, if it be limited, and the character, extent, and locality of fishing operations.

4. Transportation of fresh salmon for canning, salting, or otherwise preserving will not be permitted between any two districts within the reservation or between any district within the reservation and any outside district.

5. The pack of each salmon cannery shall be made exclusively from the proceeds of the fishing gear specifically allotted to it, except as provided in section 7. Transfer of salmon from one plant to another will not be permitted.

6. Increase in the capacity of any cannery by installing additional equipment is prohibited.

7. Natives and other local inhabitants who have secured individual permits may sell salmon or other fishery products to operators of plants situated in the same district, but such fish or fishery products shall, unless otherwise specified, be included in the pack limit which has been allotted to the plant purchasing them.

8. Fox farmers may take and prepare salmon or other fishery products for fox feed in all legal ways, but permits must be secured from the Secretary of Commerce or from some representative of the department in Alaska authorized to issue permits. Salmon lawfully taken may be used for codfish bait.

9. The minimum size of razor clams taken for canning is fixed at 4½ inches in total length of shell. Not more than 5 per cent of the clams used in any cannery may measure less than this minimum.

10. These regulations shall be subject to such annual revision by the Secretary of Commerce as may appear advisable in view of the investigation and the experience of the preceding season. They shall be in full force and effect immediately from and after date of issue.

SOUTHWESTERN ALASKA FISHERIES RESERVATION

Fishing operations in the Southwestern Alaska Fisheries Reservation were divided naturally into three districts, Bristol Bay, Cook Inlet, and Kodiak-Afognak waters, as established by the regulations issued under date of December 16, 1922. In all, 71 permits issued by the Secretary of Commerce were in effect in the reservation during the season of 1923.

BRISTOL BAY DISTRICT

Limitations on fishing operations in the Bristol Bay district were imposed entirely through specifying the number of gill-net boats which might be operated from each plant in the district. This number was determined by the number of lines of machinery operated in preceding seasons, 10 gill-net boats per line being the basis of the allotment. In view of this limitation on gear no pack limits were imposed on the output of the plants for which permits were issued.

Fishing operations in this district were carried on under 31 permits issued by the Secretary of Commerce in the season of 1923. Two other permits, No. 72 for 2 gill-net boats and No. 73 for 4 gill-net boats, were issued to Peter M. Nelson for salting operations at Copenhagen Creek and Igushik, respectively, but a fishermen's strike and other difficulties prevented operations under them. In addition, 89 permits were issued by Agent Dennis Winn to local residents, of whom 58 fished independently and sold their catch, totaling 152 king, 115 chum, and 148,080 red salmon, to canneries. Of the remaining permittees 20 worked on company boats, 2 worked in a cannery, and 9 others did not fish.

Pack of salmon under permits in the Bristol Bay district, Alaska, in 1923

Permit No.	Name of permittee	Location	Number of gill-net boats allotted	Pack								
				Cohos	Chums		Kings		Reds		Total	
				Cases	*Barrels*	*Cases*	*Barrels*	*Cases*	*Barrels*	*Cases*	*Barrels*	*Cases*
14, 15	Alaska Packers Association	Kvichak Bay	122			366	9	159	8	189, 210	17	189, 735
16-18	do	Naknek River	180			576	13	155	193	228, 376	206	229, 107
19	do	Egegik River	36			435			157	48, 735	157	49, 170
20	do	Ugashik River	24			246		13		18, 639		18, 898
21, 22	do	Nushagak Bay	108	247		2, 587	36	2, 163		49, 088	36	54, 085
24	Alaska-Portland Packers' Association	Naknek River	42			129		9		65, 062		65, 200
26	Alaska Salmon Co	Wood River	36	61	1	1, 084	(1)		[1] 40	12, 296	[1] 41	13, 441
27	Bristol Bay Packing Co	Kvichak Bay	60			182		37		96, 667		96, 886
28	Carlisle Packing Co	Koggiung	36			76		6		50, 114		50, 196
29	Columbia River Packers Association	Nushagak Bay	36	222		2, 567		2, 487		17, 167		22, 443
30	International Packing Co	Ugashik River	18			235				15, 100		15, 335
31	Libby, McNeill & Libby	Egegik	36		10		1		1, 235		1, 246	(2)
32	do	Ekuk	36	63		1, 632		1, 917		13, 965		17, 577
33	do	Nushagak	36	47		1, 606		1, 735		14, 000		17, 388
34	do	Lockanok	48									(3)
35	do	Libbyville	48			287		37		48, 468		48, 792
36	do	Koggiung	60			109			1, 231	75, 049	1, 231	75, 158
37	do	Igushik	10				1		1, 256		1, 257	
38	Naknek Packing Co	Naknek River	48			297		45		63, 873		64, 215
39	Peter M. Nelson	Kvichak River	12				16		4, 558		4, 574	
40	Northwestern Fisheries Co	Naknek River	48			132				61, 137		61, 269
41	do	Nushagak	36	104		1, 969		3, 302		16, 416		21, 791
42	Red Salmon Canning Co	Ugashik River	24			501		30		21, 628		22, 159
43	do	Naknek River	36							53, 680		53, 680
77	Bering Sea Salmon Packing Co	King Salmon Creek	12						400		400	
85	Alaska-Portland Packers' Association	Nushagak Bay	54	72		2, 330		754		17, 610		20, 766
88	Alaska Salmon Co	Kvichak Bay	12		5	50	4		1, 354	17, 246	1, 363	17, 296
	Total		1, 254	816	16	17, 396	[1] 80	12, 849	[1] 10, 432	1, 193, 526	[1] 10, 528	1, 224, 587

[1] Also thirteen 600-pound tierces kings and six 600-pound tierces red salmon, mild cured.
[2] Included in pack at Libbyville.
[3] Included in pack at Koggiung.

Fishery permits issued by local representative of the Bureau of Fisheries in the Bristol Bay district, Alaska, in 1923

[Permits not used indicated by (*)]

Permit No.	Name of permittee	Locality	Operations	Permit No.	Name of permittee	Locality	Operations
W-1*	William Sullivan	Kvichak	Salmon fishing.	W-47	Mike Anderson	Naknek	Salmon fishing.
W-2*	Eric Dohlberg	do	Do.	W-48	Willis Zumgumgmik.	Ugashik	Do.
W-3*	August Nelson	Nushagak	Do.	W-49	Chas. Smith	do	Do.
W-4*	Andrew Nelson	do	Do.	W-50	Luis Smith	do	Do.
W-5*	Joseph Shaffer	do	Do.	W-51	Nick Mikuguglak	do	Do.
W-6*	Peter Knudsen	do	Do.	W-52	Joe Mikuguglak	do	Do.
W-7*	John Nichelson	Clark Point	Do.	W-53	R. Neucklavacla	do	Do.
W-8*	Chris Peterson	Snag Point	Do.	W-54	J. Aleauk	do	Do.
W-9*	Peter Krause	do	Do.	W-55	Charles Johnson	do	Do.
W-10	F. Garne	Ugashik	Do.	W-56	Mike Thompson	do	Do.
W-11*	Galba Meluk	Egegik	Do.	W-57	Mike Oknak	Igushik	Do.
W-12*	A. Meluk	do	Do.	W-58	Petla Ivanowich	do	Do.
W-13	Alek Strom	do	Do.	W-59	Aloxi	do	Do.
W-14	Fuma Afognak	do	Do.	W-60	Medicine Man	do	Do.
W-15	Matteo Nanakin	do	Do.	W-61	Sam Sapsop	Ugashik	Do.
W-16	Charley Strom	do	Do.	W-62	Barney Sapsop	do	Do.
W-17	Dan Amaguk	do	Do.	W-63	John Spoon	do	Do.
W-18	Demmion Begeroff.	do	Do.	W-64	Frank Spoon	do	Do.
W-19	Constantine Mekan.	do	Do.	W-65*	John Nickelson	do	Do.
W-20	Luke Mekan	do	Do.	W-66*	John Washa	do	Do.
W-21	George Amelek	do	Do.	W-67*	Alfred Anderson	do	Do.
W-22	Evan Takudak	do	Do.	W-68*	Chas. Dahl	do	Do.
W-23	Custro Takudak	do	Do.	W-69*	Axel Johnson	do	Do.
W-24	Ablama Takudak	do	Do.	W-70*	Sig Heglund	do	Do.
W-25	Tamelak Meluk	do	Do.	W-71	P. Evans	Nushagak	Do.
W-26	Fedore Upugak	do	Do.	W-72	M. Pavlo	do	Do.
W-27*	Pete Olympic	Naknek	Do.	W-73	P. Vasile	do	Do.
W-28*	Harold Beckman	do	Do.	W-74	Farmer Nelson	do	Do.
W-29*	James Roach	do	Do.	W-75	Evan Togiak	do	Do.
W-30*	Ed Ahola	do	Do.	W-76*	Wesley Togiak	do	Do.
W-31*	D. Andrew	Nushagak	Do.	W-77	Joe the Jap	do	Do.
W-32*	Mike Micolie	do	Do.	W-78*	Oscar Kuskokwim	do	Do.
W-33*	E. Sarge	do	Do.	W-79	Gregorg	do	Do.
W-34	B. Sarguis	do	Do.	W-80	Julius	do	Do.
W-35	Andrew Krause	do	Do.	W-81*	Willis Togiak	do	Do.
W-36	George Gakup	do	Do.	W-82	Evan Togiak No. 2.	do	Do.
W-37	K. Wassalie	do	Do.	W-83*	Tyon	do	Do.
W-38	H. Moxie	do	Do.	W-84	Fred Carlson	do	Do.
W-39	L. Bronchos	do	Do.	W-85*	E. Day	do	Do.
W-40	Evan Hiyeuak	do	Do.	W-86*	H. Helmerson	do	Do.
W-43	Nicholas Christenson.	Ugashik	Do.	W-87	Jim Timmerman	Snag Point	Do.
W-44	Andrew Arenson	Naknek	Do.	W-88	H. Johnson	Nushagak	Do.
W-45	Antone Roe	do	Do.	W-89	Malka	do	Do.
W-46	John A. Johnson	do	Do.	W-90*	Paplok	do	Do.
				W-91	Ole Nelson	do	Do.

COOK INLET DISTRICT

Salmon fishing operations in the Cook Inlet district in 1923 were carried on under 10 permits issued by the Secretary of Commerce. Permits Nos. 50, 66, and 84 for salmon-fishing operations were also issued by the Secretary of Commerce to the Kamishak Canning Co., Delorne & Wilson, and C. B. Meyers, respectively, but were not utilized. There were in effect in the district during the season 19 permits in all.

Pack of canned salmon under permits in the Cook Inlet district, Alaska, in 1923

Permit No.	Name of permittee	Location	Allotment	Pack					
				Cohos	Chums	Humpbacks	Kings	Reds	Total
			Cases	*Cases*	*Cases*	*Cases*	*Cases*	*Cases*	*Cases*
44	Alaska Packers Association.	Kasilof	40,000	1,529	308	48	[1] 1,292	11,430	[1] 14,611
46	Anchorage Packing Co.	Anchorage	15,000	554	185	1	203	3,598	4,541
48	Fidalgo Island Packing Co.	Port Graham	40,000	942	970	1,507	355	11,570	15,344
51	Libby, McNeill & Libby.	Kenai	40,000	4,810	255	262	3,192	17,569	26,088
52	North Coast Packing Co.	Ninilchik	5,000	431			573	1,118	2,122
53	Northwestern Fisheries Co.	Kenai	40,000	2,936	194	100	988	12,213	16,431
75	Henry J. Emard	Moose Point	5,000				60	1,483	[2] 1,543
[3] 81	Pioneer Canneries (Inc.)	Snug Harbor	15,000	814	414		258	5,160	6,646
82	Arctic Packing Co.	English Bay	[4] 5,000					1,054	1,054
[5] 90	Alaska Year-Round Canneries Co.	Seldovia	8,500	55		90	12	1,911	2,098
	Total		213,500	12,071	2,324	2,008	6,933	67,142	90,478

[1] Also 9 barrels salted.
[2] Also 1,500 pounds coho salmon bellies, 2,000 pounds red salmon bellies, and 3,000 pounds dried red salmon.
[3] Combined operations under permits No. 49 and 54 previously issued to G. E. Halferty and Polar Fisheries Co.
[4] Also 100 barrels salmon bellies and coho salmon for fox feed.
[5] Combined operations under permits No. 45 and 55 previously issued to Alaska Year-Round Canneries Co. and to W. A. Estus in name of Seldovia Packing Co.

Permits issued by the Secretary of Commerce for other than salmon operations were as follows: No. 46 to Anchorage Packing Co. for crabs and clams; No. 48 to Fidalgo Island Packing Co. for herring; No. 66 to John Delorne and James Wilson for clams; No. 81 to Pioneer Canneries (Inc.), combining permits Nos. 49 and 54 previously issued to Guy P. Halferty and Polar Fisheries Co. for clams; No. 84 to C. B. Meyers for clams; No. 90 to Alaska Year-Round Canneries Co. for crabs; and Nos. 91, 92, 93, 94, 95, and 96 to R. E. McIver Packing Co., Fred O'Neill, Harry Arensbach, Oscar Russel, G. E. Meredith, and San Juan Fishing & Packing Co., respectively, for herring.

In addition, 142 permits for various fishery operations in the Cook Inlet district were issued by Assistant Agent Shirley A. Baker. Approximately 27,267 coho, 6,633 chum, 10,941 humpback, 10,633 king, and 241,363 red salmon taken under these permits were sold to canneries in the district. Miscellaneous salmon products amounted to approximately 25 tierces mild-cured king salmon, 9 barrels king-salmon bellies, 3 barrels salted king salmon, 57 barrels salted humpbacks, 3 tierces salted humpbacks for fox feed, and 4 barrels of 150 pounds each of king-salmon tips. In addition, approximately 91,000 salmon, chiefly coho, humpback, and chum, were dried, salted, or smoked for fox feed.

The pack of clams under permits was as follows: No. 84, C. B. Meyers, Paulie Creek, 1,504 cases whole clams; No. 81, Pioneer Canneries (Inc.), Snug Harbor, 16,473 cases ½-pound cans and 5,679 cases 1-pound cans of minced clams; and No. 9, Cordova, Fred I. Munson, Halibut Cove, 4 cases ½-pound cans of minced clams and 1 case 1-pound cans of clam juice. F. I. Munson also prepared 20 cases ½-pound cans of crabs.

Herring operations were carried on extensively in the Cook Inlet district, particularly at Halibut Cove.

Fishery permits issued by local representative of the Bureau of Fisheries in Cook Inlet district, Alaska, in 1923

Permit No.	Name of permittee	Locality	Operations
2	J. A. Gustavason and W. L. Lippincott.	Kamishak Bay	Salmon fishing.
3	Nick Elznit and Tom N. Anderson	East shore	Do.
4, 194	Ralph Sparks	Kachemak Bay	Herring fishing.
5, 195	U. G. Norton	do	Salmon, crab, herring, and cod fishing.
6	Gudni Jackson	East shore and Halibut Cove.	Salmon, herring, and cod fishing.
7, 196	Nathan White	Kamishak Bay and Kachemak Bay.	Do.
8, 197	John Leiren	do	Do.
9, 186	Fred I. Munson	Halibut Cove	Salmon, herring, cod, clam, and crab fishing.
10	Ansium Alexanderoff	Kachemak Bay	Salmon fishing.
11	Andy Lundgren and Hilmar Olsen	do	Do.
12	Andrew Berg and Chas. D. LaMatyr	East shore	Do.
13	John Peterson and Martin Peterson	Kachemak Bay	Do.
15	Wm. H. Cantwell	East shore and Kachemak Bay.	Salmon, crab, and cod fishing.
16	Niels M. Jensen	Kamishak Bay	Salmon fishing.
17	Edward T. Jensen, Simon Josefson, and Axel Anderson.	East shore and Kamishak Bay.	Do.
18	James A. Hart	do	Do.
19, 198	Andy Anderson	Seldovia Head or east shore and Halibut Cove.	Salmon, crab, herring, and cod fishing.
20	Isam F. Burgin, Lawrence A. Dunning, and Frank H. Burgin.	Kachemak Bay	Salmon fishing.
21	John Yackaloff	do	Do.
22	Tollak Tollestad	do	Do.
23	Keith McCullough	do	Do.
24	Anton Johansen and Peter D. Olssen	do	Do.
25	Chas. R. Olssen	East shore	Do.
26	Rufus H. Bowen	do	Do.
27	Sholin Bros. Fox Ranch Co	Kachemak Bay	Do.
28	William J. Babis	do	Cod fishing.
29	Arne C. Olson	do	Halibut and cod fishing.
30	Henry Ladehoff and Arsendo Romanoff.	do	Salmon fishing.
31	Julius Christiansen and Tim Balashoff	do	Do.
32	Mike Moonin	Port Chatham to Port Graham.	Do.
33	DeMetrick Moonin	Port Chatham to Halibut Cove.	Do.
34	Emil Berg	East shore	Do.
35	Gust Ness	Corea Bend	Do.
36	Matt Yuth	Kachemak Bay	Do.
37	Tom O. Perry	do	Do.
39	Knik Pete	Kustatan River	Do.
40	Paul Kalifonski	Kalifonski Beach	Do.
41	Jim Marmelia	Kustatan River	Do.
42	Ed G. Kagden	do	Do.
43	Little Maxime	do	Do.
44	Nick P. Mishakof	do	Do.
45	John Nicholai	do	Do.
46	Knik Paul	do	Do.
47	Nakishka Pete	do	Do.
48	Serge Pete	do	Do.
49	Alex Shaska	do	Do.
50	Ely Stephen	do	Do.
51	Victor Anton	do	Do.
52	Julius Kallender	Point Possession	Do.
53	Harry Wodell	Point Possession to Moose Point.	Do.
54	Johnny X. Nicholai	Point Possession	Do.
55	Alex Cleutna	Anchorage to Fire Island	Do.
56	August Juntunen	Point Possession to Moose Point.	Do.
57	Emil Anderson	do	Do.
58	Alfred Danilof	Kustatan River	Do.
59	Richard Crisp and Gus Abrahamson	Point Possession to Nakishka.	Do.
60	George Bolja, Russell R. Hermann, and George Hermann.	Chuit River to Beluga River.	Do.
110, 199	Axel Norstad	Anchor Point and Kachemak Bay.	Salmon, herring, and cod fishing.
111, 200	Eric Albert A. Gissberg	East shore and Halibut Cove.	Do.

Fishery permits issued by local representative of the Bureau of Fisheries in Cook Inlet district, Alaska, in 1923—Continued

Permit No.	Name of permittee	Locality	Operations
112	Anderson and Koch	Trading Bay to Tyonek	Salmon fishing.
113	Frank Standifer and Albert Thompson	East Forelands	Do.
114	Pitka Backoff and Alex Demidoff	Kalgin Island	Do.
115	Charlie Wagner	Kustatan River	Do.
116	Nick Kalifonski	Kalifonski Beach	Do.
117	Heywood March	Corea Bend	Do.
118	Ero Walli	Anchor Point to Starichkof	Do.
119	Clyde Coombs	Port Chatham	Do.
120	Harry Leonhardt and C. S. Patterson	Kachemak Bay	Do.
121	James S. Collins and Gus Drimeris	Elizabeth Island	Do.
122	Alex Elxnit	Anchor Point to Ninilchik	Do.
123, 201	W. E. Ludy	Port Chatham Bay	Herring fishing.
124	Virgil Waller	Anchor Point	Salmon fishing.
125	Fred Sundel	Corea Bend	Do.
127	Chas. M. Robinson and E. W. Robinson.	Chuit River to Beluga River	Do.
128	T. W. Lloyd	Seldovia Bay	Do.
129	J. E. Dwyer	Chugach and Rocky Bays	Do.
130	Gabriel Egoraff	Kachemak Bay	Do.
131	Axel Ursin	East Shore	Do.
132	Per E. Johnson	Lewis River to Three Mile Creek.	Do.
133	Albert Johnson	Knik Arm	Do.
134	Ed Rothe	Kustatan River	Do.
135	John Lund	do	Do.
136	Eric Isaacson	do	Do.
137	Chas. West	Humpy Point	Do.
138	Gregory Oskalkof	Corea Bend	Do.
139	Mike Graford	Corea Bend to Deep Creek	Do.
140	Steff Churkin	do	Do.
141	Philip Wilson	Kustatan River	Do.
142	Billy Stephon	do	Do.
143	Mike Danilof	do	Do.
144	Nicholai L. Meshagof	do	Do.
145	Louis Nisson	Kasilof River	Do.
146	Garasen Oskolkof	Corea Bend to Deep Creek	Do.
147	Louis Kvasnikof	do	Do.
148	Mike Oskolkof	do	Do.
149	Alex Kalifonski	Kalifonski Beach	Do.
150	Nick Onorka	do	Do.
151	Nick A. Sackalof	Kustatan River	Do.
152	P. S. Meshagof	do	Do.
153	Andrew Dolchak	do	Do.
154	Chief Nicholai	do	Do.
155	Simeon Ynasha	do	Do.
156	William Avemof	do	Do.
157	Joe Oskolkof	do	Do.
158	Paul Murphy	do	Do.
159	Nick Toman	do	Do.
160	William Hunter	do	Do.
161	John Otterstrom	Salamato to East Forelands	Do.
162	Joe Martinez	Kasilof River	Do.
163	Eric Soderberg	do	Do.
164	R. O. Burgess	Port Chatham to Halibut Cove.	Do.
165	Lloyd Swan	Port Chatham to Anchor Point.	Do.
166	George Hilleary, Pat McNamara, and Alvin Norton.	Boulder Point to Swanson's Creek or Kalgin Island and Fire Island.	Do.
167	Joe Filardo	Kachemak Bay	Do.
168	Joe Magill	Three Mile Creek and Beluga River.	Do.
169	Ivan Asou Paulik and Pavilla Tokolnik	Kamishak Bay	Do.
170	Ivan John Chenik and Simeon John Chenik.	do	Do.
171	Chas. Danielson	Chuit River to Three Mile Creek.	Do.
172	William Hauck	Moose Point	Do.
173	Ent. N. Pond, R. E. McDonald, and Fred M. O'Neill.	Northern end	Do.
175	L. W. Bishop	Russian River	Do.
176	Jones and Williamson Silver Black Fox Farm.	Kasilof River	Do.
182	Carl E. Anderson	Halibut Cove	Herring fishing.
183	J. A. Gustavson, Axel Anderson, and Simon Josefson.	do	Do.
184	Fred Stone	do	Do.
185	Charles Engstrom	do	Do.
187	San Juan Fishing and Packing Co. (Inc.).	Halibut Cove and Kachemak Bay.	Do.

Fishery permits issued by local representative of the Bureau of Fisheries in Cook Inlet district, Alaska, in 1923—Continued

Permit No.	Name of permittee	Locality	Operations
188	Northern Products Corp	Halibut Cove	Herring fishing.
189	Vogen and Uthein	do	Do.
190	Charles F. Dies	do	Do.
191	Meyers and Armstrong	do	Do.
192	H. B. Sundsby	do	Do.
193	Edward T. Jensen and Anton J. Johnson.	do	Do.

KODIAK-AFOGNAK DISTRICT

Salmon fishery operations were carried on in the Kodiak-Afognak district under nine permits issued by the Secretary of Commerce. No operations were reported under permits Nos. 61, 78, and 80, issued, respectively, to Michael P. Galvin, Opheim and Sargent, and Ragnor M. Dahl. In all, 19 permits issued by the Secretary of Commerce were in effect in the district during the season.

Pack of canned salmon under permits in Kodiak-Afognak district, Alaska, in 1923

Permit No.	Name of permittee	Location	Allotment	Pack					
				Cohos	Chums	Humpbacks	Kings	Reds	Total
			Cases	*Cases*	*Cases*	*Cases*	*Cases*	*Cases*	*Cases*
56	Alaska Packers Association.	Larsen Bay		2,079	234	334	149	31,494	34,290
57	Northwestern Fisheries Co.	Uyak		363	82	92	184	13,659	14,380
58	Robinson Packing Corporation.	Zachar Bay	20,000	395	846	2,185	10	9,827	13,263
62	Kodiak Fisheries Co	Kodiak	40,000	588	1,738	17,742		6,087	26,155
63	Katmai Packing Co	Uzinki	20,000	2,121	140	7,347		4,789	14,397
64	Kodiak Island Fishing & Packing Co.	Uganik Bay	20,000	362	375	6,639		748	8,124
65	Pajoman & Trout	Raspberry Island.	2,000			25		626	651
[1] 87	Alitak Packing Co	Lazy Bay		2,782	1,886	18,095		12,765	35,528
89	Hopp & Danielson	Uganik Bay	[2] 500	[3]					[3]
	Total			8,690	5,301	52,459	343	79,995	146,788

[1] Combined operations under permits Nos. 59 and 60 previously issued to Alaska Packers Association and Alitak Packing Co.
[2] Also 200 barrels coho salmon.
[3] Two barrels and 300 pounds coho salmon.

Permits for other than salmon operations were as follows: Nos. 62 63, 64, 68, 69, 71, 76, and 89 to the Kadiak Fisheries Co., Katmai Packing Co., Kodiak Island Fishing & Packing Co., Alaska Sea Food Products Co., San Juan Fishing & Packing Co., W. J. Imlach Packing Co., Uganik Packing Co., and Hopp & Danielson, respectively, for herring operations; No. 67 to W. J. Erskine Co. for herring, codfish, halibut, and clams; Nos. 78 and 83 to Opheim and Sargent and to Theo Breyer and A. C. Freund, respectively, for herring and codfish; and Nos. 79 and 87 to the Hemrich Packing Co. and Alitak Packing Co., respectively, for clams. In addition, 61 permits issued locally by Assistant Agent Shirley A. Baker and

Superintendent Fred R. Lucas for salmon, herring, cod, and halibut operations, were in effect during the year.

The pack of canned clams in the district was as follows: No. 79, Hemrich Packing Co., Kukak Bay, 1,442 cases 1-pound tall cans of whole clams and 5,274 cases No. 1 eastern oyster cans of minced clams; and No. 87, Alitak Packing Co., Lazy Bay, 305 cases 1-pound tall cans of whole clams.

Fishery permits issued by local representatives of the Bureau of Fisheries in the Kodiak-Afognak district, Alaska, in 1923

Permit No.	Name of permittee	Location	Operations
1	John Brodtkorb	Kiupalik Island	Salmon, cod, and halibut fishing.
61	John P. Johnson	Paramanof Bay	Salmon fishing.
62	Simeon Barrestof, Daniel Elynak, John Peterson, Nick Barrestof, and Yaska Barrestof.	Malina Bay	Do.
63	Peter Chichenof, Alexander Chichenof, Alexis Chichenof, and Peter Nekrasof.	do	Do.
64	Gregora Chernikof and Afony Lukin	Paramanof Bay	Do.
65	Mike Boskofsky, Dimitry Boskofsky, William Boskofsky, and John Demidof.	Malina Bay	Do.
66	Afoney Malutin, Nicolai Agik, Tichon Sheratine, and Herman Pichoon.	do	Do.
67	John Arlof, Peter Arlof, Wanka Panamariof, and Wasili Izuwawak.	Seal Bay	Do.
68	Joe McCormick	Raspberry Strait	Do.
69	Ivan Alghoon, Tim Noya, and Nekifer Noya.	Paramanof Bay	Do.
70	Ella Knagin, George Chanium, and Herman Shangin.	Little Afognak	Do.
71	Gregora Yakonak, Paul Yakonak, Fred Demidof, and William Lukin.	Paramanof Bay	Do.
72	Zenovia Boskofsky, Simeon Alexandrof, Kelly Gregora, and Willie Gregora.	Little Afognak	Do.
73	Peter Derenof, Macar Derenof, and Nick Anderson.	Malina Bay	Do.
74	Nick Amachuk, Walter Kewan, and Nick Lukin.	Paramanof Bay	Do.
75	Ernest Strickler	Raspberry Strait	Do.
76	Barney Mullin and John Noumeof	Little Afognak	Do.
77	C. D. Whitney	Kizhuyak Bay	Do.
78	Albert Johnson	Kodiak and Spruce Island waters.	Salmon, herring, cod, and halibut fishing.
79	Arthur Levine	do	Do.
80	William Castell and Leo Haskins	do	Do.
81	Theodore Rosenberg	do	Salmon, herring, and cod fishing.
82	Hardy Hofstad	Zone 3	Do.
83	Rickleff C. Richardson	Nelson Island	Salmon fishing.
84	George Chernikof, Mike Chernikof, Tichon Chernikof, and Alexis Wacho.	Seal Bay	Do.
85	Senofone Yagashof, Dick Yagashof, Trafen Chernikof, and Herman Shanagan.	Little Afognak	Do.
86	Gus Freeburg and Oscar Carlson	Zone 3	Salmon, herring, and cod fishing.
87	John Vick	do	Salmon fishing.
88	Harry Eden	do	Do.
89	Otto Erickson and Leo Erickson	do	Salmon, herring, and cod fishing.
90	John Swanson	do	Salmon fishing.
91	Charles W. Gunderson, Adrian E. Moorehead, Bud Bergh, and Frank Reeder.	Shuyak Island	Salmon, herring, cod, and halibut fishing.
92	Harry Morrison, Peter Maltsoff, and Larry Cope.	Kodiak and Spruce Island waters.	Do.
93	August Heitmann	Chiniak Bay and vicinity	Salmon fishing.
94	Robert Scott	Zone 3	Salmon, herring, cod, and halibut fishing.
95	Ole Olsen	do	Do.
96	Charlie G. Anderson	do	Do.

Fishery permits issued by local representatives of the Bureau of Fisheries in the Kodiak-Afognak district, Alaska, in 1923—Continued

Permit No.	Name of permittee	Location	Operations
97	Alfred Paakkanen	Alf's Island	Salmon and cod fishing.
98	Peter Petrovsky	Amook Island	Do.
99	William H. Boll	Harvester Island	Do.
100	Harry Carlsen	Carlsen Lagoon	Do.
101	Charles Pajoman, Roy Trout, Fritz Laurenzen, Philip Katellnakoff, and Carl Pajoman.	Raspberry Island	Salmon fishing.
102	Fritz Laurensen	Dry Island	Salmon, herring, and cod fishing.
103	Dr. Basil C. Parker	Whale Island	Do.
104	Alexander Lukin	Paramanof Bay	Salmon fishing.
105	Tony Benchola	do	Do.
106	Fred Squartzoff, Sergay Panaronioff, Tete Pestrikoff, and John Panaronioff.	Seal Bay	Do.
107	Wasceli Squartzof, Dick Squartzof, Innocence Squartzof.	do	Do.
108	Nick Katellnakof, Fred Thorsen, Nick Susarenkin, and Nick Susarenkin, jr.	do	Do.
109	Nicholai Laireionoff	Whale Strait and Kizhuyak Bay.	Do.
126	Charles Peterson	Northeast Harbor	Do.
174	M. C. Knutsen	Black Island	Do.
1	Mike Taoshwak and Antone Noya	Litnik Bay	Do.
2	Peter Malutin, Paul Malutin, and Ralph Demidoff.	do	Do.
3	Martin Larsen, John Keegan, and Antone Larson.	do	Do.
4	Oscar Ellison, Fred Sunberg, and Rudolph Sunberg.	do	Do.
5	John Ketelnikoff, Pete Squartoff, Stepan Panimarioff, and Teet Pestrekoff.	do	Do.
6	Stephan Apalone, Andrew Shenagak, and Martin Panimarioff.	do	Do.
7	Waselie Nikrassoff and Gabriel Nikrassoff.	do	Do.
9	Efim Alpiak, Paul Nikrossoff, Willie Apalone, and Alesa Knagin.	do	Do.
10	Robert Knagin, Alek Knagin, and Fred Knagin.	do	Do.

Revised regulations for the administration of the Southwestern Alaska Fisheries Reservation were issued under date of October 25, 1923, as follows:

By virtue of authority conferred by Executive order of November 3, 1922, creating the Southwestern Alaska Fisheries Reservation, the following regulations are hereby promulgated:

1. For purposes of administration the following districts and zones are established:

(*a*). *Bristol Bay district.*—All that portion of the reservation lying within Bering Sea, the coast line extending from Cape Menshikof to Cape Newenham, and thence northward to 59° 15′ north latitude.

Zone 1. Including all the Ugashik fishing grounds lying between the southern line of the district and the fifty-eighth parallel of north latitude and east of the one hundred and fifty-ninth meridian of west longitude.

Zone 2. All that portion of Bristol Bay north of the fifty-eighth parallel of north latitude and east of the one hundred and fifty-ninth meridian of west longitude, including the Egegik, Naknek, Kvichak, and Nushagak fishing grounds.

Zone 3. All waters of the Bering Sea included in the reservation but not included in Zones 1 and 2.

(*b*) *Cook Inlet district.*—Embracing all that portion of the reservation east of Bristol Bay and north of the latitude of Cape Douglas (approximately 58° 50′) including the Barren Islands, the shores and outlying islands of Kenai Peninsula, and all the shores and waters of Cook Inlet.

(c) *Kodiak-Afognak district.*—All that portion of the reservation south and east of the Alaska Peninsula and south of the latitude of Cape Douglas, including the Kodiak-Afognak group of islands, the Trinity and the Semidi groups, Chirikof Island, Shelikof Strait, and all the mainland shores from Cape Douglas to the southwestern boundary of the reservation.

Zone 1. Extends on Kodiak Island from Low Cape to Cape Ugat, and on the mainland coast from the latitude of Cape Ugat to the western limit of the reservation. Includes Red (Ayakulik) and Karluk Rivers and Uyak Bay.

Zone 2. Extends from Low Cape on the western coast of Kodiak Island to but not including Three Saints Bay on the southeastern coast, and includes Alitak and Olga Bays and Chirikof, Trinity, and Semidi Islands.

Zone 3. Embraces all that portion of the district not included in Zones 1 and 2. Includes the western shores of Kodiak and Afognak Islands north of the latitude of Cape Ugat and the northern and eastern shores as far south as Three Saints Bay. It also includes Shelikof Strait and the mainland shores north of the latitude of Cape Ugat.

2. No corporation, company, or person operating for his own account, shall engage in fishing or in the preparation of fishery products of any description, including salmon, clams, crabs, herring, halibut, and cod, except for personal or family use and not for sale or barter, within the above specified districts without first securing a permit from the Secretary of Commerce. Applications for permits covering minor fishery operations by local residents shall be made before the beginning of the fishing season to representatives of the Department of Commerce in Alaska authorized to issue such permits. Applications for all other permits shall be made on or before October 1 of the preceding year to the Secretary of Commerce, Washington, D. C., and shall give full information on the following points:

(a) Name and permanent address of person or corporation desiring permit.

(b) Character of business proposed, whether fishing, or canning, salting, or otherwise curing fish.

(c) Location and capacity of plant. If a cannery, state number of lines of machinery and whether for pound or half-pound cans.

(d) Number and kind of each class of fishing gear desired and location where same is to be operated.

(e) The quantity which it is desired to pack. In regard to canned salmon the amount shall be stated upon the basis of 48 one-pound cans per case.

(f) If application is for continuance of operations previously conducted, the pack of salmon by species, and of other fishery products, and the amount of each class of gear operated in the next preceding season must be shown.

(g) Affidavit as to correctness of facts set forth in the application must be made by competent authority.

3. Permits will specify the amount of pack allowed, if it be limited, and the character, extent, and locality of fishing operations.

4. The use of purse seines in fishing for salmon will not be permitted within the reservation.

5. Fox farmers may take and prepare salmon or other fishery products for fox feed in all legal ways, but permits must be secured from the Secretary of Commerce or from some representative of the department in Alaska authorized to issue permits. Salmon lawfully taken may be used for codfish bait.

6. Transportation of fresh salmon for canning, salting, or otherwise preserving will not be permitted between any two districts or zones within the reservation or between any district or zone within the reservation and any outside district.

7. Throughout the Cook Inlet and the Kodiak-Afognak districts the pack of each salmon cannery shall be made exclusively from the proceeds of the fishing gear specifically allotted to it, except as provided in section 8. Transfer of salmon from one plant to another will not be permitted.

8. Natives and other local inhabitants who have secured individual permits may sell salmon or other fishery products to operators of plants situated in the same district or zone, but such fish or fishery products shall, unless otherwise specified, be included in the pack limit which has been allotted to the plant purchasing them.

9. No fishing for salmon shall be permitted to Chignik Inlet, Kamishak Bay, within a line which joins the outer headlands of the inlet and passes outside the two small islands which lie near its entrance. Markers shall be placed on the headlands to designate the closed area.

10. In the Bristol Bay district the following regulations shall be in effect:

(*a*) In Zone 2 it is permitted that fishing boats discharge their catch wherever convenient, but lighters or other collecting boats shall not transport salmon between the Nushagak, the Egegik, and the Naknek-Kvichak areas. For the purposes of this regulation the fishing grounds off Cape Etolin shall be considered as belonging to the Nushagak River and the Egegik grounds shall be bounded on the north by the parallel of Cape Chichagof.

(*b*) Fishing for salmon for commercial purposes shall be conducted solely by the use of drift gill nets.

(*c*) Each fishing boat may be provided with gill nets the total length of which shall not exceed 200 fathoms hung measure.

(*d*) King-salmon nets shall have a mesh not less than 8½ inches knit measure, and red salmon nets a mesh not less than 5¾ inches stretched measure between knots.

(*e*) The use of salmon traps, beach seines, or purse seines is prohibited.

(*f*) The use of motor fishing boats is prohibited in the Bristol Bay district.

(*g*) Fishing for red salmon shall not begin prior to midnight of June 25 and shall close at or before midnight of July 25 of each year, but each cannery may operate one commissary net at any time to supply fresh salmon for the mess.

(*h*) Fishing for king salmon with drift gill nets having a mesh not less than 8½ inches knit measure is permitted at any time prior to midnight of July 25 of each year, at which time all fishing for salmon shall close in this district.

(*i*) In the Kvichak area no fishing shall be permitted above a true east and west line drawn across the river from the Koggiung (Diamond J) cannery of the Alaska Packers Association. Stakes shall be set to mark this boundary.

(*j*) Each cannery is required to place its fishing boats on a limit as to their daily delivery whenever the intensity of the run is such that it can not pack in a safe and sanitary manner all the salmon that may be caught by the gear in use. Such a limit shall become immediately effective, but no salmon shall be refused which were caught before the fishermen had received adequate notice. Canneries will be held responsible for the accumulation of stale fish accepted in excess of the packing requirements of the day.

11. Increase in the capacity of any cannery by installing additional equipment is prohibited.

12. The minimum size of razor clams taken for canning is fixed at 4½ inches in total length of shell. Not more than 5 per cent of the clams used in any cannery may measure less than this minimum.

13. These regulations shall be subject to such annual revision by the Secretary of Commerce as may appear advisable in view of the investigation and the experience of the preceding season. They shall be in full force and effect immediately from and after date of issue.

AFOGNAK RESERVATION

Approximately 100 natives living on Afognak and Spruce Islands availed themselves of fishing privileges in the Afognak Reservation in 1923 under permits issued by the bureau's representatives. These are listed elsewhere under the heading of Kodiak-Afognak district of the Southwestern Alaska Reservation. They operated at eight localities and used beach seines almost exclusively in taking salmon. The total catch was 268,178 salmon, or an increase of 94,923 over the catch of 1922. The gains by species were as follows: Humpbacks 2,781, kings 16, reds 104,612. Cohos fell off 12,103 and chums 383. The catch was sold by the natives to the canneries of the Kadiak Fisheries Co., Katmai Packing Co., and Pajoman & Trout.

In order to permit an escapement of salmon to the several spawning areas in the reservation, close seasons of a few days were ordered and enforced at the more important localities. The districts thus affected were Little Afognak, Seal Bay, Paramanof Bay, and Malina. While the escapement in most localities was regarded as good, the lack of water in the streams seriously impeded the ascent of salmon and retarded their movement into the streams. For this reason the catch of the fishermen was larger than it otherwise would have been.

Litnik Bay, which has been closed to commercial fishing for red salmon since the establishment of the hatchery in 1908, was opened to red-salmon fishing to a limited degree in 1923. Fishing by authorized natives was allowed to the extent of not to exceed one-third of the run of red salmon as indicated by the count at a rack erected in the river a short distance above the bay. The run was very disappointing, and fishing was stopped July 15. The total count of red salmon passing through the rack for the season ended September 8 was 8,025.

Patrol work in the Afognak district was carried on under the immediate direction of Warden William E. Baumann.

Number of salmon caught for commercial use in Afognak Reservation in 1923

Locality	Coho	Chum	Humpback	King	Red	Total
Malina	1,328	98	19,729	15	68,281	89,451
Little Afognak	5,161		434	3	17,411	23,009
Paramanof	34	83	32,601		19,724	52,442
Litnik Bay	15,018	1	354	28	758	16,159
Danger Bay	2,225		40,177			42,402
Seal Bay	24	2	3,325		25,349	28,700
Izhut Bay	544		233		13,720	14,497
Pauls Bay					1,518	1,518
Total	24,334	184	96,853	46	146,761	268,178

ALEUTIAN ISLANDS RESERVATION

Data regarding all permits for fishing operations within the Aleutian Islands Reservation will be found under the heading Alaska Peninsula Fisheries Reservation (pp. 51 to 53) in this report. Permits for grazing purposes on the lands of the Aleutian Islands Reservation, which have heretofore been issued jointly by the Secretaries of Agriculture and Commerce, are now being issued by the Secretary of Agriculture.

ANNETTE ISLAND FISHERY RESERVE

On April 30, 1917, the Secretary of the Interior leased the fishing and canning privileges of the Annette Island Fishery Reserve to the Annette Island Packing Co. for five years. This lease expired with the close of the fishing season in 1922. On March 26, 1923, the Assistant Secretary of the Interior entered into a new contract with the Annette Island Packing Co., leasing it the fishing and canning privileges of the reserve for another period of five years. The new lease provides for an annual permit fee of $200 for each trap erected in the reserve, and royalties of 5 cents for each red salmon, 2 cents for each coho, and 1 cent for each salmon of other species taken in traps. The old rate was a fee of $100 for each trap and a royalty of 1 cent for each salmon taken in traps. The present lease also provides for the payment of other fees on canned products at the rate of 7 cents per case of red salmon, 3½ cents per case on cohos, and 3 cents per case on all other grades.

In 1923 the company operated seven traps, for which fees amounting to $1,414 were paid. The traps caught 1,223,207 salmon, on which a royalty of $13,700.15 was paid. There was paid to the natives for labor in the cannery and for other purposes the sum of $38,540. In addition the natives received $10,299 for 221,790 salmon taken in seines and gill nets. The total return to the Metlakatlans for royalties, fees, and labor was therefore $63,953.15.

The suit brought by the Territory of Alaska against the Annette Island Packing Co. for the collection of territorial license taxes in 1922 was appealed by the Territory to the circuit court of appeals at San Francisco, which denied, on May 28, 1923, the right of the Territory of Alaska to impose occupational taxes on the Annette Island Packing Co. On October 22, 1923, the petition by the Territory for a review of the suit was denied by the United States Supreme Court.

STREAM MARKERS

In general, the marking of stream mouths was limited to the replacement of markers that had been removed or destroyed since the season of 1922. In southeast Alaska several unnamed streams on the west coast of Chichagof and Baranof Islands were marked, and a few on the west coast of Prince of Wales Island were also marked.

STREAM GUARDS

The bureau employed 46 men as stream guards in 1923. Of these 25 were stationed in southeast Alaska, 15 in central, and 6 in western Alaska.

The localities in southeast Alaska to which attention was given are as follows: Takanis and Klag Bays, Basket Bay, Chilkoot Inlet, Chilkat Inlet, Tenakee Inlet, Pavlof Harbor, Redoubt Bay, Taku Inlet, Taylor Bay, Wilson Cove to Killisnoo, Salmon Bay, Petersburg Creek, Eagle Creek, Rocky Bay and Menefee Inlet, Staney Creek and Deweyville, Thorne Bay, Port Johnson, Thom's Place, Anan Creek, Naha Bay, Karta Bay, Moira Sound, Olive Creek, Lake Bay, Whale Passage, and Sockeye Creek. These fields were watched for a period of approximately 50 days, beginning early in July and continuing late in August. In a few instances longer details were arranged.

In central Alaska guards were placed in the following districts: Bering River, Copper River delta, Coghill River, Eshamy Lagoon, Cook Inlet, Afognak Island, Karluk River, and Olga Bay. In western Alaska two guards were stationed on the Ugashik River, one each on the Kvichak, Naknek, and Igushik Rivers, and one on the Egegik River.

In addition to this force, 4 statutory employees of the bureau operated in southeast Alaska, 8 in central Alaska, 4 in western Alaska, and 1 on the Yukon River. There were also 36 persons on the bureau's vessels and 10 others temporarily employed in various capacities. The foregoing makes a total of 17 statutory employees and 92 others, or a grand total of 109 persons identified with fishery protective work in Alaska in 1923.

FISHERY PATROL

Nine vessels owned by the bureau were operated in fishery patrol work in Alaska in 1923. Of these the *Auklet*, *Murre*, *Petrel*, and *Widgeon* were used in southeast Alaska; the *Kittiwake* was used in Central Alaska from Cordova to Cook Inlet; and the *Ibis* was stationed at Chignik, the *Merganser* at Ikatan, the *Scoter* in the Bristol Bay district, and the *Tern* on the Yukon River. The *Puffin* and *Swan* were not in service during the season. Fourteen small power boats were chartered in southeast and central Alaska for patrol work chiefly by stream guards.

The *Kittiwake* is new to the Alaska service. This vessel, which is about 70 feet in length and 15 feet in breadth, was acquired by transfer from the Navy Department, in which it served during the war as a scout patrol on the east coast of the United States. The vessel was transported to Seattle, Wash., and there reconditioned and equipped with a 65-horsepower Union Diesel engine. Following the completion of repairs and alterations the *Kittiwake* left Seattle in August and arrived at Cordova September 3. The *Kittiwake* is of seaworthy type and will be used chiefly in the Prince William Sound and Cook Inlet districts.

The Pribilof Islands tender *Eider* was assigned during the month of August to furnish transportation for an inspection of the fisheries of the Kodiak-Afognak district and along the southern coast of the Alaska Peninsula. Agent Dennis Winn boarded the vessel at Seldovia on August 2, Dr. C. H. Gilbert at Seward on August 3, and Willis H. Rich at King Cove on August 10. Messrs. Rich and Winn left the vessel at Iliamna on August 19 for a trip over the spawning grounds of the Iliamna district and returned again to the *Eider* at Iliamna Bay on August 27. The whole party left the *Eider* at Seward on August 28, when the vessel returned to its regular duties.

Near the close of the year arrangements were made to transfer the *Puffin* from the Alaska service to the division of fish culture for use at the McDonald Lake hatchery. The *Puffin* is rather too small for patrol work, but can be utilized to advantage in necessary trips between the hatchery landing on Yes Bay and Ketchikan.

Vessels of the United States Coast Guard that were detailed to carry on the fur-seal patrol in Alaskan waters rendered valuable service to fishery vessels and in connection with the fisheries industry in Alaska also.

ALASKA FISHERY INTELLIGENCE SERVICE

This service had its inception several years ago in the desire of the bureau to make available at frequent intervals, particularly to the fishermen at all important coastal points in Alaska, the market price of fresh halibut, fresh and pickled salmon, and fresh sablefish at Ketchikan and Juneau, Alaska, and Seattle, Wash. These prices are reported by cable to the following points in Alaska: Ketchikan, Wrangell, Petersburg, Juneau, Sitka, Craig, Cordova, and Seward, and they are posted for the information of the public at the cable office in each of the places named. This arrangement is made possible through the courtesy of the Alaska Military Telegraph and Cable System, and by it the fishermen are enabled to keep in touch with market prices at three American ports, two of which, Ketchikan and Seattle, are among the most important centers of the fresh-fish trade on the Pacific coast.

VIOLATIONS OF THE FISHERIES LAWS AND REGULATIONS

Practically all reported violations of the fishery laws and regulations fall into four general classifications, namely, fishing during the weekly close season of 36 hours, fishing in streams and closed areas, wasting salmon, and failing to observe the regulation which requires that all fixed fishing appliances shall bear a sign showing in 6-inch letters the name of the owner of each apparatus.

Of the cases reported by the bureau in southeastern Alaska 22 indictments were returned against the owners and watchmen of traps that were not closed in accordance with law during the 36-hour period, 1 against the owner of a trap for locating it within 500 yards of the mouth of a salmon stream, 3 against the operators of seines for fishing in streams or in the closed area at the mouths of streams, and 1 against a canning company and an individual for the wanton waste of salmon.

Fourteen trap cases were closed by pleas of guilty being entered and the payment of fines aggregating $2,070, 3 were continued until the next term of court, and 4 resulted in acquittals or dismissals. In most instances the cases against the trap watchmen were dismissed. Five were held to answer the indictments, and upon being arraigned pleaded guilty and paid fines amounting to $280, and, in addition, 2 were given jail sentences of 10 days each. All indictments alleging failure to place identification signs on traps were dismissed.

Trials of cases involving unlawful fishing by seiners at the mouths of streams resulted in two acquittals and one conviction upon which a fine of $50 was paid.

Two indictments against one company charged with the wanton waste of salmon were called for trial at Ketchikan and resulted in the dismissal of one and an instructed verdict for the defendant in the other.

At the spring term of the district court at Ketchikan one company and one individual were indicted for the wanton waste of salmon at Scow Bay in 1922. These cases were called for trial at the September term of court, when the company pleaded guilty and paid a fine of $200. The case against the individual was dismissed, as he was only an employee of the company concerned.

Two other cases alleging violation of the fishery laws and regulations of Alaska were reported to the grand jury at Juneau in November by private parties, and indictments were returned. One accused P. E. Harris & Co. of having operated its Point Marsden trap every Sunday in June and the first three in July; the other alleged that two natives had fished within the closed area at Neka Creek near Hoonah. The natives were acquitted, but no verdict was reached in the case against the company.

Two cases of fish piracy were brought to the attention of the grand jury at Ketchikan, resulting in the indictment of two gangs of natives under the charge of grand larceny for taking several thousand salmon from traps of the Alaska Consolidated Canneries on

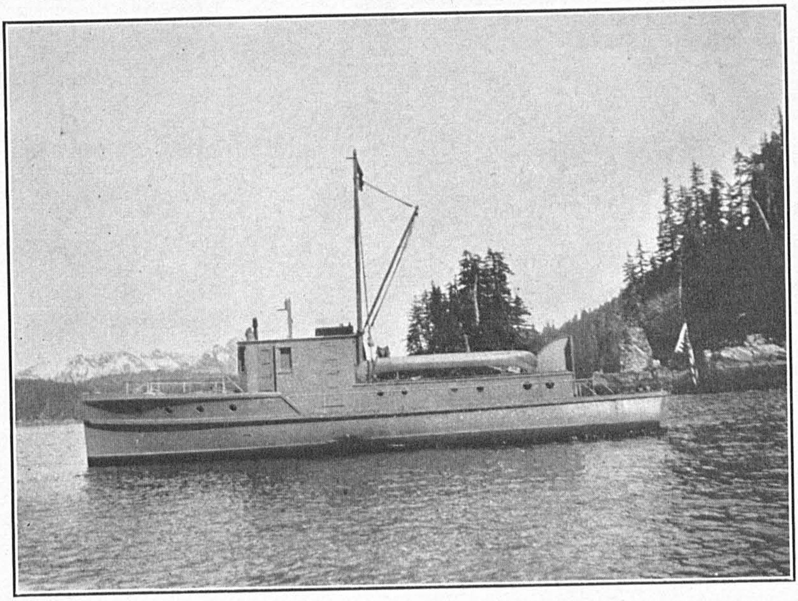

FIG. 2.—Patrol vessel *Petrel*

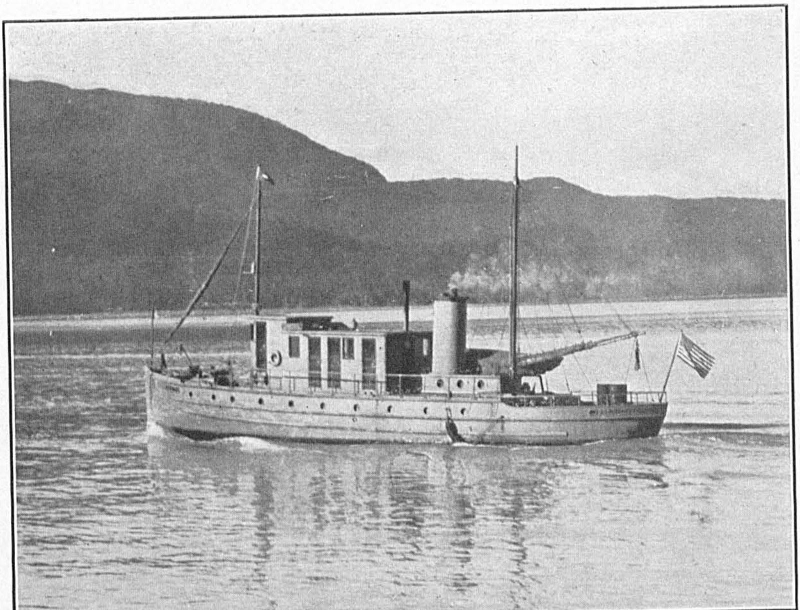

FIG. 3.—Patrol vessel *Kittiwake*

the west coast of Prince of Wales Island. Both cases were continued until the next term of court at Ketchikan.

One piracy case was reported to the grand jury at Juneau in November, and a true bill was found against Frank Harris, W. L. Beach, and Arthur Carter, who were accused of stealing fish from traps in Chatham Strait. In the course of the trial the defendants testified that they were not at a certain trap on a certain day, as had been shown by Government witnesses, but were several miles away, a statement known by the district judge to be false, he having personal knowledge of the facts. Taking judicial knowledge of these things, Judge Reed adjudged the defendants in contempt of court and sent them to jail for 90 days. Upon expiration of this prison sentence they will face charges of perjury. Meanwhile the piracy case remains unsettled.

In central Alaska complaints were filed against 12 individuals, charging them with gill-net and seine fishing in the protected waters of the Copper River Delta, Bering River, Bay of Isles, and other streams of Prince William Sound. Seven pleaded guilty and paid fines and costs amounting to $478.95. Two were not apprehended, and three were discharged, being Indians of the Copper River Valley and unacquainted with the law and regulations.

Three cases were brought in the United States District Court at Seattle against one packing company and three of its trap watchmen operating in the Alaska Peninsula Fisheries Reservation, charging them with fishing three traps in the weekly close periods of June 17 and 25 and July 21. Convictions were secured in all cases and fines of $1,150 and $400 were paid by the company and watchmen, respectively.

Six violations were reported in the Bristol Bay district of western Alaska, involving two fishermen in each case. Two of them were charged with fishing in Wood River, six in Nushagak River, and four in Ugashik River, all above the markers indicating the closed areas. No service was had against four who fished in Ugashik River and two in Nushagak River. The six men who were apprehended appeared at the fall term of the district court at Valdez, pleaded guilty, and paid fines of $50 each.

In all, $4,880, exclusive of costs, was paid in 1923 as fines by the violators of the fishery laws and regulations of Alaska. The amounts by districts are as follows: Southeastern Alaska, $2,600; central Alaska, $1,980; and western Alaska, $300.

In addition to the foregoing record of criminal proceedings the grand jury at Ketchikan returned 55 indictments of packing companies and individuals under chapter 95, Session Laws of Alaska, 1923, which provides close seasons of 20 days in southeastern Alaska east of the one hundred and thirty-ninth meridian of west longitude. At Juneau, in November, the United States attorney filed information, comprising 217 counts, against 44 packers and fishermen. Auk Bay Salmon Canning Co., being one of this number, was tried in the district court before Judge Thomas M. Reed, who handed down a decision upholding the validity of the Territorial act.

The cases against the Kenai Packing Co. and the Copper River Packing Co., alleging that in 1921 they wantonly wasted considerable quantities of salmon, were finally dismissed in 1923 on account of the death of the Government's material witness.

TERRITORIAL LICENSE TAX

Fisheries license taxes were collected by the Territory under the general revenue law of May 5, 1921, as amended by the act of May 5, 1923. A statement from the treasurer, under date of May 23, 1924, gives the collections made to that date for the year 1923. It was stated that approximately only about $2,500 remained uncollected on the basic rate taxes on canned salmon, but that many cannery companies are contesting the graduated pack taxes, and pending the outcome of the test cases now in the courts they are withholding payment of such additional taxes in the approximate sum of about $140,000. Collections under all other fisheries tax schedules were reported as practically complete, with but little outstanding. The total collections for the calendar year 1923 thus reported are about $146,000 greater than in the preceding year. Details in regard to collections on account of 1923 are shown in the following table:

Fishery license taxes collected by Territory for fiscal year ended December 31, 1923

Schedule	Division No. 1	Division No. 2	Division No. 3	Total
Salmon canneries (pack)	$123, 687. 72		$207, 446. 85	$331, 134. 57
Salmon canneries (net income)	4, 633. 29		17, 315. 56	21, 948. 85
Clam canneries	72. 93		878. 45	951. 38
Salteries	3, 913. 64	$329. 80	5, 617. 35	9, 860. 79
Cold-storage plants	1, 625. 00		500. 00	2, 125. 00
Fresh-fish dealers	6, 288. 88		8. 26	6, 297. 14
Fish-oil works and fertilizer and fish-meal plants	7, 174. 39	1. 20	1, 764. 40	8, 939. 99
Fish traps	77, 000. 67		27, 182. 95	104, 183. 62
Gill and stake nets	672. 00	48. 00	6, 151. 10	6, 871. 10
Seines	4, 800. 00		1, 880. 00	6, 680. 00
Total	229, 868. 52	379. 00	268, 744. 92	498, 992. 44

ALASKA FISHERY LEGISLATION ENACTED

The Legislature of Alaska, at its biennial session in 1923, passed three acts affecting the fisheries of Alaska.

The first of these provides for the licensing of fishermen annually, and makes it unlawful for any person to engage in fishing for commercial purposes without first obtaining a license. Fishermen are divided into four classes, which are required to pay license fees as follows:

Resident fishermen of all classes	$1
Nonresident hook-and-line fishermen, exclusive of those who use set lines	3
Nonresident gill-net and set-line fishermen	10
Nonresident seine and set-net fishermen	25

Licenses issued under this act are to be exhibited, upon demand therefor, to any officer, agent, or employee of the Federal or Territorial Government.

The second act is intended to supplement the fishery laws of the United States applicable to Alaska, to conserve the salmon supply of Alaska, and to provide for close seasons for salmon fishing. Under its terms southeastern Alaska is divided into two zones, in both of which commercial fishing for salmon is stopped for 20 days. The act is as follows:

CHAPTER 95

Be it enacted by the Legislature of the Territory of Alaska:

Section 1. That it shall be unlawful to take or fish for salmon for commercial purposes, except by trollers, in the waters of Alaska between the 57th and 60th degrees of north latitude and east of 139th meridian west longitude from the tenth day of August to the first day of September in each year.

Section 2. That it shall be unlawful to take or fish for salmon for commercial purposes, except by trollers, in the waters of Alaska south of the 57th degree of north latitude and east of 139th meridian from the 20th day of August to the 9th day of September in each year.

Section 3. That any person, firm, or corporation violating any of the provisions of this act shall be guilty of a misdemeanor, and upon conviction thereof for each and every offense shall be punished by a fine of not less than fifty dollars ($50.00) nor more than one thousand dollars ($1,000.00), or by imprisonment in jail for not less than ten days nor more than one year, or by both such fine and imprisonment, in the discretion of the court.

Section 4. This act shall not be so construed as in anywise to alter, amend, modify, or repeal any of the fish laws of the United States applicable to Alaska, or any act of Congress whatsoever relating to the fisheries of Alaska, whether designed to regulate the same or passed for any other purpose whatsoever, but all such laws and acts of Congress shall be and remain in full force and effect. The purpose of this act is not to alter, amend, modify, or repeal any of such laws, but to provide for further and additional regulation of the fisheries with a view to giving additional protection to the salmon and insuring a future supply thereof, and this act shall be construed so as to carry out the intention herein expressed and not otherwise.

Section 5. An emergency is hereby declared to exist, and this act shall be in effect immediately upon its passage and approval.

The legislature also amended the license tax law of 1921 by increasing the tax rate on various fishery products, imposing a tax on fish caught in traps in excess of 100,000, and repealing the tax of 2 cents per case on canned herring. The present law, as far as it applies to the fishery industry, is as follows:

CHAPTER 101

AN ACT

Be it enacted by the Legislature of the Territory of Alaska:

Section 1. That Section 1 of Chapter 31 of the laws of 1921 is hereby amended so as to read as follows:

* * * * * * *

8th: *Fisheries:*

(*a*) Clam canneries, three (3) cents per case.

(*b*) Salmon canneries; on kings, reds, sockeyes, ten (10) cents per case.

(*c*) On a pack of kings, reds, and sockeyes, counted together, at any one cannery, an additional tax shall be paid as follows: On all cases in excess of ten thousand (10,000) and not more than twenty-five thousand (25,000), five (5) cents per case; on all cases in excess of twenty-five thousand (25,000) and not more than forty thousand (40,000), ten (10) cents per case; on all cases in excess of forty thousand (40,000) and not more than fifty thousand (50,000), fifteen (15) cents per case; on all cases in excess of fifty thousand (50,000), twenty (20) cents per case.

(*d*) On medium reds, cohos, and pinks, four and one-half (4½) cents per case.

(*e*) On a pack of medium reds, cohos, and pinks, counted together, at any one cannery, an additional tax shall be paid as follows: On all cases in excess of twenty-five thousand (25,000) and not more than forty thousand (40,000), two (2) cents per case; on all cases in excess of forty thousand (40,000) and not more than fifty thousand (50,000), four (4) cents per case; on all cases in excess of fifty thousand (50,000), (6) cents per case.

(*f*) On chums, three (3) cents per case.

In addition to the above tax, salmon canneries shall pay 1 per cent of their net annual income. The net income shall be determined in the same manner as the net income is determined under the Federal income tax law, except that no deduction shall be allowed on account of interest on bonds or money borrowed except on account of other Territorial taxes paid.

(*g*) Salteries: Fifteen (15) cents per one hundred pounds of mild cured red king salmon; five (5) cents per one hundred pounds on mild cured white king salmon: ten (10) cents per one hundred pounds on salted codfish: two and one-half (2½) cents per one hundred pounds on all other salted and mild cured fish.

(*h*) Fish traps, fixed or floating, two hundred ($200.00) dollars per annum, so-called dummy traps included; and an additional tax of two ($2.00) dollars per one thousand shall be paid on all fish caught in any one trap in excess of one hundred thousand (100,000).

(*i*) Gill nets and stake nets, two ($2.00) dollars per 100 fathoms or fraction thereof.

(*j*) Seines, ten ($10.00) dollars for the first one hundred fifty (150) fathoms, and five ($5.00) dollars additional for each twenty-five (25) additional fathoms or fraction thereof.

(*k*) Fishermen who are not residents of the Territory, five ($5.00) dollars per annum. The term "fishermen" shall mean to include all persons employed on a boat engaged in fishing. This tax on non-resident fishermen shall continue only until January 1, 1924.

9th: *Cold storage plants.*

Doing a business of one hundred thousand ($100,000) dollars per annum or more, five hundred ($500.00) dollars per annum; doing a business of seventy-five thousand ($75,000.00) dollars per annum and less than one hundred thousand ($100,000) dollars, three hundred seventy-five ($375.00) dollars per annum; doing business of fifty thousand ($50,000.00) dollars and less than seventy-five thousand ($75,000.00) dollars per annum, two hundred fifty ($250.00) dollars per annum: doing business of twenty-five thousand ($25,000.00) dollars and less than fifty thousand ($50,000.00) dollars per annum, one hundred twenty-five ($125.00) dollars per annum: doing business of ten thousand ($10,000.00) dollars and less than twenty-five thousand ($25,000.00) dollars per annum, fifty ($50.00) dollars per annum: doing business of four thousand ($4,000.00) dollars per annum and less than ten thousand ($10,000.00) dollars per annum, twenty-five ($25.00): doing business under four thousand ($4,000.00) dollars per annum, ten ($10.00) per annum.

The "annual business" under this subdivision shall be considered the gross amount received for the product and for storage of produce for others.

10th: Fish buyers (dealers in fresh fish), one-tenth of one per cent per pound on fish purchased, except for sale at retail, whether or not the fish buyer operated a cold-storage plant.

11th: (*a*) Fish-oil works and fertilizer plants, forty (40) cents per fifty (50) gallon barrel for oil and forty (40) cents per ton for fertilizers and fish meal.

(*b*) Whale oil, fifty (50) cents per fifty (50) gallon barrel for oil, and fifty (50) cents per ton for fertilizer.

WATER-POWER PROJECTS IN ALASKA

There was referred to the bureau from the Federal Power Commission in 1923 one application for a permit for a water-power project in Alaska, on Lagoon Creek, at Port Wells, about 70 miles west of Valdez. Assistant Agent Shirley A. Baker made an examination of the locality, and on the basis of his report the bureau advised the commission that it appeared that the proposed project would not interfere with the protection or utilization of fishery resources, and therefore no objection would be made to the granting of the permit. As in previous cases, however, it was suggested that a clause be inserted in the permit that no rights are granted contrary to the fishery laws of Alaska or the regulations made in pursuance thereof by the Secretary of Commerce.

TAGGING OF SALMON

The tagging experiments begun in 1922 were continued during the season of 1923. The work was conducted in the same region—that is, along the Alaska Peninsula—and, as before, for the purpose of obtaining information as to the direction and rate of the migration of salmon and in order to determine the spawning grounds frequented by the fish constituting the basis of this important fishery. The work was done under the direction of Dr. C. H. Gilbert and Dr. W. H. Rich, assisted by W. P. Studdert. Ten thousand tags were attached, mainly to red salmon, although a few hundred humpback, chum, and coho salmon were tagged also. The work was done in the district south of the westernmost part of the Alaska Peninsula between the Shumagin Islands and Isanotski Strait. An additional feature of the work of 1923 was the collection of scales from each salmon tagged.

The results confirmed in every important respect the results obtained in 1922 and gave some additional information of value and interest. A large percentage of returns was obtained from Bristol Bay, showing beyond question that the run of fish, which is of such importance commercially along the southern shore of the Alaska Peninsula, is composed in large measure of fish bound for Bristol Bay. A few returns were obtained from the local spawning grounds along the northern shore of the peninsula and more from those located along the southern shore. Others were obtained from points to the eastward, especially from Chignik, but also from Alitak, Karluk, Afognak, and Cook Inlet. The rate of migration, as indicated by these returns, is approximately the same as was observed in 1922. The rate of travel is apparently slower to near-by streams and faster to more distant regions, such as Bristol Bay and Cook Inlet. On these longer journeys the rate of travel approximates 20 miles per day, though this is subject to much variation and at certain times averages much higher. The examination of the scales has not yet been completed, but enough has been done to indicate that interesting and valuable results will be obtained.

SALMON FOR FOX FEED

The raising of foxes in Alaska has developed into a considerable industry, as approximately 200 farms are now established and many suitable islands from Dixon Entrance to the western end of the Aleutian Chain are occupied as fox farms. In addition, a number of farms have been established along the mainland coast of Alaska by the use of corrals.

Those engaged in this industry require large quantities of fish for feed for their animals, and, as the business grows, demands on the fisheries will increase correspondingly. Salmon enter largely into this feed supply because of the comparative ease with which they are obtained.

In southeast Alaska, where more than 100 farms are established, it is estimated that at least 500,000 salmon and 500,000 pounds of fish heads from the canneries are used annually for fox feed. In central Alaska, where there is about an equal number of farms, approximately 250,000 salmon are used each year. Most of the salmon so used are taken by seines or purchased from local fishermen, but one fox-farm corporation in southeast Alaska operated a trap. All species of salmon are used, though the bulk of the supply consists of humpback, chum, and coho salmon.

BRISTOL BAY DISTRICT

In 1923 a special force, consisting of two regular wardens and a number of other employees under the direction of Agent Dennis Winn, again operated in the Bristol Bay district. As in preceding seasons attention was devoted during the spring to the destruction of predatory fishes, and after the beginning of active salmon-fishing operations a patrol was maintained on Bristol Bay and in all tributary waters. Two employees were again detailed to remain in the district over the winter for the purpose of making further observations on the spawning grounds of the Wood River lake system. Mr. Winn's report is as follows:

GENERAL REPORT OF SEASON'S OPERATIONS

This report deals with operations in connection with a survey of lakes and spawning areas, improvement of salmon streams, destruction of predatory enemies of salmon, and enforcement of fishery laws and regulations in Bristol Bay through the season of 1923.

The plan of operations varied but little from that of previous years. The employees went forward on different cannery ships, together with supplies and equipment. Men and suppl es were landed at or near their respective districts by the packers who furnished transportation. This was of great assistance, as the bureau's vessel *Scoter* was late in being launched, due primarily to necessary repairs and alterations. The fishermen's strike in the States delayed departure of the ships, and consequently they arrived at Br stol Bay later than formerly; also the fact that some of the ships carried a portion of the bureau's supplies resulted in some delay in beginning the work.

Transportation to Bristol Bay was secured as follows: Eight men on the Alaska Packers Association ship *Star of Lapland* from Semiahmoo, Wash.; 5 men on the Alaska-Portland Packers' Association steamer *North King* from Portland, Oreg.; 3 men on the Columbia River Packers' Association ship *Chillicothe* from Astoria, Oreg.; 3 men on the Carlisle Packing Co.'s steamer *Brookdale* from Seattle, Wash.; and 1 man on the Naknek Packing Co.'s ship *Heckla* from San Francisco. On the return to the States 5 men received passage on the *Star of Zealand* to San Francisco, 3 men on the *North King* to Portland, 2 men on the *Chillicothe* to Astoria, 2 men on the *Brookdale* to Seattle, and 1 man on the *Heckla* to San Francisco. The Alaska Packers Association transported the necessary subsistence supplies on their different ships for the bureau's use at Kvichak, Egegik, and Ugashik. The Alaska-Portland Packers' Association carried subsistence supplies for Naknek and part of Nushagak, together with all needed fuel oils for the different sectors. Part of the supplies for Nushagak also were taken on the Northwestern Fisheries Co.'s ship *Guy C. Goss* from Seattle. Ship chandlery and machinery for the bureau's boat *Scoter* was delivered at Kvichak by the *Brookdale*. Sincere appreciation is expressed at this time for the assistance and cooperation extended by these companies and their employees.

The bureau employees engaged in this work were Dennis Winn, A. T. Looff, F. G. Morton, Joe Paulsean, Gordon McGill, Bud Murphy, and John Watson. Others were carried as last year on the packers' roll until June 30, when most of the men were transferred to the bureau's pay roll for the remainder of the season. As in former years as many local men as possible were secured.

DESTRUCTION OF PREDATORY FISHES

This work is showing results in every section, especially Wood River, and trout are becoming more difficult of capture each year. It is an encouraging fact that trout in numbers were found only in the first two lakes in the Wood

River district. While more trout than formerly were captured in Becharoff Lake, they were widely distributed, and continuous travel was necessary this year in order to reach the different sources. Those creeks that were closely fished in previous years showed greatly reduced numbers of trout this year.

Naknek.—The writer, together with four men of the Naknek crew, in charge of Gus Severson, proceeded on the *North King* from Portland, leaving that point May 5 and arriving at Naknek May 17. The crew was immediately taken ashore, and the different boats were painted and placed in the water. All equipment was overhauled and nets tanned. Mr. Severson and crew left for the lake on the 23d and made camp below the rapids for a short period. Set nets were placed and fishing was conducted with fair success for five days, during which time several trips were made over the rapids with equipment and supplies. When all was in readiness and the fishing became poor, a start was made for the outlet of the lake, arriving there on the 31st, when camp was established, and fishing progressed with satisfactory results to June 3. Strong winds prevailed from June 2 to 9, accompanied by heavy rain during the last two days. Extreme difficulty was experienced throughout the blow to keep nets fishing owing to the amount of grass and drift, but fair catches of trout, all containing young salmon in their stomachs, were made each day. Great schools of young salmon just out of the gravel were noted around the shores with the trout preying upon them. The stomach of one 10-pound lake trout taken on a spinner on the 4th contained 343 of these young salmon with 8 still alive.

The first migrating sockeye was noted May 26, but no large schools were seen at the lake outlet before June 1. On that date an 18-pound lake trout, which had 54 young migrating salmon in its stomach, all about 3 inches in length, was taken.

On the arrival of Warden Looff on June 8 with a knockdown boat to be used on Grosvenor Lake, it was decided to move to the head of Naknek Lake, and while assistance was available the boat lumber was portaged across from Naknek to Grosvenor Lake, where it was assembled. As the salmon are late in arriving at this point, it was thought best to return to Kidawik Creek and operate there as extensively as possible until they put in an appearance at that point. During the preliminary investigation in Grosvenor Lake several large pike and lake trout were taken. One of the latter measured 20 inches in girth and weighed 24 pounds.

Good results attended operations at Kidawik. While but few Dolly Vardens were taken, most of them were extremely large and one specimen measured 28 inches in length. The first salmon noticed here was on June 19, and the following day numbers appeared when nets were removed and the crew left for Lake Grosvenor. Supplies and equipment were taken over the portage, and camp was established on the Grosvenor side. Excellent results attended efforts here until the 30th, when the salmon began arriving, thus necessitating the removal of all gill nets from the water. Hand and set lines were then resorted to.

Lake Coville and the narrows between Coville and Grosvenor Lakes contain the best spawning beaches in this section. Trout are fairly plentiful, and the prospects for work there in the spring are excellent as there is now available a suitable boat for beginning operations immediately upon arrival there another year. Lake Grosvenor has very rocky shores with deep water close to shore. Many places that appeared to be suitable spawning areas were noticed, but it was too early to note whether they were used for that purpose. Salmon were noticed jumping all over the lake and passing up through the narrows from Grosvenor to Coville in large schools.

The escapement of fish was good, although not as large as last year (possibly 80 per cent of 1922), and was considered sufficient for the needs of this district. Salmon in satisfactory numbers were entering the lake throughout July. A small number of kings and chums was noticed in the river below the rapids on July 28, and a few silvers made their appearance there August 1. This is too far up the river for the occurrence of any number of these species, although small numbers of each spawn in the vicinity.

Before the departure of the crew boats were scraped and painted and, together with all equipment, were stored in the Alaska-Portland Packers' Association cannery.

The total number of trout destroyed for the season was 3,429, averaging from 10 to 12 pounds each, with a total weight of 37,719 pounds. All but about 2 per cent were lake trout, the remainder being Dolly Vardens, suckers, and pike.

Ugashik.—Transportation north for the Ugashik crew, with Harry Allen in charge, was secured on the *Star of Lapland*, leaving Semiahmoo April 27 and arriving at Bristol Bay May 21. As the bureau's launch *Scoter* was late in being launched, the Alaska Packers Association boat *Kodiak* and the *St. Katherine*, of the Red Salmon Canning Co., carried the men to their destination at the cannery of the latter company, where the fishing gear was stored.

The supplies for this crew were on the *Star of Finland*, which was yet en route. With the small amount of groceries stored from last year and a supplementary supply borrowed from the Red Salmon Canning Co., a start up the river was immediately made and camp established below the first rapids. A further supply of groceries was borrowed from the cannery for a second trip up the river before the landing of the bureau's shipment from the *Star of Finland* on June 17.

Fishing in the vicinity of the first rapids was not satisfactory, and camp was moved to the upper rapids on a stream connecting the two lakes, where good results were secured. A trap was installed, and in connection therewith set nets, seines, and hand lines were used to good advantage. Trips were made with light camping outfits and nets to all the different streams around both lakes, and good work was accomplished. The best results were attained at the upper rapids, where the trout were ascending from the lower to the upper lake. Those of any size in the upper lake were schooling just above the rapids, seemingly waiting for the salmon to ascend, although many were taken in the trap while descending to the lower water. The majority, however, schooled above and were feeding partly on the young sockeyes just out of the gravel, but mainly on the migrating salmon fingerlings. The last of these passed into the lower lake about July 17, and after that date many of the trout stomachs examined contained crawfish. The migration was in excess of the previous year, which in itself is satisfactory and encouraging.

Seventeen creeks were visited, of which 14 were along the west shores. Five were of good size and several apparently were suitable for spawning salmon, although it was too early to ascertain definitely. Each creek contained many small Dolly Vardens and grayling, which were fished as closely as possible with fyke nets and small seines. For purposes of recognition the creeks in the upper lake are referred to by numbers and in the lower lake by letters. There are but few creeks of importance as salmon streams, and these only will be mentioned in this report.

Creek No. 3, on the east shore of the lake, is a large sluggish stream with its source about 30 miles back in the hills. It contains considerable good spawning territory, and some red salmon were noticed ascending.

Creeks Nos. 4 and 5 are similar to No. 3. All flow into a small bay along the east shore, which is well adapted for spawning in the vicinity of the mouths of the creeks.

Creeks Nos. 7 and 8, on the east shore, are large and deep with suitable spawning gravel on the lake shore around their mouths.

Other creeks in the upper lake contained some trout and whitefish, mostly small in size and few in number, but no salmon, and had very little suitable spawning territory.

In the lower lake there are four streams along the east shore, all of good size, with spawning area around the mouth of each. Creek A was not promising, but creeks B, C, and D have some gravel bottoms suitable for spawning.

Salmon made their appearance later than usual, it not being necessary to remove the gills nets from the stream until July 11. The run was never large and passed up in small schools at short intervals. The escapement was poor, and from all appearances the spawning grounds will be sparsely seeded. It is estimated that the escapement was less than 30 per cent of that of last year. Some red salmon were entering on the occasion of our trip down the river at the end of the season to join the ship. A fair school was observed below the lower rapids, and the native fishermen who were operating set nets in the river below, for home consumption, were making small catches, which proved that fresh red salmon were then en route to the lakes. The waters were too badly discolored to permit an intelligent estimate of the number of salmon ascending, but from the extent of the schools passing on the crest of the run it is probable that no great numbers were en route at the season's end.

Specimens taken on July 11 had in their stomachs young feeding sockeyes just out of the gravel. One Dolly Varden's stomach contained approximately 200 young salmon, a lake trout 250, and a grayling about 125. These counts were conservative, as many of the young fish were partly digested. The total number of fish destroyed was 9,510, of which 85 per cent were Dolly Vardens and the remainder miscellaneous predatory species. The Dolly Vardens averaged 22½ inches in length and from 3 to 4 pounds in weight, and the average lake trout weighed 2½ pounds and was 14 inches in length, the total weight being 33,285 pounds.

Egegik.—The Egegik crew, with H. B. Looff in charge, was transported on the *Star of Lapland*, landing at Egegik on May 26. After overhauling the Evinrude and equipment and assembling supplies they left for upriver on May 30. Camp was made for a short period at the rapids near the outlet of the lake. Boats with equipment and supplies were lined over the rapids and a start made for the Little Becharoff Lake district. A severe storm forced a landing and delayed progress for four days at Gass Rocks. While efforts were made with set nets here, results were negligible. As soon as the weather permitted camp was moved and established at Salmon Creek, where operations were begun. Work here was not satisfactory, and camp was again moved to Kanatak village, where part of the supplies were stored in a native barabara. Heavy windstorms, accompanied by rain, occurred through the first two weeks and prevented much work. Camp was then moved from creek to creek, the crew traveling with light equipment, the method being to fish each creek as effectively as possible and then move on to another. In this way good catches were made, and when the routine was established the daily catch averaged from 300 to 500 trout. Specimens weighing 8 pounds were taken, and 5-pound trout were common. The number of small trout taken reduced the average weight considerably.

The most successful method of capture early in the season was by stretching gill nets entirely across the streams. It was noticed that the trout entered the creeks from the lake late in the evening to feed and departed at daylight. Later in the season quantities of bait were placed along the shore of the lake in the vicinity of the creek mouths to attract the trout, after which seines were used with considerable success. The season continued stormy, which made it necessary to do most of the work in the creeks, operating throughout their full length in some cases.

A trip to the cannery was made on July 20 to take up more supplies and arrange to operate as late as possible before proceeding to the States via Kanatak about September 1. This gave a month longer for operations. Storms and heavy rains delayed the return of the party to Kanatak village until August 10, when work was resumed with results nearly equal to those before the departure for the cannery. This absence of 20 days just at the time fishing was so good was a severe loss, but the men were in no way to blame, as it was due entirely to weather conditions. Good catches were made up to the day of departure for Kanatak to take the steamer *Starr* for Seward en route to Seattle. Equipment was overhauled and stored in a cabin at Little Becharoff Lake.

Another year it is the intention to have employees proceed via the regular transportation steamer to Kanatak and thence over the short portage to Little Becharoff. Operations can thus be started at least a month earlier than by proceeding on the cannery ships and ascending to the lake, as the ice disappears from its upper portion several weeks before travel is possible on the main lake.

Owing to the localities where operations were carried on, it was impossible to obtain any very accurate check on the migration of salmon. The escapement was good, being on a par with 1921 and a trifle smaller than 1922. Salmon arrived on the spawning grounds early. The first noted was on June 10 and the main run entered June 21.

All fish captured here were Dolly Vardens, 17,210 of which were destroyed. These averaged 3 pounds and weighed a total of 51,630 pounds. Gill nets, fyke nets, seines, traps, hand lines, and spears constituted the equipment used.

Wood River.—The Wood River crew, with Eric Fenno in charge, was taken north on the ship *Chillicothe*, leaving Astoria April 28 and reaching Nushagak May 21. The men went ashore at the Columbia River Packers' Association cannery and the following day were transferred to Snag Point by patrol boat *No. 6*. As the bureau's groceries had not yet come ashore, a 10 days' outfit of supplies was procured from the Alaska Packers Association cannery and a trip was made to Aleknagik Lake on May 23. Camp was established at the mouth of the lake, this being necessary owing to the 10-inch sheet of ice that covered the entire lake with the exception of about one-half mile around the outlet. Operations were begun here, but results were meager. The party was unable to reach the upper end of the lake until June 2.

No trout were running in the main river at this time, and a floating trap was installed near the entrance to the stream connecting Lakes Aleknagik and Nerka. Trout appeared to be scarce and continued so until the salmon made their appearance on June 27, when they were noted in increasing numbers passing up with the salmon. Most of those taken on that date appeared to be sea run.

The migration was passing out in good schools, and at times parts of the lake appeared alive with young salmon. It is estimated that there were about four times as many as last year. This migration was passing at the time of the arrival of the party at the head of the lake and continued through July and early August.

Native boys were engaged in order that the crew might divide and operate in Nerka Lake also. Fair results were obtained, but they were not up to expectations. Without doubt the trout are diminishing here, as was evidenced by the difficulty experienced in capturing large numbers. A certain percentage of large Dolly Vardens enter and ascend with the salmon, which are always to be contended with. In checking the ascent passing the tally scow, in which camp was made at the mouth of the river connecting Aleknagik and Nerka Lakes, there were at times nearly half as many large trout as salmon passing up. According to the tally on July 15, 175 Dolly Vardens as large as red salmon passed up with the salmon in a period of 40 minutes.

Salmon entered very slowly in small schools, usually with long intervals between. The first red salmon was noted passing the tally scow on June 27. The run reached its crest about July 11, when they passed steadily, but only one or two at a time. This condition was of short duration, and by July 26 the run to the upper lakes was practically over. It was estimated that from 70,000 to 80,000 red salmon passed into the upper lakes, and since the greater number spawn there the extent of the run is not encouraging.

As trout were noted ascending the lower Wood River on the occasion of the departure of the crew, two extra local men were engaged, so that operations could be carried on in this river as late as possible, in addition to the Tikchik Lake survey. A floating trap was installed in the lower river, and it is believed the results will warrant the outlay. All trout taken were Dolly Vardens.

The previous winter a trip was made by Warden A. T. Looff and party, leaving Snag Point on January 2, 1923, with a dog team, and the district was covered to gather data relative to the loss of eggs from water receding, freezing, etc. An extensive water system was shown by this survey, with an extremely large area devoted to spawning. The party returned to Snag Point on February 26. An extremely heavy snowfall impeded progress and made travel difficult. A report of this trip was forwarded to the bureau, but apparently was lost in the mails, as it was never received. At most places where spawning was noted and at practically every point where nests were marked the water did not freeze over, showing springs to be in the locality. Considerable work on trout was accomplished. Mr. Looff and an assistant have again been detailed by the bureau to winter in that section, and this year will give special attention to the Nushagak River section and Tikchik Lake system.

During Mr. Looff's fall trip last year 1,018 trout were destroyed and 6,501 were captured previous to the departure of the regular crew on the *Chillicothe* on August 4 of this year, making a total of 7,519, averaging 2½ pounds, or a total of 18,797 pounds. Many more trout will be destroyed during the fall and winter operations conducted by Mr. Looff this year.

Iliamna.—The Iliamna crew, in charge of Otto Kestner, obtained passage on the *Brookdale*, leaving Seattle May 15 and arriving at Bristol Bay the end of the same month. Transportation was then immediately secured for them with O. B. Millett to Iliamna Lake.

Arrangements had been made the previous fall for H. H. Millett, who lives at the lake, to begin operations as early as possible in the spring. Nets were set April 28, as soon as the ice disappeared sufficiently, and operations were continued by Mr. Millett from that date to June 1, when he proceeded to the cannery to have the launch repaired and painted and to erect markers and prepare for patrol. Through this period and during a short period of operation before the freeze up in November, 1922, Mr. Millett captured a total of 2,849 fish, 98 per cent being Dolly Varden trout and 2 per cent miscellaneous predatory species. On the departure of Mr. Millett from the lake the work was turned over to Mr. Kestner and crew.

The regular crew from the States established camp in Intricate Bay and accomplished fair results. The camp was established in a protected bay and set nets were placed in every suitable fishing locality that could be reached without difficulty from the camp with dory and outboard motor. The early spring work was carried on in the locality where results were the best last year, namely, Goose Bay, along the north shore of the lake, and Woody Island Lakes. Trout were never found in large numbers at any point of operation.

Predatory fishes taken in 1923

Location operated	Fish taken	Average weight	Total weight	Dolly Vardens	Lake trout	All others
	Number	*Pounds*	*Pounds*	*Per cent*	*Per cent*	*Per cent*
Naknek	3,429	11	37,719		98	2
Egegik	17,210	3	51,630	100		
Ugashik	9,510	2½	33,285	85	2	13
Nushagak	7,519	2½	18,797	100		
Iliamna	8,204	2½	20,510	50		50
Total	45,872		161,941			

As there were no trout in Iliamna River during 1921 and 1922 no effort was made to operate there this year. When it was too late to give this stream attention, information was received that large numbers of trout had been present in the early spring months, feeding on the enormous schools of young salmon coming from the gravel and working down into the lake. During the fall inspection in the current year very few trout were noticed. This condition is accounted for partly by the scarcity of young salmon in this river during 1921 and 1922, while during the past spring the waters appeared alive with the fry just leaving the gravel. They constituted the attraction for the trout that ascended from the lake. This coming spring it is anticipated there will be a fair number of salmon fry in this stream, and every attention will be given the trout. Suitable local help has been engaged for early spring work, and a man will proceed from Seattle via Cook Inlet as early as possible in the coming year to supervise operations.

Owing to the inaccessibility of the places where the operations were conducted, it was impossible to note the extent of migrating fingerling salmon and no report is available on that subject. The number of predatory fishes destroyed by the regular crew totaled 5,355, of which 30 per cent were Dolly Vardens and the remainder pike and lake trout in nearly equal proportions, together with some suckers. This number, added to the 2,849 taken in the late fall and early spring, makes a grand total of 8,204 fish averaging 2½ pounds, or 20,510 pounds destroyed for the season.

EXTENT OF SALMON RUNS

In the Naknek-Kvichak district a light run was on when the season opened on June 26, and the fish came in large numbers on the morning of the 28th, when a few of the canneries placed their fishermen on limit. The following day practically all canneries were displaying the limit flag. On June 29 the run slackened, and it declined very materially to July 1 and 2, when the limit flags were removed. On July 3 the run again showed a decided increase, and on the following morning tide the fish came with a rush. All limit flags were up by 6 a. m. but were not effective before midnight of the same day, according to an agreement between fishermen and packers. The water was alive with salmon in the vicinity of Naknek River, and an excellent escapement into that stream was occurring. On the morning of July 9 the run slackened in the vicinity of the ships, and most of the fishing boats appeared to be en route for the upper Kvichak in the vicinity of Squaw Creek. Small catches, with an occasional good capture, were made. On the following day more of the boats were successful, and good captures were made at various points by most fishermen, but many of the limit flags were taken down. Fish struck in extremely heavily again on July 12, and limit flags were again displayed. The run was spasmodic throughout, and showed a perceptible slackening by

July 14, and all limit flags were down the following day. Good catches continued to be made occasionally by fishermen from Graveyard to the closing markers up to and including the morning of July 17. On this date exceptional catches were made on the drift in the upper portion of the bay during the morning flood, and the nets drifting in on that occasion were too numerous to count. All apparently made good catches, but this was practically the last heavy run. The movements of the fish at Egegik were similar.

At Ugashik no heavy run occurred throughout the season. Fish entered slowly through early July, increasing in numbers toward the middle of the month and falling off to extremely small numbers on July 21, with discouraging prospects and but little fishing resulting from that date to the end of the season.

On the Nushagak side the run was small and at no time assumed encouraging proportions. A light run set in on June 28 and continued slow until July 6, when it increased greatly in volume. The heavier portion of the run was of short duration, however, extending over a period of less than two days, when it dropped back again to small numbers and continued small to the end of the season.

Slightly over 1,200,000 cases were packed in Bristol Bay through the season. 87 per cent of which were taken from the Naknek-Kvichak section, the remainder being divided between the Egegik, Ugashik, and Nushagak districts.

PATROL

The patrol was conducted as formerly and was most effective throughout the season. Launches were used in the Kvichak, Naknek, Nushagak, Igushik, and Ugashik districts, with two men on each boat, while one man with a dory and Evinrude constituted the Egegik patrol. Two launches were used in the early part of the season in the Ugashik River, but a scarcity of help reduced this patrol to one boat when the season was partly over. Good work was accomplished by this boat and there was less illegal fishing than during any previous season.

The bureau's boat *Scoter* kept in touch with the different patrol boats, supervising and directing the work. This boat was under the direction of the writer until his departure on July 15, when Warden A. T. Looff assumed charge.

Seven boats were reported for law violations and four cases were tried at Valdez. On account of being exceedingly busy, the marshal was unable to place fishermen of the other three boats under arrest before the departure of their ships, and charges went by default.

Close watch was kept on the fishermen to prevent red-salmon fishing before midnight of June 25 and later than midnight of July 25. During the season many nets were removed from the rivers above the dead line and a number were destroyed.

ESCAPEMENT

The writer left Bristol Bay July 15, proceeding via Iliamna Lake and across Cook Inlet to Seldovia, meeting the bureau's boat *Eider* at that point, for an extended trip of inspection through the Alaska Peninsula Fisheries Reservation, in company with Dr. C. H. Gilbert, special assistant, and Dr. Willis H. Rich, chief of the division of scientific inquiry of the Bureau of Fisheries. After completing this inspection the *Eider* with party returned to Iliamna Bay August 19. Doctor Rich and the writer proceeded from that point over the portage to Iliamna Village and embarked on patrol boat *No. 3* for the purpose of making a trip around the lake to observe the spawning areas at about the same dates as in previous years. All the principal spawning grounds in Iliamna were visited and checked against previous years.

A trip was made first with dory and outboard motor up Iliamna River about 6 miles. No large numbers of fish were noted at any point, with the exception of a short stretch just above the Indian village, and the greater portion of the spawning in the stream was confined to this area. The stream as a whole was poorly stocked, and although in excess of 1920 and 1921, when very few salmon spawned in this stream, the number was far below that of 1922. An excess of spawners was reported last year throughout the district, there being two to three times more than necessary for capacity seeding on some beds. In 1921 a good escapement was reported, which was considered to be nearly normal although there were some streams with negligible numbers and none was crowded. This year the escapement fell below that of 1921 in all streams with the exception of Iliamna River, in which 6,000 red salmon were estimated in 1921 and 15,000 the current year. The latter is about 15 per cent that of last year and about 20 per cent of capacity stream production.

Ascending Copper River about 5 miles it was estimated that the spawners were about one-sixth as numerous as last year, with no signs of schooling at the river mouth or in the extensive lagoon beyond. When Kokhonak Creek was examined, more encouraging numbers were noted, as the stream was partially covered with spawners. Numbers of fish were noticed in the deep water along the shores and also in the mouth of the stream. These two banner streams of the district showed a smaller number of spawners than in 1921, the first having an estimated maximum of 150,000 fish as against 300,000 in 1921, with no schools outside or in the stream, while Kokhonak Creek contained an estimated maximum of 200,000 salmon as against 250,000 in 1921. It may be stated that Kokhonak is the only creek considered to contain sufficient seeding for normal results. The spring pond near Chekok, where last year it was estimated there were 5,000 salmon and in 1921 1,000, this year contained about 500, which, with the exception of Copper River, Kokhonak Creek, and Iliamna River, is representative of comparative numbers noted throughout the area.

The Newhalen River was high and badly discolored with sediment on the occasion of the party's visit, making it impossible to pass intelligently on the numbers of fish in that stream. However, observations were sufficiently conclusive to indicate that the escapement throughout the whole area was below that of 1921 and only about 10 per cent of last year.

The small number of fish came as a great surprise, as it had been felt that when the canneries were on limit there must be a safe margin of escapement. This season, however, proved the exception to the rule, and it is attributed to the very favorable weather conditions and the movements of the fish which permitted fishermen and packers to make the most of the available supply.

RECAPITULATION

In closing attention is directed to certain practices which must be rectified, mainly by agreement between the packers and their fishermen.

1. *Placing limit flags.*—By the present agreement the limit flag can only be officially placed and fishermen notified of the limit at 6 p. m., and it is not in force before midnight of the same day. On occasions such as the present year, when the fish strike in heavy in the early morning or soon after midnight, there will be a period of about 18 hours or more before the limit is applicable. During the last season one boat delivered over 6,000 fish within that period, and this was not exceptional. Also, while the limit is in force a large percentage of the fishermen, after delivering their quota for the day, will immediately lay out again for another limit, and fish must be held about 24 hours before delivery. This condition leads to waste or at best the canning of stale fish, a supply of which accumulates through the heaviest period of the run.

2. *Small mesh nets.*—The fishermen either carry quantities of web to Alaska in trunks or knit web en route on the ships. Many of the canneries then supply them with lead and cork lines for this web.

3. *Nets thrown overboard at end of season.*—At the close of the past season a number of nets were noticed, mostly without lead and cork lines, drifting back and forth with the tide. In many cases they drift around the piling underneath the docks where they hang and fish during the flood period, and many salmon are thus caught and wasted. Several of these nets containing fish were noticed at low tide in the bay and rivers, and the patrol boat was fouled many times by picking up quantities of web in the propeller. On investigation it was found that some of the fishermen were cutting away the web from the lead and cork lines and casting it adrift.

It is not known what arrangement fishermen have with the canneries for the return of nets after the season closes, and in most cases it would not be profitable to carry over the web to the next season, but it should be destroyed on shore; and canneries should hold the fishermen to a strict accounting for all web issued, as this situation is most serious.

KUSKOKWIM RIVER

Inspector C. F. Townsend, of the Yukon River district, was on the Kuskokwim from July 14 to July 25, 1923, for the purpose of observing operations and making a general investigation of conditions. During this period and for two weeks prior thereto the run of salmon had been the lightest experienced in years, the low and clear condition of the stream being given as the cause. Fishing is most successful when the water is high and muddy. Another reason reported for the light catch is that when the river is low the fish follow the middle of the stream instead of the banks and bars as they would during high water. Apprehension was expressed as to whether there might not be a shortage of salmon for dog feed all along the river. Attempted purse-seine operations off the mouth of the Kuskokwim River are said to have been wholly unsuccessful on account of the swift tides.

YUKON RIVER FISHERY

Salmon fishing on the Yukon River was carried on in 1923 as in the preceding year. Two mild-cure outfits were operated on Leslie Island off the mouth of the river by Waechter Bros. and Kern & Colussi, of Seattle. The run of fish arrived later than in the previous season, which probably is accounted for by the fact that the ice remained in the mouth of the river about a week longer. Fishing began June 8, but only small catches were made until June 21. It was reported that 287 tierces of mild-cured kings and 10 barrels of pickled chums were prepared and shipped out by the two companies, and 900 chums and 478 kings were frozen for shipment.

The catch of salmon by natives apparently was better than usual, the run of both kings and chums being exceptionally good in the lower river. Data gathered by the bureau's representative on his return from the Delta to Fairbanks, during the latter part of August, indicated that the local fishermen took about 17,500 kings and 79,000 chums in addition to preparing 231 tons of dried chum salmon for dog feed.

ALITAK SALMON COUNT

Through the courtesy of the Alitak Packing Co. weirs were constructed for the counting of red salmon ascending two small streams in Olga Bay, one located about 100 yards from the cannery of the Alaska Packers Association on the east shore of Olga Bay and known as the Home Station or Cannery River, and the other in the extreme northwest corner of the bay, about 7½ miles from the cannery, and known as the Upper Station or Red Salmon River. These two streams receive practically all the red salmon entering Olga Bay.

The weirs were installed early in June and counting began at both places on June 6. The count at the Upper Station continued until September 9, when the weir was washed out. The run was so nearly over at the time that the weir was not rebuilt. The total count at this place was 167,775 red salmon. Counting continued at the Home Station until September 16, with a total of 15,855 reds for the season.

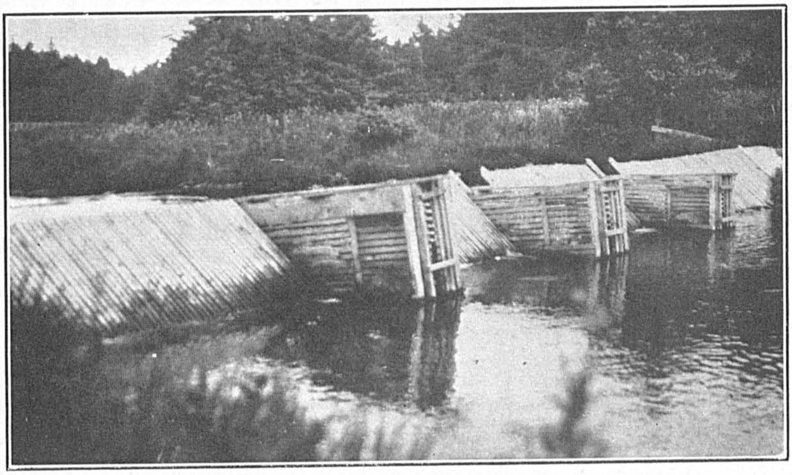

FIG. 4.—Salmon weir, Afognak River

FIG. 5.—Seining salmon for hatchery at McDonald Lake

The total escapement for spawning purposes in both streams was 183,630 red salmon, or slightly over half of the run since the company reported the capture of 165,945 red salmon in the waters of Alitak and Olga Bays.

A run of coho salmon began about September 1 at both streams, the number counted from that date until the weirs were dismantled being 403 at the Home Station and 2,588 at Upper Station. Operations at this place were under the immediate supervision of A. J. Suomela, a temporary assistant.

CHIGNIK SALMON COUNT

Work on the construction of the rack in Chignik River began early in May, but floods and extreme high water prevented its completion before the end of June. The rack was located about 50 feet above the site used during the previous season, at a point where the river is about 460 feet wide. The same plan was used as in the preceding year, with a 6-foot wire-netting fence above the pickets and tripods to keep the salmon from going over the weir during high tides.

The rack was completed the end of June, and counting began on July 1, prior to which time it was estimated that possibly 10,000 salmon had ascended. Counting was then continued until October 10, when the run had practically ceased and high water compelled its discontinuance. A total of 216,124 red salmon were counted through the rack and passed up the river during this period. In addition to the red salmon 286 king salmon were counted through the rack from July 3 to September 7, and 58,524 coho salmon from August 17 to October 10. Humpback and chum salmon were not counted.

On account of the small escapement of red salmon at Chignik the permits for the three canneries operating there were revoked and all commercial fishing ordered discontinued at the close of August 21. These companies reported the capture of a total of 677,602 red salmon to that date, or over three-fourths of the total run for the season. In 1922 the escapement was also less than one-fourth of the total run. Warden Charles Petry was in charge of the Chignik work, in connection with which he had the use of the patrol boat *Ibis*.

On July 29 the counting operations at Chignik were inspected by Senator W. L. Jones, Representative L. H. Hadley, Delegate Dan Sutherland, Commissioner of Fisheries O'Malley, and Dr. C. H. Gilbert, special assistant of the Bureau of Fisheries.

KARLUK SALMON COUNT

A count of red salmon ascending Karluk River to spawn was made in 1924 in a manner similar to that of 1923. Counting began on May 24 and continued until October 12, during which period a total of 694,579 red salmon passed upstream. From May 23 to July 15 it was reported that 14,442 king salmon ascended, and from September 1 to October 12, 34,337 steelheads and coho salmon, with cohos predominating. There was a light run of humpback salmon, also, which spawned chiefly in the lagoon and in the vicinity of the rack. The three companies operating off the mouth of the Karluk River reported the capture of 662,140 red salmon, or a little less than half of the run. In 1922, previous to the establishment of a reservation, the escapement was slightly over 35 per cent.

Operations at this point were under the immediate supervision of Fred R. Lucas, superintendent of the bureau's hatchery at Afognak.

NELSON RIVER SALMON COUNT

Plans were made for the counting of salmon ascending Nelson River in the season of 1923, and with the assistance of the Pacific American Fisheries in June a trap with leads extending to both banks was constructed in the west channel of the river about 10 miles distant from the Nelson Lagoon cannery. The river at that point was about 1,200 feet wide and from 4 to 12 feet deep, according to the tides. Much difficulty was experienced as a result of heavy winds and tides. In the sandy river bottom great holes formed around and loosened the piles, thus permitting the fish to escape. It was felt to be impracticable to continue counting, and the trap was dismantled, only 25,371 salmon having passed through up to July 19. Homer H. Whitford, from the Afognak hatchery, was in charge of this work at Nelson River.

HATCHERIES

EXTENT OF OPERATIONS

Salmon propagation in Alaska, exclusive of Territorial activities, was carried on by the Government at McDonald Lake in southeastern Alaska and at Afognak Lake on Afognak Island in central Alaska, by the Alaska Packers Association at Heckman Lake, and by the Northwestern Fisheries Co. at Hugh Smith Lake. Collections of red-salmon eggs at these stations in 1923 were 58,915,000, or 51,830,000 less than in 1922. This decline in collections is accounted for by the temporary suspension of operations at Afognak while the station was being repaired.

Operations of Federal and private hatcheries in Alaska in 1923

Location of hatchery	Red or sockeye salmon		
	Eggs taken in 1922	Salmon liberated in 1922-23	Eggs taken in 1923
McDonald Lake	25, 000, 000	24, 099, 045	25, 550, 000
Afognak Lake	[1] 61, 790, 000	46, 333, 000	
Heckman Lake (Fortmann)	17, 760, 000	16, 985, 000	15, 480, 000
Hugh Smith Lake (Quadra)	6, 195, 000	6, 007, 000	17, 885, 000
Total	110, 745, 000	93, 424, 045	58, 915, 000

[1] Shipped red-salmon eggs to other commissions, as follows: Alaska Territorial Fish Commission, Juneau, Alaska, 5,098,936; Oregon Fish Commission, Bonneville, Oreg., 5,045,000; Washington State Fish Commission, Seattle, Wash., 534,464.

HATCHERY REBATES

The owners of private salmon hatcheries in Alaska, who are also packers of canned salmon, are exempt by law from the payment of all license fees and taxation of every nature on their catch and pack of salmon at the rate of 40 cents per 1,000 king or red salmon liberated in Alaskan waters.

Rebates credited to private salmon hatcheries, fiscal year ended June 30, 1923

Owner	Location	Red-salmon fry liberated	Rebate due
Alaska Packers Association	Heckman Lake	16,985,000	$6,794.00
Northwestern Fisheries Co	Hugh Smith Lake	6,007,000	2,402.80
Total		22,992,000	9,196.80

HATCHERY OPERATIONS

M'DONALD LAKE

The Federal salmon hatchery at McDonald Lake produced and liberated 24,099,045 red-salmon fry from the collection of 25,000,000 eggs made in 1922, a loss of 3.6 per cent. It also liberated 393,600 humpback-salmon fry resulting from the collection of 499,200 eggs made in the same year. In 1923 a collection of 25,550,000 red-salmon eggs was made at this station.

AFOGNAK

In 1922 red-salmon eggs aggregating 61,790,000 were taken at the Afognak hatchery. Of these 10,678,400 were shipped to State and Territorial hatcheries and 46,333,000 fry and fingerlings were hatched and planted in Afognak Lake. Out of the 600,000 humpback-salmon eggs taken at this station in the same season 278,616 were transferred to the bureau's hatchery at Birdsview, Wash., and 240,000 fingerlings were produced and released at the Afognak hatchery. The loss during incubation was 81,384.

HECKMAN LAKE (FORTMANN)

The collection of salmon eggs at the Fortmann hatchery of the Alaska Packers Association on Heckman Lake in 1923 began September 4 and ended November 24. In that period 15,480,000 red-salmon eggs and 1,200,000 humpback-salmon eggs were taken.

From the collection of 17,760,000 red-salmon eggs secured in 1922 there were hatched and released in Heckman Lake and Naha Stream 16,985,000 fry. The loss was 775,000, or 4.36 per cent. In the same season 220,000 humpback-salmon fry were produced from a take of 240,000 eggs, the loss being approximately 8 per cent.

HUGH SMITH LAKE (QUADRA)

The Northwestern Fisheries Co. operated a salmon hatchery on Hugh Smith Lake on the mainland of Alaska near Boca de Quadra. In 1923 egg collecting began on August 12 and stopped November 7. A total of 17,885,000 red-salmon eggs was obtained, which is an increase of nearly 200 per cent over the collections of the preceding year.

The take in 1922 was 6,195,000 red-salmon eggs, from which 6,007,000 fry were hatched and liberated in the headwaters of Sockeye Creek. The loss was 188,000, or 3.03 per cent.

TERRITORIAL HATCHERIES

Early in the year the Alaska Territorial Fish Commission discontinued fish-cultural work at Juneau and transferred its activities in southeastern Alaska to Ketchikan. This resulted from the action of the legislature in appropriating $80,000 in May, 1923, to be expended by the vice chairman of the commission for the exclusive purpose of furthering the best interests of the Territory in the protection and propagation of salmon. Ketchikan, being in the center of the most important fishing district, was selected as the place at which to build a permanent hatchery for the propagation of humpback salmon in southeastern Alaska. This plant was built and put in operation in 1923. Two other hatcheries were constructed during the year—one on Eyak Lake near Cordova for the propagation of red salmon and one on Bear River near Seward for the propagation of king salmon. The Ketchikan and Cordova plants were successful in securing good takes of eggs, but the Seward hatchery was not completed in time for fish-cultural work in 1923.

A rack was constructed at the outlet of Eyak Lake, and the salmon that ascended to the spawning grounds were counted. The total number of red salmon passing through in the period from June 24 to August 19 was 1,405. Trout of predatory species to the number of 7,257 were captured and destroyed. Egg taking began June 30 and continued until August 10. The total number of ripe salmon handled in connection with the Eyak Lake hatchery was 2,174, and 4,504,000 red-salmon eggs were secured. In addition, 80 pairs of ripe salmon were placed in a protected area in the stream near the hatchery. This area covers approximately 2 acres of excellent natural spawning ground.

The legislature made a further appropriation of $6,500 to enable the commission to carry out the purposes of House Concurrent Resolution No. 14, which directs it to prepare and submit to the next legislature a report on the following points:

1. The amount of salmon of each species taken from or near each stream, as near as can be ascertained, for the years 1919 to 1924, inclusive.
2. The number and location of the various fish traps and the distance of each from the nearest salmon stream.
3. The number of seines and nets used in the waters appurtenant to such streams, as near as can be ascertained.
4. The location of the cannery or canneries to which the salmon from the various localities are taken.
5. The streams in which salmon eggs in the eyed state have been deposited or salmon fry released each year by the Territory and by Federal and private hatcheries and the quantity thereof.

GENERAL STATISTICS OF THE FISHERIES

The total investment in the fisheries of Alaska in 1923 was $60,039,677, or $5,449,375 more than in 1922. The investment in the salmon industry increased $5,629,774. The number of persons employed was 25,246, or 3,272 more than in 1922. The products of the fisheries in 1923 were valued at $38,678,825, or $2,507,887 more than in 1922.

Summary of investment, persons engaged, and products of the Alaska fisheries in 1923

Items	Southeast Alaska		Central Alaska		Western Alaska		Total	
INVESTMENT	*Quantity*	*Value*	*Quantity*	*Value*	*Quantity*	*Value*	*Quantity*	*Value*
Salmon canning		$23,172,260		$10,264,679		$17,198,947		$50,635,886
Salmon mild-curing		1,295,433		12,825		116,955		1,425,213
Salmon pickling				69,388		759,479		828,867
Salmon drying and smoking						17,700		17,700
Salmon, fresh		6,053						6,053
Salmon by-products		225,193						225,193
Halibut fishery		2,336,350						2,336,350
Herring fishery		960,003		1,392,856		22,939		2,375,798
Cod fishery				967,216				967,216
Shrimp fishery		268,656						268,656
Whale fishery						472,998		472,998
Clam fishery				476,747				476,747
Trout fishery		3,000						3,000
Total		28,266,948		13,183,711		18,589,018		60,039,677
PERSONS ENGAGED		*Number*		*Number*		*Number*		*Number*
Whites		6,327		3,576		4,774		14,677
Natives		3,018		1,200		462		4,680
Chinese		523		274		518		1,315
Japanese		701		258		132		1,091
Filipinos		748		311		381		1,440
Mexicans		166		124		1,466		1,756
Negroes		31		24		106		101
Miscellaneous		73		16		37		126
Total		11,587		5,783		7,876		25,246
PRODUCTS								
Salmon:	*Quantity*	*Value*	*Quantity*	*Value*	*Quantity*	*Value*	*Quantity*	*Value*
Canned ... cases	3,007,119	15,689,956	743,640	5,766,188	1,284,938	11,416,863	5,035,697	32,873,007
Mild cured ... pounds	3,025,450	645,339	51,200	11,827	295,600	69,456	3,372,250	726,622
Pickled ... do	47,500	2,960	115,244	9,691	2,170,100	174,139	2,332,844	186,790
Frozen ... do	1,734,478	131,407			30,811	1,115	1,765,289	132,522
Fresh ... do	2,926,257	244,838					2,926,257	244,838
Dried and smoked ... pounds	4,000	600	3,115	518	771,297	38,210	778,412	39,328
Fertilizer ... do	820,000	20,450	68,220	1,959			888,220	22,409
Oil ... gallons	27,450	12,425	1,581	822			29,031	13,247
Herring:								
Fresh for bait ... pounds	403,000	2,661	1,437,386	14,373			1,840,386	17,034
Frozen for bait ... do	3,354,139	26,493					3,354,139	26,493
Pickled for bait ... pounds	40,000	400					40,000	400
Pickled, Scotch cure ... pounds	2,591,450	157,042	10,386,183	800,474	69,800	8,509	13,047,433	966,025
Pickled, Norwegian cure ... pounds	203,250	11,824	250,200	17,444			453,450	29,268
Roused for food ... pounds	50,200	2,510					50,200	2,510
Bloaters ... do			64,222	1,939			64,222	1,939
Fertilizer ... do	5,170,445	157,232	1,212,000	36,849			6,382,445	194,081
Oil ... gallons	724,998	299,382	161,114	65,439			886,112	364,821
Halibut:								
Fresh ... pounds	3,959,105	449,638					3,959,105	449,638
Frozen ... do	6,654,204	688,392	1,559,965	115,921			8,214,169	804,313
Cod:								
Dry salted ... do	2,100	95	5,630,868	403,435			5,632,968	403,530
Pickled ... do	1,200	120	74,367	2,230			75,567	2,350
Frozen ... do	30,136	602					30,136	602
Tongues ... do			9,000	450			9,000	450
Whale:								
Oil ... gallon					655,250	317,417	655,250	317,417
Fertilizer ... pounds					2,313,980	59,660	2,313,980	59,660
Whalebone ... do					3,280	2,604	3,280	2,604
Pickled meat ... do					130,000	9,000	130,000	9,000
Clams ... cases	2,427	13,589	74,856	527,550			77,283	541,139
Shrimps ... pounds	460,560	178,474					460,560	178,474

Summary of investment, persons engaged, and products of the Alaska fisheries in 1923—Continued

Items	Southeast Alaska		Central Alaska		Western Alaska		Total	
PRODUCTS—continued	*Quantity*	*Value*	*Quantity*	*Value*	*Quantity*	*Value*	*Quantity*	*Value*
Crabs:								
Canned ....cases..	1,120	$11,200	170	$2,190			1,290	$13,390
Whole in shell ....dozen..	400	1,200					400	1,200
Trout:								
Fresh ....pounds..	14,449	1,741					14,449	1,741
Frozen ....do....	25,879	2,054					25,879	2,054
Canned ....cases..	77	327					77	327
Sablefish......pounds..	849,585	49,172					849,585	49,172
Flounders ....do....	6,691	190					6,691	190
Red rockfish......do....	7,035	140					7,035	140
Smelts............do....	1,063	100					1,063	100
Total............		18,802,553		7,779,299		12,096,973		[1]38,678,825

[1] These figures represent the value of the manufactured product. It is estimated that the value of the catch to the fishermen was approximately $10,700,000. The round weight of the salmon catch landed by the fishermen was approximately 390,460,000 pounds, and the corresponding figures for herring were approximately 69,000,000 pounds. The statistics of the cod fishery include 4,667,869 pounds of dry-salted cod, valued at $307,377, and 9,000 pounds of tongues, valued at $450, taken in waters adjacent to Alaska and landed in the Pacific Coast States, as well as the personnel and investment concerned in the production thereof, amounting to approximately 354 persons and $523,337, respectively.

SALMON INDUSTRY

The most striking feature of the salmon industry of Alaska in 1923 was the great increase (approximately 51 per cent) in the number of salmon, chiefly humpbacks, captured in the southeastern district. A considerable decrease occurred in both the central and western districts, where the red salmon is the most important species. The catch in central Alaska declined approximately 32 per cent, due chiefly to the practical failure of the runs at Chignik and in Cook Inlet. The catch of salmon in western Alaska was about 22 per cent smaller than in the preceding year, this being attributable in part, at least, to necessary restrictions placed on operations in the Southwestern Alaska Fisheries Reservation for the first time during 1923.

SALMON CATCH AND APPARATUS

The total number of seines used in the salmon industry of Alaska in 1923 was 510, of which 173 were beach seines and 337 were purse seines. The beach seines aggregated 24,756 fathoms of webbing and the purse seines 54,377 fathoms. The number of gill nets used in salmon fishing in Alaska was 3,473, having a total length of 353,463 fathoms. There were 282 driven traps and 160 floating traps, or a total of 442, operated in the salmon industry of Alaska in 1923.

Southeast Alaska is credited with 365 seines or a total of 52,417 fathoms of webbing, an increase of 57 seines, or 4,037 fathoms over the number used in 1922; also with 232 gill nets aggregating 19,166 fathoms of web, a reduction of 38 nets, or 9,609 fathoms less than the quantity used in the previous season; and with 171 driven and 153 floating traps, an increase of 33 and 42, respectively, over the number operated in 1922.

Corresponding figures for central Alaska show 130 seines, or 25,841 fathoms, as compared with 119 seines and 17,525 fathoms in

1922: 1,085 gill nets, or 63,237 fathoms, as against 1,010 nets and 71,930 fathoms in 1922, showing an increase of 75 in the number of nets but a reduction in quantity of web of 8,693 fathoms. The number of traps operated was 106 driven and 7 floating, as compared with 118 and 2, respectively, in 1922.

Western Alaska used 15 seines, or 875 fathoms of web, a reduction from the number shown in 1922 of 7 seines, or 3,725 fathoms of webbing. A total of 2,156 gill nets was used, having an aggregate length of 271,060 fathoms, an increase of 101 nets, but a reduction of 6,675 fathoms in the quantity of webbing used. In western Alaska 5 driven traps were operated as compared with 9 in 1922.

Seines and gill nets each caught approximately 27 per cent of salmon taken in Alaska in 1923, traps took 44 per cent, while lines and wheels took the remaining 2 per cent.

Percentage of salmon caught in each Alaska district, by principal forms of apparatus

Apparatus	Southeast Alaska		Central Alaska		Western Alaska	
	1922	1923	1922	1923	1922	1923
Seines	36	37	28	29	6	2
Gill nets	2	1	7	18	90	93
Traps	60	60	65	52	3	2

The total catch of salmon in 1923 was 77,422,311, an increase of 5,051,911 over the number taken in 1922. Southeast Alaska shows a gain of 15,905,921, while central and western Alaska fell off 5,081,933 and 5,772,077, respectively. The catch by species shows that cohos decreased 70,406, kings 88,889, and reds 6,960,121. Chums increased 441,630 and humpbacks 11,729,697.

Salmon taken in 1923, by apparatus and species, for each geographic section of Alaska

Apparatus and species	Southeast Alaska	Central Alaska	Western Alaska	Total
Seines:				
Coho, or silver	381,950	88,580		470,530
Chum, or keta	2,404,865	177,083	5,953	2,587,901
Humpback, or pink	14,096,807	1,617,233		15,714,040
King, or spring	17,772	2,335	3,711	23,818
Red, or sockeye	747,980	1,229,270	359,124	2,336,374
Total	17,649,374	3,114,510	368,788	21,132,672
Gill nets:				
Coho, or silver	134,601	42,829	9,814	187,244
Chum, or keta	17,695	56,687	252,081	326,463
Humpback, or pink	72,722	714,237	3	786,962
King, or spring	48,176	18,028	91,164	157,368
Red, or sockeye	290,398	1,050,792	18,184,654	19,525,844
Total	563,592	1,882,573	18,537,716	20,983,881
Traps:				
Coho, or silver	741,262	258,716	61	1,000,039
Chum, or keta	1,551,354	629,993	19,802	2,201,149
Humpback, or pink	24,605,551	1,212,486		25,818,037
King, or spring	23,420	28,264	5,367	57,051
Red, or sockeye	1,300,621	3,404,368	371,444	5,076,433
Total	28,222,208	5,533,827	396,674	34,152,709

Salmon taken in 1923, by apparatus and species, for each geographic section of Alaska—Continued

Apparatus and species	Southeast Alaska	Central Alaska	Western Alaska	Total
Lines:				
Coho, or silver	99,866			99,866
King, or spring	426,183			426,183
Total	526,049			526,049
Wheels:				
Coho, or silver			10,000	10,000
Chum, or keta			600,000	600,000
King, or spring			17,000	17,000
Total			627,000	627,000
Total:				
Coho, or silver	1,357,679	390,134	19,875	1,767,688
Chum, or keta	3,973,914	863,763	877,836	5,715,513
Humpback, or pink	38,775,080	3,543,956	3	42,319,039
King, or spring	515,551	48,627	117,242	681,420
Red, or sockeye	2,338,999	5,684,430	18,915,222	26,938,651
Grand total	46,961,223	10,530,910	19,930,178	77,422,311

SALMON CANNING

CHANGES IN CANNERIES

Several changes in the ownership and control of canneries occurred in 1923, while other plants were dismantled and will therefore be dropped from the list of salmon canneries.

The Alaska Consolidated Canneries acquired the Pybus Bay cannery of the Admiralty Packing Co., thus giving it a total of seven canneries in southeast Alaska. The A. & P. Products Corporation continued its lease of the Ford Arm cannery of the Deep Sea Salmon Co. and the Heceta Island plant of Swift-Arthur-Crosby Co. It purchased the Union Bay cannery of G. W. Hume Co. early in the year, and at the close of the year it added to its holdings in southeast Alaska by the purchase of the Waterfall cannery of the Alaska Fish Co. The Pavlof Harbor Packing Co.'s plant at Pavlof Harbor was operated by Carlson Bros. (Inc.). The J. D. Roop Co., at Tenakee, became the Superior Fisheries Co. The Petersburg Packing Co. resumed operation of its plant at Petersburg, superseding the Mitkof Island Packing Co., which was organized as an operating company for the original owners pending the settlement of bankruptcy proceedings. The plant of the Hood Bay Packing Co. at Hood Bay was converted into a fish-oil and meal factory and herring saltery and was operated by the Hamilton Packing Co.

The Ketchikan Packing Co. and the Revilla Packing Co., both at Ketchikan, are defunct, and their plants have been dismantled and put to other uses. The Northern Packing Co., at Juneau, is likewise permanently out of business and the buildings are for sale. The Alaska Union Fisheries (Inc.), at Port Conclusion; the Todd Packing Co., at Todd; the Cape Fanshaw Fish & Packing Co. and the American Packing Co., at Juneau; and E. R. Strand, on Wrangell Narrows, are permanently out of the salmon-canning business. The Fanshaw cannery of the Marathon Fishing & Packing Co. was advertised for sale to satisfy the creditors of the company.

The Sitka Packing Co. resumed operation of its cannery at Sitka, taking it over from A. P. Wolf & Co. The Big Harbor Packing Co., at Craig, became insolvent and did not continue in business after 1922. The Ness Fish Co., at Petersburg, retired from the salmon-canning industry to engage in the shrimp business.

In central Alaska the Copper River Canning Co. took over the floating cannery of the Star Canning Co. and operated it on the Copper River delta. Operations of the Polar Fisheries Co., at Snug Harbor, and G. P. Halferty, a clam packer, were carried on at the plant of the former under the name of Pioneer Canneries (Inc.). The Pioneer Sea Foods Co., at Cordova, again changed its name to Pioneer Packing Co. The Bainbridge Fisheries Co. was reorganized and moved its plant from Evans Island to Flemming Island, approximately 10 miles north of the first location.

In western Alaska the Phoenix Packing Co., at Herendeen Bay, sold its cannery to the Pacific American Fisheries. The Bristol Bay Packing Co.'s plant on Naknek River was purchased by the Alaska Salmon Co., but no change in the name of the operating company was made.

NEW CANNERIES

Nine new salmon canneries opened in 1923. Four of these were owned and located in southeast Alaska, as follows: Straits Packing Co., at Skowl Arm; Sunrise Packing Co., at Ketchikan; New England Fish Co., at Ketchikan; and Chas. W. Demmert, floating cannery on the west coast of Prince of Wales Island. Four plants were opened in central Alaska by the following named firms: Alaska Year-Round Canneries Co. (Inc.), operating jointly with the Seldovia Packing Co., at Seldovia; Kodiak Island Fishing & Packing Co., at Uganik Bay; Pajoman & Trout, on Raspberry Island; and Northern Light Packing Co., at Mountain Slough. The Alaska Salmon Co. opened a new cannery in western Alaska at the plant formerly operated as a saltery.

In addition, the International Packing Co. operated its floating cannery, *Santa Flavia*, for the first time in southeast Alaska at Waterfall on the west coast of Prince of Wales Island and at Controller Bay in central Alaska.

CANNERIES NOT OPERATED

Several canneries were not operated in 1923, while others were converted to other uses, and yet others were dismantled and abandoned. In the latter category are the plants of the Todd Packing Co., at Todd, the machinery of which was purchased by the Sunrise Packing Co. and transferred to its new cannery at Ketchikan, and the Cape Fanshaw Fish & Packing Co. The plant of the Alaska Union Fisheries (Inc.), at Port Conclusion, was dismantled of canning machines and remained closed during the season. The machinery was sold to the New England Fish Co., at Ketchikan, who used it in the equipment of a new cannery adjacent to its cold-storage plant.

Charles Homeier and W. F. O'Connor, small cannery operators on the Yukon River in 1922, did not engage in salmon canning in 1923 and are no longer listed as salmon canners. The Mount Baker Packing Co., which operated a floating cannery at Red Bluff Bay in 1922, did not return this year. In addition to the foregoing there were 31 idle salmon canneries in Alaska in 1923. They were owned and located as follows:

Alaska Packers Association	Alitak. Wrangell.
Alaska Sanitary Packing Co	Cape Fanshaw.
Alaska Salmon and Herring Packers	Tyee.
Baranof Packing Co	Red Bluff Bay.
John L. Carlson & Co	Auk Bay.
Chilkat Packing Co	Haines.
Central Alaska Fisheries	Drier Bay.
Fidalgo Island Packing Co	Herendeen Bay.
Hoonah Packing Co	Hoonah.
Hopp & Danielson	Uganik Bay.
G. W. Hume Co	Scow Bay.
Kamishak Canning Co	Kamishak Bay.
Kenai Packing Co	Drier Bay.
King Salmon Fisheries Co	Unakwik Inlet.
Libby, McNeill & Libby	Egegik River. Lockanok.
Marathon Fishing & Packing Co	Fanshaw.
Midnight Sun Packing Co	Kotzebue Sound.
Nelson Lagoon Packing Co	Nelson Lagoon.
Northwestern Fisheries Co	Hunter Bay. Orca. Roe Point. Santa Ana. Seldovia.
Phoenix Packing Co	Herendeen Bay.
Point Warde Packing Co	Point Warde.
San Juan Fishing & Packing Co	Seward.
Southern Alaska Canning Co	Big Port Walter.
Steamboat Bay Packing Co	Noyes Island.
Seldovia Packing Co	Seldovia.

TOTAL CANNERIES OPERATED

There were 130 canneries operated in Alaska in 1923 as compared with a total of 123 in 1922. Southeast Alaska had 65, an increase of 8; central Alaska had 37, a gain of 1; and western Alaska, 28, or 2 less than in 1922, owing to the omission of the two small plants on the Yukon River. The International Packing Co. operated its floating cannery in each of the three districts, but it is included in the total of western Alaska only.

Companies canning salmon in Alaska, number and location of canneries operated, and number of pound nets owned by each, 1923

[New canneries indicated by (*)]

Company	Canneries		Pound nets		
	Number	Location	Driven	Floating	Total
Southeast Alaska:					
Alaska Consolidated Canneries	7	Pybus Bay		4	4
		Chomley	4	4	8
		Tee Harbor	3	5	8
		Boca de Quadra	4	3	7
		Rose Inlet	1	5	6
		Yes Bay	3	8	11
		Tenakee	3	2	5
Alaska Fish Co	1	Waterfall	1	3	4

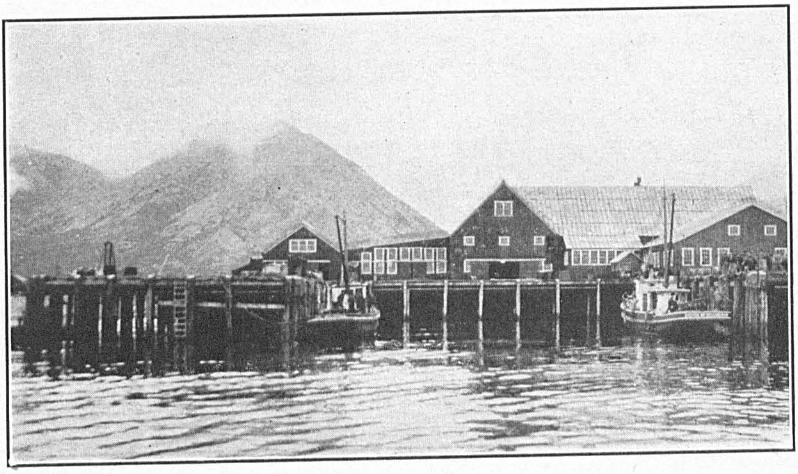

FIG. 6.—Salmon cannery, western Alaska

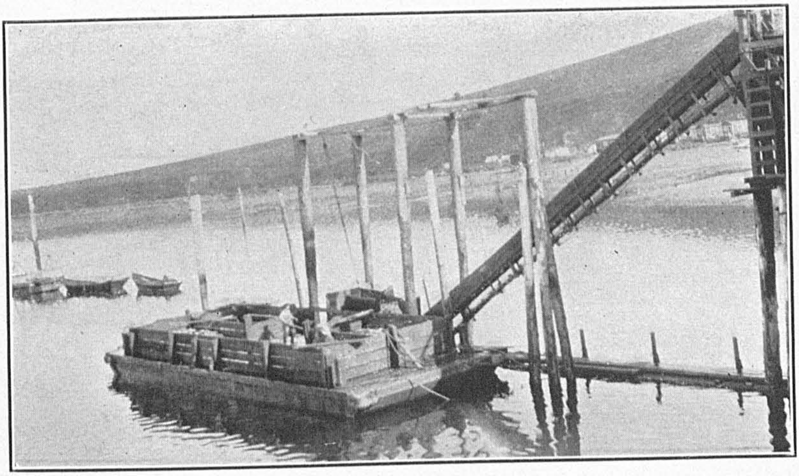

FIG. 7.—Salmon lighter and elevator at cannery, western Alaska

Companies canning salmon in Alaska, number and location of canneries operated, and number of pound nets owned by each, 1923—Continued

Company	Canneries		Pound nets		
	Number	Location	Driven	Floating	Total
Southeast Alaska—Continued.					
Alaska Herring & Sardine Co.	1	Port Walter	1	3	4
Alaska Packers Association	1	Loring	4	2	6
A. & P. Products Corporation	4	Ford Arm		6	6
		Heceta Island		8	8
		Hidden Inlet	1	4	5
		Union Bay	3	4	7
Alaska Sanitary Packing Co.	1	Wrangell	1		1
Annette Island Packing Co.	1	Metlakatla	6	1	7
Astoria & Puget Sound Canning Co.	1	Excursion Inlet	3	2	5
Auk Bay Salmon Canning Co.	1	Auk Bay	3		3
F. C. Barnes Co.	1	Lake Bay	1		1
Beauclaire Packing Co.	1	Port Beauclerc		1	1
Beegle Packing Co.	1	Ketchikan	4		4
Burnett Inlet Packing Co.	1	Burnett Inlet		5	5
Carlson Bros. (Inc.)	1	Pavlof Harbor	3	1	4
Deep Sea Salmon Co.	1	Port Althorp		15	15
Chas. W. Demmert	1	Shakan (floating) *			
Dobbins Packing Co.	1	Petersburg (floating)			
Douglas Island Packing Co.	1	Douglas			
Fidalgo Island Packing Co.	2	Ketchikan	8	1	9
		Bay of Pillars	5		5
George Inlet Packing Co.	1	George Inlet	2		2
Haines Packing Co.	1	Letnikof Cove			
P. E. Harris & Co.	1	Hawk Inlet	3	6	9
Hetta Packing Co.	1	Coppermount			
Hidden Inlet Canning Co.	1	Hood Bay	2		2
Hoonah Packing Co.	1	Gambier Bay	7	1	8
International Packing Co.	1	Waterfall (floating)			
Karheen Packing Co.	1	Karheen	4	1	5
Libby, McNeill & Libby	2	Taku Harbor	12		12
		Yakutat			
Mountain Point Packing Co.	1	Wrangell Narrows	1		1
George T. Myers & Co.	1	Chatham	4	4	8
New England Fish Co.	1	Ketchikan*			
North Pacific Trading & Packing Co.	1	Klawak	1	2	3
Northwestern Fisheries Co.	4	Dundas Bay		4	4
		Shakan	2		2
		Kasaan	5	1	6
		Boca de Quadra	7	1	8
Pacific American Fisheries	1	Excursion Inlet	14	4	18
Petersburg Packing Co.	1	Petersburg	7	4	11
R. J. Peratovich	1	Bay View			
Pure Food Fish Co.	1	Ketchikan	3		3
Pyramid Packing Co.	1	Sitka		2	2
Red Salmon Packers Association	1	Dry Bay and Ketchikan (floating).			
Sanborn Cutting Co.	1	Kake		6	6
Sea-Coast Packing Co.	1	Craig	1	3	4
Sitka Packing Co.	1	Sitka			
J. L. Smiley & Co.	1	Ketchikan	4	2	6
Starr-Collinson Packing Co.	1	Moira Sound		2	2
Straits Packing Co.	1	Skowl Arm*			
Stuart Packing Corporation	1	Ketchikan (floating)			
Superior Fisheries Co.	1	Tenakee	2	2	4
Sunny Point Packing Co.	1	Ketchikan	5		5
Sunrise Packing Co.	1	Ketchikan*	1	2	3
The Trading Union	1	Petersburg			
Thlinket Packing Corporation	1	Funter Bay	1	11	12
Ward's Cove Packing Co.	1	Ward Cove	2		2
Central Alaska:					
Alaska Packers Association	3	Chignik	3		3
		Kasilof	10		10
		Larsen Bay			
Alaska Year Round Canneries Co. (Inc.).	1	Seldovia*	2		2
Alaska Sea Food Co.	1	Point Whitshed		3	3
Alitak Packing Co.	1	Lazy Bay	3		3
Anchorage Packing Co.	1	Anchorage	4		4
Arctic Packing Co.	1	English Bay			
Bainbridge Fisheries Co.	1	Flemming Island			
Canoe Pass Packing Co.	1	Shepard Point	3	3	6
Carlisle Packing Co.	1	Cordova			
Columbia River Packers' Association	1	Chignik	2	1	3
Copper River Canning Co.	1	Copper River delta (floating).	1		1

Companies canning salmon in Alaska, number and location of canneries operated, and number of pound nets owned by each, 1923—Continued

Company	Canneries		Pound nets		
	Number	Location	Driven	Floating	Total
Central Alaska—Continued.					
Copper River Packing Co	1	McClure Bay	3		3
Emel Packing Co	1	Valdez	1		1
Eyak River Packing Co	1	Eyak River			
Fidalgo Island Packing Co	1	Port Graham	6		6
P. E. Harris & Co	1	Isanotski Strait	4		4
Hoonah Packing Co	1	Bering River			
International Packing Co	1	Controller Bay (floating)			
Kodiak Fisheries Co	1	Kodiak	1		1
Katmai Packing Co	1	Uzinki			
Kodiak Island Fishing & Packing Co	2	Seward			
		Uganik Bay *			
Libby, McNeill & Libby	1	Kenai River	17		17
Moore Packing Co	1	Orca Inlet	1		1
North Coast Packing Co	1	Ninilchik	2		2
Northern Light Packing Co	1	Mountain Slough *			
Northwestern Fisheries Co	3	Chignik	3		3
		Kenai	10		10
		Uyak			
Pacific American Fisheries	2	Ikatan	8		8
		King Cove	8		8
Pajoman & Trout	1	Raspberry Island *			
Pioneer Canneries (Inc.)	1	Snug Harbor	3		3
Pioneer Packing Co	1	Cordova			
Robinson Packing Corporation	1	Zachar Bay (floating)			
Shumagin Packing Co	1	Squaw Harbor	3		3
Western Alaska:					
Alaska Packers Association	9	Kvichak Bay (2)			
		Naknek River (3)			
		Nushagak Bay (2)			
		Egegik River			
		Ugashik River			
Alaska-Portland Packers' Association	2	Naknek River			
		Nushagak Bay			
Alaska Salmon Co	2	Kvichak Bay *			
		Wood River			
Bristol Bay Packing Co	1	Kvichak Bay			
Carlisle Packing Co	1	Koggiung (floating)			
Columbia River Packers' Association	1	Nushagak Bay			
Everett Packing Co	1	Herendeen Bay			
International Packing Co	1	Ugashik River (floating)			
Libby, McNeill & Libby	4	Ekuk			
		Koggiung			
		Libbyville			
		Nushagak			
Naknek Packing Co	1	Naknek River			
Northwestern Fisheries Co	2	Naknek River			
		Nushagak			
Pacific American Fisheries	1	Port Moller	5		5
Red Salmon Canning Co	2	Naknek River			
		Ugashik River			

LOSSES AND DISASTERS

Property losses in this industry in 1923 aggregated $196,320, consisting of boats, nets, buildings, and equipment. The largest single item was the fire loss of the Northwestern Fisheries Co. at Kasaan, when property valued at $28,362 was destroyed. The Stuart Packing Corporation, at Ketchikan, lost by fire the gas boat *Aberdeen*, valued at $11,000; and the Sanborn Cutting Co., at Kake, lost the *Phoenix*, valued at $12,500. Ten lives were lost in this industry. Four fishermen and one shoresman were drowned; one fisherman and four shoresmen were accidentally killed.

STATISTICS

The total active investment in the 130 canneries operated in Alaska in 1923 was $50,635,886, an increase of $5,428,329 over the investment in 1922. Southeast Alaska shows a gain of $6,140,225; central and western Alaska show decreases of $109,135 and $602,761, respectively. The industry gave employment to 19,439 persons, which is 1,742 more than the number employed in 1922. The number of whites increased 864, natives 328, Chinese 92, Japanese 170, Mexicans 387, and Negroes 34. Filipinos decreased 89, and miscellaneous 18.

The total pack of canned salmon was 5,035,697 cases, valued at $32,873,007, an increase of 534,045 cases, which occurred wholly in southeastern Alaska, as in both central and western Alaska the pack was smaller than in 1922.

The value of the canned product in 1923 was $3,085,814 more than in 1922. Southeast Alaska increased from 2,018,743 to 3,007,119 cases, central Alaska decreased from 988,143 to 743,640 cases, and western Alaska from 1,494,766 to 1,249,839 cases. Cohos decreased from 175,993 to 164,107 cases, chums from 565,918 to 525,622 cases, and reds from 2,070,658 to 1,859,496 cases. Kings increased from 30,660 to 38,343 cases and humpbacks from 1,658,423 to 2,448,129 cases. Southeast Alaska shows an increase in pack of 988,376 cases, or approximately 49 per cent more than in 1922; central Alaska declined 244,503 cases, or approximately 25 per cent; and western Alaska fell off 244,927 cases, or approximately 17 per cent.

Investment in the Alaska salmon-canning industry in 1923

Items	Southeast Alaska		Central Alaska		Western Alaska		Total	
	Number	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Canneries operated	65	$6,375,314	37	$2,973,763	28	$5,543,600	130	$14,892,677
Working capital		8,260,830		2,826,291		3,770,393		14,857,514
Wages paid		3,638,700		1,866,601		3,807,475		9,312,875
Vessels:								
Power, over 5 tons	301	1,961,478	99	882,416	70	1,570,991	479	4,414,885
Net tonnage	5,969		2,551		15,753		24,273	
Sailing	1	45,000	5	290,000	25	1,035,430	31	1,370,430
Net tonnage	1,944		9,870		41,542		53,356	
Barges	2	14,649					2	14,649
Net tonnage	2,384						2,384	
Launches, under tonnage	75	99,973	108	139,432	72	141,878	255	381,283
Boats, row and sail	1,022	127,971	771	119,190	1,216	463,522	3,009	710,683
Lighters, scows and houseboats	355	326,733	209	171,171	183	352,609	747	850,513
Pile drivers	61	424,531	38	212,828	23	61,415	122	698,774
Pile pullers	4	14,373					4	14,373
Apparatus:								
Beach seines	34	12,670	92	44,693	4	800	130	58,163
Fathoms	4,095		19,936		400		24,431	
Purse seines	290	222,310	36	26,000	11	9,200	337	257,510
Fathoms	48,222		5,680		475		51,752	
Gill nets	224	27,533	1,027	120,116	1,939	416,634	3,190	564,283
Fathoms	18,091		59,569		255,160		332,820	
Pound nets, driven	171	1,149,030	105	572,765	5	25,000	281	1,746,795
Pound nets, floating	155	471,156	7	19,323			162	490,479
Total		23,172,260		10,264,679		17,198,947		50,635,886

Persons engaged in the Alaska salmon-canning industry in 1923

Occupation and race	Southeast Alaska	Central Alaska	Western Alaska	Total
Fishermen:				
Whites	1,023	910	2,348	4,281
Natives	1,193	367	73	1,633
Miscellaneous [1]	28			28
Total	2,244	1,277	2,421	5,942
Shoresmen:				
Whites	1,819	781	1,810	4,410
Natives	1,457	608	237	2,302
Chinese	520	274	517	1,311
Japanese	666	258	132	1,056
Filipinos	740	311	380	1,431
Mexicans	159	124	1,466	1,749
Negroes	30	24	106	160
Miscellaneous [1]	13	14	36	63
Total	5,404	2,394	4,684	12,482
Transporters:				
Whites	536	250	131	917
Natives	30	34		64
Miscellaneous [1]	31	2	1	34
Total	597	286	132	1,015
Total:				
Whites	3,378	1,941	4,289	9,608
Natives	2,680	1,009	310	3,999
Chinese	520	274	517	1,311
Japanese	666	258	132	1,056
Filipinos	740	311	380	1,431
Mexicans	159	124	1,466	1,749
Negroes	30	24	106	160
Miscellaneous [1]	72	16	37	125
Grand total	8,245	3,957	7,237	19,439

[1] Koreans, Porto Ricans, Kanakas, etc.

Output and value of canned salmon in Alaska in 1923 [1]

Product	Southeast Alaska		Central Alaska		Western Alaska		Total	
	Cases	*Value*	*Cases*	*Value*	*Cases*	*Value*	*Cases*	*Value*
Coho, or silver:								
½-pound flat	9,947	$82,486	3,891	$28,951	28	$240	13,866	$111,683
1-pound flat	8,128	56,215	2,023	12,947			10,151	69,162
1-pound tall	112,276	611,535	27,017	146,557	797	4,381	140,090	762,473
Total	130,351	750,236	32,931	188,455	825	4,627	164,107	943,318
Chum, or keta:								
½-pound flat	6,150	38,144	206	1,400			6,356	39,544
1-pound flat	16	76					16	76
1-pound tall	427,210	1,999,026	72,358	320,492	19,682	88,533	519,250	2,408,051
Total	433,376	2,037,246	72,564	321,892	19,682	88,533	525,622	2,447,671
Humpback, or pink:								
½-pound flat	26,536	174,552	2,827	19,175			29,363	193,727
1-pound flat	6,988	37,382	2,440	11,712			9,428	49,094
1-pound tall	2,218,495	10,753,740	190,843	903,395			2,409,338	11,657,135
Total	2,252,019	10,965,674	196,110	934,282			2,448,129	11,899,956
King, or spring:								
½-pound flat	4,865	50,330	601	8,191			5,466	58,521
1-pound flat	4,093	40,074	3,188	34,930			7,281	75,004
1-pound tall	4,090	33,301	6,914	53,343	14,592	108,041	25,596	194,745
Total	13,048	123,765	10,703	96,464	14,592	108,041	38,343	328,270
Red or sockeye:								
½-pound flat	43,914	560,555	67,621	898,129	10,240	135,519	121,775	1,594,203
1-pound flat	35,313	370,994	68,799	687,154	55,159	541,029	159,271	1,599,177
1-pound tall	99,098	881,486	294,912	2,639,812	1,184,440	10,539,114	1,578,450	14,060,412
Total	178,325	1,813,035	431,332	4,225,095	1,249,839	11,215,662	1,859,496	17,253,792
Grand total	3,007,119	15,689,956	743,640	5,766,188	1,284,938	11,416,863	5,035,697	32,873,007

[1] Cases containing ½-pound cans have been reduced one-half in number, and thus, for the purpose of affording a fair comparison, all are put upon the basis of forty-eight 1-pound cans per case.

Output of canned salmon in Alaska, in cases, 1918 to 1923 [1]

Product	1918	1919	1920	1921	1922	Average for 5-year period, 1918–1922	1923	Percentage of increase (+) or decrease (−) in 1923 as compared with 5-year average
Coho, or silver:								
½-pound flat	26,238	9,719	8,915	4,084	22,237	14,239	13,866	−2.62
1-pound flat	12,786	10,438	10,746	7,918	12,099	10,797	10,151	−5.98
1-pound tall	179,934	212,713	172,424	94,553	141,657	160,256	140,090	−12.58
Total	218,958	232,870	192,085	106,555	175,993	185,292	164,107	−11.43
Chum, or keta:								
½-pound flat	3,559	3,981	53	608	3,698	2,380	6,356	+170.59
1-pound flat	2,996		46,167		6,185	11,070	16	−99.86
1-pound tall	1,358,405	1,361,582	987,297	254,887	556,035	903,641	519,250	−42.54
Total	1,364,960	1,365,563	1,033,517	255,495	565,918	917,091	525,622	−42.69
Humpback, or pink:								
½-pound flat	63,557	28,185	18,970	1,292	42,736	30,948	29,363	−5.12
1-pound flat	20,215	7,553	76,017		30,879	26,933	9,428	−64.99
1-pound tall	2,355,182	1,575,870	1,498,133	422,692	1,584,808	1,487,337	2,409,338	+61.99
Total	2,438,954	1,611,608	1,593,120	423,984	1,658,423	1,545,218	2,448,129	+58.43
King, or spring:								
½-pound flat	6,000	7,584	10,196	4,061	3,770	6,322	5,466	−13.54
1-pound flat	5,267	11,532	18,319	19,192	3,967	11,655	7,281	−37.53
1-pound tall	37,959	76,870	81,488	21,741	22,923	48,196	25,596	−46.89
Total	49,226	95,986	110,003	44,994	30,660	66,173	38,343	−42.06
Red, or sockeye:								
½-pound flat	137,008	122,236	101,716	60,831	171,896	118,737	121,775	+2.56
1-pound flat	151,864	110,491	120,147	71,108	121,449	115,012	159,271	+38.48
1-pound tall	2,244,865	1,044,934	1,278,875	1,633,859	1,777,313	1,595,969	1,578,450	−1.08
Total	2,533,737	1,277,661	1,500,738	1,765,798	2,070,658	1,829,718	1,859,496	+1.63
Grand total	6,605,835	4,583,688	4,429,463	2,596,826	4,501,652	4,543,492	5,036,697	+10.83

[1] The number of cases shown has been put upon the common basis of forty-eight 1-pound cans per case.

Relative importance of each district in the production of each species of canned salmon in 1923

District	Coho	Chum	Pink	King	Red	Total, all species
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Southeastern Alaska	79.4	82.5	91.9	34.0	9.6	59.7
Central Alaska	20.1	13.8	8.1	27.9	23.2	14.8
Western Alaska	.5	3.7		38.1	67.2	25.5
Total	100	100	100	100	100	100

Relative importance of each species of canned salmon within each district in 1923

District	Coho	Chum	Pink	King	Red	Total
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Southeast Alaska	4.3	14.4	74.9	0.5	5.9	100
Central Alaska	4.4	9.8	26.4	1.4	58.0	100
Western Alaska	.1	1.5		1.1	97.3	100
All Alaska	3.3	10.4	48.6	.8	36.9	100

Average annual price per case of forty-eight 1-pound cans of salmon, 1913 to 1923

Product	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923
Coho, or silver	$3.45	$4.39	$4.31	$5.34	$8.76	$9.15	$11.27	$9.13	$5.63	$5.47	$5.74
Chum, or keta	2.21	3.37	2.59	3.34	6.14	6.27	6.82	4.19	3.68	3.98	4.65
Humpback, or pink	2.58	3.50	2.78	3.64	6.44	6.58	8.35	5.47	4.21	4.34	4.86
King, or spring	4.04	5.01	4.63	5.36	10.40	9.85	13.13	10.97	10.22	8.08	8.56
Red, or sockeye	4.54	5.58	5.82	6.04	9.48	9.44	12.98	13.05	8.96	9.24	9.27

SALMON PACK IN CERTAIN AREAS

It has seemed desirable to assemble certain heretofore unpublished information in respect to the pack of canned salmon in Alaska by subdivisions of the three main districts in order that the increase or decline in production in rather localized areas may be easily apparent from year to year. The areas determined upon are described as follows:

Bristol Bay area.—Canneries on the Bering Sea shore east and north of the Ugashik River.

Port Moller and Herendeen Bay area.—Canneries of Port Moller, Herendeen Bay, and Nelson Lagoon.

Ikatan and Shumagin Islands area.—Canneries of False Pass, Ikatan Bay, King Cove, and the Shumagin Islands.

Chignik area.—Three canneries located at Chignik.

Kodiak-Afognak Islands area.—Canneries of Kodiak, Spruce, and Raspberry Islands.

Cook Inlet area.—Canneries on the shores of Cook Inlet.

Prince William Sound area.—Extends from Resurrection Bay to Point Whitshed, except that the packs of king and red salmon at canneries eastward from Shepard Point to the end of the district are omitted.

Copper and Bering River area.—Extends from Point Whitshed to Bering River and includes the red and king salmon pack at Cordova canneries not credited to Prince William Sound.

Yakutat and Dry Bay area.—Extends from Yakutat Bay to and including Dry Bay.

Icy Strait and Lynn Canal area.—West coast of Baranof and Chichagof Islands, the shores of Cross Sound, Icy Strait, Lynn Canal, and Stephens Passage south to Taku Harbor. Only part of the pack at Taku Harbor is credited to this district, as some of it originated elsewhere.

Chatham Strait-Frederick Sound area.—Includes part of the Taku cannery pack and the Petersburg Packing Co.'s pack, in addition to that of all canneries on both shores of Chatham Strait and its bays from Point Augusta to Cape Ommaney, and through Frederick Sound and its bays northward to Taku Harbor, including Kake.

Sumner Strait-Dixon Entrance area.—Extends southward from Petersburg and eastward from Port Beauclerc to Cape Chacon and Dixon Entrance, and includes all canneries on the mainland and intervening islands from the Stikine River to Portland Canal.

West coast of Prince of Wales Island area.—Territory west and south of a line from Cape Chacon to Point Baker and Cape Ommaney.

Pack of canned salmon in Alaska in 1923, by districts[1]

District	Coho	Chum	Humpback	King	Red	Total
	Cases	*Cases*	*Cases*	*Cases*	*Cases*	*Cases*
Bristol Bay	815	17,396		12,849	1,193,527	1,224,587
Port Moller and Herendeen Bay	10	2,286		1,743	56,312	60,351
Ikatan-Shumagin Islands	6,115	48,611	6,316	836	139,533	201,411
Chignik	1,465	5,749	451	76	62,146	69,887
Kodiak-Afognak Islands	8,690	5,301	52,459	343	79,994	146,787
Cook Inlet	12,071	2,324	2,008	6,933	67,144	90,480
Prince William Sound	1,525	10,579	134,876	64	15,028	162,072
Copper and Bering Rivers	3,065			2,451	67,487	73,003
Yakutat and Dry Bay	21,954		18,685	3,205	23,102	66,946
Icy Strait-Lynn Canal	30,274	76,858	285,255	6,869	62,465	461,721
Chatham Strait-Frederick Sound	20,911	73,690	389,030	2,024	17,611	503,266
Sumner Strait-Dixon Entrance	49,863	246,645	1,254,419	950	65,955	1,617,832
West Coast Prince of Wales Island	7,349	36,183	304,630		9,192	357,354
Total	164,107	525,622	2,448,129	38,343	1,859,496	5,035,697

[1] Pack reduced to the basis of forty-eight 1-pound cans per case.

MILD CURING OF SALMON

The salmon mild-cure industry gave employment to 1,831 persons, including 1,600 independent trollers in southeast Alaska. Whites numbered 1,615, natives 215, and Filipinos 1. Approximately 89 per cent of the mild-cured salmon was prepared in southeast Alaska, where the bulk of the catch is made by trollers. In 1923 this industry represented an investment of $1,425,213, which is a decrease of $146,812 as compared with $1,572,025 in 1922. The pack was 4,219 tierces, as against 5,283 tierces in 1922. There were packed 143 tierces of cohos, 4,070 of kings, and 6 of reds. In 1922 the pack was 83 tierces of cohos and 5,200 of kings.

Investment, persons engaged, and products of Alaska salmon mild-curing industry in 1923

Items	Number	Value
INVESTMENT		
Plants	10	$67,000
Operating capital		429,128
Vessels:		
Power, over 5 tons	16	80,800
Net tonnage	300	
Barges	1	1,200
Scows	2	4,500
Launches, under 5 tons[1]	811	819,850
Other boats, skiffs, lighters, and floats	43	8,240
Apparatus:		
Seines, beach (100 fathoms)	1	420
Gill nets (5,240 fathoms)	68	7,845
Lines	3,151	6,230
Total		1,425,213
PERSONS ENGAGED		
Fishermen:		
Whites	1,549	
Natives	162	
Total	1,711	
PERSONS ENGAGED—contd.		
Shoresmen:		
Whites	45	
Natives	41	
Filipinos	1	
Total	87	
Transporters:		
Whites	21	
Natives	12	
Total	33	
Grand total	1,831	
PRODUCTS (POUNDS)		
Coho, or silver[2]	113,850	$9,767
King, or spring[3]	3,254,800	716,509
Red, or sockeye[4]	3,600	346
Total	3,372,250	726,622

[1] Includes 800 trolling launches, valued at $800,000.
[2] 143 tierces.
[3] 4,070 tierces.
[4] 6 tierces.

SALMON PICKLING

The investment in the salmon-pickling industry in 1923 was $828,867, an increase of $317,869 over 1922. This gain occurred wholly in western Alaska, where an advance of almost 100 per cent was noted, the investment being $759,479 as compared with $387,219 in 1922. In central Alaska the investment dropped to $69,388, or approximately 44 per cent less than in 1922, when it was $123,779. No capital was invested in this industry in southeast Alaska, and the small production of pickled salmon in that district was incidental to other business. Employment was given to 265 persons, or 15 more than in 1922. Production dropped from 3,585,100 pounds, valued at $284,015 to 2,332.844 pounds, valued at $186,790, a decrease of almost 35 per cent in quantity and 34 per cent in value.

Investment, persons engaged, and products of Alaska salmon-pickling industry in 1923, by districts

Items	Southeast Alaska		Central Alaska		Western Alaska		Total	
INVESTMENT	Number	Value	Number	Value	Number	Value	Number	Value
Salteries			4	$32,110	4	$362,965	8	$395,075
Operating capital				27,398		230,405		257,803
Vessels:								
Power, over 5 tons					4	60,100	4	60,100
Net tonnage					119		119	
Sailing					2	23,000	2	23,000
Net tonnage					820		820	
Launches			2	3,000	5	17,800	7	20,800
Gill net boats			8	600	101	27,913	109	28,513
Row boats and skiffs			14	680	17	1,700	31	2,380
Lighters and pile drivers			1	500	10	19,560	11	20,060
Apparatus:								
Beach seines			2	800			2	800
Fathoms			225				225	
Gill nets			35	3,500	136	16,036	171	19,536
Fathoms			1,628		12,300		13,928	
Pound nets, driven			1	800			1	800
Total				69,388		759,479		828,867
PERSONS ENGAGED								
Fishermen:								
Whites			4		106		110	
Natives			15		18		33	
Total			19		124		143	
Shoresmen:								
Whites			8		61		69	
Natives					50		50	
Chinese					1		1	
Total			8		112		120	
Transporters: White			2				2	
Grand total			29		236		265	
PRODUCTS (POUNDS) [1]								
Coho, or silver	33,000	$2,200	38,644	2,080			71,644	4,280
Chum, or keta	1,500	120	6,000	900	5,200	270	12,700	1,290
Humpback, or pink	5,000	400	3,000	150			8,000	550
King, or spring	3,000	240	4,800	411	64,000	10,656	71,800	11,307
Red, or sockeye			62,300	6,390	2,106,400	162,973	2,168,700	169,363
Total	42,500	2,960	114,744	9,931	2,175,600	173,899	2,332,844	186,790

[1] 200 pounds equal one barrel.

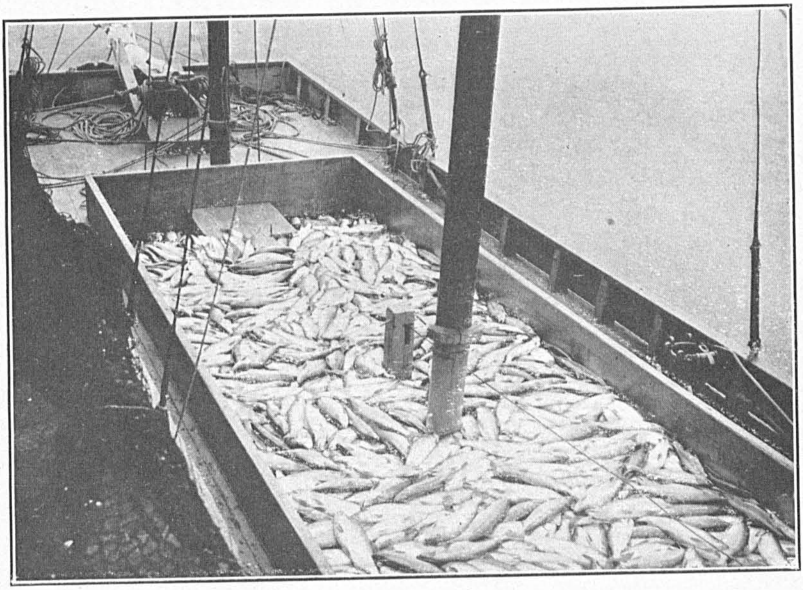

FIG. 8.—Red salmon delivered at cannery, central Alaska

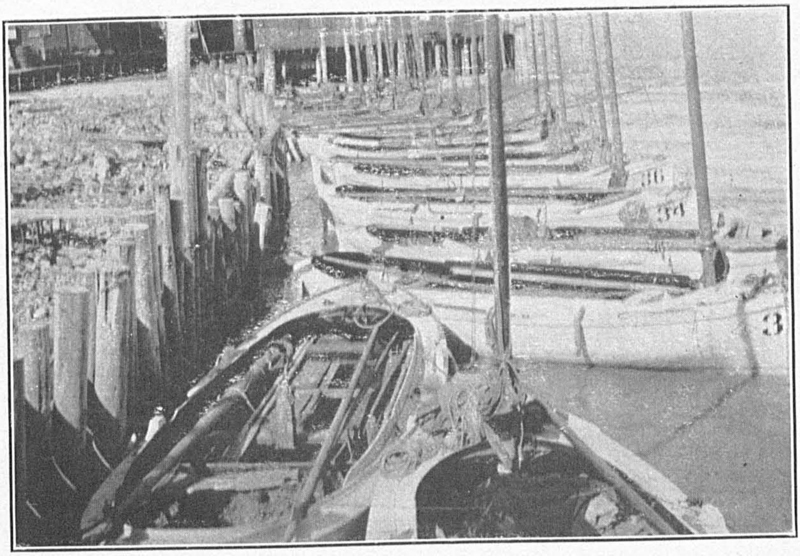

FIG. 9.—Salmon gill-net fishing boats, Bristol Bay

FRESH SALMON

The fresh-salmon business of Alaska fell off approximately 30 per cent in 1923, as compared with the figures shown for this trade in 1922. Investments dropped from $35,541 to $6,053 and products decreased from 3,802,729 pounds, valued at $271,869, to 2,926,257 pounds, valued at $244,838.

There is some evidence that considerable quantities of salmon taken by American trollers in Alaskan waters are picked up by Canadian vessels plying along the international boundary in Dixon Entrance and landed at Prince Rupert or near-by canneries in British Columbia.

Products of the Alaska fresh-salmon industry in 1923

Products	Pounds	Value
Coho, or silver	559,980	$31,231
Chum, or keta	15,310	632
Humpback, or pink	45,994	603
King, or spring	2,266,503	209,878
Red, or sockeye	38,470	2,494
Total	2,926,257	244,838

SALMON FREEZING

The production of frozen salmon in 1923 was 1,765,289 pounds, valued at $132,522. All of this product was prepared in southeast Alaska, except 30,811 pounds, valued at $1,115, which was reported from the Yukon River by Waechter Bros. Co. Five companies engaged in this business in southeast Alaska, as follows: Sebastian Stuart Fish Co., at Taku Harbor and Ketchikan; Booth Fisheries Co., at Sitka and Ketchikan; New England Fish Co., Marlyn Fish Brokerage Co., and Atlantic & Pacific Packing Co., all at Ketchikan. As compared with similar products in 1922, there was a decrease in quantity of 2,083,864 pounds and in value of $128,572.

Quantity and value of salmon frozen in Alaska in 1923, by species

Species	Pounds	Value
Coho, or silver	385,484	$21,657
Chum, or keta	234,009	9,040
King, or spring	1,145,796	101,825
Total	1,765,289	132,522

DRYING AND SMOKING OF SALMON

The Indians of the Yukon and Kuskokwim River Valleys prepared for local use 747,588 pounds of dried salmon, valued at $37,378. Waechter Bros., also operating on the Yukon River, dried 19,824 pounds of chum salmon, valued at $500. Cook Inlet produced 3,000 pounds, valued at $450. The total production of dried salmon was 774,412 pounds, valued at $38,728. The Juneau Cold Storage Co. kippered 4,000 pounds of king salmon, valued at $600. No dry-salted salmon was produced in 1923. The total investment in this business was estimated at $17,700, there being 168 wheels, valued at $16,800, and 900 fathoms of gill nets, valued at $900.

Quantity and value of dried and kippered salmon in Alaska in 1923, by species

Species	Dried		Kippered	
	Pounds	*Value*	*Pounds*	*Value*
Coho, or silver	12,341	$846		
Chum, or keta	670,094	33,067		
Humpback, or pink	272	30		
King, or spring	91,705	4,785	4,000	$600
Total	774,412	38,728	4,000	600

SALMON BY-PRODUCTS

The Alaska Reduction Co., at Hawk Inlet, and the Petersburg By-Products Co., at Scow Bay, both in southeast Alaska, and the Alaska Packers Association, at Larsen Bay in Central Alaska, utilized the offal at salmon canneries in the manufacture of oil and fertilizer. The total production was 888,220 pounds of fertilizer, valued at $22,409, and 29,031 gallons of oil, valued at $13,247. The two plants in southeast Alaska show an investment of $225,193 and that employment was given to 27 men. The plant at Larsen Bay was operated in connection with the salmon cannery of the Alaska Packers Association at that place, and the investment represented by it was included in statistics of cannery investments. Louis Peterson, at Scow Bay, prepared 1,800 pounds of salmon caviar, valued at $81.

Production of salmon oil and fertilizer in Alaska in 1923

Districts	Oil		Fertilizer	
	Gallons	*Value*	*Pounds*	*Value*
Southeast Alaska	27,450	$12,425	820,000	$20,450
Central Alaska	1,581	822	68,220	1,959
Total	29,031	13,247	888,220	22,409

HERRING FISHERY

In 1923 there was a considerable falling off in the output of Alaska pickled herring for food as compared with 1922. The output in 1922, however, was more than double that of any preceding year except 1918. The output in 1923, when compared with the average for the 5-year period from 1918 to 1922, showed decreases as follows: Scotch cure, 14.4 per cent; Norwegian cure, 81.4 per cent; and total, both methods, 23.6 per cent.

Early in 1923 there remained on the market a considerable quantity of herring packed in the preceding year. This did not encourage efforts to prepare for a large pack in 1923. Later, when an active demand came for the 1923 product, the operators found it impossible to secure adequate quantities of fish suitable for their requirements. This was particularly the situation in the Prince William Sound region, where there was a marked shortage of herring for a considerable period.

STATISTICAL SUMMARY

The herring industry of Alaska in 1923 represented an investment of $2,375,798, as compared with $3,367,841 in 1922, a decrease of $992,043. Nineteen plants were operated, or three less than in 1922. The number of persons employed was 881, a decrease of 399 from 1922. The products in 1923 were valued at $1,602,571, as compared with $2,329,116 in 1922, a decrease of $726,545. Scotch-cured herring fell off from 35,995,450 pounds in 1922 to 13,047,433 pounds in 1923. Fertilizer increased from 3,292,000 pounds to 6,382,445 pounds, and oil advanced from 425,241 gallons to 866,112 gallons.

Investment, persons engaged, and products of Alaska herring fishery in 1923, by districts

Items	Southeast Alaska		Central Alaska		Western Alaska		Total	
	Number	Value	Number	Value	Number	Value	Number	Value
INVESTMENT								
Plants operated	6	$332,154	12	$371,152	1	$8,219	19	$711,525
Operating capital		449,637		785,684		7,778		1,243,099
Vessels:								
Power, over 5 tons	18	142,000	33	159,600			51	301,600
Net tonnage	480		624				1,104	
Launches, under 5 tons	1	1,200	40	12,725	3	3,087	14	17,012
Boats, row and seine	25	3,775	40	2,150	19	950	84	6,875
Lighters and scows	1	1,000	6	6,200	1	600	8	7,800
Barges	1	1,000					1	1,000
Pile drivers			2	5,800			2	5,800
Apparatus:								
Beach seines	2	2,950	10	9,800	3	755	15	13,505
Fathoms	230		1,220		300		1,750	
Purse seines	12	26,287	21	31,700	2	1,000	35	58,987
Fathoms	1,775		2,840		250		4,865	
Pound nets			6	4,325	1	150	7	4,475
Gill nets			33	3,720	57	400	90	4,120
Fathoms			1,510		950		2,460	
Total		960,003		1,392,856		22,939		2,375,798
PERSONS ENGAGED								
Fishermen:								
Whites	79		157		4		240	
Natives	6		8		2		16	
Total	85		165		6		256	
Shoresmen:								
Whites	197		371		2		570	
Natives	15		7				22	
Total	212		378		2		592	
Transporters:								
Whites	14		18				32	
Miscellaneous	1						1	
Total	15		18				33	
Grand total	312		561		8		881	
PRODUCTS (POUNDS)								
Fresh, for bait	403,000	2,661	1,437,386	14,373			1,840,386	17,034
Frozen, for bait	3,354,139	26,493					3,354,139	26,493
Pickled, for bait	40,000	400					40,000	400
Pickled, for food, Scotch cure	2,591,450	157,042	10,386,183	800,474	69,800	8,509	13,047,433	966,025
Pickled, for food, Norwegian cure	203,250	11,824	250,200	17,444			453,450	29,268
Roused, for food	50,200	2,510					50,200	2,510
Bloaters			64,222	1,939			64,222	1,939
Fertilizer	5,170,445	157,232	1,212,000	36,849			6,382,445	194,081
Oil	[1] 5,437,485	299,382	[2] 1,208,355	65,439			[3] 6,645,840	364,821
Total	17,249,969	657,544	14,558,346	936,518	69,800	8,509	31,878,115	1,602,571

[1] 724,998 gallons. [2] 161,114 gallons. [3] 886,112 gallons.

HALIBUT FISHERY

Marked improvement in the halibut trade was evidenced in 1923 by the high price received and the constant demand for halibut. Production was larger than in 1922, but owing to the fact that many American boats delivered their fares at Prince Rupert, British Columbia, the quantity credited to Alaska is not greatly in excess of that in 1922.

On March 2, 1923, a convention was concluded between the United States and Great Britain for the purpose of securing the preservation of the halibut fishery of the northern Pacific Ocean. The convention was ratified by Canada on March 2, 1923, and by the United States on May 31, 1924. The terms of the convention provided that it shall remain in force for a period of five years and thereafter until two years from the date when either of the contracting parties shall give notice to the other of a desire to terminate it. The convention comes into force on the day of the exchange of ratifications.[2] Provision is made for an International Fisheries Commission consisting of four members, two to be appointed by each party to the convention. This commission will continue in existence so long as the convention remains in force. It will make a thorough investigation into the life history of the Pacific halibut and will report findings and make recommendations in regard to regulations for the halibut fishery of the North Pacific. After the close season provided by the convention has been in effect for three seasons it may be modified or suspended by the contracting countries by special agreement upon recommendation by the commission. Legislation has been enacted by Canada to give effect to the convention. The Northern Pacific Halibut Act, approved June 7, 1924, gives effect to the convention on the part of the United States.

A close season is provided for halibut covering the period from November 16 in any year to February 15 in the next following year, both dates inclusive. The close season applies to the Territorial waters contiguous to the western coast of the United States and of Alaska, the Territorial waters contiguous to the western coast of Canada, and the high seas, including Bering Sea, extending westerly from the limits of the territorial waters of the United States and of Canada. The use of ports of the United States and of Canada in connection with unlawful fishery operations is forbidden. Penalties for violation of the law are fixed, and provision is made for patrol, searches, seizures, and forfeitures in connection with the enforcement of the law. As a result of this convention and enabling legislation the first close season for halibut will begin November 16, 1924.

Fishing banks off the coast of Alaska have for a number of years been the most important source of Pacific coast halibut, yet during the past 10 years—1914 to 1923—the quantity actually landed at Alaskan ports has amounted to only about one-third of the total American Pacific coast catch. The principal reason for this is found in the fact that Prince Rupert and Vancouver, British Columbia, and Seattle, Wash., are in direct touch with consuming centers by rail, while Alaska must ship by boat and then by rail via one of these three railroad terminals.

In 1923, 12,173,274 pounds of halibut were landed in Alaska, of which 7,949,132 pounds were shipped to Seattle, Wash., and 4,224,-

[2] Ratifications were exchanged Oct. 21, 1924.

142 pounds to Prince Rupert and Vancouver, British Columbia. Of the total quantity landed in 1923, 8,214,169 pounds were frozen. The business centers at Ketchikan, although freezing operations are conducted at Sitka, Juneau, and Seward, while at both Petersburg and Wrangell halibut trade is carried on.

It is the ambition of Ketchikan business interests to have the 20,000,000 pounds of halibut now landed direct by American fishing vessels at Prince Rupert, British Columbia, landed at Ketchikan instead. The aspirations of Ketchikan for this trade have been in evidence since the opening of the Grand Trunk Pacific Railway to Prince Rupert in 1915. The trade was originally secured and has been retained by Prince Rupert through orders in council which permit American fishing vessels to land their fares in British Columbia and transship to the United States without payment of the Canadian customs tariff.

The conditions under which halibut taken by American vessels and landed at British Columbia ports for shipment in bond may be brought into the United States as the product of American fisheries have been the subject of several recent Treasury Decisions, the latest of which (T. D. 40089), under date of March 27, 1924, reads as follows:

Since the publication of T. D. 39822, October 10, 1923, relating to fish, the product of American fisheries, the department has given further consideration to various questions affecting the fishing industry.

It is apparent that American fishermen catching fish in the northern Pacific Ocean often find it to their advantage to land their catches of fish at a Canadian port, particularly at Prince Rupert, British Columbia, and there sell the fish either to American or foreign dealers for shipment to the United States rather than to ship the fish for their own account.

It has long been the settled policy of Congress to encourage the American fishing industry by providing that fish and all other products of American fisheries should be free of duty, and this policy is continued in paragraph 1630 of the tariff act of 1922. In pursuance of this policy, therefore, it is hereby held under said paragraph 1630 that—

1. Fish and all other products of American fisheries may be brought into any port of the United States by the vessel taking the same and landed free of duty without any entry being required therefor. (Art. 436, Customs Regulations of 1915.)

2. American-caught fish may be landed in foreign territory and there stored, salted, dried, or otherwise preserved, without losing their right to free entry as the product of American fisheries when shipped to the United States, provided the fish are not sold in the foreign country, and the storing, salting, etc., is done by the master and crew of the fishing vessel or by persons employed by them for the purpose; ownership of the fish remaining in the master or owner of the vessel until the fish are entered at a port in the United States (T. D. 32138).

3. American-caught fish may be landed and sold in foreign territory to American or foreign purchasers, and such purchasers may ship the fish to the United States and enter the same free of duty under paragraph 1630, provided the fish be shipped to the United States within 30 days after landing from the fishing vessel without their having been stored, salted, dried, or otherwise preserved in the foreign country. Freezing the fish or packing them in ice to keep them in a fresh condition for shipment, or the removal of the heads, fins, or other refuse parts would not be a bar to their free entry under this ruling.

4. If such fish are sold in a foreign country and there stored, salted, dried, or otherwise preserved they would thus become, by such sale and storage or preservative treatment, so far mingled with foreign commerce as to deprive them of their status as the product of American fisheries, and they would therefore be subject to duty as the product of a foreign country.

T. D. 39494 and T. D. 39822 are hereby modified accordingly.

While official data are lacking as to American exports of halibut, it is interesting to note Alaska's position with regard to the Canadian market as shown by Canadian import statistics. Prior to 1915 the bulk of the Canadian supply of foreign halibut was derived from points in the United States other than Alaska. From 1916 through 1922, however, there has been a steady growth in the Alaska-Canadian trade. From Canadian imports of Alaskan halibut in 1916, amounting to 27,257 pounds, the peak was reached in 1921, when 1,900,182 pounds were imported. The marked decline in 1923 to 434,610 pounds is attributed to the decline in Canadian exports during that year resulting in the retention of a portion of the Canadian vessel catch for home consumption.

About 27 per cent of our domestic halibut catch is preserved by freezing. The result of a three months' closed season, from November 16 to February 15, each year, will doubtless increase this percentage materially. With its present cold-storage facilities, Alaska will probably obtain a considerable portion of the new business, inasmuch as rapid transit is of minor importance in the handling of the frozen product.

With the successful introduction of brine freezing into the Alaska halibut industry and its promise of eliminating packing of the product in chopped ice, there is the possibility that eventually the bulk of the American catch will be landed in Alaska. It is contended that brine freezing results in a product that, when thawed out, is the equal of the fresh fish.

STATISTICAL SUMMARY

The halibut industry of Alaska shows an investment of $2,336,350 in 1923, an increase over 1922 of $496,340. Complete statistics of this nature are not easily obtained, as many boats regularly engaged in the halibut fishery off the Alaskan coast are credited by the owners to Seattle. Halibut deliveries at Alaskan ports in 1923 aggregated 12,173,274 pounds, valued at $1,253,951, as compared with 11,075,237 pounds in 1922, valued at $1,034,967.

Investment, persons engaged, and products of Alaska halibut fishery in 1923

Items	Number	Value	Items	Number	Value
INVESTMENT			PERSONS ENGAGED		
Vessels:			Whites	1,061	
Steam and gas	321	$1,665,000	Natives	12	
Net tonnage	3,311				
Launches	1	1,000	Total	1,073	
Apparatus		67,930			
Shore property		302,530	PRODUCTS (POUNDS)		
Cash capital		299,890			
			Fresh (including local)	3,959,105	$449,638
Total		2,336,350	Frozen	8,214,169	804,313
			Total	12,173,274	1,253,951

COD FISHERY

In 1923 the Alaska Codfish Co. increased its fleet of fishing vessels by the addition of the schooner *Bangor,* the Union Fish Co. added the schooners *Beulah* and *Galilee* to its fleet, and the W. J. Erskine Co. operated two small power schooners in connection with its shore station at Kodiak. The North Star Fish Packing Co., at Tacoma, Wash., withdrew from the cod industry of Alaska.

Alaska cod fleet in 1923

Name	Rig	Net tonnage	Operators
Glendale	Schooner	281	Alaska Codfish Co., San Francisco, Calif.
Maweema	do	392	Do.
City of Papeete	do	370	Do.
Bangor	do	398	Do.
S. N. Castle	do	464	Do.
Alasco	Power schooner	23	Do.
Alasco II	do	5	Do.
Alasco III	do	8	Do.
Alasco IV	do	14	Do.
Golden State	do	223	Union Fish Co., San Francisco, Calif.
Louise	Schooner	328	Do.
Beulah	do	328	Do.
Galilee	do	339	Do.
Martha	Sloop	14	Do.
Progress	Power schooner	115	Do.
Mary G	Power sloop	21	Do.
Pirate	do	30	Do.
Union Flag	do	7	Do.
Wawona	Schooner	413	Robinson Fisheries Co., Anacortes, Wash.
John A	do	235	Pacific Coast Codfish Co., Seattle, Wash.
Charles R. Wilson	do	328	Do.
Brant	Power schooner	8	W. J. Erskine Co., Kodiak, Alaska.
Hillside II	do	28	Do.
Fanny Dutard	Schooner	252	J. A. Matheson, Anacortes, Wash.

STATISTICAL SUMMARY

In 1923 the cod industry of Alaska represented an investment of $967,216, an increase of $188,840 over that of 1922. Employment was given to 457 persons, as compared with 357 in 1922. Products consisted of dry-salted, pickled, and frozen cod aggregating 5,747,671 pounds, valued at $406,932. No oil was produced. There was a falling off in production of 386,978 pounds and in value of $57,237 from the totals reported in 1922.

Investments, persons engaged, and products of Alaska cod fishery in 1923

Items	Number	Value
INVESTMENT		
Value of shore stations		$232,948
Cost of operations		188,664
Wages paid		169,832
Vessels:		
Power, over 5 tons	10	99,800
Net tonnage	269	
Sailing	14	229,100
Net tonnage	4,365	
Launches	51	29,225
Dories	219	15,225
Scows	4	850
Apparatus: Lines	4,755	1,572
Total		967,216
PERSONS ENGAGED		
Fishermen:		
Whites	385	
Natives	30	
Total	415	
Shoresmen:		
Whites	23	
Natives	10	
Total	33	
PERSONS ENGAGED—con.		
Transporters: Whites	9	
Grand total	457	
PRODUCTS (POUNDS)		
Vessel catch:		
Dry-salted cod	4,729,815	$309,566
Pickled cod	75,567	2,350
Tongues	9,000	450
Frozen cod	30,136	602
Total	4,844,518	312,968
Shore station catch:		
Dry-salted cod	903,153	93,964
Recapitulation:		
Dry-salted cod	5,632,968	403,530
Pickled cod	75,567	2,350
Tongues	9,000	450
Frozen cod	30,136	602
Grand total	5,747,671	406,932

WHALE FISHERY

The North Pacific Sea Products Co., at Akutan, was the only firm engaged in the whaling industry of Alaska in 1923. It employed 120 whites and 28 natives. The investment, covering value of plant, vessels, wages, and other operating charges, was $472,998. Whaling was carried on in the North Pacific Ocean and Bering Sea, and the catch was 2 bowheads, 151 finbacks, 155 humpbacks, 29 sulphur bottoms, 16 sperm, 1 right, and 1 sei whale. Products consisted of 655,250 gallons of oil, valued at $317,417; 2,313,980 pounds of fertilizer, valued at $59,660; 3,280 pounds of whalebone, valued at $2,604; and 130,000 pounds of pickled whale meat, valued at $9,000.

The United States Whaling Co. discontinued operations at Port Armstrong, and transferred its activities to the South Pacific Ocean in the region of New Zealand.

CLAMS

Dr. F. W. Weymouth and H. B. Holmes, of Stanford University, were engaged in an extensive investigation of clam beds in certain districts of Alaska during part of the summer of 1923. Attention was directed chiefly to the beds in the Snug Harbor section of Cook Inlet and the region around Cordova, but a brief visit was also made to Alitak at the southern end of Kodiak Island.

Preliminary reports indicate that a profitable and permanent industry along this line may be established in Alaska, but that care will be necessary to prevent the depletion of the beds through too intensive digging. The Alaska razor clam, the only species studied, is of considerably slower growth than those of the Pacific Coast States. The beds at Cordova after somewhat intensive development in 1917 and 1918 showed a noticeably reduced production in succeeding years.

The investigators recommended particularly two measures of conservation, namely, a minimum size limitation of 4½ inches, not more than 5 per cent of the take to fall below this limit, and also a limit on the quantity of clams to be taken from specified beds. It was further suggested that a system of rotation of digging on the beds be established by the operators. It is contemplated that Dr. Weymouth will make further investigation of the clam resources of Alaska in the season of 1924.

STATISTICAL SUMMARY

Eleven firms in central Alaska and one in southeast Alaska prepared clam products. The largest producing areas were those of the Copper River bars and the beaches along the southwestern shore of Cook Inlet near Snug Harbor. This industry shows an investment of $476,747 and the employment of 338 persons. The output of clam products was materially increased over that of 1922. The pack of 1923 was 77,283 cases, valued at $541,139, as compared with 32,290 cases in 1922, valued at $185,007.

Products of the Alaska clam industry in 1923

Items	Cases	Value
Minced:		
½-pound cans	49,269	$314,613
10-ounce cans	16,256	129,084
1-pound cans	5,679	43,160
Whole:		
20-ounce cans	788	3,546
1-pound cans	4,795	48,004
5-pound cans	495	2,722
Juice, 1-pound cans	1	10
Total	77,283	541,139

SHRIMPS

The shrimp industry of southeast Alaska made a material advance in 1923 over the volume of business shown in any preceding season. Petersburg was the center of this trade, as the three largest producers of shrimp—the Alaskan Glacier Sea Food Co., Olympic Fisheries Co., and the Ness Fish Co.—were located at that place. The Wrangell Shell Fish Co., at Wrangell, a newly organized firm, entered this trade early in the year, but owing to difficulty encountered in marketing its products operations were interrupted during the summer and not resumed until fall. In November the Olympic Fisheries Co. sold out to the Alaskan Glacier Sea Food Co. and discontinued business in Alaska.

The investment in the shrimp industry in 1923 was $268,656, as compared with $163,111 in 1922. Of this total $30,400 represents the value of plants, $97,252 the cost of operations exclusive of labor, $80,934 wages paid, and $60,070 the value of boats and apparatus. Employment was given to 243 persons, of which 39 were whites, 150 natives, 35 Japanese, 3 Chinese, 8 Filipinos, 7 Mexicans, and 1 Negro. Products aggregated 460,560 pounds of meat, valued at $178,474, as compared with 336,380 pounds in 1922, valued at $126,690.

CRABS

The pack of canned crabs in Alaska in 1923 was 1,290 cases, valued at $13,390. The Dobbins Packing Co., at Petersburg, was the chief producer. The quantity of crabs in the shell sold in Alaska is not definitely known, but it is estimated that 400 dozens, valued at $1,200, were absorbed by local markets. The total value of all crab products in 1923 was $14,590, as against $47,379 in 1922.

TROUT

The production of trout in Alaska in 1923 was largely incidental to other fishery business. This is due to the fact that trout can rarely be taken outside of lakes and streams in sufficient quantity for profitable commercial use. The investment of one operator, amounting to $3,000, is credited directly to the trout industry. The products were 14,449 pounds of fresh and frozen Dolly Vardens, valued at $1,741, and 25,879 pounds of frozen steelheads, valued at $2,054. In addition 77 cases of 48 one-pound cans per case of Dolly Vardens, valued at $327, were canned by the Pacific American Fisheries at Port Moller. Thus the total quantity of trout produced in 1923 aggregated 44,024 pounds, valued at $4,122. The total production in 1922 was 133,504 pounds, valued at $18,925.

MISCELLANEOUS FISHERY PRODUCTS

Small quantities of miscellaneous fishes are taken in Alaskan waters as products incident more particularly to halibut fishing. In 1923 these products were sablefish, 849,585 pounds, valued at $49,172; red rockfish, 7,035 pounds, valued at $140; smelt, 1,063 pounds, valued at $100; and flounders, 6,691 pounds, valued at $190.

FUR SEAL INDUSTRY

PRIBILOF ISLANDS

GENERAL ADMINISTRATIVE WORK

In the calendar year 1923, 15,920 fur-seal skins were taken on the Pribilof Islands. Approximately 10,000 3-year-old male seals reserved for breeders were marked for the purpose of fully complying with the law. Additions and improvements were made to the washing and blubbering plant on St. Paul Island, and the number of sealskins washed and blubbered there during the year was 11,115. Work was continued on the new water-supply system for the village of St. Paul, and progress was made on the construction of the road from that village to Northeast Point. Systematic work, in charge of a specialist, was undertaken for the development of the fox herds of the islands. The construction of three houses for the use of white employees of the bureau on St. Paul Island was undertaken and carried well toward completion.

The regular annual supplies were transported to the islands by the U. S. S. *Gold Star*. In addition to the maintenance of the usual fur-seal patrol by the Coast Guard, vessels of that service rendered valuable assistance in transporting passengers, mail, and freight for the Pribilof Islands. The bureau's power vessel *Eider* was utilized principally in connection with the Pribilof Islands work. The *Eider* made a trip to Seattle, where a new 140-horsepower engine of the Diesel type was installed.

VISIT BY JAPANESE GOVERNMENT VESSEL

Following arrangements made through the Japanese Ambassador at Washington and the Department of State, the Japanese patrol ship *Hakuhoo Maru* arrived at St. Paul Island August 2, bringing Mr. Keishi Ishino, fur-farming expert of the Imperial Fisheries Bureau. Mr. Ishino remained at the Pribilofs until September 1, making a careful study of questions pertaining to the fur seals, the foxes, and to the Government's operations on the islands generally.

PURCHASE AND TRANSPORTATION OF SUPPLIES

The schedules of the general supplies required for the Pribilof Islands were not printed this year. Competitive bids were secured through the medium of separate schedules placed in the hands of prospective bidders. The supplies were purchased early in the year and were transported from Seattle to the Pribilof Islands aboard the U. S. S. *Gold Star*, which left Seattle May 11. For this transportation the bureau is under obligation to the Navy Department. Likewise the bureau is indebted to the Coast Guard for transportation afforded on vessels of that service. The bureau's vessel *Eider* and the steamship *Buford* also transported supplies.

POWER SCHOONER "EIDER"

The power schooner *Eider* proceeded to Seattle early in the year, where a new 140-horsepower Atlas Diesel engine was installed, and then returned to Alaska in connection with the salmon fisheries and the fur-seal work.

CONSTRUCTION WORK

On St. Paul Island the enlargement of the building used as a general residence for employees was finished, and the construction of three cottages, also for employees, was carried well toward completion. A greenhouse for supplying fresh vegetables was built. Progress was made on the new roadway between the village and Northeast Point.

On St. George Island improvements to the wharf at the village and the construction of a residence for the physician were completed. A double concrete dwelling for natives' use and a garage for the station's trucks were built. A washhouse and a pumphouse for the prospective work of washing and blubbering sealskins on this island also were built.

WATERWORKS

Further tests were made to determine whether the amount of water obtainable from Ice House Lake would be adequate to supply the needs of the village on St. Paul Island. The results being favorable, the work of laying a 4-inch wood pipe between the village and the lake was begun early in September and continued until about the middle of October, when it became necessary to discontinue operations for the season. About 1,600 feet of pipe were laid.

BY-PRODUCTS PLANT

The work of putting the by-products plant on St. Paul Island in operation for the season was begun on July 5, and operations for production purposes were begun July 14. The blubber from sealskins and a quantity of seal carcasses were utilized for the manufacture of oil and meal. During the season, which continued a few weeks, there were produced 8,703 pounds of seal meal, 4,504 gallons of blubber oil, 1,277 gallons of press oil, and 144 gallons of oil foots.

Of the season's output all the blubber oil (4,504 gallons) and 763 gallons of the press oil were shipped to the Fouke Fur Co., St. Louis, Mo. The shipment from St. Paul Island to Seattle was by the United States Coast Guard cutter *Bear*, which received the oil aboard September 17. Forty-nine gallons of press oil were sent to St. George Island for experimental fox feeding. There were reserved for experimental fox feeding on St. Paul Island 465 gallons of press oil, 144 gallons of oil foots, and the 8,703 pounds of seal meal. There was also at the plant, available for fox feeding, an additional 2,213 pounds of seal meal manufactured previous to 1923.

NATIVES

CENSUS

An annual census is taken of the natives of the Pribilof Islands, including such details as are deemed of value for purposes of record. The census is taken as of December 31 of each year.

Recapitulation of census of natives

St. Paul Island:	
Resident population on Dec. 31, 1922	193
Births, Jan. 1 to Dec. 31, 1923	10
	203
Deaths, Jan. 1 to Dec. 31, 1923	9
	194
Arrivals, Jan. 1 to Dec. 31, 1923	9
	203
Departures, Jan. 1 to Dec. 31, 1923	22
Resident population on Dec. 31, 1923	181
Natives away from St. Paul Island but considered residents	21
Total natives accredited to St. Paul Island	202
St. George Island:	
Resident population on Dec. 31, 1922	127
Births, Jan. 1 to Dec. 31, 1923	7
	134
Deaths, Jan. 1 to Dec. 31, 1923	4
	130
Arrivals, Jan. 1 to Dec. 31, 1923	5
	135
Departures, Jan. 1 to Dec. 31, 1923	1
Resident population on Dec. 31, 1923	134
Natives away from St. George Island but considered residents	1
Total natives accredited to St. George Island	135
Both islands:	
Total resident population on Dec. 31, 1923	315
Natives away from islands but considered residents	22
Grand total natives accredited to Pribilof Islands	337

HEALTH CONDITIONS

There were no unusual circumstances in respect to health conditions on the Pribilof Islands in 1923. In January Agent C. E. Crompton, St. George Island, while skiing met with an accident and suffered what was probably a fracture of the lower portion of the spine. Gradual recovery was made, but it was necessary for him to sever his connection with the service later in the year. A physician was on duty on each island throughout the year.

SCHOOLS

St. Paul Island.—The school term of 1922–23 opened October 3, 1922, with an enrollment of 14 boys and 14 girls in the senior school and 16 boys and 16 girls in the junior school, a total of 60 pupils. The school term closed April 27, 1923.

St. George Island.—The 1922–23 term began October 23, 1922, with an attendance of 15 boys and 22 girls. The term ended April 20, 1923.

ATTENDANCE AT SALEM INDIAN TRAINING SCHOOL, CHEMAWA, OREG.

Six native children of St. Paul Island—Tatiana Krukoff, Kleopatra Krukoff, Mariamna Merculieff, Gavriel Kochergin, Auxenty Stepetin, and Nicolai Stepetin—left the island on the U. S. S. *Gold Star* on June 2 en route for the Salem Indian Training School at Chemawa, Oreg. One of these, Nicolai Stepetin, had previously been in attendance at the school. Two other native children of St. Paul Island, Andrey Rukovishnikoff and Dosofey Merculieff, left St. Paul Island on the Coast Guard cutter *Haida* in September to enter the school. Serge Shaishnikoff, also of St. Paul Island, who entered the school in 1922, remained there throughout the year. At the end of the year all the above nine were in attendance at the school.

SAVINGS ACCOUNTS

Certain of the Pribilof Island natives have personal funds in the custody of the United States Commissioner of Fisheries. Through the year 1923 these funds were kept on deposit with the Washington Loan and Trust Co., Washington, D. C., and interest was paid at the rate of 3 per cent per annum, calculated on monthly balances. One new account was opened during the year. A summary of the accounts as a whole for the year 1923 is shown in the statement that follows:

Balance on hand Jan. 1. 1923	$11, 833. 94
Interest earned from Jan. 1 to Dec. 31, 1923	350. 54
Deposited by natives in 1923	88. 76
	12, 273. 24
Withdrawn by natives in 1923	484. 73
Balance on hand, Dec. 31, 1923	11, 788. 51

An itemized statement of the account showing the individual balances of the natives follows:

Pribilof Islands natives' savings accounts in custody of United States Commissioner of Fisheries, as trustee, December 31, 1923

St. Paul Island:	
Bourdukofsky, Appollon[1]	$98. 77
Bourdukofsky, Peter	. 90
Fratis, Agrippina[2]	101. 51
Fratis, Akalina[2]	491. 89
Fratis, Martha[2]	101. 49
Fratis, Iuliania[2]	101. 49
Gromoff, Iuliania	278. 31
Kochutin, Alexandra	4,651. 50
St. Paul Island—Continued.	
Krukoff, Ekaterina	$130. 35
Krukoff, Iuleta[1]	68. 75
Mandregan, Alexandra M	11. 13
Melovidov, Alfey	47. 08
Melovidov, Anton	3. 98
Melovidov, Iosef	47. 08
Merculieff, Agafia	42. 19
Merculieff, Dosofey	42. 19

[1] Deceased. [2] Not living on islands in 1923.

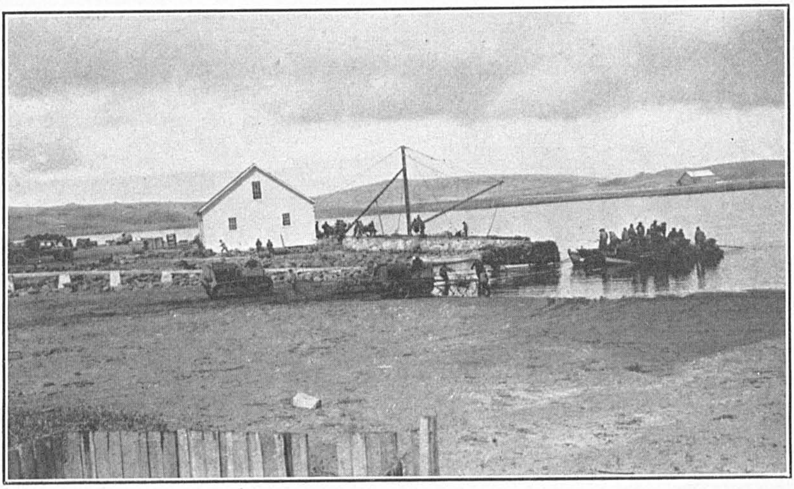

FIG. 10.—Landing supplies, St. Paul Island

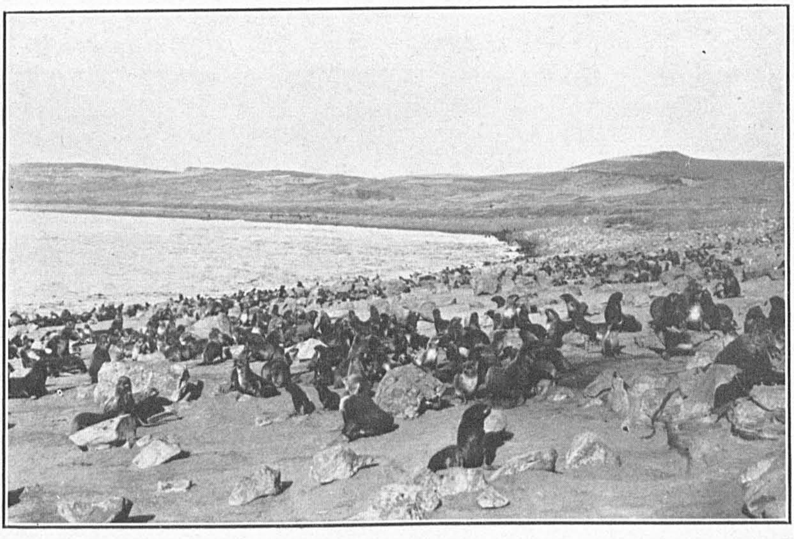

FIG. 11.—Fur seals on rookery, St. Paul Island

Pribilof Islands natives' savings account in custody of United States Commissioner of Fisheries, as trustee, December 31, 1923—Continued

St. Paul Island—Continued.		St. George Island:	
Merculieff, Makary	$42.19	Borenien, Zoya [1]	$257.97
Merculieff, Mariamna	70.35	Galanin, Mary	36.58
Merculieff, Paul A[1]	26.60	Lestenkof, Michael	142.81
Pankoff, Agrippina	257.60	Merculief, Agrippina	19.97
Pankoff, Maria M	47.09	Merculief, Joseph	36.83
Sedick, Feofania [1]	14.68	Merculief, Polyxenia	20.27
Sedick, Lavrenty	14.68	Merculief, Stefanida	4,456.91
Sedick, Leonty	14.68	Shane, Michael	42.68
Sedick, Marina	.38	Zacharof, Emanuel	.45
Shaishnikoff, George [3],[1]	20.10		
Tetoff, Vikenty M	47.08	Total	11,788.51

[1] Deceased.

[3] New account.

PAYMENTS FOR TAKING SEALSKINS

As in preceding years certain persons employed in the taking of sealskins on the Pribilofs in 1923 were paid for their services from funds advanced by the bureau's selling agents, the Fouke Fur Co., who were subsequently reimbursed from proceeds of sales of skins. The funds were deposited in a bank at Seattle and disbursed by a bonded agent of the bureau. The natives of the Pribilofs were paid for their share of the work of taking the sealskins at the rate of 75 cents for each skin taken, this rate being an advance of 25 cents per skin over the rate paid in preceding years. This higher rate was paid the natives for the reason that they were employed in branding about 10,000 seals for the breeding reserve, for which they received no compensation. Four native foremen also received in addition a total of $200 for their special services. A number of sealing assistants and temporary native workmen from the Aleutian Islands were also employed on sealing operations and paid from the funds advanced by the Fouke Fur Co. The amounts earned by these persons during 1923 were as follows:

Salaries of sealing assistants	$24,710.87
Wages of temporary native workmen	16,421.99
Native workmen, St. Paul Island	9,732.25
Native workmen, St. George Island	2,409.25
Total	53,274.36

St. Paul Island.—For the 12,841 sealskins taken on St. Paul Island in the calendar year 1923 the resident natives received 75 cents per skin, and in addition one native foreman received $75 and one $25 for special services. Through an error the total payment made was for 12,843 sealskins instead of for 12,841, the actual number taken. The natives were divided into classes according to their ability and work, and payments were made as follows:

Payments to St. Paul Island natives for sealing operations, calendar year 1923

Classification	Number of men	Share of each	Total	Classification	Number of men	Share of each	Total
First class	28	$239.25	$6,699.00	Foreman (additional compensation)			$75.00
Second class	5	188.25	941.25	Do			25.00
Third class	5	155.25	776.25				
Fourth class	6	120.00	720.00	Total	50		9,732.25
Fifth class	5	96.75	483.75				
Special class	1	12.00	12.00				

St. George Island.—For the 3,079 skins taken on St. George Island in the calendar year 1923 the resident natives received 75 cents per skin, and in addition one native foreman received $55 and one $45 for special services.

Payments to St. George Island natives for sealing operations, calendar year 1923

Classification	Number of men	Share of each	Total	Classification	Number of men	Share of each	Total
First class	18	$82.50	$1,485.00	Foreman (additional compensation)			$55.00
Second class	1	69.00	69.00	Do			45.00
Do	3	67.50	202.50				
Third class	5	54.75	273.75				
Fourth class	6	46.50	279.00	Total	33		2,409.25

PAYMENTS FOR TAKING FOX SKINS

For the work of taking fox skins on the Pribilof Islands the resident natives receive $5 for each pelt taken. In the trapping season of 1922-23 there were taken on St. Paul Island 233 pelts and on St. George Island 684 pelts, a total of 917, for which the St. Paul Island natives received $1,165 and the St. George Island natives $3,420, a total of $4,585. On St. Paul Island the taking of fox skins is a matter of individual effort on the part of the natives, and each person receives payment in accordance with the number of skins he secures. On St. George Island the foxing work is collective in character, and individuals share in the amount due for the total number of skins taken on the island during the season in accordance with what is considered to be their just shares.

FUR-SEAL HERD

QUOTA FOR KILLING

On April 18, 1923, the Secretary of Commerce approved the bureau's recommendation that the quota of seals to be killed in the calendar year 1923 should be 25,800 3-year-old males. This quota was apportioned as follows: St. Paul Island, 23,000; St. George Island, 2,800. It was provided that the interisland quotas would be subject to adjustment upon short notice and that as killings progressed the quotas would be subject to increase or decrease by the department should developments make any change desirable.

KILLINGS OF SEALS

The total number of seals killed on both islands in 1923 was 15,920, of which 14,753 were 3-year-old males. Among the other 1,167 seals, 705 were 2-year-old males and 246 4-year-old males. Details regarding the killings are shown in the table below.

St. Paul Island.—In the calendar year 73 drives were made and 12,841 skins secured, including a small number from seals that died as a result of the reserving operations, were found dead during the season, or were killed for food at odd times.

St. George Island.—In the calendar year 22 drives were made and 3,079 skins were secured, including a few from seals found dead or killed for fox feed.

Seal killings on Pribilof Islands in 1923

ST. PAUL ISLAND

Date	Serial No. of drive	Hauling ground	Skins secured
Feb. 13	1	Sea Lion Rock	204
Mar. 24	2	do	200
May 12	3	do	54
May 31	4	do	120
June 14	......	From seal dying during reserving operations	3
June 16	......	do	1
June 17	......	From seals killed for food, Vostochni	4
Do	......	From seal dying during reserving operations	1
June 18	......	From seals found dead	23
Do	......	From seals dying during reserving operations	1
June 21	......	do	1
June 23	5	Tolstoi	100
June 28	......	From seals killed through reserving operations	2
June 29	......	do	1
July 1	......	From seals killed for food	2
Do	......	From seal killed through reserving operations	1
July 3	6	Little Zapadni	35
Do	7	Zapadni	72
July 6	......	From seal dying during reserving operations	1
Do	8	Reef and Gorbatch	508
July 7	9	Tolstoi	209
Do	10	Kitovi	28
July 8	11	Little Zapadni	54
Do	12	Zapadni	312
July 9	13	Polovina and Polovina Cliffs	106
Do	14	Little Polovina	10
July 10	15	Reef and Gorbatch	792
July 11	16	Tolstoi	206
Do	17	Kitovi and Lukanin	64
July 12	......	From seals found dead	2
July 13	18	Little Zapadni	197
Do	19	Zapadni	421
July 14	......	From seal dying during reserving operations	1
Do	20	Polovina and Polovina Cliffs	185
July 15	......	From seals killed for food, Vostochni and Morjovi	2
Do	21	Reef and Gorbatch	1,200
July 16	22	Tolstoi	340
Do	23	Lukanin	37
July 17	24	Zapadni	147
Do	25	Little Zapadni	20
July 18	......	From seal dying through reserving operations	1
Do	26	Polovina Cliffs	102
Do	27	Little Polovina	16
July 19	......	From seals killed for food, Vostochni and Morjovi	2
Do	28	Reef and Gorbatch	475
July 20	29	Tolstoi	134
July 21	......	From seals found dead	3
Do	30	Little Zapadni	32
July 21	31	Zapadni	90
July 22	32	Polovina Cliffs	55
July 23	33	Reef and Gorbatch	726
July 24	34	Tolstoi	203
Do	35	Lukanin and Kitovi	101
Do	36	Vostochni (vicinities of rocks 64 and 70)	301
July 25	37	Zapadni	203
July 26	38	Vostochni (vicinities of rocks 42, 49, and 53) and Morjovi	179
Do	39	Polovina and Polovina Cliffs	183
Do	40	Little Polovina	10
July 27	41	Vostochni (vicinities of rocks 64 and 70)	81
Do	42	Reef and Gorbatch	897
July 28	43	Tolstoi	171
Do	44	Lukanin	48
July 29	45	Little Zapadni	24
Do	46	Zapadni	124
Do	47	Vostochni (vicinities of rocks 42, 44, 49, and 53) and Morjovi	369
July 30	48	Polovina, Polovina Cliffs, and Little Polovina	80
Do	49	Vostochni (vicinities of rocks 64 and 70)	71
July 31	50	Reef and Gorbatch	152
Aug. 1	51	Tolstoi	94
Do	52	Lukanin	14
Do	53	Vostochni (vicinities of rocks 42, 49, and 53) and Morjovi	168
Aug. 2	54	Zapadni and Little Zapadni	90
Do	55	Vostochni (vicinities of rocks 64 and 70)	35
Aug. 4	56	Reef and Gorbatch	369
Do	57	Vostochni (vicinities of rocks 42, 49, and 53) and Morjovi	174
Aug. 5	58	Vostochni (vicinities of rocks 64 and 70)	70
Do	59	Tolstoi	128
Do	60	Lukanin	19
Oct. 24	61	Tolstoi	128
Oct. 26	62	Little Zapadni	84
Do	63	Zapadni	78
Oct. 27	64	Reef	93
Oct. 31	65	Gorbatch	137
Nov. 2	66	Polovina	18
Do	67	Little Polovina	23
Nov. 4	68	Morjovi	92
Nov. 5	69	Vostochni	167
Nov. 8	70	Lukanin and Kitovi	53
Do	71	Tolstoi	8
Nov. 21	72	Vostochni	130
Nov. 22	73	Morjovi	110
		Total	12,841

ST. GEORGE ISLAND

Date	Serial No. of drive	Hauling ground	Skins secured
June 15	1	North and East Cliffs	95
June 20	2	Zapadni	11
July 2	3	East Cliffs	63
July 3	4	Zapadni	36
July 7	......	Seal accidentally killed during reserving operations	1
July 13	5	North and Staraya Artil	148
July 16	6	East Cliffs	196
July 17	7	North and Staraya Artil	415
July 19	8	Zapadni	89
July 20	9	East Cliffs	90
July 21	10	North and Staraya Artil	206

Seal killings on Pribilof Islands in 1923—Continued

ST. GEORGE ISLAND—Continued

Date	Serial No. of drive	Hauling ground	Skins secured
	......	Skin from seal which fell from cliff	1
July 24	11	North, Staraya Artil, and East Cliffs	452
July 27	12	Zapadni	29
July 28	13	North, Staraya Artil, and East Cliffs	165
		Skin from seal found dead	1
July 31	14	North, Staraya Artil, East Reef, and East Cliffs	117
Aug. 3	15	Zapadni	15
Aug. 4	16	North, Staraya Artil, East Reef, and East Cliffs	180
Sept. 6	......	From seals killed for fox food	4
Sept. 11	......	do	4
Sept. 13	......	do	2
Sept. 25	......	do	1
Oct. 20	17	North and East Cliffs	218
Oct. 22	18	Zapadni	39
Oct. 23	19	Staraya Artil	13
Oct. 25	20	North and East Cliffs	224
Oct. 30	21	do	216
Nov. 1	22	Staraya Artil	39
		Total	3,079

AGE CLASSES OF SEALS

The method by which the sizes of male seals of the various age classes have been determined has been described in previous reports. For convenience the limits of these age classes are shown in the following table:

Age standards of body lengths of male seals, Pribilof Islands

Age.	Lengths of summer seals	Lengths of fall seals	Age	Lengths of summer seals	Lengths of fall seals
	Inches	*Inches*		*Inches*	*Inches*
Yearlings	Up to 36.75	Up to 38.75	4-year-olds	46 to 51.75	48 to 53.75
2-year-olds	37 to 40.75	39 to 42.75	5-year-olds	52 to 57.75	54 to 59.75
3-year-olds	41 to 45.75	43 to 47.75	6-year-olds	58 to 63.75	60 to 65.75

Ages of seals killed on Pribilof Islands, calendar year 1923[1]

Age	Summer (Jan. 1 to Aug. 5)			Fall (Aug. 6 to Dec. 31)			Total for year		
	St. Paul	St. George	Total	St. Paul	St. George	Total	St. Paul	St. George	Total
Yearlings	5	....	5	....	....	....	5	....	5
2-year-olds	600	3	603	97	5	102	697	8	705
3-year-olds	10,716	2,276	12,992	1,009	752	1,761	11,725	3,028	14,753
4-year-olds	225	14	239	7	....	7	232	14	246
5-year-olds	5	....	5	....	....	....	5	....	5
6-year-olds	1	....	1	....	....	....	1	....	1
7-year-olds and over	1	....	1	....	....	....	1	....	1
Cows [2]	167	26	193	8	3	11	175	29	204
Total	11,720	2,319	14,039	1,121	760	1,881	12,841	3,079	15,920

[1] The above table does not include skins from animals that died after shipment to the Steinhart Aquarium, San Francisco, as mentioned elsewhere in the report.
[2] Cows unavoidably and accidently killed.

MARKING OF RESERVED FUR SEALS

In 1923 it was decided to place a mark upon a definite number of the male seals constituting the breeding reserve made in that year from the 3-year-old class. Plans were accordingly made for marking with branding irons 5,000 seals and for shearing a patch of fur from the top of the heads of 5,000 others, a total of 10,000 to be marked. The work of marking the seals was taken up at the beginning of the regular sealing season and was brought to a conclusion as rapidly as practicable.

On St. Paul Island iron branding was begun on June 14 and was finished on July 1, when a total of 4,235 seals had been branded. Thirty-five seals were known to have died after being branded, leaving 4,200 reserved seals that had been marked with the branding iron. A demonstration branding on July 16 increased the number by 11, making a total of 4,211. All seals thus branded were also marked by having a patch of fur sheared from the top of the head in order that they might be more easily recognized when they appeared in drives made for killing operations. From July 1 to August 5, inclusive, 4,208 additional reserved seals were marked by shearing a patch of fur from the top of the head. Three of these animals are known to have died subsequently, thus leaving 4,205 marked by shearing only.

On St. George Island, from June 19 to July 5, inclusive, 801 reserved seals were marked both by the branding iron and by shearing a patch of fur from the top of the head. From July 7 to July 12, inclusive, 801 additional reserved seals, one of which died subsequently, were marked by shearing alone. The marking operations for the season are summarized in the following tabular statement:

Reserved 3-year-old male seals marked on Pribilof Islands, 1923

Mark used	St. Paul Island	St. George Island	Total
Seals marked by branding iron and also by shearing	4,246	801	5,047
Seals that subsequently died	35	0	35
Number remaining	4,211	801	5,012
Seals marked by shearing only	4,208	801	5,009
Seals that subsequently died	3	1	4
Number remaining	4,205	800	5,005
Net total seals marked	8,416	1,601	10,017

On most of the seals marked with the branding iron the brand was placed on the back; on some, however, it was placed at the back of the head.

WASHING AND BLUBBERING SEALSKINS

The Fouke Fur Co. continued in 1923 its work of washing and blubbering sealskins on St. Paul Island, a total of 11,115 skins being handled during the year. Some additional equipment was provided, and improvements were made in respect to the arrangement of that already on hand. In order to supplement the pumping facilities previously installed, a 20-horsepower Fairbanks-Morse combined type Y engine and pump was purchased and shipped to St. Paul Island. A building 14 feet by 48 feet was erected to house the entire pumping equipment for the washing and blubbering work. The building has a concrete base with upper structure of wood. In addition to the new combined pump and engine there was installed in this building the pumping equipment previously used, namely, one combined pump and engine and one centrifugal pump, together with the 10-horsepower engine for operating it. The intake pipes for all three pumps were led to a corner of the wharf at the village landing.

In the washhouse the number of wooden tanks in which sealskins are washed and cooled was increased to 12. A better method of draining used water from the building was also devised and the necessary changes made for putting it into effect. Subsequent to the sealing season of 1922 a 50-foot extension was added to the washhouse. The building now has ground dimensions of 42 feet by 120 feet.

On St. George Island building operations for extending the washing and blubbering operations to that island were begun and carried well along toward completion.

CENSUS

In 1923 the census of the Pribilof Islands fur-seal herd was taken by Edward C. Johnston. His report is printed in full on pages 135 to 140. The following is a comparative statement of the numerical strength of the various elements of the herd in the years 1912 to 1923, inclusive.

General comparison of recent censuses of the seal herd on the Pribilof Islands

Classes	1912	1913	1914	1915	1916	1917
Harem bulls	1,358	1,403	1,559	2,151	3,500	4,850
Breeding cows	81,984	92,269	93,250	103,527	116,977	128,024
Surplus bulls						8,977
Idle bulls	113	105	172	673	2,632	2,706
Young bulls (chiefly 5-year-olds)	199	259	1,658			
6-year-old males					11,167	15,397
5-year-old males				11,271	15,494	14,813
4-year-old males	100	2,000	9,939	15,848	15,427	16,631
3-year-old males	2,000	10,000	13,880	18,282	19,402	19,507
2-year-old males	11,000	15,000	17,422	23,990	24,160	26,815
Yearling males	13,000	20,000	23,068	30,307	33,645	38,013
2-year-old cows	11,000	15,000	17,422	23,990	24,245	26,917
Yearling cows	13,000	20,000	23,067	30,306	33,646	38,018
Pups	81,984	92,269	93,250	103,527	116,977	128,024
Total	215,738	268,305	294,687	363,872	417,281	468,692

Classes	1918	1919	1920	1921	1922	1923
Harem bulls	5,344	5,158	4,066	3,909	3,562	3,412
Breeding cows	142,915	157,172	167,527	176,655	185,914	197,659
Surplus bulls	17,110	9,619	6,115	3,301	2,346	1,801
Idle bulls	2,444	2,239	1,161	747	508	312
6-year-old males	13,755	8,991	4,153	3,991	3,771	4,863
5-year-old males	11,941	5,282	5,007	4,729	6,080	10,612
4-year-old males	7,114	5,747	5,667	6,780	11,807	5,710
3-year-old males	9,117	13,596	10,749	14,668	7,459	22,786
2-year-old males	30,159	33,081	39,111	41,893	40,920	43,112
Yearling males	41,595	46,444	51,074	50,249	52,988	55,769
2-year-old cows	30,415	33,287	39,480	43,419	46,280	48,801
Yearling cows	41,608	46,447	51,081	54,447	57,413	60,422
Pups	142,915	157,172	167,527	176,655	185,914	197,659
Total	496,432	524,235	552,718	581,443	604,962	653,008

SPECIMEN SEALS

In 1923, from seals found dead, one adult female was prepared as a specimen for the Colorado Museum of Natural History, and two pup seals for the Fouke Fur Co. Remittances of $2.50 and $2, respectively, were received for these specimens, and in addition the natives were paid for their work in securing them.

SHIPMENT OF FUR SEALS TO STEINHART AQUARIUM

A request was received from the director of the Steinhart Aquarium, San Francisco, for a number of fur seals for exhibition and educational purposes. The bureau compiled with the request with the understanding that the expense entailed would be borne by the aquarium, and that the animals or the pelts of any that died would remain the property of the Government. Twelve seals were shipped, of which 4 died en route. Of the 8 animals delivered at the aquarium, 4 had died through July, 1924.

FOXES

FOX-TRAPPING SEASON OF 1923–24

The season's take of fox pelts on St. Paul and St. George Islands consisted of 787 blue and 15 white pelts, a total of 802.

On St. Paul Island trapping began December 11 and ceased December 18. The season's take, including 2 skins secured after the close of trapping operations, consisted of 46 blue and 14 white fox skins, a total of 60. The small take on this island, as compared with recent years, is accounted for by the fact that trapping operations were limited to four stations—Northeast Point, Marunich, Tsammana, and Southwest Point. Furthermore, the work was carried on under very adverse weather conditions, the men not succeeding in obtaining any foxes at Marunich. The limitation of trapping to four stations was due to the inauguration of fox-feeding experiments, it being desired not to disturb the animals in the vicinity of places where food was given them. Furthermore, it was felt that in view of the prospective large amount of food that would be available during future winters, as a result of systematic feeding operations, the fox herd should be expanded as rapidly as possible. One of the first steps necessary to accomplish this end would be, of course, to provide a larger breeding reserve.

On St. George Island the season's take consisted of 741 blue and 1 white, a total of 742 pelts. Trapping began in December and was continued until the latter part of February, when signs of mating were observed. Trapping for the purpose of securing data in regard to the breeding reserve was continued until March 6. During the season 265 males and 263 females were marked and released as breeders on St. George Island.

DEVELOPMENT OF FOX HERDS

Early in the year the bureau secured the services of a veterinarian, Dr. H. L. Van Volkenberg, previously employed by the United States Biological Survey, for the primary purpose of developing the Pribilof Islands fox herds. It was planned at the same time that attention would also be given to the reindeer herds and, if occasion arose, to the seals.

Experiments in the feeding of the foxes on St. Paul Island were begun, and various kinds of food and different methods of preparation were studied. No difficulty was experienced in inducing the foxes to come to the established feeding places for food. While the work this year was necessarily somewhat preliminary in character, the results were quite promising.

SALE OF LIVE BLUE FOXES

The policy of selling a limited number of blue foxes for the purpose of assisting in stocking privately owned fur farms was continued in 1923. During the year 48 animals were thus sold at a price of $175 for each animal. The foxes were delivered to the purchasers or their agents at Unalaska. Sales were as follows: 3 to George Marks, Yakutat; 3 to E. M. Axelson, Yakutat; 39 to the Goldstein-Glacier Fur Farms (Inc.), Juneau; and 3 to N. E. Bolshanin, Unalaska, Alaska.

The foxes were all secured on St. George Island. Shipments were made as follows: 20 pairs by the Coast Guard cutter *Algonquin*, September 11, for the Goldstein-Glacier Fur Farms (Inc.), one of which animals died before delivery to purchaser's agent at Unalaska; 3 foxes each for George Marks and E. M. Axelson by the *Eider*, September 14; and 3 foxes for N. E. Bolshanin by the *Algonquin*, September 27. A payment of $5 for each fox sold was made to the natives employed in capturing the animals.

It has been decided to discontinue the policy of selling blue foxes from the Pribilof Islands hereafter except to natives and possibly white residents of the Aleutian Islands Reservation. The shipping of foxes long distances, especially from western Alaska, where transportation is infrequent and slow, necessarily involves some risk of loss. This risk, after the animals are delivered to the purchasers at Unalaska, must be borne by them, and any loss inevitably leads to some dissatisfaction. The securing of any considerable number of foxes in the summer season causes an undesirable disturbance of the herd. Furthermore, the removal of a large number of the choicest animals from the herd lowers its average condition. Assisting fur farmers in the Aleutian Islands Reservation will not involve any considerable number of foxes, and the problem of making shipments will be much simplified.

REINDEER

Reindeer were introduced on both St. Paul and St. George Islands in 1911. Statistics in regard to the size of the two herds and the use made of the animals for each year to 1922 were published in a corresponding report (Bureau of Fisheries Document No. 951) for 1922.

At the end of the year 1923 the St. Paul Island herd numbered approximately 150 animals and the St. George Island herd approximately 145 animals. During the year 14 reindeer were killed for food on St. Paul Island and 34 on St. George Island.

PRIBILOF FUR-SEAL SKINS

SHIPMENTS OF COMMERCIAL SKINS

On May 29, 1923, there were placed aboard the U. S. S. *Gold Star* at St. Paul Island 22 barrels containing 1,028 fur-seal skins. This shipment consisted of 624 skins taken in 1922 and 404 skins taken in 1923.

On May 31, 1923, there were placed aboard the *Gold Star* at St. George Island 7 barrels containing 272 fur-seal skins, which were taken in the fall killings at St. George Island in 1922.

These 1,300 skins were delivered by the *Gold Star* at Bremerton, Wash., from which point they were forwarded by freight, July 27, to the Fouke Fur Co., St. Louis, arriving at their destination on August 9.

On August 11 there were placed aboard the steamship *Buford*, operated by the Alaskan-Siberian Navigation Co., at St. Paul Island, 68 barrels containing 6,071 fur-seal skins taken in 1923. The *Buford* arrived at Seattle with the skins September 4, whence they were shipped on September 5, consigned to the Fouke Fur Co., St. Louis, Mo., via Union Pacific and Wabash. They arrived at St. Louis September 15.

On September 17 there were shipped on the Coast Guard cutter *Bear*, from St. Paul Island, 55 barrels containing 5,247 sealskins. This shipment consisted of 5,245 skins taken in 1923 and 2 skins from a previous year's take found in a salt house.

On September 18 the *Bear* took aboard at St. George Island 32 barrels containing 1,619 fur-seal skins taken in 1923.

On September 19 there were placed aboard the *Eider* at St. George Island 14 barrels containing 700 fur-seal skins taken in 1923. Weather conditions had made it impossible to place these skins aboard the *Bear* the preceding day. It was planned that the *Eider* should deliver them to the *Bear* at Unalaska.

The *Bear*, having taken aboard the 700 skins shipped September 19 from St. George Island on the *Eider*, left Unalaska October 1 with a total of 7,566 skins and arrived at Seattle October 11. The skins left Seattle October 12, consigned to the Fouke Fur Co., St. Louis, Mo., via Union Pacific System and Wabash, and arrived at destination October 21.

SALES OF COMMERCIAL SKINS

Two public auction sales of fur-seal skins from the Pribilof Islands were held in 1923. Both sales took place at St. Louis, Mo., and a total of 20,854 skins was sold. All skins had been dressed, dyed, and machined before being offered for sale. The total bid price for the 20,854 skins was $632,135.75, an average of $30.31 per skin. The tables below give the details regarding the prices secured for each lot of skins at each of the sales, and the table on page 126 is a summary showing the prices obtained for the skins in the various trade classes and the percentages that the number of skins in these several classes bore to the totals in each sale.

May 28, 1923.—At the sale on this date 18,118 dressed, dyed, and machined Pribilof skins were sold for $565,224.75, an average of

$31.20 per skin. This average price was practically the same as the average price ($31.17) obtained for dressed, dyed, and machined Pribilof skins sold at the last previous sale, October 9, 1922.

October 8, 1923.—At the sale on this date 2,736 dressed, dyed, and machined Pribilof skins were sold for $66,911, an average of $24.46 per skin, a decrease of 21.6 per cent, as compared with dressed, dyed, and machined Pribilof skins sold at the last previous sale, May 28, 1923.

At this sale 14,756 dressed, dyed, and machined Pribilof skins were offered, but, owing to the low bids obtained, all but 2,736 were withdrawn by the Government before being sold.

Sales of Pribilof fur-seal skins at St. Louis, Mo., 1923

SALE OF 18,118 DRESSED, DYED, AND MACHINED SKINS, MAY 28, 1923

Lot No.	Number of skins	Trade classification	Price per skin	Total for lot	Lot No.	Number of skins	Trade classification	Price per skin	Total for lot
1	60	Extra extra large	$61.00	$3,660.00	54	80	Large	$37.50	$3,000.00
2	60	do	60.00	3,600.00	55	80	do	44.00	3,520.00
3	60	do	62.00	3,720.00	56	80	do	43.00	3,440.00
4	60	do	60.00	3,600.00	57	80	do	40.00	3,200.00
5	60	do	62.00	3,720.00	58	80	do	43.00	3,440.00
6	60	do	66.00	3,960.00	59	80	do	42.50	3,400.00
7	60	do	63.00	3,780.00	60	80	do	42.50	3,400.00
8	42	22 wigs, 20 extra extra large	46.00	1,932.00	61	80	do	40.00	3,200.00
9	65	4 wigs, 61 extra extra large; cut, scarred, etc	40.00	2,600.00	62	80	do	38.00	3,040.00
10	70	Extra large	56.00	3,920.00	63	80	do	37.50	3,000.00
11	70	do	56.00	3,920.00	64	80	do	37.50	3,000.00
12	70	do	57.00	3,990.00	65	80	do	38.00	3,040.00
13	70	do	57.00	3,990.00	66	80	do	37.00	2,960.00
14	70	do	57.00	3,990.00	67	80	do	37.50	3,000.00
15	70	do	60.00	4,200.00	68	80	do	37.00	2,960.00
16	70	do	60.00	4,200.00	69	80	do	37.50	3,000.00
17	70	do	55.00	3,850.00	70	80	do	37.00	2,960.00
18	70	do	60.00	4,200.00	71	80	do	52.00	4,160.00
19	70	do	54.00	3,780.00	72	80	do	38.00	3,040.00
20	70	do	60.00	4,200.00	73	80	do	39.00	3,120.00
21	70	do	57.00	3,990.00	74	80	do	37.50	3,000.00
22	70	do	57.00	3,990.00	75	80	do	37.50	3,000.00
23	70	do	56.00	3,920.00	76	80	do	37.00	2,960.00
24	70	do	60.00	4,200.00	77	80	do	37.50	3,000.00
25	70	do	56.00	3,920.00	78	80	do	39.00	3,120.00
26	70	Extra large; cut, scarred, etc	43.00	3,010.00	79	80	do	37.00	2,960.00
27	70	do	39.00	2,730.00	80	80	do	36.50	2,920.00
28	70	do	40.00	2,800.00	81	80	do	36.50	2,920.00
29	45	do	37.00	1,665.00	82	80	do	36.50	2,920.00
30	45	do	39.00	1,755.00	83	80	do	36.00	2,880.00
31	80	Large	44.00	3,520.00	84	80	do	37.50	3,000.00
32	80	do	46.00	3,680.00	85	80	do	37.00	2,960.00
33	80	do	43.00	3,440.00	86	31	do	40.00	1,240.00
34	80	do	45.00	3,600.00	87	80	Large; cut, scarred, etc	24.00	1,920.00
35	80	do	42.50	3,400.00	88	80	do	24.00	1,920.00
36	80	do	41.00	3,280.00	89	80	do	23.00	1,840.00
37	80	do	44.00	3,520.00	90	80	do	21.50	1,720.00
38	80	do	44.50	3,560.00	91	80	do	21.50	1,720.00
39	80	do	45.00	3,600.00	92	80	do	22.00	1,760.00
40	80	do	44.50	3,560.00	93	80	do	22.00	1,760.00
41	80	do	42.50	3,400.00	94	80	do	21.50	1,720.00
42	80	do	43.00	3,440.00	95	80	do	23.50	1,880.00
43	80	do	44.00	3,520.00	96	80	do	21.50	1,720.00
44	80	do	42.50	3,400.00	97	80	do	23.50	1,880.00
45	80	do	43.50	3,480.00	98	80	do	22.00	1,760.00
45a	18	do	55.00	990.00	99	80	do	28.00	2,240.00
46	80	do	44.00	3,520.00	100	80	do	25.00	2,000.00
47	80	do	44.00	3,520.00	101	80	do	23.50	1,880.00
48	80	do	44.00	3,520.00	102	80	do	28.50	2,280.00
49	80	do	42.00	3,360.00	103	80	do	27.50	2,200.00
50	80	do	45.00	3,600.00	104	80	do	25.00	2,000.00
51	80	do	43.50	3,480.00	105	80	do	26.50	2,120.00
52	80	do	40.00	3,200.00	106	61	do	30.00	1,830.00
53	80	do	39.00	3,120.00	107	90	Medium	29.00	2,610.00
					108	90	do	29.00	2,610.00
					109	90	do	29.00	2,610.00
					110	90	do	26.50	2,385.00

Sales of Pribilof fur-seal skins at St. Louis, Mo., 1923—Continued

SALE OF 18,118 DRESSED, DYED, AND MACHINED SKINS, MAY 28, 1923—Continued

Lot No.	Number of skins	Trade classification	Price per skin	Total for lot
111	90	Medium	$27.00	$2,430.00
112	90	do	30.50	2,745.00
113	90	do	30.00	2,700.00
114	90	do	30.50	2,745.00
115	90	do	28.00	2,520.00
116	90	do	27.50	2,475.00
117	90	do	30.00	2,700.00
118	90	do	27.00	2,430.00
119	90	do	28.50	2,565.00
120	90	do	30.50	2,745.00
121	90	do	27.50	2,475.00
122	90	do	26.50	2,385.00
123	90	do	25.00	2,250.00
124	90	do	27.00	2,430.00
125	90	do	27.00	2,430.00
125a	90	do	37.00	3,330.00
125b	47	do	33.00	1,551.00
126	90	do	30.00	2,700.00
127	90	do	29.00	2,610.00
128	90	do	30.50	2,745.00
129	90	do	30.50	2,745.00
130	90	do	30.50	2,745.00
131	90	do	28.00	2,520.00
132	90	do	27.00	2,430.00
133	90	do	26.50	2,385.00
134	90	do	26.50	2,385.00
135	90	do	26.00	2,340.00
136	90	do	26.50	2,385.00
137	90	do	25.50	2,295.00
138	90	do	26.00	2,340.00
139	90	do	25.50	2,295.00
140	90	do	25.00	2,250.00
141	90	do	29.00	2,610.00
142	90	do	26.50	2,385.00
143	90	do	25.50	2,295.00
144	90	do	29.50	2,655.00
145	90	do	29.50	2,655.00
146	90	do	26.00	2,340.00
147	90	do	26.00	2,340.00
148	90	do	25.00	2,250.00
149	90	do	29.00	2,610.00
150	90	do	27.00	2,430.00
151	90	do	26.00	2,340.00
152	90	do	25.00	2,250.00
153	90	do	24.50	2,205.00
154	90	do	26.00	2,340.00
155	90	do	27.00	2,430.00
156	90	do	26.50	2,385.00
157	90	do	26.00	2,340.00
158	90	do	27.00	2,430.00
159	90	do	25.50	2,295.00
160	90	do	25.50	2,295.00
161	90	do	25.00	2,250.00
162	90	do	25.50	2,295.00
163	90	do	28.00	2,520.00
164	90	do	25.75	2,317.50
165	90	do	27.50	2,475.00
166	90	do	25.50	2,295.00
167	90	do	27.50	2,475.00
168	90	do	26.00	2,340.00
169	90	Medium	$25.50	$2,295.00
170	90	do	28.25	2,542.50
171	60	do	26.50	1,590.00
172	90	Medium; cut, scarred, etc	17.50	1,575.00
173	90	do	16.00	1,440.00
174	90	do	16.50	1,485.00
175	90	do	16.50	1,485.00
176	90	do	16.25	1,462.50
177	90	do	17.00	1,530.00
178	90	do	16.50	1,485.00
179	90	do	17.00	1,530.00
180	90	do	16.50	1,485.00
181	90	do	16.75	1,507.50
181a	22	do	22.00	484.00
182	90	do	16.50	1,485.00
183	90	do	16.50	1,485.00
184	90	do	17.00	1,530.00
185	90	do	17.50	1,575.00
186	90	do	17.50	1,575.00
187	90	do	16.75	1,507.50
188	90	do	16.50	1,485.00
189	90	do	17.50	1,575.00
190	90	do	17.00	1,530.00
191	90	do	16.50	1,485.00
192	90	do	17.00	1,530.00
193	90	do	17.00	1,530.00
194	90	do	17.25	1,552.50
195	90	do	18.00	1,620.00
196	90	do	17.25	1,552.50
197	90	do	17.00	1,530.00
198	90	do	17.00	1,530.00
199	90	do	17.25	1,552.50
200	90	do	17.25	1,552.50
201	90	do	17.75	1,597.50
202	47	do	17.75	834.25
203	46	do	19.25	885.50
204	90	Small medium	22.00	1,980.00
205	90	do	25.50	2,295.00
206	90	do	25.00	2,250.00
206a	35	do	27.00	945.00
207	90	do	27.00	2,430.00
208	90	do	25.50	2,295.00
209	90	do	26.00	2,340.00
210	57	do	27.50	1,567.50
211	90	Small medium; cut, scarred, etc	15.00	1,350.00
212	90	do	15.50	1,395.00
213	90	do	17.25	1,552.50
214	90	do	17.50	1,575.00
215	90	do	17.25	1,552.50
216	65	do	17.25	1,121.25
217	59	III, 2 extra extra large, 5 extra large, 52 large	13.25	781.75
218	58	III, medium	11.50	667.00
219	58	do	12.25	710.50
220	47	III, small medium	10.00	470.00
	18,118			565,224.75

SALE OF 2,736 DRESSED, DYED, AND MACHINED SKINS, OCTOBER 8, 1923

Lot No.	Number of skins	Trade classification	Price per skin	Total for lot
3	60	Extra extra large	$57.50	$3,450.00
5	38	do	57.50	2,185.00
7	39	I wig, 38 extra extra large; cut, scarred, etc	38.50	1,501.50
37	80	Large	38.50	3,080.00
44	80	do	38.50	3,080.00
45	80	do	38.50	3,080.00
77	80	Large; cut, scarred, etc	23.00	1,840.00
79	80	do	23.00	1,840.00
87	27	Large; cut, scarred, etc	$23.50	$634.50
88	90	Medium	27.00	2,430.00
89	90	do	26.50	2,385.00
90	90	do	26.00	2,340.00
92	90	do	26.00	2,340.00
95	90	do	26.00	2,340.00
98	90	do	26.00	2,340.00
100	90	do	26.00	2,340.00
109	90	Medium; cut, scarred, etc	16.00	1,440.00

Sales of Pribilof fur-seal skins at St. Louis, Mo., 1923—Continued

SALE OF 2,736 DRESSED, DYED, AND MACHINED SKINS, OCTOBER 8, 1923—Con.

Lot No.	Number of skins	Trade classification	Price per skin	Total for lot
110	90	Medium; cut, scarred, etc.	$16.00	$1,440.00
111	90	do	16.00	1,440.00
112	90	do	16.25	1,462.50
113	90	do	16.00	1,440.00
114	41	do	16.50	676.50
116	60	Small medium	24.00	1,440.00
117	35	Small medium; cut, scarred, etc.	15.50	542.50
118	41	III, 5 extra large, 25 large, 7 medium, 4 small medium	11.00	451.00
119	60	Extra extra large	57.00	3,420.00
121	60	Extra extra large; cut, scarred, etc.	38.00	2,280.00
175	35	Medium	$26.00	$910.00
178	90	Medium; cut, scarred, etc.	16.00	1,440.00
180	90	do	16.00	1,440.00
181	90	do	16.00	1,440.00
182	90	do	16.00	1,440.00
183	90	do	16.00	1,440.00
185	56	do	16.50	924.00
186	90	Small medium	24.00	2,160.00
190	90	Small medium; cut, scarred, etc.	15.00	1,350.00
102	74	III, 3 wigs, 16 extra extra large, 55 extra large	15.25	1,128.50
	2,736			66,911.00

Comparative values by sizes and grades, with percentages each size, of Pribilof sealskins sold in 1923

Classes and sales	Grade	Number	High	Low	Average	Total	Total number	Average price	Total price	Percentage
Wigs:										
May 28	I and II	22	$46.00	$46.00	$46.00	$1,012.00	26	$45.08	$1,172.00	0.14
	Cut, scarred, etc.	4	40.00	40.00	40.00	160.00				
October 8	do	1	38.50	38.50	38.50	38.50	4	21.06	84.25	.15
	III	3	15.25	15.25	15.25	45.75				
Extra extra large:										
May 28	I and II	440	66.00	46.00	61.27	26,960.00	503	58.50	20,426.50	2.78
	Cut, scarred, etc.	61	40.00	40.00	40.00	2,440.00				
	III	2	13.25	13.25	13.25	26.50				
October 8	I and II	158	57.50	57.00	57.31	9,055.00	272	47.95	13,012.00	9.94
	Cut, scarred, etc.	98	38.50	38.00	38.19	3,743.00				
	III	16	15.25	15.25	15.25	244.00				
Extra large:										
May 28	I and II	1,120	60.00	54.00	57.38	64,260.00	1,425	53.53	76,286.25	7.86
	Cut, scarred, etc.	300	43.00	37.00	39.87	11,960.00				
	III	5	13.25	13.25	13.25	66.25				
October 8	do	60	15.25	11.00	14.90	893.75	60	14.90	893.75	2.19
Large:										
May 28	I and II	4,449	55.00	36.00	40.79	181,470.00	6,082	36.22	220,309.00	33.57
	Cut, scarred, etc.	1,581	30.00	21.50	24.13	38,150.00				
	III	52	13.25	13.25	13.25	689.00				
October 8	I and II	240	38.50	38.50	38.50	9,240.00	452	30.60	13,829.50	16.52
	Cut, scarred, etc.	187	23.50	23.00	23.07	4,314.50				
	III	25	11.00	11.00	11.00	275.00				
Medium:										
May 28	I and II	5,957	37.00	21.50	27.46	163,566.00	8,888	23.96	212,912.25	49.06
	Cut, scarred, etc.	2,815	22.00	16.00	17.04	47,968.75				
	III	116	12.25	11.50	11.88	1,377.50				
October 8	I and II	665	27.00	26.00	26.20	17,425.00	1,669	20.09	33,525.00	61.00
	Cut, scarred, etc.	997	16.50	16.00	16.07	16,023.00				
	III	7	11.00	11.00	11.00	77.00				
Small medium:										
May 28	I and II	632	27.50	22.00	25.48	16,102.50	1,194	21.04	25,118.75	6.59
	Cut, scarred, etc.	515	17.50	15.00	16.59	8,546.25				
	III	47	10.00	10.00	10.00	470.00				
October 8	I and II	150	24.00	24.00	24.00	3,600.00	279	19.84	5,536.50	10.20
	Cut, scarred, etc.	125	15.50	15.00	15.14	1,892.50				
	III	4	11.00	11.00	11.00	44.00				
All classes:										
May 28							18,118	31.20	565,224.75	100.00
October 8							2,736	24.46	66,911.00	100.00

In addition to the sealskins sold at public auction there were sold as of March 20, 1923, to the Fouke Fur Co., 12 skins taken at the

Pribilof Islands in 1920. Of these skins 9 were dressed, dyed, and finished and 3 were raw, washed, and dried. For these 12 skins the Government received $286.35. Record is also made of 5 skins sold to the Fouke Fur Co. as of April 14, 1922. The price was $37.80 each. The skins were taken at the Pribilof Islands in 1919.

DISPOSITION OF FUR-SEAL SKINS TAKEN ON PRIBILOF ISLANDS

The grand total of all fur-seal skins taken at the Pribilof Islands on hand on January 1, 1923, was 54,858. Of these 898 were at the Pribilof Islands, 53,953 were at St. Louis, and 7 at Washington. In 1923 a total of 15,920 was secured at the Pribilof Islands and 20,866 were sold, leaving a balance on hand on December 31, 1923, of 49,912. The 49,912 skins taken on the Pribilof Islands on hand on December 31, 1923, comprised 1,881 skins at the islands, 48,024 at St. Louis, and 7 at Washington. The following two tables show further details in regard to Pribilof Islands skins at those islands and at St. Louis:

Summary of all fur-seal skins handled on Pribilof Islands, calendar year 1923

	Balance on hand Jan. 1	Number taken	Total handled	Number shipped	Balance on hand Dec. 31
St. Paul Island	[1] 626	12,841	13,467	12,346	1,121
St. George Island	272	3,079	3,351	2,591	760
	[1] 898	15,920	16,818	14,937	1,881

[1] The preceding report for 1922 gave the number on hand Dec. 31, 1922, on St. Paul Island as 624, and the total for both islands as 896, but in 1923 two skins of a previous season's take were found in one of the salt houses on St. Paul Island.

Summary of receipts and sales of Pribilof fur-seal skins by Fouke Fur Co., St. Louis, Mo., and balance in firm's custody, calendar year 1923

Date of shipment from Pribilofs	Receipts		Sales		Balance on hand
	Date	Number of skins	Date	Number of skins	
On hand Jan. 1, 1923					[1] 53,953
			Mar. 20	12	53,941
			May 28	18,118	35,823
May 29, 31	Aug. 9	1,300			37,123
Aug. 11	Sept. 15	6,071			43,194
			Oct. 8	2,736	40,458
Sept. 17, 18, 19	Oct. 21	7,566			48,024
Total		14,937		20,866	

[1] The corresponding table of the 1922 report gave 53,966 skins on hand Dec. 31, 1922. The difference of 13 skins is accounted for as follows: 1. The 53,966 skins recorded in the 1922 report included (a) 7 skins that were at Washington and (b) 5 skins sold to the Fouke Fur Co., Apr. 14, 1922, and not taken into account in the 1922 table. 2. The 1922 table also showed 26,422 skins shipped from the Pribilofs on Sept. 24, 1922, whereas 26,420 actually were received. 3. The corresponding table in the 1921 report showed a total of 22,561 skins shipped on Aug. 13 and Sept. 15, 1921, whereas 22,562 were actually received. The table does not include receipts or sales of confiscated skins nor three skins from seals shipped from the Pribilof Islands to the California Academy of Sciences for the Steinhart Aquarium.

PRIBILOF FOX SKINS

SHIPMENT AND SALES

The fox skins—205 blues and 28 whites—taken on St. Paul Island in the season of 1922–23, were shipped on the U. S. S. *Gold Star* May 29, 1923. Those taken on St. George Island the same season—683 blues and 1 white—were shipped by the same vessel May 31. These 917 skins were delivered by the *Gold Star* at Bremerton, Wash., from which point they were shipped on July 26 by American Railway Express consigned to the Fouke Fur Co., St. Louis, Mo.

The skins were sold at public auction at St. Louis October 8, 1923. The total bid for the 888 blue-fox skins was $91,382, an average of $102.91 per skin. The maximum price was $200 per skin for a lot of four. The 29 white-fox skins brought $1,334, an average of $46 per skin. The average price at the last preceding sale, October 9, 1922, was $93.18 for blue and $46 for white-fox skins.

Sale of 888 blue and 29 white fox skins at St. Louis October 8, 1923

Lot No.	Number of skins	Trade classification	Price per skin	Total for lot
		Blue fox skins		
305	4	Extra, extra fine	$146	$584
306	4	Extra fine, extra large	113	452
307	6	Fine dark	109	654
308	4	Fine dark silvery	130	520
309	8	I dark	118	944
310	10	do	112	1,120
311	14	II dark	81	1,134
312	6	I blue	102	612
313	10	do	112	1,120
314	14	II blue	84	1,176
315	20	II low blue	52	1,040
316	27	III and IV	24	648
317	4	Extra extra fine	160	640
318	6	Extra fine	154	924
319	6	Fine dark	128	768
320	4	Fine dark silvery	140	560
321	6	Dark extra large	118	708
322	8	I dark	106	848
323	12	do	128	1,536
324	10	do	112	1,120
325	14	II dark	80	1,120
326	12	I and II dark	90	1,080
327	14	do	102	1,428
328	10	I blue	112	1,120
329	8	do	114	912
330	14	II blue	89	1,246
331	12	II low blue	52	624
332	8	I and II pale	68	544
333	10	Skins	50	500
334	6	Extra fine	154	924
335	6	Fine dark	132	792
336	6	Dark extra large	92	552
337	6	Extra dark	122	732
338	10	I dark	104	1,040
339	10	do	124	1,240
340	10	do	132	1,320
341	14	II dark	95	1,330
342	8	II low dark	43	344
343	10	I blue	112	1,120
344	16	II blue	72	1,152
345	12	I and II dark	104	1,248
346	14	do	100	1,400
347	6	I	116	696
348	10	I and II	78	780
349	10	Silvery	94	940
350	4	Extra fine	162	648
351	6	Fine dark	122	732
352	12	I dark	112	1,344
353	10	do	132	1,320
354	10	II dark	92	920
		Blue fox skins—Contd.		
355	8	Dark extra large	$110	$880
356	12	I and II dark	93	1,116
357	12	I blue	102	1,224
358	20	II blue	88	1,760
359	16	I	92	1,472
360	14	I and II	76	1,064
361	16	I and II blue	88	1,408
362	4	Extra extra fine	166	664
363	6	Fine dark	134	804
364	4	do	128	512
365	8	Dark extra large	104	832
366	12	I dark	108	1,296
367	10	do	112	1,120
368	10	I and II dark	94	940
369	8	I blue	96	768
370	26	II blue	76	1,976
371	16	I and II	86	1,376
372	4	Extra extra fine	170	680
373	4	Extra fine, extra large	154	616
374	4	Fine dark	166	664
375	4	Fine dark silvery	200	800
376	8	I dark	140	1,120
377	12	II dark	108	1,296
378	10	I blue	122	1,220
379	8	I silvery	146	1,168
380	7	II pt. low	70	490
381	4	Extra extra fine	168	672
382	4	Extra fine, extra large	136	544
383	6	Fine dark	154	924
384	14	I dark	126	1,764
385	8	Dark	118	944
386	10	I blue	120	1,200
387	8	II blue	88	704
388	4	Extra, extra fine	156	624
389	6	Fine dark	134	804
390	10	I	124	1,240
391	4	I dark silvery	150	600
392	8	I Silvery	144	1,152
393	6	Dark	144	864
394	14	I	120	1,680
395	10	I pt. II	104	1,040
396	14	I blue	116	1,624
397	8	II blue	86	688
398	6	Fine dark	132	792
	888			91,382
		White fox skins		
399	29	I and II, white fox	46	1,334
	917		------	92,716

FUR-SEAL PATROL BY UNITED STATES COAST GUARD

The customary patrol for the protection of fur seals was maintained by the Coast Guard in 1923. The cutters engaged were the *Algonquin*, *Haida*, *Mojave*, *Bear*, *Snohomish*, *Unalga*, and *Cahokia*. The *Snohomish*, *Unalga*, and *Cahokia* were detailed to carry on the patrol of waters off the Pacific Coast States and southeastern Alaska, while the *Algonquin*, *Haida*, *Mojave*, and *Bear* covered waters of the Aleutian Islands and Bering Sea. The *Bear* made its usual cruise into Arctic waters. Many courtesies were extended by the Coast Guard to the bureau in the transportation of passengers, mail, and freight to and from the Pribilof Islands during the progress of the patrol, for which acknowledgment is hereby made.

In connection with the patrol the cutters perform a great many duties of a public nature aside from those concerned with fur seals and the fisheries. The following extracts, taken from a report furnished by the Coast Guard in regard to the season's work, have been selected only as they relate to fur-seal matters:

Cahokia.—The *Cahokia*, in compliance with her orders relative to the seal patrol, sailed from Eureka, Calif., on April 1, 1923, cruised to the entrance of the Columbia River, and spent the night of April 6 at Astoria, Oreg.; sailed the following day, and returned to Eureka on April 13. On the cruise northward the 100-fathom curve was approximately followed. On the return trip the vessel zigzagged on legs of approximately 20 miles in length between the limits of 10 to 30 miles off shore. During this cruise seals were seen as follows: Twenty-two off the Columbia River on April 6, 17 in the vicinity of Cascade Head on April 8, and 50 on Heceta Bank on April 9. The total number of seals sighted was 125. Two fishing boats were boarded during the cruise. On April 15 the *Cahokia* sailed from Eureka on the second trip to the Columbia River, returning on April 29. Cruising to the northward, zigzag courses were steered to cover areas where it was thought seals might be found. The vessel sailed to the southward on the 23d to cover more thoroughly the area between Heceta Bank and the Columbia River. During this trip 20 seals were sighted on Heceta Bank and 25 off the Columbia River entrance. No fishing vessels were seen. On May 3 the *Cahokia* sailed for the third trip from Eureka, arriving at Astoria on May 7. On the first day no seals were seen, but the average for the other four days was four seals a day. No fishing vessels were sighted.

The commanding officer draws the following conclusions as a result of this patrol: That the seals proceed to the northward along the northern California and Oregon coasts with little delay until they reach a position off Heceta Bank, and between there and the Columbia River a small number stop to feed. Most of the seals sighted were lying in small groups on top of the water, the others were alone and traveling. * * * While engaged on this cruise the *Cahokia* steamed 2,905 miles and boarded two vessels.

Snohomish.—The *Snohomish* operated between the Columbia River and Dixon Entrance from April 4 to May 26, 1923, for the protection of the seal herd migrating northward. * * * During the period covered by the patrol numerous officials were interviewed on matters pertaining to sealing along the coasts of Washington and British Columbia. From information obtained it appears that the Quillayute Indians of La Push, Wash., and the Makah Indians of Neah Bay, Wash., are the only tribes that engage in sealing along the Washington coast. The Makah Indians seal from Ozette, as that place is located more advantageously to the sealing grounds than is Neah Bay. During the current season 18 canoes were sealing out of La Push and 12 out of Ozette. It is still the practice of the natives, when the weather is favorable, to leave their villages at about 3 a. m, paddle out to sea for a distance of 20 to 30 miles, hunt for four or five hours, and return to their villages by dark. As indicated, from 10 to 12 hours each sealing day is spent in going to and from the sealing grounds.

The following list shows the names of the villages along the coast of British Columbia and the number of canoes sealing from each place:

Cloose	4	Ahousat	5
Bamfield Creek	6	Refuge Cove	2
Ucluet	6	Hesquiat	6
Carmanah	3	Nootka Sound	8
Clayoquot	8	Quatsino Sound	4 or 5
Kilismoot	2		

The Indians of these villages held a conference, through representatives, and agreed among themselves not to use illegal methods in catching seals and, furthermore, to report any of their own people who violate this agreement. The conference was fostered by Canadian authorities. Fisheries Officer McCloud, at Clayoquot, who has charge of enforcing the sealing laws and treaty along the west coast of Vancouver Island, and who inspects all sealskins taken by the natives, states positively that the Indians of British Columbia are not taking seals illegally. He states he is confident that no white men are engaged in sealing along the Vancouver coast because of the difficulty experienced in disposing of the skins and the fear of being seen and reported by the Indians. The exclusive rights bestowed upon the natives of taking sealskins has awakened within them a protective spirit with respect to seals, and they are ever on the alert to report any vessels they may suspect of taking seals illegally. During the time occupied on this patrol the *Snohomish* traveled 3,730 miles, boarded 66 vessels and assisted two vessels in distress.

Unalga.—The *Unalga* was engaged on seal patrol from April 15 to May 17, 1923. The patrol was begun at Dixon Entrance and continued to Yakutat, Alaska. From May 1 until the seal herd in its migration northward had passed beyond this area the patrol was carried on between Yakutat, Alaska, and Prince William Sound, as far west as Kodiak, Alaska. It was learned from the deputy collector of customs at Sitka that native Indians had taken 23 fur seals. It is understood that the natives do not use the seals for food or the skins for clothing, as has been their custom, but take the seals for the purpose of selling the skins. This traffic in sealskins, it is reported, has become a commercial enterprise among the natives. As the natives are no longer dependent upon sealing as a livelihood it is believed that the privilege with respect to sealing, extended them by law, could be withdrawn without injury to them. * * * The commanding officer of the *Unalga* conferred with the authorities at Cordova with regard to pelagic sealing, killing of sea otter, and concerning depredations on fox farms. The officials so interviewed had no complaints to make in this respect. The commanding officer of the *Unalga* reports that no seals were sighted after May 4 off Yakutat Bay and to the westward as far as Kodiak Island and back to Cross Sound. Fishermen of the boats boarded since April 25 reported sighting no seals. As it was believed that the seal herd had passed to the northward beyond the *Unalga's* cruising area the patrol was discontinued on May 17, and the cutter returned to Juneau.

While engaged on this patrol the *Unalga* traveled 2,971 miles, boarded 9 vessels at sea and 52 in port, and sighted 118 seals. All seals thus sighted were along the 100-fathom curve, which would indicate that the seal herd in its migration northward does not venture outside or to a great extent inside this curve. It is believed, however, that the seals obtain fish as their food along the edges of the banks. No seals were sighted west of Yakutat Bay as far as Kodiak either by the *Unalga* or by the *Algonquin*. This would indicate that the seal herds travel across the Gulf of Alaska from about 20 miles off Yakutat Bay to the southward of the banks of Kodiak and to the westward thereof. No seals were seen by the *Unalga* after May 4. The commanding officer reports that there were no sailing vessels of the old two-masted schooner type, such as in earlier years were used by the Japanese and others prior to the convention between the United States, Great Britain, Japan, and Russia.

Algonquin.—On April 15, 1923, the Coast Guard cutter *Algonquin* sailed from Seattle, Wash., with orders to patrol from the entrance to the Straits of Juan de Fuca, following the seal herd and keeping a sharp lookout for poachers, cruising as far as Unga, with particular attention in the early part of the cruise to the regions between Dixon Entrance and Yakutat; to base on Latouche for fuel and to continue the patrol in the Gulf of Alaska and to the westward as far as Unga until the latter part of May, when she would work farther to the westward and arrive at Unalaska on June 1, 1923. After stopping at Port Townsend * * * the cutter cleared from the Straits on the morning of April 17 and proceeded to take up the seal patrol as directed, following the general contour of the coast and along the 100-fathom curve, cruising from 10 to 30 miles off shore. * * * Arrived at Unalaska on June 1. Few seals were seen on the banks. It was believed that the American seal herd had passed to the westward ahead of the *Algonquin*. The number of seals sighted during the cruise from Swift Sure Light Vessel to Unalaska, covering a period of one and one half months, was 128, and the number of fishing vessels seen in actual operation on the banks was two. * * * The *Algonquin* relieved the *Mojave* on the Pribilof Islands patrol and returned to Dutch Harbor on June 21. From June 21 to July 11 the cutter patrolled the Aleutian Islands as far west as Attu. * * * No evidence of poachers was found anywhere among the western Aleutian Islands.

From September 1 to 29 the vessel was employed on a cruise in Bristol Bay and on Pribilof Islands patrol duty; transported 40 live blue foxes and attendants from St. George Island to Unalaska, on account Bureau of Fisheries; also carried native laborers and United States mail. * * * The *Algonquin* arrived at Unalaska on October 27, filled fuel oil and fresh-water tanks; received from the superintendent, Pribilof Islands, account Bureau of Fisheries, five live female seals consigned to the California Academy of Sciences at San Francisco, and eight Bureau of Fisheries employees for transportation to Seattle. * * * The *Algonquin* then proceeded on a course for Seattle, arriving there on the night of November 19. During this cruise the *Algonquin* traveled 18,959 miles, boarded and examined 31 vessels, assisted 2 vessels in distress, transported 65 persons, and afforded medical treatment to 54 others.

Haida.—The *Haida* sailed from Seattle at 1 p. m., April 15, 1923, having on board general supplies and Government freight, 15 employees of Bureau of Fisheries bound for the Pribilof Islands, and 2,375 pounds of fruits, vegetables, etc., intended for various persons and Government employees stationed at Unalaska and on the seal islands. * * * Arrived at Unalaska on the morning of April 25. * * * The work of landing stores was completed on April 27. The cutter took on board approximately 2 tons of miscellaneous freight and 35 native men and 5 native women, together with their personal effects and baggage for transportation to the seal islands. * * * The cutter sailed on the same date (April 27). After landing mail, freight, and passengers, and receiving on board mail and seven passengers with their baggage, destined for Unalaska, the *Haida* returned to Dutch harbor on April 25. * * * Agent C. E. Crompton, his wife and baby, were furnished transportation from the seal islands to King Cove, where Mr. Crompton was enabled to connect with a commercial steamer for passage to Seattle, he being in need of surgical treatment.

From May 29 to 31 the *Haida* made a trip to the Pribilof Islands, transporting the mail and eight natives, employees of the Bureau of Fisheries, also approximately 1 ton of personal effects and baggage. * * * From June 22 to July 3, the *Haida* was engaged on the Pribilof Islands patrol. After receiving mail and freight from Unalaska and from the steamship *Buford*, at Dutch Harbor, the cutter sailed on June 24 for the seal islands. On June 30 received mail and passengers from the seal islands for Unalaska. Arrived there on July 3. * * * On July 13 the cutter *Unalga* arrived at Unalaska with a senatorial party on board. Owing to the delay necessary to coal the ship it was decided that the *Haida* would transport this party to the Pribilof Islands and Bristol Bay cannery region. On July 14 the *Haida* sailed, with the party on board, for St. Paul Island and visited certain places in Bering Sea and the Bristol Bay district. On July 23 the *Haida* returned to Unalaska.

The *Haida* was employed on the Pribilof Islands patrol from July 26 to August 7, on the latter date returning to Unalaska. During this cruise mail, freight, and passengers were transferred between Unalaska and the seal islands. * * * The *Haida* remained at Unalaska from August 7 to 17. After taking on board stores, mail, freight, and passengers for St. George and St. Paul Islands the cutter proceeded to the Pribilof Islands and remained until September 3, when a final season's cruise in the Bristol Bay area was begun, and ended at Unalaska on September 8. * * * On September 13 the cutter sailed from Unalaska and resumed duty on the Pribilof Islands patrol. On September 19 the *Haida* returned to Dutch Harbor, was withdrawn from the Bering Sea patrol on September 20, and arrived at Seattle on September 27, 1923. While on her northern cruise the *Haida* traveled 14,412 miles, boarded and examined 36 vessels, assisted 3 vessels in distress, and afforded medical assistance to 61 persons.

Mojave.—The *Mojave* arrived at Unalaska on May 30 and was assigned to duty on the Pribilof Islands patrol. Sailed on June 1 and was engaged in this duty until return to Unalaska June 14. * * * On July 5 the *Mojave* sailed to resume the Pribilof Islands patrol and continued until her return to Dutch Harbor on July 21 for fuel and fresh water. On August 5 the *Mojave* sailed to take up patrol duties in the Pribilof zone, and continued until August 21, when the vessel returned to Dutch Harbor and landed mail, 33 passengers, their personal effects and baggage, transported from the seal islands to Unalaska for the Bureau of Fisheries. The official seal-killing operations on the Pribilof Islands being complete for the season, native employees belonging to the Aleutian Islands were returned to their villages and the Fouke Fur Co.'s operatives sent to Unalaska on the *Mojave* for further transportation to the States by commercial steamer. * * * Arrangements had been made with the superintendent of the Pribilof Islands for the *Mojave* to transport seven live fur seals to San Francisco for the Academy of Sciences. The seals, accompanied by a keeper from the seal islands, were to be landed at Unalaska by the fisheries vessel *Eider*, but prevailing stormy weather in Bering Sea prevented the *Eider's* reaching the islands after three attempts; therefore the *Mojave* was compelled to make a special cruise to St. Paul Island in order to procure the shipment.

The *Mojave* left Dutch Harbor in the evening of September 30 and proceeded to sea, bound for St. Paul, Pribilof group. At midnight the *Mojave* was detached from the Bering Sea patrol force and became an independent command for the rest of the time while en route to San Francisco. While on her northern cruise the *Mojave* traveled 12,741 miles, boarded and examined 18 vessels, assisted 2 others, and afforded medical assistance to 25 persons.

Bear.—The *Bear* steamed from Seattle on May 16, stopped at Unga to land mail, and arrived at Unalaska on May 28, where mail for this point was put ashore. The *Bear* left Unalaska on June 2 and arrived at Nome on June 7. * * * Only a few seals were seen off the Columbia River entrance and not many in the Bering Sea. * * * After completing investigations the *Bear* on September 17 arrived at St. Paul Island, loaded 55 barrels of sealskins, 103 barrels of seal oil, 1 barrel of seal specimens, and 1 box of miscellaneous freight, after which it proceeded to St. George Island, where 32 casks of sealskins were taken on board; then proceeded to Unalaska. While at Unalaska 14 casks of sealskins from St. George Island were delivered to the *Bear* by the Bureau of Fisheries vessel *Eider*. On October 1 the *Bear* left Unalaska and arrived at Port Townsend on October 10, 1923.

Conclusion.—Reports from the commanding officers of the cutters on patrol duty indicate that but few seals (travelers) were sighted in the North Pacific Ocean. This fact may be due to the herd's migrating northward ahead of the patrol, although with the exception of a few bulls the seals did not begin to land on the rookeries, Pribilof Islands, in large numbers until the latter part of May and early in June. The Government agents on the Pribilof Islands and persons at other Alaskan points reported a very mild winter, with little or no ice in the lower section of Bering Sea. During the entire season not a marauding vessel was sighted nor was there evidence or reports from any source indicating the presence of poachers, pelagic sealers, killing of sea otter, unlawful hunting of walrus, raiding of fox farms, or the illegal killing of other fur-bearing animals in Alaska.

SEALING PRIVILEGES ACCORDED ABORIGINES

A total of 1,394 fur-seal skins was authenticated as having been lawfully taken in 1923 by Indians in the waters off the coasts of Washington and southeast Alaska. In addition there were authenticated 107 skins of unborn pups, of which 106 were secured in 1923 and 1 in 1922. The details are as follows:

Washington.—Eight hundred and forty-one skins were authenticated, of which 271 were from male seals and 569 from females. The sex of one animal was not recorded. In addition, the skins of 34 unborn pups were authenticated. The work of authenticating the skins was done for the bureau by A. D. Dodge, superintendent, United States Indian School, Neah Bay, Wash.

Southeast Alaska.—Five hundred and fifty-three skins were authenticated, of which 408 were from male seals and 145 from females. In addition, the skins of 73 unborn pups were authenticated, of which 72 were secured in 1923 and 1 in 1922.

The following description of sealing operations by Indians in southeast Alaska in 1923 is taken from a report made by Assistant Agent E. M. Ball, of the Bureau of Fisheries:

Nine Indian parties of five men each engaged in pelagic sealing off the coast of Alaska, near Sitka, in the spring of 1923. Hunting began March 29, when one bull was taken, but it was carried on only intermittently from that date to the end of April, chiefly on account of unfavorable weather conditions. Sealing began in earnest in May and was carried on assiduously during the month, there being less interruption of operations by wind. The last killing was reported on June 6, but hunting was discontinued on or before June 1 by all except two parties.

Two camps were established by the sealers on the Necker Islands—one at Biorka and the other on Tava. Two parties operated from the former base and all others from the latter. These bases were approximately 14 miles southwest of Sitka. Entire families located at the camp and feasted on seal meat and venison while the hunters were sealing.

The preferred sealing area comprised a zone approximately 40 miles in length by 15 miles in width, the easterly edge of which was about 5 miles outside the 100-fathom curve off Sitka Sound. A few seals were taken at a distance of 10 to 15 miles westerly of the Necker Islands, but the bulk of the catch was made nearly 20 miles at sea. Toward the end of the season the Indians found it necessary to go farther from shore to find the greater number of seals, distances of 25 and 30 miles being reached by some boats.

The sealing boats averaged about 22 feet in length and 6 feet in breadth. They were equipped with two masts and sails, four sets of oars, two spears, and several clubs, both plain and barbed. Each spear carries a detachable point to which is fastened a line capable of holding and hauling a seal close enough to the boat for clubbing. When the spear is successfully cast, the point penetrates the body of the seal, usually the abdomen, and as the handle is withdrawn it turns sidewise after the manner of a harpoon and, being barbed, is not easily withdrawn. A line is attached to the point about midway between its ends which enables the hunter to hold the animal. The first 10 feet of the line is fine wire, because it is less likely to be parted than hemp or manila by the struggling and biting of the seal. Large seals fight viciously and frequently attack both men and boats. For that reason the hunters avoid the larger ones and select those of a size which may be more easily killed and handled. The larger seals are skinned at sea without being loaded into the boats; the smaller ones are frequently brought ashore and skinned, according as the boat may or may not need ballast on its return to camp, or as the hunters may or may not be tired or otherwise engaged.

Much manual labor is involved in sealing, especially if there is adverse wind or none at all. The simple act of going to and returning from the sealing zone rarely means a cruise of less than 40 miles, and in addition to this many more miles must be covered each day in hunting. Seal hunting is real work, and it means action, not waiting, as is often the case in hunts on land. Gentle winds are favorable to hunting, as the sealers are able to approach their prey from leeward with less likelihood of being scented, whereas more than moderate breezes cause choppy water and then seals are not easily located. Some of the natives claim that an absolute calm is as unfavorable for hunting as too much wind. Noise carries easier in all directions, and the seals are more easily disturbed from slumber during calm weather. A ripple on the water seems to promote sound sleep, and it is while the seals are sleeping that the sealers strike. One of the most successful hunters expressed the opinion that seals feeding on herring sleep more soundly than those feeding on salmon, and that larger catches are made when the seals are following the schools of herring. He should know whereof he speaks, having had many years' experience in sealing off the coast of British Columbia.

Four boats of the bureau were on seal patrol duty from about April 20 to the end of the season. The Coast Guard cutter *Unalga* also engaged at times in patrol work in the same district.

British Columbia.—From information furnished by the Department of Marine and Fisheries, Canada, it appears that since the North Pacific Sealing Convention of July 7, 1911, went into effect fur-seal skins have been taken by Indians from waters along the coast of British Columbia as follows:

Year	Number of skins taken	Year	Number of skins taken
1912	205	1918	88
1913	404	1919	70
1914	352	1920	1,058
1915	439	1921	2,349
1916	159	1922	930
1917	218	1923	4,424

JAPANESE SEALSKINS DELIVERED TO THE UNITED STATES

As stated in the report for 1922 the United States Government's share of the sealskins taken on Robben Island in 1921 and 1922 was 55 skins and 60 skins, respectively. The 55 skins of the 1921 take, after having been dressed, dyed, and machined, were sold at public auction in St. Louis on May 28, 1923. Twenty-nine of the skins brought $40 each, and the remaining 26 brought $30 each. Twenty-seven skins of the 1922 take, dressed, dyed, and machined, were sold at public auction at St. Louis on October 8, 1923, at $20 each. The remaining 33 skins of the 1922 take were unsold at the close of 1923.

The United States Government's share of sealskins taken on Robben Island in 1923 was 82 skins. Of these 21 were from large males. The skins had not been delivered to the United States at the close of 1923.

FUR-SEAL CENSUS, PRIBILOF ISLANDS, 1923

By Edward C. Johnston

In the past few years the census of the harem and idle bulls has been taken between the dates July 16 and 23. This period was that in which there was a maximum number of harems, and it immediately preceded the breaking up of the harem formations. A few years ago, when there was a large number of idle bulls and the average harem was comparatively small, this breaking up of the harem formation did not occur before July 23, and the difficulty of counting, due to the idle bulls, was such that it took seven days on the two islands to complete the count. In 1923 the counting was started on St. Paul Island on July 16 and completed by July 19. On St. George Island the count was made on July 21 and 22. By July 19, however, it was seen that a few harem bulls had retired to the rear of the rookeries and their places had been taken by the young idle bulls.

On account of landing conditions it was impossible to get to Sivutch rookery on Sea Lion Rock during the period when the harems should have been counted. This rookery is situated on a small island in the open sea and is surrounded by shoal water. It does not require much wind to prevent a landing.

Superintendent H. J. Christoffers accompanied the enumerator on St. George Island and verified the count there. The ease with which the harem areas could be approached, together with the fact that the count was checked by a second person, practically eliminated the possibility of error.

PUPS

The count of pups in 1923 was omitted with the understanding that in 1924 an actual count would be made upon those rookeries that could be counted accurately.

A complete pup count on all rookeries was made in 1916 and another in 1922. Between these years the pups on a few of the rookeries were counted, and from the results obtained the pups on the other rookeries were estimated. In 1923, as a basis in computing the number of pups, the average annual increase in the average harem upon those rookeries counted each year was secured. Applying this to the 1922 figures it was found that the average harem for the counted rookeries increased on St. Paul Island from 42.98 in 1922 to 47.96 in 1923. On St. George Island it increased from 46.72 to 53.28. The average harem on the other rookeries was computed in the same manner as it had been in the years 1917 to 1921. With this average harem and the known number of harem bulls the number of cows and pups was obtained.

Distribution of pups on the Pribilof Islands, August 10, 1923, and comparison with distribution in 1922

Rookery	1923				1922, total pups	1923	
	Living pups	Dead pups	Total pups	Per cent dead pups		Increase (+) or decrease (−)	Per cent increase (+) or decrease (−)
St. Paul Island:							
Kitovi	5,171	77	5,248	1.47	5,934	−686	−11.56
Lukanin	3,383	75	3,458	2.17	3,544	−86	−2.43
Gorbatch	14,471	126	14,597	.86	14,117	+480	+3.40
Ardiguen	1,024	25	1,049	2.39	1,004	+45	+4.48
Reef	26,121	387	26,508	1.46	25,452	+1,056	+4.15
Sivutch	8,393	210	8,603	2.44	8,161	+442	+5.42
Lagoon	262	1	263	.37	273	−10	−3.66
Tolstoi	17,809	251	18,060	1.39	19,497	−1,437	−7.37
Zapadni	16,756	293	17,049	1.72	16,100	+949	+5.89
Little Zapadni	8,723	224	8,947	2.50	8,846	+101	+1.14
Zapadni Reef	313	3	316	.80	497	−181	−36.42
Polovina	9,942	154	10,096	1.53	8,770	+1,326	+15.12
Polovina Cliffs	4,643	88	4,731	1.85	3,949	+782	+19.80
Little Polovina	1,978	51	2,029	2.51	1,516	+513	+33.84
Morjovi	3,891	80	3,971	2.02	3,918	+53	+1.35
Vostochni	43,514	924	44,438	2.08	37,308	+7,130	+19.11
Total	166,394	2,969	169,363	1.73	158,886	+10,477	+6.59
St. George Island:							
North	10,584	150	10,734	1.40	10,364	+370	+3.57
Staraya Artil	7,980	211	8,191	2.58	7,056	+1,135	+16.09
Zapadni	1,297	15	1,312	1.12	895	+417	+46.59
South	314	6	320	1.72	232	+88	+37.93
East Reef	1,917	21	1,938	1.61	2,380	−442	−18.57
East Cliffs	5,715	86	5,801	1.49	6,101	−300	−4.92
Total	27,807	489	28,296	1.73	27,028	+1,268	+4.69
Total (both islands)	194,201	3,458	197,659	1.73	185,914	+11,745	+6.3

In the foregoing tabulation the percentage of increase of pups on St. Paul Island is 6.59 while that on St. George Island is 4.69. The total number of pups increased 6.32 per cent. St. Paul Island is credited with 169,363 pups and St. George Island with 28,296, a total of 197,659 pups.

In 1922 the dead pups were counted on all rookeries and found to be 1.73 per cent of the total. In 1923, with similar weather and with a decrease of fighting bulls but an increase in cows and number of pups, it was not believed that the percentage of dead pups varied materially from that in 1922. Consequently the same percentages were used. They show a total of 3,458 pups dead on all rookeries.

COWS

Assuming, as in the past, that the number of cows is equal to the number of pups, there were on St. Paul Island 169,363 cows and on St. George Island 28,296, a total of 197,659.[3]

Cows that were branded in 1902, or before, with a single bar across the back continue to appear on the rookeries of St. George Island.

[3] E. M. Ball, assistant agent, Bureau of Fisheries, has reported that on May 10, 1923, a native took a female seal 20 miles off Biorka Island, southeast Alaska, which carried two pups. Mr. Ball examined both pups several days later and weighed them. One weighed 5 pounds 11 ounces, the other 1 pound 8 ounces. The larger one was well haired but the other was almost hairless. The incident is worthy of note but, of course, has no practical bearing upon the census work, which utilizes the well-established biological fact that female seals of the Pribilof Islands give birth to but one pup a year.

Three were seen in 1923. These are at least 21 years old and have borne 19 pups. During the harem count no dead cows were seen. Earlier in the season a dead cow was found on Zapadni rookery on St. Paul Island.

From the complete census of 1916 and that of 1922 it is noted that the average annual increase of bearing cows has been 8 per cent. It is interesting to note that the average between the maximum and minimum predictions of Osgood, Preble, and Parker, made in 1914, was an annual increase of 8 per cent for the cows. (Bureau Fisheries Document No. 820, p. 81.)

HAREM AND IDLE BULLS

In 1923 the harem and idle bulls were counted on all rookeries with the exception of Sivutch rookery on Sea Lion Rock. The presence of bulls 7 and 8 years of age in charge of harems was plainly evident this year, and the greater number of the idle bulls were under 9 years of age. In one case the harem bull was very little larger than one of his cows. He was probably only 6 years old but was seen to attempt copulation. Although young bulls secured harems, there were found on the hauling grounds older bulls of over 9 years of age. Many were covered with wounds or otherwise injured, but a few appeared in good physical condition. There were seen 8 adult bulls with either the foreflippers or the hind flippers paralyzed.

On St. Paul Island 3,051 harem bulls were counted and on St. George Island 361, a total of 3,412, which is a decrease of 150 from 1922. The idle bulls on St. Paul Island were 303 in number and on St. George Island 9, a total of 312, which is a decrease of 196 from 1922. The percentage of idle to harem bulls decreased from 14.26 in 1922 to 9.14 in 1923 for both islands. Only two dead bulls were seen during the harem count. Three of the animals branded as pups in 1912 were observed in charge of harems.

Harem and idle bulls and percentage of idle bulls to harem bulls compared to average harem, Pribilof Islands, 1923

Rookery	Date	Harem bulls	Idle bulls	Total bulls	Per cent idle to harem bulls	Averag harem
St. Paul Island:						
Kitovi	July 16	127	13	140	10.24	41.32
Lukanin	...do	85	2	87	2.35	40.68
Gorbatch	...do	209	8	217	3.83	69.84
Ardiguen	...do	23	3	26	13.04	45.59
Reef	...do	400	41	441	10.25	66.27
Sivutch	...do	159	16	175	10.06	54.11
Lagoon	...do	7		7		37.54
Tolstoi	...do	302	28	330	9.27	59.80
Zapadni	July 17	294	15	309	5.10	57.99
Little Zapadni	...do	155	10	165	6.45	57.72
Zapadni Reef	...do	10	1	11	10.00	31.59
Polovina	July 18	181	69	250	38.12	55.78
Polovina Cliffs	...do	111	31	142	27.93	42.62
Little Polovina	...do	52	11	63	21.15	39.02
Morjovi	July 19	95	4	99	4.21	41.80
Vostochni	...do	841	51	892	6.06	52.84
Total		3,051	303	3,354	9.93	55.51

Harem and idle bulls and percentage of idle bulls to harem bulls compared to average harem, Pribilof Islands, 1923—Continued

Rookery	Date	Harem bulls	Idle bulls	Total bulls	Per cent idle to harem bulls	Average harem
St. George Island:						
North	July 21	127	3	130	2.36	84.52
Staraya Artil	do	90		90		91.01
Zapadni	do	27	4	31	14.81	48.59
South	do	5	2	7	40.00	64.00
East Reef	July 22	35		35		55.36
East Cliffs	do	77		77		75.34
Total		361	9	370	2.50	78.38
Total (both islands)		3,412	312	3,724	9.14	57.93

AVERAGE HAREM

On St. Paul Island the average harem in 1923 was 55.51 and on St. George Island 78.38. For the whole herd it was 57.93. A smaller number of small harems was seen in 1923 than in 1922. Very few harems of one, two, or three cows were observed.

Average harems in 1922 and 1923 for all fur-seal rookeries on the Pribilof Islands

Rookery	Breeding cows in 1923	Harem bulls in 1923	Average harem	
			1923	1922
St. Paul Island:				
Kitovi	5,248	127	41.32	37.56
Lukanin	3,458	85	40.68	36.92
Gorbatch	14,597	209	69.84	64.46
Ardiguen	1,049	23	45.59	41.83
Reef	26,508	400	66.27	59.89
Sivutch	8,603	159	54.11	47.73
Lagoon	263	7	37.54	34.13
Tolstoi	18,060	302	59.80	53.42
Zapadni	17,049	294	57.99	52.61
Little Zapadni	8,947	155	57.72	52.34
Zapadni Reef	316	10	31.59	29.24
Polovina	10,096	181	55.78	50.40
Polovina Cliffs	4,731	111	42.62	38.34
Little Polovina	2,029	52	39.02	35.26
Morjovi	3 971	95	41.80	38.04
Vostochni	44,438	841	52.84	46.46
Total	169,363	3,051	55.51	49.90
St. George Island:				
North	10,734	127	84.52	78.62
Staraya Artil	8,191	90	91.01	85.01
Zapadni	1,312	27	48.59	42.62
South	320	5	64.00	58.00
East Reef	1,938	35	55.36	48.57
East Cliffs	5,801	77	75.34	68.55
Total	28,296	361	78.38	71.50
Total (both islands)	197,659	3,412	57.93	52.19

COMPLETE CENSUS

The figures given below have been prepared from the best obtainable data. Counts were made of the harem and idle bulls, and pups were estimated from the quite comprehensive information obtained in previous years. A satisfactory increase in the size of the herd is shown. It will be noted that the increase in the total number of seals in 1923 over 1922 was 48,046, or 7.94 per cent. The increase in 1922 over 1921 was 23,519, or 4.04 per cent.

Complete census of fur seals, Pribilof Islands, as of August 10, 1923

	St. Paul	St. George	Total
Pups, estimated	169, 363	28, 296	197, 659
Breeding cows, 3 years old and over, by inference	169, 363	28, 296	197, 659
Harem bulls, counted	3, 051	361	3, 412
Idle bulls, counted	303	9	312
Yearlings, male and female, estimated:			
Females born in 1922	79, 443	13, 514	92, 957
Natural mortality, 35 per cent	27, 805	4, 730	32, 535
Yearling females, Aug. 10, 1923	51, 638	8, 784	60, 422
Males born in 1922	79, 443	13, 514	92, 957
Natural mortality, 40 per cent	31, 777	5, 406	37, 183
Yearling males beginning 1923	47, 666	8, 108	55, 774
Yearling males killed 1923	5		5
Yearling males, Aug. 10, 1923	47, 661	8, 108	55, 769
2-year-olds, male and female, estimated:			
Yearling females, Aug. 10, 1922	48, 706	8, 707	57, 413
Natural mortality, 15 per cent	7, 306	1, 306	8, 612
2-year-old females, Aug. 10, 1923	41, 400	7, 401	48, 801
Yearling males, Aug. 10, 1922	44, 951	8, 037	52, 988
Natural mortality, 17½ per cent	7, 867	1, 406	9, 273
2-year-old males beginning 1923	37, 084	6, 631	43, 715
2-year-old males killed 1923	600	3	603
2-year-old males, Aug. 10, 1923	36, 484	6, 628	43, 112
3-year-old males, estimated:			
2-year-old males, Aug. 10, 1922	34, 943	5, 977	40, 920
2-year-old males killed fall 1922	17	13	30
2-year-old males end of 1922	34, 926	5, 964	40, 890
Natural mortality, 12½ per cent	4, 365	746	5, 111
3-year-old males beginning 1923	30, 561	5, 218	35, 779
3-year-old males killed 1923	10, 716	2, 277	12, 993
3-year-old males, Aug. 10, 1923	19, 845	2, 941	22, 786
4-year-old males, estimated:			
3-year-old males, Aug. 10, 1922	6, 787	672	7, 459
3-year-old males killed fall 1922	602	247	849
3-year-old males end of 1922	6, 185	425	6, 610
Natural mortality, 10 per cent	618	43	661
4-year-old males, beginning 1923	5, 567	382	5, 949
4-year-olds killed 1923	225	14	239
4-year-old males, Aug. 10, 1923	5, 342	368	5, 710
5-year-old males, estimated:			
4-year-old males, Aug. 10, 1922	10, 950	857	11, 807
4-year-old males killed fall 1922		10	10
4-year-old males end of 1922	10, 950	847	11, 797
Natural mortality, 10 per cent	1, 095	85	1, 180
5-year-old males beginning 1923	9, 855	762	10, 617
5-year-old males killed 1923	5		5
5-year-old males, Aug. 10, 1923	9, 850	762	10, 612

Complete census of fur seals, Pribilof Islands, as of August 10, 1923—Continued

	St. Paul	St. George	Total
6-year-old males, estimated:			
5-year-old males, Aug. 10, 1922	5,755	325	6,080
5-year-old males killed fall 1922			
5-year-old males end of 1922	5,755	325	6,080
Natural mortality, 20 per cent	1,151	65	1,216
6-year-old males beginning 1923	4,604	260	4,864
6-year-old males killed 1923	1		1
6-year-old males, Aug. 10, 1923	4,603	260	4,863
Surplus bulls, 7 years and over, estimated:			
6-year-old males, Aug. 10, 1922	3,069	702	3,771
6-year-old males killed fall 1922			
6-year-old males end of 1922	3,069	702	3,771
Natural mortality, 20 per cent	614	140	754
7-year-old males beginning 1923	2,455	562	3,017
Surplus bulls, Aug. 10, 1922	2,196	150	2,346
Surplus bulls killed fall 1922		1	1
Surplus bulls end of 1922	2,196	149	2,345
Natural mortality, 30 per cent	659	45	704
Remaining surplus for 1923	1,537	104	1,641
Breeding bulls of 1922	3,677	393	4,070
Natural mortality, 30 per cent	1,103	118	1,221
1922 bulls remaining 1923	2,574	275	2,849
Breeding bulls 1923	3,354	370	3,724
1922 bulls remaining, deducted	2,574	275	2,849
Increment of new bulls 1923	780	95	875
7-year-old males computed for 1923	2,455	562	3,017
Surplus bulls computed for 1923	1,537	104	1,641
Total theoretical surplus bull stock 1923	3,992	666	4,658
7-year-old males killed in 1923	1		1
Total surplus in 1923	3,991	666	4,657
New increment of breeding bulls deducted	780	95	875
Surplus bulls in 1923	3,211	571	3,782
50 per cent deducted for losses due to fighting, natural causes, and errors in loss percentage in previous years	1,605	286	1,891
Surplus bulls, Aug. 10, 1923	1,606	285	1,891
RECAPITULATION			
Pups	169,363	28,296	197,659
Cows	169,363	28,296	197,659
Harem bulls	3,051	361	3,412
Idle bulls	303	9	312
Yearling females	51,638	8,784	60,422
Yearling males	47,661	8,108	55,769
2-year-old females	41,400	7,401	48,801
2-year-old males	36,484	6,628	43,112
3-year-old males	19,845	2,941	22,786
4-year-old males	5,342	368	5,710
5-year-old males	9,850	762	10,612
6-year-old males	4,603	260	4,863
Surplus bulls	1,606	285	1,891
Total, 1923	560,509	92,499	653,008
Total, 1922			604,962
Numerical increase, 1923			48,046
Per cent increase, 1923			7.94

FISHERY INDUSTRIES OF THE UNITED STATES, 1923 [1]

By Oscar E. Sette

Assistant in Charge, Division of Fishery Industries

CONTENTS

[1] Appendix IV to the Report of the U. S. Commissioner of Fisheries for 1924. B. F. Doc. 976.

INTRODUCTION

In 1923 the fishery industries to a marked degree recovered from the severe depression that existed in 1920 and 1921. This was evidenced by an increased number of landings, a greater amount of fish frozen and canned, and the generally higher prices that prevailed during the year.

The landings by vessels at the principal New England ports substantially exceeded those of previous years. The average price paid the fishermen for all fresh fish landed at Boston was 4.37 cents in 1923, as compared with 3.78 cents per pound in 1922. Although this was a substantial increase, the prices of fish as compared with those of other commodities are still below the pre-war level, though nearly approaching it. A decreased number of landings at Seattle was offset by their increased value, due to the relatively greater salmon catch in Puget Sound. The landings of fresh fish in California also exceeded those of the previous year.

The production of canned fishery products and by-products in 1923 was greater than in 1922, the total value of the former amounting to $72,445,205 and of the latter to $12,702,861. This registers an increase of 19.8 per cent in the value of canned products and of 11.5 per cent in the value of by-products. The Maine sardine and crab packs alone showed a decrease as compared with 1922. The exports of canned fish amounted to 95,365,169 pounds, an increase of 8 per cent over the 88,416,266 pounds exported in 1922.

SUMMARY OF OPERATIONS

During the year statistical canvasses were made of the fisheries of the Mississippi River and its tributaries, the Great Lakes, and the Pacific coast for the calendar year 1922; the shad and alewife fisheries of the Potomac River for 1922 and 1923; and of the canned fishery products and by-products of the United States for 1923. The landings of the vessel fisheries at the ports of Boston and Gloucester, Mass., Portland, Me., and Seattle, Wash., have been collected as heretofore, and published as monthly and annual bulletins. In addition, there have been published monthly bulletins showing the amount of the various species of fish frozen and held in cold storage in the several sections of the country. The results of the canvasses mentioned and summary analyses of the freezing and cold-storage data are embodied in the present report, together with the quantity of fish landed in California in 1923 and the fishery products received at the municipal fish wharf and market, Washington, D. C.

In fisheries technology continued investigation of net preservatives has shown results in commercial practice, the investigation of canning sardines has yielded notable results, and an investigation of the iodine content of fishes has extended our knowledge of the health properties of sea food.

PUBLICATIONS OF THE DIVISION

During the calendar year 1923 the following publications, prepared in this division, were issued. This list does not include the monthly statistical bulletins for Boston and Gloucester, Mass., Portland, Me., and Seattle, Wash., and the monthly publication of the cold-storage holdings of frozen fish.

DOCUMENTS

Trade in fresh and frozen fishery products and related marketing considerations in Boston, Mass.; by L. T. Hopkinson, 8°, 29 pp. 2 figs. Document No. 939.

Properties and values of certain fish-net preservatives (with bibliography); by Harden F. Taylor and Arthur W. Wells, 8°, 71 pp. 32 figs. Document No. 947.

Fishery industries of the United States. Report of the Division of Fishery Industries for 1922; by Harden F. Taylor, 8°, 113 pp. 4 figs. Document No. 954.

STATISTICAL BULLETINS

Statement, by fishing grounds, of the quantities and values of certain fishery products landed at Seattle, Wash., by American fishing vessels during the calendar year 1922. Statistical Bulletin No. 558.

Statement, by months, of the quantities and values of certain fishery products landed at Boston and Gloucester, Mass., and Portland, Me., by American fishing vessels during the calendar year 1922. Statistical Bulletin No. 559.

Statement, by fishing grounds, of the quantities and values of certain fishery products landed at Boston and Gloucester, Mass., and Portland Me., by American fishing vessels during the calendar year 1922. Statistical Bulletin No. 560.

Fisheries of New York, New Jersey, and Delaware, 1921. Statistical Bulletin No. 569.

Canned fishery products and by-products of the United States and Alaska, 1922. Statistical Bulletin No. 570.

TECHNOLOGICAL INVESTIGATIONS

The primary function of the Bureau of Fisheries is to properly conserve the food fishes of the Nation. Conservation should be understood to include more than a simple saving or hoarding of resources. In order that our fisheries may be of greatest value, they must be made to yield the maximum supply of fish food commensurate with their continued productivity. This means that raw materials taken from the sea should be utilized in a manner that will provide the greatest amount of properly prepared food materials to the Nation. The fishing industry is notoriously backward in the adoption of improved methods of preserving and marketing its products, the utilization of its by-products, and in so conducting its business as to furnish a stable supply of products.

Fisheries technology, as practiced by the Bureau of Fisheries, has to do with the improvement of existing and the development of new and better equipment, methods, products, and practices within the different branches of the fishing industry, and with the proper utilization of its wastes and by-products. The accomplishment of these ends calls for the application of science in many forms, and the carrying out of quite widely diversified research, both as to type and purpose. Knowledge of practices thus gained are then presented to the industry and their application thereto urged and directed until they become integral parts of it.

The fisheries industries offer an almost virgin field for work of this nature, and a large amount of such work must be done before they can be placed in the same class with other industries that supply the Nation with food. Well-directed efforts along these lines may be expected to and do yield large returns. The success now being attained with the results of the bureau's net-preservative and sardine-canning investigations bears out this statement.

The policy of the bureau is to carry on such technological investigations as are possible with the limited funds and personnel available for this purpose. Endeavor is made to select broad fundamental studies, which are urgent, promise to be of the greatest value to the largest number, and which the industry itself is least capable of undertaking. In this work direct results are not the only ones obtained. A successful investigation gives general confidence in what science can do for the fishery industries, and leads to independent initiative in fisheries technology.

CANNING SARDINES

In the bureau's experimental laboratory at San Pedro, Calif., attention to the technology of sardine canning has been continued. This research has been yielding excellent results of evident value to the industry.

An opinion has been prevalent that the method of preparing the fish for canning greatly influences the ability of the canned product to withstand the vicissitudes of storage and shipment. It was shown by the laboratory that the physical condition of the fish themselves at the time of being packed, and not the method of producing that condition, is the determining factor. Since the preparation of fish for canning as sardines is essentially a process of removing excess water from them, any procedure that effectively accomplishes this removal without adding any foreign product to the fish, and at the same time leaves them in good physical condition, gives a good final product.

Partial drying by moving air has so far been an essential step in all successful commerical methods of preparing fish for canning as sardines. Fundamental knowledge of this procedure was needed to enable further effective work upon the development of a new method. This information was therefore obtained, and now, for the first time, data are at hand, which will enable drying equipment in the sardine canning industry to be designed upon a scientific basis. Advantage has already been taken of this fact, with very good results, in the building of new equipment and the improvement of old within the industry. It has been possible to show how fish may be dried for frying in from one-third to one-fifth of the time formerly required. The size of the equipment may be decreased correspondingly.

The real outcome of the drying research and the studies that preceded it has been the development of a new process of preparing fish for canning. This process depends on rapidly moving hot air to cook and dry the fish simultaneously, followed by a period of cooling in a blast of cold air, so that they may be packed immediately. The time required for carrying out this process has finally been shortened to about 40 minutes for the largest California pilchards, and operation can be continuous. In the frying-in-oil method now in use the fish are dried at least 30 minutes, fried 7 to 10 minutes, and allowed to drain and cool over night before being packed. Fish prepared in the new way are not open to the objections to which fried fish are subject.

PRESERVATION OF NETS

The publication during the year 1923 of the results of experiments in the preservation of fish nets has enabled commercial fishermen and the trade to take advantage of the information resulting from the extensive experiments carried on in this field. Manufacturers were quick to see the possibilities and sufficient quantities of copper oleate were produced to meet the demand. Its use as a fish-net preservative has even passed beyond the borders of our own country. The results, on the whole, give very favorable evidence of the usefulness of copper oleate, but for certain fishing gear modifications of application have been found to be necessary.

Further experiments were conducted on the preservation of fish nets, and a large series of tests were made. This series included tests in salt water at Beaufort, N. C.; Boothbay Harbor, Me.; San Pedro, Calif; and Astoria, Oreg.; and in fresh water at Charlevoix, Mich.; Put in Bay, Ohio; Fairport, Iowa; and Washington, D. C. Previous tests had indicated that copper oleate was possibly slightly too soluble (especially in fresh water) to be entirely satisfactory as a preservative. In an effort to overcome this objection copper oleate was applied in combinations including both raw and boiled linseed oil, paraffin, and coal tar. It was found, however, that although linseed oil decreased the solubility to some extent, this combination does not make as efficient a preservative and anti-fouling agent as copper oleate alone. Evidently a certain degree of solubility is desirable. Tests in the Potomac River demonstrated that it is well to frequently treat with copper oleate twine that is continuously exposed, and it was found that twine treated every 30 days lasted almost twice as long as that given but one treatment.

The experiments as a whole clearly indicated that the use of coal tar with copper oleate preserved the tensile strength of the lines best. Where considerable increase in weight and stiffness is objectionable, such treatment, of course, should not be given.

Other experiments showed that, in general, twine that is periodically submerged will last longer than that continuously submerged. It was also found that there was a marked difference in effectiveness of preservatives in one year as compared with their effectiveness when similarly used in the same waters the following year. It is therefore clearly indicated that the degree of success to be attained with any net preservative in any particular case can not be predicted. It can, however, be said, when all factors are taken into consideration, that copper oleate has proved itself superior to any preservative tested experimentally.

IODINE CONTENT OF SEA FOODS

In recent years a lack of iodine in food and drinking water has been recognized as one of the most important causes of endemic goiter, cretinism, and other disorders of the thyroid gland. Thyroxin, the active principle of the thyroid gland, has been shown to be an iodine compound. Various observers have shown that it is only necessary to have small amounts of iodine in the food or drinking water to enable the thyroid gland to function properly.

Physiologists and physicians recently have called attention to the probability that sea foods might constitute an agreeable and convenient source of iodine for the public at large. In order to supply information on this subject, an investigation of the iodine content of sea foods was made in the fishery products laboratory, and the iodine content of a large number of fresh and salt water fish and shellfish was determined. The work showed that oysters, clams, and lobsters are unusually rich in iodine, containing about 200 times as much as such common foods as beefsteak, milk, eggs, etc. Shrimp contain about 100 times as much, and crabs and most marine fish an average of about 50 times as much. Fresh-water fishes were found to contain very small amounts of iodine, the quantity being about the same as that found in milk, eggs, beefsteak, etc. The results of these determinations have been published for the use of the trade.

PRODUCTION OF CERTAIN FISHERY PRODUCTS IN 1922 AND 1923

The following table has been prepared to show the general trend of the fishing industry in so far as changes can be shown by data available that apply to 1922 and 1923:

Production and value of certain fishery products in 1922 and 1923 compared

Products	1922		1923		Per cent increase (+) or decrease (−)	
	Quantity	*Value*	*Quantity*	*Value*	*Quantity*	*Value*
Fish landed by fishing vessels at Boston and Gloucester, Mass., and Portland, Me......pounds..	159,875,391	$5,465,932	174,941,469	$7,051,154	+9.4	+29.0
Trips....................number..	6,349	....	6,535	....	+2.9	....
Fish landed by fishing and collecting vessels at Seattle, Wash. ....pounds..	26,415,440	2,214,654	25,625,060	2,630,318	−2.9	+18.7
Trips....................number..	836	....	919	....	+9.9	....
Product of fisheries of California ....pounds..	168,969,733	....	230,830,942	....	+36.6	....
Fish received at Washington, D. C., municipal wharf...pounds..	6,442,663	....	5,678,157	....	−11.9	....
Sponges sold at Sponge Exchange, Tarpon Springs, Fla...pounds..	526,885	699,092	490,200	734,391	−6.9	+5.0
Canned salmon:						
Pacific Coast States.....cases..	733,246	8,633,524	1,367,263	12,660,566	+86.4	+46.6
Alaska.................do....	4,501,652	29,787,193	5,035,697	32,873,007	+11.9	+10.4
Total, canned salmon..do....	5,234,898	38,420,717	6,402,960	45,533,573	+22.8	+18.5
Canned sardines:						
Maine and Massachusetts ....cases..	1,775,878	5,750,109	1,219,075	5,288,865	−31.3	−8.0
California...............do....	728,979	3,361,480	1,115,422	4,607,931	+53.0	+37.1
Total, canned sardines.do....	2,504,857	9,111,589	2,335,007	9,896,796	−6.8	+8.6
Canned tuna and tunalike fishes in California..............cases..	629,920	4,372,806	788,611	6,914,760	+25.2	+58.1
Canned shrimp.............do....	586,691	3,064,087	691,339	4,256,379	+17.8	+38.9
Canned clams, hard, soft, and razor.....................cases..	308,640	1,716,365	328,329	1,710,616	+6.4	−.3
Canned oysters.............do....	522,549	2,423,616	537,549	2,720,073	+2.9	+12.2
All canned fishery products.do....	10,094,549	60,464,947	11,453,367	72,445,205	+13.5	+19.8
Menhaden industry:						
Fish utilized.........number..	1,212,450,669	2,457,690	1,110,291,427	4,430,463	−8.4	+80.3
Fish meal and scrap produced..................tons..	93,576	3,221,758	88,387	3,094,276	−5.5	−4.0
Oil...................gallons..	7,102,677	2,904,833	7,461,365	3,316,277	+5.1	+14.2
Fish oils other than menhaden ....gallons..	1,185,651	441,213	2,355,606	996,033	+98.7	+125.7
Fish meal and scrap other than menhaden................tons..	22,590	1,114,919	25,498	1,319,109	+12.9	+18.3
Liquid glue..............gallons..	323,003	278,424	465,814	680,054	+44.2	+144.3
All by-products......................	....	11,390,693	....	12,702,861	....	+11.5
Fish, frozen..............pounds..	75,453,674	....	91,548,043	....	+21.3	....

CANNED FISHERY PRODUCTS AND BY-PRODUCTS OF THE UNITED STATES AND ALASKA, 1923

The bureau has made a canvass of the canned fishery products and by-products of the United States and Alaska for 1923, and statistics were published and distributed to the trade as Statistical Bulletin No. 608. The total value of canned products in 1923 amounted to $72,445,205 and of by-products $12,702,861. As compared with 1922 there was an increase in the value of canned products of $11,980,258, or 19.81 per cent, and in the value of by-products of $1,312,168, or 11.52 per cent. The canned products consisted principally of canned salmon, sardines, shad, alewives, albacore, tuna, shrimp, crabs, clams, and oysters, and the by-products of fish scrap, meal, and oil, and the crushed shells of oysters, mussels, and clams for poultry food, lime, and stucco. The fish scrap, meal, and oil prepared in the menhaden industry are also included under by-products of the fisheries.

CANNED FISHERY PRODUCTS

SALMON

In 1923 there were 188 plants engaged in canning salmon in the Pacific Coast States and Alaska, as compared with 179 in the previous year. Of this number 130 were operated in Alaska, 35 in Washington, 21 in Oregon, and 2 in California. The pack of canned salmon in 1923, on the basis of 48 one-pound cans to the case, amounted to 6,402,960 cases, valued at $45,533,578.

In the Pacific Coast States the pack amounted to 1,367,263 cases, valued at $12,660,566, as follows: Chinook, 384,705 cases, valued at $5,790,419; sockeye, 105,336 cases, valued at $1,955,549; coho or silver, 245,548 cases, valued at $1,608,627; humpback or pink, 445,175 cases, valued at $2,211,742; chum, 154,342 cases, valued at $769,839; steelhead, 32,157 cases, valued at $324,390; and other salmon products to the value of $122,228.

In Alaska the pack amounted to 5,035,697 cases, valued at $32,873,007, divided as follows: Chinook, 38,343 cases, valued at $328-270; sockeye, 1,859,496 cases, valued at $17,253,792; coho or silver, 164,107 cases, valued at $943,318; humpback or pink, 2,448,129 cases, valued at $11,899,956; and chum, 525,622 cases, valued at $2,447,671.

Compared with previous years there was an increase of 7 canneries in Alaska, 1 in Washington, and 1 in Oregon. There was an increase in the pack of canned salmon of 1,168,062 cases, or 22 per cent in quantity, and of $7,112,856, or 19 per cent, in value. The Alaska pack increased 534,045 cases, or 12 per cent, in quantity and $3,085,814, or 10 per cent, in value. This was due to a moderate increase in the pack of king or chinook salmon, and a decided increase in humpbacks. The sockeyes, cohoes, and chums were packed in lesser quantities than in 1922. In the Pacific Coast States there was an increase of 634,017 cases, or 86 per cent, in quantity and $4,027,042, or 47 per cent, in value. An increase occurred in all the species, but was particularly noticeable in the humpbacks and chums.

Pack of canned salmon, 1923

Products	Pacific Coast States						Alaska	
	Washington		Oregon and California		Total		Southeast	
	Cases	*Value*	*Cases*	*Value*	*Cases*	*Value*	*Cases*	*Value*
King, chinook, or spring:								
1-pound tall	42,773	$452,609	5,913	$58,338	48,686	$510,947	4,090	$33,361
1-pound flat	42,572	637,719	86,045	1,255,263	128,617	1,892,982	4,093	40,074
1-pound oval	4,918	108,196	5,719	125,818	10,637	234,014		
½-pound flat	57,362	901,180	138,225	2,218,312	195,587	3,119,492	4,865	50,330
½-pound oval	167	4,676	1,011	28,308	1,178	32,984		
Total	147,792	2,104,380	236,913	3,686,039	384,705	5,790,419	13,048	123,765
Red or sockeye:								
1-pound tall	1,781	30,989	4,022	69,983	5,803	100,972	99,098	881,486
1-pound flat	19,783	336,311	85	1,445	19,868	337,756	35,313	370,994
½-pound flat	55,449	1,055,749	24,216	461,072	79,665	1,516,821	43,914	560,555
Total	77,013	1,423,049	28,323	532,500	105,336	1,955,549	178,325	1,813,035
Coho or silver:								
1-pound tall	77,162	447,540	34,317	199,039	111,479	646,579	112,276	611,535
1-pound flat	67,125	456,450	35,457	241,107	102,582	697,557	8,128	56,215
½-pound flat	11,514	96,718	19,973	167,773	31,487	264,491	9,947	82,486
Total	155,801	1,000,708	89,747	607,919	245,548	1,608,627	130,351	750,236
Humpback or pink:								
1-pound tall	395,732	1,915,343	489	2,367	396,221	1,917,710	2,218,495	10,753,740
1-pound flat	28,099	149,487	1,322	7,033	29,421	156,520	6,988	37,382
½-pound flat	19,282	135,745	251	1,767	19,533	137,512	26,536	174,552
Total	443,113	2,200,575	2,062	11,167	445,175	2,211,742	2,252,019	10,965,674
Chum or keta:								
1-pound tall	134,392	645,082	4,865	23,352	139,257	668,434	427,210	1,999,026
1-pound flat	553	2,721	71	349	624	3,070	16	76
½-pound flat	5,964	40,555	8,497	57,780	14,461	98,335	6,150	38,144
Total	140,909	688,358	13,433	81,481	154,342	769,839	433,376	2,037,246
Steelhead:								
1-pound tall	1,216	15,808			1,216	15,808		
1-pound flat	3,323	21,932	13,234	87,344	16,557	109,276		
½-pound flat	6,641	78,629	7,743	120,677	14,384	199,306		
Total	11,180	116,369	20,977	208,021	32,157	324,390		
Grand total	975,808	7,533,439	391,455	5,127,127	1,367,263	12,660,566	3,007,119	15,689,956

Pack of canned salmon, 1923—Continued

Products	Alaska—continued						Grand total	
	Central		Western		Total			
	Cases	*Value*	*Cases*	*Value*	*Cases*	*Value*	*Cases*	*Value*
King, chinook, or spring:								
1-pound tall	6, 914	$53, 343	14, 592	$108, 041	25, 596	$194, 745	74, 282	$705, 692
1-pound flat	3, 188	34, 930			7, 281	75, 004	135, 898	1, 967, 986
1-pound oval							10, 637	234, 014
½-pound flat	601	8, 191			5, 466	58, 521	201, 053	3, 178, 013
½-pound oval							1, 178	32, 984
Total	10, 703	96, 464	14, 592	108, 041	38, 343	328, 270	423, 048	6, 118, 689
Red or sockeye:								
1-pound tall	294, 912	2, 639, 812	1, 184, 440	10, 539, 114	1, 578, 450	14, 060, 412	1, 584, 253	14, 161, 384
1-pound flat	68, 799	687, 154	55, 159	541, 029	159, 271	1, 599, 177	179, 139	1, 936, 933
½-pound flat	67, 621	898, 129	10, 240	135, 519	121, 775	1, 594, 203	201, 440	3, 111, 024
Total	431, 332	4, 225, 095	1, 249, 839	11, 215, 662	1, 859, 496	17, 253, 792	1, 964, 832	19, 209, 341
Coho or silver:								
1-pound tall	27, 017	146, 557	797	4, 381	140, 090	762, 473	251, 569	1, 409, 052
1-pound flat	2, 023	12, 947			10, 151	69, 162	112, 733	766, 719
½-pound flat	3, 891	28, 951	28	246	13, 866	111, 683	45, 353	376, 174
Total	32, 931	188, 455	825	4, 627	164, 107	943, 318	409, 655	2, 551, 945
Humpback or pink:								
1-pound tall	190, 843	903, 395			2, 409, 338	11, 657, 135	2, 805, 559	13, 574, 845
1-pound flat	2, 440	11, 712			9, 428	49, 094	38, 849	205, 614
½-pound flat	2, 827	19, 175			29, 363	193, 727	48, 896	331, 239
Total	196, 110	934, 282			2, 448, 129	11, 899, 956	2, 893, 304	14, 111, 698
Chum or keta:								
1-pound tall	72, 358	320, 492	19, 682	88, 533	519, 250	2, 408, 051	658, 507	3, 076, 485
1-pound flat					16	76	640	3, 146
½-pound flat	206	1, 400			6, 356	39, 544	20, 817	137, 879
Total	72, 564	321, 892	19, 682	88, 533	525, 622	2, 447, 671	679, 964	3, 217, 510
Steelhead:								
1-pound tall							1, 216	15, 808
1-pound flat							16, 557	109, 276
½-pound flat							14, 384	199, 306
Total							32, 157	324, 390
Grand total	743, 640	5, 766, 188	1, 284, 938	11, 416, 863	5, 035, 697	32, 873, 007	6, 402, 960	45, 533, 573

SARDINES

In 1923 there was a marked increase in the California pack of sardines and a decrease in the Maine pack. In Maine 29 plants were engaged in the canning of sardines and in Massachusetts there was 1. These produced 1,219,675 cases, valued at $5,288,865. Most of the pack was in quarter-pound cans, 100 to the case. When the entire pack is converted to this standard and the 1922 pack is similarly treated, the total amounts are 1,272,277 and 1,869,719 cases, respectively, which shows a decrease in 1923 of 597,442 cases, or 32 per cent. The decrease in value was $461,244, or 8 per cent. This indicates a substantial increase in prices.

In California 22 plants were engaged in the canning of sardines, producing 1,115,422 cases, valued at $4,607,931. These were packed mostly in 1-pound cans, 48 to the case. When the entire pack is converted to this standard and the 1922 pack similarly treated, we find that the total amounts in these two years were 1,100,162 and 715,364 cases respectively, which shows an increase in 1923 of 384,798 cases, or 54 per cent. The value increased $1,246,451, or 37 per cent, indicating a lower price for this product in 1923.

Pack of sardines, 1923

Sardines (herring)	Maine and Massachusetts		Sardines (pilchard)	California	
	Cases	Value		Cases	Value
In olive oil: Quarters (100 cans)	38,704	$243,783	½-pound oval (48 cans) [1]	6,431	$21,788
In other oils: Quarters (100 cans)	964,261	4,143,461	1-pound oval (48 cans):		
In mustard:			In tomato sauce	888,541	3,553,080
Quarters (100 cans)	87,463	378,578	In mustard	136,828	547,278
Three-quarters (48 cans)	119,549	479,329	Soused	38,751	154,977
In other sauces: Quarters (100 cans) [1]	9,698	43,714	In other sauces	17,294	74,248
			¼-pound square (100 cans) [2]	25,342	227,347
			½-pound square (100 cans) [2]	[3] 2,235	29,213
Total	1,219,675	5,288,865	Total	1,115,422	4,607,931

[1] Largely in tomato sauce.
[2] Largely in oil.
[3] Includes a few cases of 48 cans each which have been converted to a basis of 100 cans to the case.

SHAD AND ALEWIVES

The canning of shad and shad roe is carried on solely in the Pacific Coast States. In 1923 there were 6 plants in Washington and 8 plants in Oregon engaged in canning these products. The total production amounted to 3,409 cases, valued at $53,483 in 1923, and is a substantial increase over the 1922 production, both in amount and value.

The pack of alewives and alewife roe was prepared in Maryland, Virginia, and North Carolina, where there were 9, 21, and 2 plants, respectively, making a total of 32 plants engaged in this business. The production in 1923 was 43,920 cases, valued at $171,350, consisting mostly of alewife roe. This is an increase both in amount and value, as compared with the previous year.

Pack of shad and alewives, 1923

Shad	Washington and Oregon		Alewives	Maryland, Virginia, and North Carolina	
	Cases	Value		Cases	Value
½-pound flat (48 cans)	350	$2,800	No. 2 (24 cans)	1,145	$1,915
1-pound flat (48 cans)	[1] 706	16,944	Roe:		
1-pound tall (48 cans)	1,281	17,421	No. ½ and No. 1 (48 cans)	[2] 2,266	10,499
Roe:			No. 2 (24 cans)	40,509	158,936
½-pound flat (48 cans)	376	3,760			
½-pound oval (48 cans)	696	12,528	Total	43,920	171,350
Total	3,409	53,483			

[1] Includes a few cases of 1-pound oval.
[2] The No. ½ cans have been converted to a basis of No. 1 cans, 48 to a case.

TUNA AND TUNALIKE FISHES

The canning of these fishes is confined to the State of California, where, in 1923, there were 19 plants operating in this business. The total pack, including "tonno," bonito, and yellowtail, amounted to 788,611 cases, valued at $6,914,760, as compared with 654,183 cases, valued at $4,511,873, packed the previous year.

Most of the tunas are packed in half-pound cans, 48 to the case. In the following comparisons the entire pack is converted to this standard. The total amount packed in 1923 was 817,836 cases, as compared with 672,321 cases the previous year. This is an increase of 145,515 cases, or 22 per cent, in amount. The value increased 53 per cent. The pack of the highly prized white-meated tuna (albacore), however, does not show such a distinct increase. In 1923 there were 310,037 cases packed, as compared with 296,210 in 1922, representing an increase of only 5 per cent. The pack of bluefin, yellowfin, and striped tuna, "tonno," and bonito amounted to 497,740 cases, as compared with 371,393 cases in 1922, an increase of 126,347 cases, or 34 per cent. This increase was to a large extent accomplished by extending fishing operations into Mexican waters.

A development worthy of note is the "tonno" pack. This consists of a highly seasoned pack in oil, prepared after the Italian method. A recent ruling of the Bureau of Chemistry permits canning of the striped tuna, or skipjack, as well as the yellowfin and bluefin tunas under this name. In 1921 this pack consisted of only 1,256 standard cases, valued at $1,953; in 1923 this product attained the amount of 124,420 standard cases, valued at $1,136,184.

The pack of tuna and tunalike fishes, 1923

Sizes	Albacore		Yellowfin		Bluefin		Tuna, bluefin and yellowfin	
	Cases	*Value*	*Cases*	*Value*	*Cases*	*Value*	*Cases*	*Value*
¼-pound round (48 cans)	27,264	$170,402	10,058	$47,777	3,328	$15,810		
¼-pound round (100 cans)							1,299	$12,665
½-pound round (48 cans)	240,159	2,401,590	149,552	1,121,643	57,910	434,327	7,525	56,438
1-pound round (48 cans)	28,123	534,337	11,149	156,086	5,157	72,198	2,001	28,014
4-pound round (12 cans)			1,061	14,854				
Total	295,546	3,106,329	171,820	1,340,360	66,395	522,335	10,825	97,117

Sizes	Tuna, striped		"Tonno"		Bonito		Yellowtail		Total	
	Cases	*Value*	*Cases*	*Value*	*Cases*	*Value*	*Cases*	*Value*	*Cases*	*Value*
¼-pound round (48 cans)	4,846	$18,330	21,504	$118,275					67,000	$370,603
¼-pound round (100 cans)	3,368	25,260	[1] 12,882	153,120	458	$4,988			18,007	196,042
½-pound round (48 cans)	72,838	437,404	[2] 95,435	829,816	13,828	69,140	5,349	$29,740	642,596	5,380,098
1-pound round (48 cans)	8,841	97,251			397	3,778	2,355	25,905	58,023	917,569
4-pound round (12 cans)									1,061	14,854
5-pound round (12 cans)			1,924	35,594					1,924	35,594
Total	89,893	578,254	131,745	1,136,814	14,683	77,906	7,704	55,645	788,611	6,914,760

[1] Includes a few cases packed 50 cans to the case which have been converted to the equivalent of 100 cans to the case.

[2] Includes a few cases packed 50 cans to the case which have been converted to the equivalent of 48 cans to the case.

SHRIMP AND CRABS

In 1923 there were 8 shrimp canneries operated in Georgia, 1 in North Carolina, 9 in Florida, 7 in Alabama, 28 in Mississippi, 23 in Louisiana, and 2 in Texas, making a total of 78 plants engaged in this business. The production of canned shrimp in tins amounted to 691,339 cases, valued at $4,256,379. In addition to this, there were packed in 5½ and 14 ounce glass jars in Florida and Mississippi 29,166 cases, valued at $125,155. When the entire pack is converted to the basis of No. 1 cans, 48 to the case, the total amount is 700,429 cases, valued at $4,381,534, which, compared to 1922 on the same basis, represents an increase of 120,632 standard cases, or 21 per cent, in amount, and $1,317,447, or 43 per cent, in value.

Crabs were canned at 2 plants in Alaska, 1 in Maine, 3 in Maryland, 1 in Mississippi, and 2 in Virginia. The total pack amounted to 4,138 cases, valued at $47,023, as compared with 9,111 cases, valued at $104,171, in 1922.

Pack of shrimp and crabs, 1923

SHRIMP

States	No. 1 cans (4 dozen)		No. 1½ cans (2 dozen)		Total	
	Cases	*Value*	*Cases*	*Value*	*Cases*	*Value*
Georgia and North Carolina	81, 858	$488, 954	6, 601	$35, 080	88, 459	$524, 034
Florida	71, 367	446, 238	4, 322	27, 320	75, 689	473, 558
Alabama	57, 830	361, 246	3, 800	23, 372	61, 630	384, 618
Mississippi	163, 200	1, 005, 460	5, 832	35, 950	169, 032	1, 041, 410
Louisiana and Texas	281, 110	1, 737, 743	15, 419	95, 016	296, 529	1, 832, 759
Total	655, 365	4, 039, 641	35, 974	216, 738	691, 339	4, 256, 379

CRABS

States	7½, 8, 9, and 12 ounce cans (4 dozen)		15 and 16 ounce cans (2 dozen)		Total	
	Cases	*Value*	*Cases*	*Value*	*Cases*	*Value*
Alaska, Maine, Maryland, Mississippi, and Virginia	[1] 2, 993	$33, 390	[2] 1, 145	$13, 633	4, 138	$47, 023

[1] The 8, 9, and 12 ounce cans have been converted to the equivalent of 7½-ounce cans, 4 dozen to the case.
[2] The 16-ounce cans have been converted to the equivalent of 15-ounce cans, 4 dozen to the case.

CLAMS

In 1923 razor clams were canned at 24 plants in Washington, 3 in Oregon, and 12 in Alaska; hard clams at 2 plants in Florida, 1 in Rhode Island, and 2 in Washington; and soft clams at 19 plants in Maine and 2 in Massachusetts; making a total of 65 canneries engaged in this business. The total production amounted to 328,229 cases, valued at $1,710,616, as compared with 308,640 cases, valued at $1,716,365, in 1922.

Pack of clams, 1923

RAZOR CLAMS

Sizes	Washington		Oregon		Alaska		Total	
Whole:	*Cases*	*Value*	*Cases*	*Value*	*Cases*	*Value*	*Cases*	*Value*
½-pound flat (4 dozen)	251	$1, 355					251	$1, 355
No. 2 (2 dozen)	75	450					75	450
1-pound (4 dozen)	4, 601	47, 030			4, 795	$48, 004	9, 396	95, 034
20-ounce (2 dozen)					788	3, 546	788	3, 546
5-pound (1 dozen)					495	2, 722	495	2, 722
Minced:								
½-pound flat (4 dozen)	29, 206	160, 048	66	$362	49, 269	314, 613	78, 541	475, 023
No. 1 (4 dozen)	16, 975	120, 862	962	6, 849	16, 256	129, 084	34, 193	256, 795
No. 2 (2 dozen)	605	3, 751	180	1, 116			785	4, 867
1-pound (4 dozen)	55	583			5, 679	43, 160	5, 734	43, 743
Juice: No. 2 (2 dozen)	130	299			1	10	131	309
Total	51, 898	334, 378	1, 208	8, 327	77, 283	541, 139	130, 389	883, 844

HARD CLAMS

Sizes	Florida, Rhode Island, and Washington		Sizes	Florida, Rhode Island, and Washington	
Whole:	*Cases*	*Value*	Chowder and soup:	*Cases*	*Value*
½-pound flat (4 dozen)	300	$405	No. 1 (4 dozen)	12, 473	$60, 272
1-pound (4 dozen)	1, 202	9, 135	No. 1½ (4 dozen)	9, 709	40, 000
No. 1 (4 dozen)	7, 846	60, 926	No. 2 (2 dozen)	26	104
No. 2 (2 dozen)	14, 649	77, 891	No. 3 (2 dozen)	14, 052	64, 200
No. 10 (½ dozen)	3, 265	21, 968	No. 10 (½ dozen)	287	1, 866
Minced:			Bouillon, juice, and broth:		
No. 1 (4 dozen)	2, 764	16, 113	1½ and 3 ounce bottles	1, 246	6, 286
No. 2 (2 dozen)	1, 671	7, 823	7 and 14 ounce bottles (2 dozen)	3, 284	18, 163
No. 10 (½ dozen)	96	676	No. 1 (4 dozen)	77	291
			No. 2 (2 dozen)	979	3, 045
			No. 10 (½ dozen)	180	910
			Total	74, 096	390, 134

Pack of claims, 1923—Continued

SOFT CLAMS

Sizes	Maine and Massachusetts		Sizes	Maine and Massachusetts	
	Cases	*Value*		*Cases*	*Value*
Whole:			Chowder:		
4-ounce (4 dozen)	740	$4,685	10-ounce (2 dozen)	14,792	$17,841
5-ounce (4 dozen)	35,752	168,416	10½-ounce (2 dozen)	31,928	51,468
6-ounce (2 dozen)	2,260	12,814	32 and 34 ounce (2 dozen)	[1]15,227	55,070
8-ounce (4 dozen)	8,871	54,954	1-gallon (½ dozen)	1,034	2,965
8½-ounce (2 dozen)	627	3,070	Bouillon and juice:		
10-ounce (4 dozen)	7,887	46,391	8-ounce (2 dozen)	296	296
15-ounce (4 dozen)	1,084	7,480	10-ounce (4 dozen)	37	113
18-ounce (2 dozen)	3,084	10,750	14 ounce (4 dozen)	50	220
			No. 2 (2 dozen)	75	105
			Total	123,744	436,638

[1] The 34-ounce cans have been converted to equivalent of 32-ounce cans, 2 dozen to the case.

OYSTERS

Oysters were canned at 12 plants in Maryland, 4 in North Carolina, 10 in South Carolina, 7 in Georgia, 5 in Florida, 6 in Alabama, 3 in Louisiana, and 21 in Mississippi, the total pack amounting to 537,549 cases, valued at $2,720,073. Most of the pack was in No. 1 5-ounce cans, 48 to the case. When the entire pack is converted to this standard and the 1922 pack is similarly treated, the total amounts are 524,544 and 505,973 cases, respectively, which shows an increase in 1923 of 4 per cent. The value increased $296,457, or 12 per cent.

Pack of oysters, 1923

Sizes	Maryland		North Carolina		South Carolina		Georgia	
	Cases	*Value*	*Cases*	*Value*	*Cases*	*Value*	*Cases*	*Value*
4-ounce (4 dozen)	8,886	$48,000	600	$2,760	[1] 5,058	$19,890		
5-ounce (4 dozen)	42,041	240,248	49,370	228,388	83,338	337,719	16,250	$75,939
6-ounce (4 dozen)	19,181	196,429			157	737	99	891
8-ounce (2 dozen)	2,883	14,140	800	3,200	957	3,775		
10-ounce (2 dozen)	16,264	89,553	7,000	36,075	20,443	88,174		
12-ounce (2 dozen)	1,901	18,603					24	192
Total	91,156	606,973	57,770	270,423	109,953	490,295	16,373	77,022

Sizes	Florida		Alabama		Louisiana and Mississippi		Total	
	Cases	*Value*	*Cases*	*Value*	*Cases*	*Value*	*Cases*	*Value*
4-ounce (4 dozen)	1,068	$5,340	673	$2,906	43,176	$196,126	59,461	$275,022
5-ounce (4 dozen)	9,800	48,772	41,222	201,222	100,515	499,352	342,536	1,671,640
6-ounce (4 dozen)					1,242	11,136	20,679	209,193
8-ounce (2 dozen)	120	456	525	1,785	22,983	106,537	28,268	129,893
10-ounce (2 dozen)	86	344	11,356	54,428	29,431	145,356	84,580	413,930
12-ounce (2 dozen)					100	1,600	2,025	20,395
Total	11,074	54,912	53,776	260,341	197,447	960,107	537,549	2,720,073

[1] Includes pack of 3-ounce cans converted to equivalent of 4-ounce cans, 4 dozen to the case.

MISCELLANEOUS CANNED FISHERY PRODUCTS

In addition to the products shown above, there were packed in Maine, Massachusetts, New York, New Jersey, Maryland, and Wisconsin, 254,562 cases of miscellaneous fishery products, valued at $658,583, and in California, 34,387 cases of tuna flakes, abalone, barracuda, mackerel, and squid, valued at $235,186.

EXPORTS OF CANNED FISHERY PRODUCTS IN 1923

Statistics of the quantity of canned fish exported from the United States during the calendar year 1923, collected and compiled by the Bureau of Foreign and Domestic Commerce, are given in the following table:

Domestic exports of canned fish from the United States, by countries, 1923

Countries	Salmon		Sardines		Tuna		Other canned fish	
	Lbs.	*Dolls.*	*Lbs.*	*Dolls.*	*Lbs.*	*Dolls.*	*Lbs.*	*Dolls.*
Belgium	814, 367	91, 817	627, 520	58, 945			13, 750	1, 200
Denmark	6, 000	635					7, 214	2, 537
France	57, 700	6, 049	33, 560	3, 757			1, 540	482
Germany	82, 918	11, 478	1, 089	223	63	23	107	48
Greece	120, 041	14, 534	23, 245	2, 645			33, 812	8, 306
Italy	194, 800	19, 210			121	15	725	283
Netherlands	479, 836	76, 799	80, 055	7, 420				
Norway	45, 192	10, 855	157	19	85	27	710	204
Russia in Europe	45, 000	3, 675	344	75				
Spain	1, 008	119					9, 000	1, 950
Sweden	20, 041	3, 739					11, 400	4, 038
Turkey in Europe	12, 560	1, 581					108	53
Ukraine	572	157	51, 320	8, 543			1, 360	192
England	31, 090, 188	5, 685, 074	543, 940	53, 664	36	11	64, 440	25, 600
Scotland	637, 768	125, 416	7, 200	612				
Ireland	40, 800	7, 700						
Canada:								
Maritime Provinces	13, 742	1, 667	272, 964	23, 351			2, 536	459
Quebec and Ontario	245, 809	29, 848	1, 779	267	27, 495	7, 726	24, 223	5, 556
Prairie Provinces	23, 560	3, 665			1, 740	548	1, 997	601
British Columbia and Yukon	1, 073, 172	137, 562	10, 369	1, 042	20, 045	6, 107	16, 302	3, 830
British Honduras	36, 375	3, 926	40, 064	4, 430			220	27
Costa Rica	87, 393	9, 353	137, 459	13, 670	216	89	1, 137	333
Guatemala	51, 066	5, 605	121, 094	12, 982	531	185	1, 426	429
Honduras	69, 266	8, 753	126, 391	17, 176	445	193	4, 356	816
Nicaragua	89, 027	9, 553	99, 814	11, 965	363	126	503	171
Panama	220, 927	29, 459	112, 453	13, 442	3, 799	1, 216	11, 168	2, 968
Salvador	16, 800	1, 807	96, 863	9, 427	32	17	1, 579	277
Mexico	1, 654, 380	143, 263	2, 373, 308	231, 359	1, 606	566	132, 736	25, 403
Newfoundland and Labrador			12	5	126	37	211	68
Bermuda	41, 326	8, 134	17, 696	2, 770	642	234	1, 702	502
Barbados	118, 346	16, 008	575	49	94	54	61	43
Jamaica	86, 171	15, 592	97, 190	10, 270			1, 450	548
Trinidad and Tobago	139, 119	22, 499	12, 613	1, 672	412	202	571	152
Other British West Indies	67, 570	12, 107	30, 356	4, 267	60	15	2, 101	514
Cuba	844, 877	82, 169	1, 801, 671	155, 519	3, 444	1, 127	472, 675	36, 336
Dominican Republic	190, 885	20, 271	231, 320	30, 617	495	174	3, 881	1, 183
Dutch West Indies	39, 942	6, 902	12, 683	1, 433	188	61	649	175
Haiti	4, 084	575	1, 838	326	100	42	25, 621	1, 399
French West Indies	700	82						
Virgin Islands of the U. S.	30, 454	3, 829	10, 824	2, 072	21	13	1, 827	224
Argentina	1, 021, 474	116, 777	1, 489, 709	126, 017			40, 345	3, 944
Bolivia	65, 676	6, 154	255, 162	18, 696			4, 065	954
Brazil	3, 491	741					801	419
Chile	216, 696	23, 299	548, 018	45, 336	60	28	5, 636	1, 311
Colombia	414, 017	47, 561	115, 449	13, 573	4, 286	1, 672	9, 807	3, 278
Ecuador	117, 542	10, 832	224, 646	19, 984			92	33
British Guiana	212, 694	37, 525	101, 177	11, 214			3, 970	1, 019
Dutch Guiana	32, 497	3, 594	22, 757	3, 126	130	81	1, 432	413
French Guiana	9, 948	1, 164						
Paraguay	840	105						
Peru	426, 163	45, 684	487, 880	43, 717	206	127	2, 434	1, 136
Uruguay	8, 096	1, 404	7, 200	586			4, 459	1, 574
Venezuela	577, 041	58, 614	86, 430	8, 889	2, 473	882	9, 718	2, 018
Aden	480	60						
British India	205, 472	30, 706	197, 931	23, 227	565	227	7, 967	1, 076
Ceylon	54, 931	8, 607	15, 670	1, 936	306	128	3, 626	468
Straits Settlements	115, 750	19, 431	6, 053, 497	503, 511	96	27	229, 574	13, 746
Other British East Indies	2, 736	350	2, 700	270			144	18
China	51, 357	8, 295	334, 050	33, 359	2, 741	870	17, 004	1, 343
Chosen	5, 610	635	96	10	72	30	146	41
Java and Madura	249, 343	27, 207	2, 126, 161	197, 514	66	35	13, 942	1, 207
Other Dutch East Indies	115, 724	11, 961	435, 173	42, 381				
Far Eastern Republic			820	162			2, 000	276
French Indo-China	240	51	108, 260	11, 070			15, 440	1, 308
Hongkong	24, 710	4, 307	442, 598	37, 885	54	22	22, 210	4, 405
Japan	1, 577, 926	150, 328	62, 528	6, 227	470	160	152, 163	16, 753
Kwangtung, leased territory	144	32	84, 712	7, 342			192	24

Domestic exports of canned fish from the United States, by countries, 1923—Con.

Countries	Salmon		Sardines		Tuna		Other canned fish	
	Lbs.	*Dolls.*	*Lbs.*	*Dolls.*	*Lbs.*	*Dolls.*	*Lbs.*	*Dolls.*
Palestine and Syria	31,588	3,676	1,690	117			744	159
Philippine Islands	7,055,041	667,713	13,225,126	1,051,186	1,521	640	586,671	37,255
Russia in Asia	1,491	159	5,760	449				
Siam	2,916	794	71,516	4,570	24	11		
Turkey in Asia	19,200	2,280						
Other Asia	336	29						
Australia	6,142,166	999,702	15,463	2,911	1,044	211	5,425	1,759
British Oceania	27,317	3,871	7,953	833			75	31
French Oceania	190,548	21,263	75,785	9,878			116	69
New Zealand	153,854	28,405	1,491	158	21	13	218	74
Other Oceania	33,893	3,688	1,778	206			138	37
Belgian Kongo	1,498	216					143	59
British West Africa	34,778	3,631	6,470	826			88	22
British South Africa	1,495,449	160,324	33,020	4,127			23,455	4,605
British East Africa	450	97						
Canary Islands	8,202	742						
Egypt	41,755	5,572	295	54				
Other French Africa	384	54						
Liberia	1,684	195					95	10
Morocco	1,353	186	910	105	36	13		
Portuguese East Africa	46,095	5,150	33,200	4,211			64	36
Other Portuguese Africa	44	13			12	7	6,962	1,124
Total	59,594,422	9,154,711	33,660,937	2,919,767	76,342	23,992	2,033,468	228,071

BY-PRODUCTS OF THE FISHERIES

Although the value of the by-products does not make an impressive total, as compared to the value of canned products, their production is of importance in offsetting excessive overhead costs and salvaging valuable materials that would otherwise be completely lost. Principal among the by-products are the fish oils, fish scrap, crushed shells, and fish glue. Including the oil and scrap produced in the menhaden industry, the by-products in 1923 had a total value of $12,702,861, as compared with $11,390,693 in 1922.

FISH OILS

The fish-oil production in the United States and Alaska in 1923 amounted to 9,590,875 gallons, valued at $4,228,592. This does not include the production of whale oil, which in 1923 was 1,346,356 gallons, valued at $701,731, nor sperm oil, which was 210,474 gallons, valued at $90,153. The largest item of fish oil was menhaden oil, of which 7,461,365 gallons were produced, valued at $3,316,277. In 1922 the total production of fish oil was 8,288,328 gallons, valued at $3,346,046. There was thus in 1923 an increase of 16 per cent in the total quantity of fish oils (exclusive of whale and sperm) and 26 per cent in value.

FISH SCRAP AND MEAL

The total value of all fish scrap and meal, green and dry, including that prepared from shrimp and menhaden, was, in 1923, $4,413,385, as compared with $4,336,677 the previous year, an increase of 24 per cent. There was a relatively greater production of the crude or green scrap this year than last.

LIQUID FISH GLUE

In 1923 the production of liquid fish glue was 465,814 gallons, valued at $680,054, an increase of 44 per cent in quantity and 145 per cent in value over the production of 1922, which was 323,003 gallons, valued at $278,424.

SHELL BY-PRODUCTS

The principal source of shells is the oyster industry, which in 1923 furnished the material for the production of 224,983 tons of crushed shells for poultry food and 83,808 tons of oyster-shell lime, both together having a value of $2,358,535, as compared with $2,437,051 in 1922. The shell by-products of the pearl-button industry in the interior United States consisted of 6,830 tons of crushed mussel shells, 510 tons of lime dust, and 1,417 tons of stucco, valued altogether at $68,271.

Production of various by-products of the fisheries, 1923

Products	Maine, Massachusetts, and New York		Maryland and Virginia		North Carolina, Georgia, and Florida		Alabama, Mississippi, and Louisiana	
	Quantity	*Value*	*Quantity*	*Value*	*Quantity*	*Value*	*Quantity*	*Value*
Fish scrap and meal:								
Dried ..... tons	3,233	$132,519	2,203	$69,062				
Crude or green ..... do	1,593	13,721						
Shrimp bran ..... do					325	$17,475	944	$30,815
Oil:								
Herring ..... gallons	49,579	15,861						
Sperm ..... do	93,505	46,753						
Cod-liver, crude [1] ..... do	94,394	49,166						
Miscellaneous ..... do	5,099	1,772	22,250	7,438	1,320	876		
Liquid glue ..... do	465,814	680,054						
Miscellaneous by-products [2] ..... pounds	624,666	56,920	40,000	2,800	63,324	13,498		
Total		996,766		79,300		31,849		30,815

Products	Alaska, Washington, Oregon, and California		Indiana, Pennsylvania, and Wisconsin		Total	
	Quantity	*Value*	*Quantity*	*Value*	*Quantity*	*Value*
Fish scrap and meal:						
Dried ..... tons	17,200	$1,055,517			22,636	$1,257,098
Crude or green ..... do					1,593	13,721
Shrimp bran ..... do					1,269	48,290
Oil:						
Salmon ..... gallons	78,801	33,178			78,801	33,178
Sardine ..... do	966,247	424,103			966,247	424,103
Tuna ..... do	44,584	21,815			44,584	21,815
Herring ..... do	895,845	368,192			945,424	384,053
Whale ..... do	1,346,356	701,731			1,346,356	701,731
Sperm ..... do	116,969	43,400			210,474	90,153
Cod-liver, crude [1] ..... do					94,394	49,166
Miscellaneous ..... do	167,707	59,337	29,720	$14,295	226,096	83,718
Liquid glue ..... do					465,814	680,054
Miscellaneous by-products [2] ..... pounds	3,280	2,604			731,270	75,822
Total		2,709,877		14,295		3,862,902

[1] Includes about 5,000 gallons refined for medicinal use.
[2] Includes shark hides and fins, herring skins and scales, pearl or fish-scale essence, and whalebone.

Production of shell by-products, 1923

States	Crushed oyster shells (for poultry)		Oyster-shell lime		Total	
	Tons	*Value*	*Tons*	*Value*	*Tons*	*Value*
Rhode Island, New York, New Jersey, and Pennsylvania	18,063	$211,982	5,402	$20,026	23,465	$232,008
Maryland	81,862	726,226	36,319	95,694	118,181	821,920
Virginia	19,682	201,488	31,341	215,506	51,023	416,994
North Carolina, South Carolina, and Georgia	5,818	61,218	5,300	30,500	11,118	91,718
Alabama and Florida	19,693	165,272	999	3,775	20,692	169,047
Mississippi	32,789	278,031	2,285	2,285	35,074	280,316
Louisiana and Texas	47,076	342,032	2,162	4,500	49,238	346,532
Total	224,983	1,986,249	83,808	372,286	308,791	2,358,535

States	Crushed fresh-water mussel shells (for poultry)	
	Tons	*Value*
Iowa	5,072	$38,642
Illinois	590	4,588
Indiana, Kentucky, and Ohio	412	3,146
Kansas and Missouri	225	1,804
Wisconsin	531	3,746
Total	6,830	51,826

NOTE.—In addition to the above there were produced elsewhere 217 tons crushed marine clam shells, valued at $2,600, and in Iowa, Illinois, Kentucky, Missouri, Ohio, and Wisconsin 510 tons of lime dust, valued at $1,522, and 1,417 tons of stucco, valued at $14,923.

MENHADEN INDUSTRY

In 1923 there were 52 factories engaged in the manufacture of fish oil, scrap, and meal from menhaden, distributed as follows: Massachusetts, 1; Connecticut, 1; New York, 2; New Jersey, 3; Delaware, 3; Virginia, 18; North Carolina, 17; Georgia, 1; Florida, 4; and Texas, 2. This is an increase of 7 plants as compared with 1922.

The number of fish utilized was 1,110,291,427, or 666,174,873 pounds, as compared with 1,212,450,669 fish, or 747,470,402 pounds, in 1922. The production of dry scrap and meal was 43,452 tons, valued at $2,029,406, and of wet or acidulated scrap 44,935 tons, valued at $1,064,870, as compared with 67,821 tons, valued at $2,665,441, and 25,712 tons, valued at $555,973, respectively, in 1922. The production of menhaden oil amounted to 7,461,365 gallons, valued at $3,316,277, as compared with 7,102,677, valued at $2,904,833, in 1922 The total value of menhaden products in 1923 amounted to $6,410,553, as compared with $6,126,591 in the previous year.

Products of the menhaden industry, 1923

Products	Massachusetts, Connecticut, and New York		New Jersey and Delaware		Virginia	
	Quantity	*Value*	*Quantity*	*Value*	*Quantity*	*Value*
Fish utilized: Menhaden ....number..	270, 688, 228	$1, 083, 007	142, 774, 000	$598, 584	390, 377, 144	$1, 523, 064
Manufactured products:						
Dry scrap and fish meal..tons..	1, 730	34, 300	852	38, 340	28, 944	1, 402, 303
Acidulated scrap........do..	21, 250	494, 250	11, 445	261, 563	....	....
Total..................	22, 980	528, 550	12, 297	299, 903	28, 944	1, 402, 303
Oil..................gallons..	2, 479, 235	1, 097, 127	909, 050	411, 805	2, 717, 922	1, 206, 757
Grand total..............	....	1, 625, 677	....	711, 708	....	2, 609, 060

Products	North Carolina		Georgia, Florida, and Texas		Total	
	Quantity	*Value*	*Quantity*	*Value*	*Quantity*	*Value*
Fish utilized: Menhaden ....number..	132, 665, 178	$530, 660	173, 786, 907	$695, 148	[1] 1, 110, 291, 427	$4, 430, 463
Manufactured products:						
Dry scrap and fish meal ....tons..	4, 596	196, 672	7, 330	357, 791	[2] 43, 452	2, 029, 406
Acidulated scrap........do..	7, 068	178, 785	5, 172	130, 272	44, 935	1, 064, 870
Total..................	11, 664	375, 457	12, 502	488, 063	88, 387	3, 094, 276
Oil..................gallons..	777, 829	349, 245	577, 329	251, 343	7, 461, 365	3, 316, 277
Grand total..............	....	724, 702	....	739, 406	....	6, 410, 553

[1] 666,174,873 pounds.
[2] Of this quantity 10,004 tons, valued at $357,178, were reported as fish meal.

COLD-STORAGE HOLDINGS OF FROZEN FISH IN 1923

The statistics of the cold-storage holdings of frozen fish and the quantity of fish frozen are collected by the Bureau of Agricultural Economics, Department of Agriculture. These statistics were collected by the Bureau of Markets and Crop Estimates, Department of Agriculture, from October, 1916, to June, 1922. The reports give the holdings on the 15th of each month. Through the courtesy of that bureau arrangements were made in December, 1921, for the Bureau of Fisheries to publish and disseminate this information, beginning with the returns for January 15, 1922, in the form of a monthly statistical bulletin. This bulletin gives the holdings by species and sections, total holdings for the current month and for the same month the previous year, the 5-year average, holdings for the previous month, and the quantity of each species frozen during the month and during the same month the previous year.

In 1923 the cold-storage holdings of fish, as compared with 1922, were smaller from January to June and larger from July to December being smallest in April and largest in December.

The following table gives the total holdings of all the freezers in 1923 which were devoted wholly or in part to the cold storage of fish, together with the totals for the years 1917 to 1922, inclusive, for comparison:

Monthly holdings of frozen fish in the United States in 1923, by species, and in 1917 to 1922, by totals

Species	Month ended					
	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Bluefish (all trade sizes)	584, 272	353, 467	164, 225	77, 095	47, 518	64, 102
Butterfish (all trade sizes)	459, 800	218, 224	137, 786	84, 233	25, 083	146, 548
Catfish	431, 262	363, 682	244, 264	158, 877	165, 206	115, 365
Ciscoes (including bluefin, blackfin, chub, lake herring, etc.)	5, 035, 408	2, 881, 589	1, 405, 389	725, 489	270, 788	184, 625
Ciscoes (tullibees)	861, 644	778, 923	552, 997	322, 554	227, 515	195, 809
Cod, haddock, hake, pollock	325, 654	153, 731	125, 286	191, 596	354, 031	472, 220
Croaker	4, 210	2, 863	653	114, 563	211, 873	488, 593
Flounders	259, 541	120, 551	91, 925	94, 035	200, 796	576, 312
Halibut (all trade sizes)	3, 779, 318	2, 296, 364	711, 655	381, 808	1, 284, 648	2, 641, 059
Herring, sea (including alewives and bluebacks)	2, 484, 139	1, 518, 641	1, 172, 046	936, 217	1, 647, 713	2, 050, 867
Lake trout	1, 441, 352	836, 531	285, 443	49, 776	43, 211	195, 577
Mackerel (except Spanish)	4, 652, 764	3, 440, 104	2, 696, 475	1, 705, 987	1, 474, 894	1, 721, 709
Pike perches and pike or pickerel	2, 015, 425	1, 317, 595	820, 767	329, 358	695, 255	1, 499, 231
Sablefish (black cod)	393, 824	257, 757	142, 851	59, 441	60, 428	129, 487
Salmon, silver and fall	2, 785, 545	2, 563, 165	1, 671, 868	908, 567	518, 714	310, 641
Salmon, steelhead trout	679, 824	342, 985	67, 439	50, 866	62, 106	54, 351
Salmon, all other	3, 309, 030	1, 739, 652	1, 111, 900	771, 933	589, 057	634, 392
Scup (porgies)	1, 549, 700	1, 199, 858	1, 090, 304	1, 027, 904	909, 940	953, 293
Shad and shad roe	229, 507	136, 098	43, 733	35, 396	151, 205	260, 150
Shellfish	428, 465	268, 764	182, 663	214, 020	230, 015	231, 872
Smelts, eulachon, etc	236, 845	166, 662	283, 371	91, 771	85, 617	74, 341
Squeteagues or "sea trout"	352, 049	55, 197	11, 592	9, 582	204, 603	348, 784
Squid	233, 037	99, 331	83, 647	40, 129	37, 900	951, 828
Sturgeon and spoonbill cat	445, 895	410, 407	310, 267	265, 154	214, 425	232, 965
Suckers	17, 569	3, 109	10, 176	4, 703	18, 330	22, 918
Whitefish	1, 561, 553	1, 220, 814	852, 204	256, 260	146, 902	175, 675
Whiting	2, 395, 008	1, 144, 828	729, 262	380, 563	165, 410	159, 040
Miscellaneous frozen fish	3, 311, 051	2, 627, 328	1, 884, 916	1, 216, 773	1, 881, 890	2, 787, 373
Total, 1923	40, 263, 691	26, 519, 120	16, 894, 164	10, 594, 710	11, 925, 073	17, 679, 127
Total, 1922	48, 320, 212	37, 742, 262	25, 474, 714	17, 484, 975	17, 075, 917	20, 821, 345
Total, 1921	53, 851, 000	42, 116, 000	33, 404, 000	28, 440, 000	26, 346, 000	32, 311, 000
Total, 1920	61, 510, 357	47, 904, 057	29, 958, 132	20, 632, 834	19, 803, 817	27, 779, 230
Total, 1919	80, 683, 761	67, 617, 473	50, 036, 475	37, 110, 856	37, 174, 104	48, 840, 359
Total, 1918	51, 116, 037	35, 907, 071	28, 457, 301	26, 548, 272	31, 403, 425	50, 298, 027
Total, 1917	32, 234, 530	14, 727, 099	13, 374, 429	9, 516, 217	14, 040, 024	27, 791, 047

Monthly holdings of frozen fish in the United States in 1923, by species, and in 1917 to 1922, by totals—Continued

Species	Month ended					
	July 15	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Bluefish (all trade sizes)	260, 079	281, 548	330, 373	503, 004	465, 986	474, 180
Butterfish (all trade sizes)	235, 730	383, 557	409, 358	496, 165	605, 085	518, 635
Catfish	114, 715	176, 516	164, 553	315, 077	381, 606	340, 389
Ciscoes (including bluefin, blackfin, chub, lake herring, etc.)	440, 389	4, 011, 074	8, 347, 401	10, 317, 394	9, 590, 272	12, 110, 876
Ciscoes (tullibees)	193, 353	215, 417	309, 435	444, 941	545, 396	657, 852
Cod, haddock, hake, pollock	537, 061	875, 276	1, 019, 013	1, 243, 287	1, 450, 754	1, 541, 771
Croaker	363, 266	351, 850	339, 445	392, 356	348, 064	327, 493
Flounders	640, 948	690, 650	593, 838	735, 933	702, 963	653, 863
Halibut (all trade sizes)	4, 500, 103	5, 788, 723	7, 574, 946	7, 191, 619	6, 870, 307	6, 287, 017
Herring, sea (including alewives and bluebacks)	2, 818, 420	3, 435, 332	3, 484, 113	3, 830, 883	4, 118, 240	3, 385, 846
Lake trout	281, 412	370, 868	383, 122	576, 372	1, 191, 235	1, 611, 529
Mackerel (except Spanish)	2, 698, 169	2, 934, 802	5, 322, 185	6, 755, 510	6, 253, 804	5, 505, 332
Pike perches and pike or pickerel	1, 368, 776	1, 193, 426	1, 126, 067	1, 477, 014	1, 955, 150	3, 326, 930
Sablefish (black cod)	864, 023	1, 438, 279	1, 912, 926	2, 126, 880	2, 234, 092	2, 123, 445
Salmon, silver and fall	713, 120	981, 622	1, 828, 089	3, 505, 965	3, 832, 490	3, 251, 575
Salmon, steelhead trout	290, 023	571, 714	845, 094	889, 762	986, 485	879, 119
Salmon, all other	2, 138, 638	3, 345, 629	4, 725, 535	4, 908, 772	4, 684, 777	3, 787, 517
Scup (porgies)	1, 124, 537	1, 154, 520	1, 222, 977	1, 155, 134	1, 036, 881	836, 085
Shad and shad roe	306, 481	419, 169	439, 940	470, 886	466, 951	565, 195
Shellfish	240, 381	345, 290	376, 846	625, 364	666, 308	932, 481
Smelts, eulachon, etc	68, 606	75, 560	78, 703	109, 638	145, 565	244, 103
Squeteagues or "sea trout"	578, 527	643, 656	726, 573	1, 698, 677	1, 538, 208	1, 211, 522
Squid	1, 343, 477	1, 403, 842	1, 284, 967	1, 159, 907	925, 792	774, 103
Sturgeon and spoonbill cat	277, 193	318, 391	336, 828	333, 916	388, 052	343, 985
Suckers	24, 918	19, 077	18, 054	17, 353	20, 744	17, 357
Whitefish	257, 771	568, 127	677, 003	833, 469	1, 124, 697	1, 688, 948
Whiting	1, 343, 637	3, 187, 652	4, 697, 684	5, 058, 395	5, 087, 778	4, 507, 470
Miscellaneous frozen fish	3, 288, 013	3, 855, 408	4, 622, 371	5, 570, 808	5, 840, 229	6, 386, 962
Total, 1923	27, 321, 366	39, 036, 975	53, 197, 438	62, 744, 481	63, 457, 884	64, 291, 589
Total, 1922	25, 620, 042	32, 226, 170	41, 141, 144	54, 756, 783	54, 502, 283	48, 689, 830
Total, 1921	40, 160, 000	47, 431, 000	54, 469, 000	58, 899, 000	61, 228, 000	59, 125, 646
Total, 1920	36, 617, 706	47, 140, 132	56, 295, 975	64, 730, 531	67, 549, 377	65, 841, 000
Total, 1919	59, 674, 301	65, 145, 234	69, 580, 565	76, 763, 253	78, 769, 101	74, 202, 339
Total, 1918	64, 864, 532	82, 554, 798	80, 203, 946	93, 811, 909	99, 631, 789	96, 600, 247
Total, 1917	38, 431, 221	44, 024, 666	47, 107, 660	60, 676, 722	70, 938, 957	69, 986, 671

QUANTITIES OF FISH FROZEN IN 1923

The total quantity of fish frozen during the year ended December 15, 1923, was 91,548,643 pounds, an increase of 16,094,969 pounds, or 21.3 per cent, over the previous year. The principal species frozen during the year were ciscoes, 16,101,224 pounds; salmon, 11,043,424 pounds; halibut, 10,211,251 pounds; whiting, 8,664,680 pounds; mackerel, 7,248,381 pounds; herring, 5,748,228 pounds; and pike perches and pike or pickerel, 4,283,697 pounds. The following table gives the quantity of fish frozen in the United States in 1923, by months, with totals for 1920 to 1922, inclusive, for comparison:

Fish frozen monthly in 1923, by species, and in 1920 to 1922, by totals

Species	Month ended						
	Jan. 15	Feb. 15	Mar. 15	Apr. 15	May 15	June 15	July 15
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Bluefish (all trade sizes)	3,056	259	240	50	1,000	24,910	204,275
Butterfish (all trade sizes)	330	295	35	3,500	7,782	154,457	105,946
Catfish	214,550	12,407	14,497	18,136	39,621	10,108	22,808
Ciscoes (including bluefin, blackfin, chub, lake herring, etc.)	921,082	76,765	66,249	24,352	15,863	72,640	397,146
Ciscoes (tullibees)	139,217	26,944	30,051	13,660		3,725	2,253
Cod, haddock, hake, pollock	33,604	31,507	28,150	40,104	214,780	166,401	145,733
Croaker				114,244	105,783	18,052	52,668
Flounders	4,372	23,255	10,725	32,237	147,592	413,179	78,578
Halibut (all trade sizes)	160,895	142,996	81,301	182,762	1,209,740	1,432,445	2,244,047
Herring, sea (including alewives and bluebacks)	58,425	131,759	104,820	514,440	982,782	701,399	667,523
Lake trout	26,204	10,747	2,172	5,837	3,919	106,209	85,724
Mackerel (except Spanish)	191,297	185,010	216,052	24,211	207,812	451,799	1,041,630
Pike perches and pike or pickerel	43,074	25,942	33,187	14,523	449,123	961,693	185,504
Sablefish (black cod)	17,243	27,130	17,732	18,781	33,633	77,974	757,041
Salmon, silver and fall	93,203	95,437	8,808	19,541	51,159	55,582	493,093
Salmon, steelhead trout	2,485			480	856	20,213	255,365
Salmon, all other	26,490	74,686	28,929	11,103	203,264	245,445	1,749,376
Scup (porgies)	782					137,500	214,241
Shad and shad roe	1,009	257	20	16,038	126,390	142,120	31,996
Shellfish	123,762	109,570	42,283	100,574	95,250	97,963	95,614
Smelts, eulachon, etc	28,200	28,357	13,372	11,570	17,635	110	15
Squeteagues or "sea trout"	2,275			2,432	200,415	52,265	237,833
Squid		3,091			21,964	928,905	463,277
Sturgeon and spoonbill cat	3,550	13,986	30	10,607	63,447	71,679	61,512
Suckers	833				11,411	13,020	
Whitefish	80,463	73,823	21,417	41,952	2,843	41,197	86,046
Whiting	231,886	129,270	468,078	4,434		121,568	1,518,104
Miscellaneous frozen fish	333,251	438,642	224,342	173,820	812,815	1,088,569	674,297
Total frozen fish, 1923	2,741,538	1,662,135	1,412,490	1,400,078	5,026,888	7,671,127	11,871,645
Total frozen fish, 1922	1,452,801	1,363,942	1,496,538	1,980,435	5,849,537	7,376,237	9,121,160
Total frozen fish, 1921	2,843,000	1,770,000	2,413,000	2,698,000	9,624,000	10,151,000	9,845,000
Total frozen fish, 1920	2,273,744	2,630,482	2,465,375	3,687,538	10,094,367	12,761,791	13,620,232

Species	Month ended					Total
	Aug. 15	Sept. 15	Oct. 15	Nov. 15	Dec. 15	
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Bluefish (all trade sizes)	43,017	44,463	197,203	22,811	59,127	600,411
Butterfish (all trade sizes)	154,344	46,689	117,263	176,142	26,438	793,221
Catfish	59,468	28,139	135,469	70,727	25,290	651,220
Ciscoes (including bluefin, blackfin, chub, lake herring, etc.)	3,583,530	5,194,742	2,004,259	678,663	3,065,933	16,101,224
Ciscoes (tullibees)	1,526	27,710	26,404	5,300	113,781	390,571
Cod, haddock, hake, pollock	418,164	239,808	337,984	344,835	221,517	2,222,677
Croaker	6,296	7,316	61,541	14,000		379,900
Flounders	97,707	27,286	161,512	45,554	45,188	1,087,185
Halibut (all trade sizes)	1,574,852	1,797,756	401,152	569,229	414,067	10,211,251
Herring, sea (including alewives and bluebacks)	914,347	367,819	563,179	528,471	213,264	5,748,228
Lake trout	106,801	64,594	124,374	614,453	609,094	1,820,128
Mackerel (except Spanish)	340,610	2,521,194	1,770,455	178,640	110,671	7,248,381
Pike perches and pike or pickerel	21,621	128,079	434,203	450,639	1,536,109	4,283,697
Sablefish (black cod)	569,913	378,032	281,027	240,210	73,108	2,491,824
Salmon, silver and fall	249,946	612,052	1,685,185	977,257	132,225	4,473,488
Salmon, steelhead trout	283,456	279,591	182,203	29,574	14,134	1,068,357
Salmon, all other	1,200,689	1,138,630	473,132	203,534	146,301	5,501,579
Scup (porgies)	71,780	82,867	8,313	74		515,557
Shad and shad roe	8,705	2,861	1,932	281	3,837	336,046
Shellfish	67,193	155,492	275,271	162,544	351,296	1,676,812
Smelts, eulachon, etc	1,373	2,203	30,432	38,467	23,243	194,977
Squeteagues or "sea trout"	142,953	150,645	976,592	5,741	12,853	1,784,004
Squid	198,468	21,401	37,862	10,020	9,302	1,694,290
Sturgeon and spoonbill cat	77,557	48,443	22,649	74,661	33,950	482,071
Suckers	350	4,454	1,707	4,066	3,799	39,640
Whitefish	303,401	83,694	52,597	210,259	602,223	1,599,915
Whiting	2,546,912	1,845,098	1,032,249	414,998	352,083	8,664,680
Miscellaneous frozen fish	898,990	1,116,074	1,115,477	880,489	1,730,554	9,487,309
Total frozen fish, 1923	13,943,978	16,417,132	12,511,606	6,951,639	9,938,387	91,548,643
Total frozen fish, 1922	10,826,942	16,830,080	9,344,469	7,069,995	2,741,538	75,453,674
Total frozen fish, 1921	9,356,000	9,990,000	9,869,000	8,173,000	2,441,892	79,173,892
Total frozen fish, 1920	11,803,606	11,168,810	9,711,800	9,750,844	4,005,000	93,973,589

NEW ENGLAND VESSEL FISHERIES

GENERAL STATISTICS

The vessel fisheries centering at Boston and Gloucester, Mass., and Portland, Me., were more productive in 1923 than in either of the two previous years. There was an increase of 2.93 per cent in the number of trips, and of 9.42 per cent in the quantity and 29 per cent in the value of the products as compared with 1922. The increase in the number of trips and in the quantity of the products was all at Boston, but there was an increase in the value of the products at each of the three ports. The increase in the number of trips at Boston was 16.42 per cent, with a decrease at Gloucester of 4.48 per cent, and at Portland of 11.92 per cent. At Boston the increase in the products landed amounted to 16.97 per cent in quantity and 35.16 per cent in value; at Gloucester there was a decrease of 7.21 per cent in quantity, with an increase of 11.97 per cent in value; and at Portland a decrease of 1.49 per cent in quantity, with an increase of 11.73 per cent in value. Statistics of the fisheries have been collected by the local agents and published in monthly bulletins, showing by species and fishing grounds the quantities and values of fishery products landed by American fishing vessels during the year at these ports. Two annual bulletins have been issued, one showing the catch by months and the other by fishing grounds.

The fishing fleet at these ports during the calendar year 1923, numbered 306 sail, steam, and gasoline vessels, including 33 steam trawlers. These vessels landed at Boston 3,368 trips, aggregating 124,215,034 pounds of fish, valued at $5,433,731; at Gloucester, 1,579 trips, aggregating 35,029,848 pounds, valued at $910,739; and at Portland, 1,588 trips, aggregating 15,696,587 pounds, valued at $706,684. The total for the three ports amounted to 6,535 trips, aggregating 174,941,469 pounds of fresh and salted fish, having a value to the fishermen of $7,051,154.

Compared with the previous year there was an increase of 186 trips, or 2.93 per cent, in the total number landed at Boston, Gloucester, and Portland, and an increase of 15,066,078 pounds, or 9.42 per cent, in the quantity, and of $1,585,222, or 29 per cent, in the value of the products landed. There was an increase in both the quantity and value of cod, haddock, hake, cusk, and mackerel, and a decrease in quantity with an increase in value of pollock, halibut, and swordfish. In the herring catch there was a decrease in both quantity and value. The catch of cod increased 7,475,109 pounds, or 13.55 per cent, in quantity and $548,862, or 33.56 per cent, in value; haddock increased 3,565,525 pounds, or 5.08 per cent, in quantity and $613,777, or 33.92 per cent, in value; hake increased 963,530 pounds, or 17.93 per cent, in quantity and $31,036, or 27.88 per cent, in value; cusk increased 750,756 pounds or 33.40 per cent in quantity and $27,176, or 78.65 per cent in value; and mackerel increased 6,838,481 pounds or 144.68 per cent in quantity and $211,138 or 76.36 per cent in value. The catch of pollock decreased 292,759 pounds or 5.74 per cent in quantity and increased $34,183, or 28.97 per cent, in value; halibut decreased 749,645 pounds, or 13.33 per cent, in quantity and increased $138,597, or 17.68 per cent, in value; and swordfish decreased 826,329 pounds, or 25.18 per cent, in quantity and increased $1,103, or 0.25 per cent, in value. The herring catch decreased 1,161,514 pounds, or 43.92 per cent, in quantity and $36,636, or 45.14 per cent, in value. The Newfoundland herring catch decreased from 2,302,420 pounds, valued at $76,855 in 1922, to 1,219,300 pounds, valued at $40,861 in 1923. In the various other species combined there was a decrease of 1,497,076 pounds, or 27.20 per cent, in quantity and an increase of $15,986, or 9.48 per cent, in value.

The catch of scrod cod landed at these ports decreased from 815,371 pounds, valued at $9,200, in 1922, to 414,659 pounds, valued at $6,447, in 1923, and the catch of scrod haddock increased from 253,283 pounds, valued at $4,261, in 1922, to 4,845,695 pounds, valued at $94,481, in 1923. The small quantity of these grades landed, as compared with other grades of these species, is said to be due to the fact that the price is so low that the fishermen do not save all that are caught.

The following tables present in detail, by fishing grounds and also by months, the fishery products landed at Boston and Gloucester, Mass., and Portland, Me., by American fishing vessels for the calendar year 1923. The weights of fresh and salted fish given in these statistics represent the fish as landed from the vessels, and the values are those received by the fishermen. The grades, or sizes, given for certain species are those recognized in the trade.

Statement, by fishing grounds, of quantities and values of certain fishery products landed at Boston and Gloucester, Mass., and Portland, Me., by American fishing vessels during the calendar year 1923

Fishing grounds	Cod							
	Large (10 pounds and over)				Market (under 10 and over 2½ pounds)			
	Fresh		Salted		Fresh		Salted	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
LANDED AT BOSTON								
East of 66° W. longitude								
La Have Bank	454,892	$17,034			96,602	$2,703		
Western Bank	2,768,700	112,060	17,500	$700	1,747,385	43,497		
Quereau Bank	38,975	1,434	2,375	112	1,500	30		
Grand Bank	1,670	50						
St. Peters Bank	6,900	233			400	10		
Cape Shore	20,650	1,745			24,820	1,008		
The Gully	2,450	98			170	3		
West of 66° W. longitude								
Browns Bank	2,331,581	117,416			2,165,542	56,551		
Georges Bank	11,711,036	501,490	8,000	360	4,016,222	113,517		
Cashes Bank	40,950	3,629			24,707	1,206		
Clark Bank	25,510	766			4,260	93		
Fippenies Bank	50,365	1,909			40,645	846		
Middle Bank	164,575	10,579			111,020	4,869		
Jeffreys Ledge	177,587	10,889			127,525	4,328		
Ipswich Bay	5,520	386						
South Channel	3,624,659	185,277			4,228,715	106,777		
Nantucket Shoals	555,124	27,144			1,045,400	23,600		
Off Highland Light	9,160	275			7,160	179		
Off Chatham	239,098	9,918			267,545	6,664		
Seal Island	76,065	4,134			102,860	3,177		
Shore, general	1,209,402	57,415	2,065	81	354,777	10,654		
Total	23,514,769	1,063,881	29,940	1,253	14,307,255	379,712		

Statement, by fishing grounds, of quantities and values of certain fishery products landed at Boston and Gloucester, Mass., and Portland, Me., by American fishing vessels during the calendar year 1923*—Continued

Fishing grounds	Cod—Continued							
	Large (10 pounds and over)				Market (under 10 and over 2½ pounds)			
	Fresh		Salted		Fresh		Salted	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
LANDED AT GLOUCESTER								
East of 66° W. longitude								
La Have Bank	188,905	$4,643	12,720	$615	148,505	$2,519	2,815	$112
Western Bank	4,538,430	101,533	920,090	43,415	3,429,460	59,448	864,407	32,066
Quereau Bank	372,439	8,597	662,185	31,537	346,030	6,246	207,230	9,258
Misaine Bank	13,245	331			670	13		
Grand Bank	104,890	2,298	475,455	22,702	7,362	108	65,545	2,545
St. Peters Bank	154,345	3,515	248,160	12,201	13,515	255	88,630	3,407
The Gully	86,710	1,927	72,355	3,448	5,955	107	9,055	341
West of 66° W. longitude								
Browns Bank	260,765	6,498	19,865	947	260,640	4,985	4,144	156
Georges Bank	1,790,395	44,219	241,060	11,735	1,499,385	29,211	40,665	1,492
Jeffreys Ledge					120	2		
South Channel	123,250	3,087			429,410	8,352		
Nantucket Shoals					130	3		
Shore, general	2,008,756	101,819	160	8	7,460	149		
Total	9,642,130	278,467	2,652,059	126,698	6,148,642	111,398	1,282,401	49,377
LANDED AT PORTLAND								
East of 66° W. longitude								
La Have Bank	2,460	74	27,015	1,370	145	3	7,325	307
Western Bank	1,432,455	30,259	60,400	2,978	130,260	4,516	13,215	395
Quereau Bank	5,840	263	8,800	418	1,410	28	1,600	60
Green Bank			15,150	847			700	35
Grand Bank	22,645	1,023	79,210	3,793	1,125	42	5,680	218
St. Peters Bank	11,625	610	14,410	684			320	12
The Gully	10,230	256	9,840	467	500	10	290	11
West of 66° W. longitude								
Browns Bank	24,780	1,206	33,827	1,798	31,370	725	12,140	592
Georges Bank	22,355	889	21,397	1,008	17,325	454	6,375	225
Cashes Bank	140,481	5,401	3,500	175	114,073	2,529	535	19
Fippenies Bank	8,178	348			7,345	248		
Platts Bank	99,495	5,120			61,380	1,803		
Jeffreys Ledge	235,980	14,131	4,420	221	157,055	5,872	950	38
Seal Island	2,570	167			4,070	116		
Shore, general	1,387,042	64,622	17,677	762	321,164	9,560	5,195	200
Total	3,406,136	124,369	295,646	14,521	847,222	25,900	54,325	2,112
Grand total	36,563,035	1,466,717	2,977,645	142,472	21,363,119	517,016	1,336,816	51,489

NOTE.—The items under "Miscellaneous" includes bluebacks, 44,740 pounds, value $368; butterfish, 19,209 pounds, value $2,678; flounders, 3,436,820 pounds, value $163,683; herring, fresh, 263,540 pounds, value $3,657; herring, salted, 1,219,300 pounds, value $40,861; rosefish, 15,260 pounds, value $334; salmon, 41 pounds, value $10; scup, 600 pounds, value $30; shad, 4,747 pounds, value $289; sharks, 12,407 pounds, value $234; skates, 9,705 pounds, value $110; smelt, 1,217 pounds, value $139; sturgeon, 1,413 pounds, value $260; swordfish, 2,455,419 pounds, value $448,119; tuna, 822 pounds, value $57; wolffish, 195,414 pounds, value $4,666; lobster, 69 pounds, value $24; squid, 110 pounds, value $6; scallops, 72 pounds, value $23; livers, 125,375 pounds, value $2,453; spawn, fresh, 129,376 pounds, value $8,972; spawn, salted, 8,600 pounds, value $258; and tongues, 375 pounds, value $30.

Statement, by fishing grounds, of quantities and values of certain fishery products landed at Boston and Gloucester, Mass., and Portland, Me., by American fishing vessels during the calendar year 1923—Continued

Fishing grounds	Cod—Continued				Haddock			
	Scrod (1 to 2½ pounds)				Large (over 2½ pounds)			
	Fresh		Salted		Fresh		Salted	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
LANDED AT BOSTON								
East of 66° W. longitude								
La Have Bank					272,210	$6,062		
Western Bank	8,450	$125			4,763,420	129,316		
Cape Shore	2,900	23			83,400	3,510		
West of 66° W. longitude								
Browns Bank	26,130	265			7,788,227	293,053		
Georges Bank	11,260	192			14,262,805	553,120		
Cashes Bank					22,665	1,440		
Clark Bank					136,400	4,787		
Fippenies Bank	3,140	21			24,505	613		
Middle Bank	18,670	340			1,137,814	66,866		
Jeffreys Ledge	8,270	151			736,257	39,296		
South Channel	30,066	440			24,131,326	845,296		
Nantucket Shoals	2,040	35			1,151,715	34,272		
Off Highland Light	360	4			5,750	460		
Off Chatham	6,865	69			1,067,780	52,621		
Seal Island	700	7			323,275	9,623		
Shore, general	11,305	165			216,829	11,786		
Total	130,155	1,837			56,124,378	2,052,121		
LANDED AT GLOUCESTER								
East of 66° W. longitude								
La Have Bank	640	4			107,225	1,072		
Western Bank	20,890	160	86,010	$2,568	2,869,060	29,389	40,250	$895
Quereau Bank	1,105	8	8,325	156	123,475	1,235	1,360	27
Grand Bank			500	12				
St. Peters Bank			13,570	465	150	2		
The Gully			490	18	100	1		
West of 66° W. longitude								
Browns Bank	3,110	25			419,365	4,194		
Georges Bank	5,990	46			2,567,265	27,154		
Middle Bank	730	5						
Jeffreys Ledge	600	5						
South Channel	650	6			1,137,230	11,135		
Nantucket Shoals					60,410	1,812		
Seal Island					59,000	1,475		
Shore, general	400	3			368,711	20,942		
Total	34,115	262	108,895	3,219	7,711,991	98,411	41,610	922
LANDED AT PORTLAND								
East of 66° W. longitude								
La Have Bank			7,160	128				
Western Bank	2,225	23	723	18	3,231,035	64,396		
Quereau Bank			5,200	94				
West of 66° W. longitude								
Browns Bank	2,975	15	1,200	27	85,100	3,216		
Georges Bank	925	5	550	11	101,660	3,951		
Cashes Bank	9,840	58			118,555	5,600		
Fippenies Bank	620	3			4,085	270		
Platts Bank	9,390	54			65,894	4,004		
Jeffreys Ledge	33,829	182			773,728	54,685		
Seal Island	165	1			6,610	446		
Shore, general	61,467	357	5,225	153	651,182	40,674		
Total	121,436	698	20,058	431	5,037,849	177,242		
Grand total	285,706	2,707	128,953	3,650	68,874,218	2,327,774	41,610	922

Statement, by fishing grounds, of quantities and values of certain fishery products landed at Boston and Gloucester, Mass., and Portland, Me., by American fishing vessels during the calendar year 1923—Continued

Fishing grounds	Haddock—Continued				Hake			
	Scrod (1 to 2½ pounds)				Large (6 pounds and over)			
	Fresh		Salted		Fresh		Salted	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
LANDED AT BOSTON								
East of 66° W. longitude								
La Have Bank	1, 200	$24						
Western Bank	38, 950	550						
Cape Shore	600	9						
West of 66° W. longitude								
Browns Bank	7, 600	85						
Georges Bank	674, 350	21, 878			700	$49		
Cashes Bank	475	5			600	12		
Fippenies Bank	67, 625	684						
Middle Bank	229, 629	5, 363			50, 974	3, 201		
Jeffreys Ledge	182, 735	4, 075			26, 135	1, 507		
South Channel	2, 923, 999	52, 914			38, 920	1, 056		
Nantucket Shoals	171, 180	3, 154						
Off Highland Light	470	19						
Off Chatham	68, 785	1, 015			2, 300	69		
Seal Island	2, 625	45						
Shore, general	46, 045	906	1, 975	$35	3, 015	168		
Total	4, 416, 268	90, 726	1, 975	35	122, 644	6, 062		
LANDED AT GLOUCESTER								
East of 66° W. longitude								
La Have Bank					4, 985	50		
Western Bank	37, 030	244			40, 880	410	270	$5
Quereau Bank					9, 885	104	3, 415	60
Grand Bank					18, 595	196	10, 125	175
St. Peters Bank					4, 425	45	1, 825	34
The Gully							70	1
West of 66° W. longitude								
Browns Bank	10, 100	102			53, 050	660		
Georges Bank	24, 790	130			11, 835	121	550	9
Middle Bank	3, 000	15			147, 675	1, 846		
Jeffreys Ledge	4, 900	25			25, 510	319		
South Channel	1, 770	35			57, 395	621		
Nantucket Shoals	9, 560	72			460	6		
Seal Island	1, 760	9						
Shore, general	7, 615	38			197, 290	4, 369		
Total	100, 585	670			571, 985	8, 747	16, 255	284
LANDED AT PORTLAND								
East of 66° W. longitude								
La Have Bank					3, 895	49		
Western Bank	1, 340	7						
Quereau Bank					6, 900	86	1, 135	23
West of 66° W. longitude								
Browns Bank	4, 700	41						
Georges Bank	4, 075	46						
Cashes Bank	25, 652	201			345	14		
Fippenies Bank	3, 155	23						
Platts Bank	14, 845	193			3, 715	185		
Jeffreys Ledge	152, 361	1, 364			20, 315	345		
Seal Island	910	5						
Shore, general	119, 829	1, 170			3, 625	127	49	2
Total	326, 867	3, 050			38, 795	806	1, 184	25
Grand total	4, 843, 720	94, 446	1, 975	35	733, 424	15, 615	17, 439	309

Statement, by fishing grounds, of quantities and values of certain fishery products landed at Boston and Gloucester, Mass., and Portland, Me., by American fishing vessels during the calendar year 1923—Continued

Fishing grounds	Hake—Continued: Small (under 6 pounds): Fresh		Salted		Pollock: Fresh		Salted	
	Pounds	*Value*	*Lbs.*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
LANDED AT BOSTON								
East of 66° W. longitude								
La Have Bank	13,202	$209			3,495	$63		
Western Bank	29,425	604			498,020	14,532		
Quereau Bank	3,900	29						
Cape Shore					1,140	25		
The Gully	300	6			50	1		
West of 66° W. longitude								
Browns Bank	44,775	1,568			213,265	6,928		
Georges Bank	115,040	3,269			626,200	21,633		
Cashes Bank	44,920	891			5,380	180		
Clark Bank					500	20		
Fippenies Bank	960	35			12,910	206		
Middle Bank	400,210	12,416			104,090	4,083		
Jeffreys Ledge	417,499	12,994			79,010	2,601		
South Channel	3,092,908	55,211			966,302	36,736		
Nantucket Shoals	28,735	414			82,205	2,312		
Off Highland Light	1,700	51			500	25		
Off Chatham	52,665	1,783			46,825	1,448		
Seal Island	16,140	259			2,420	58		
Shore, general	114,760	2,262	1,500	$24	434,359	13,274		
Total	4,377,145	92,001	1,500	24	3,076,671	104,125		
LANDED AT GLOUCESTER								
East of 66° W. longitude								
La Have Bank					6,060	61		
Western Bank					97,650	1,022	24,335	$508
Quereau Bank					6,570	65	6,760	134
Grand Bank							80	2
St. Peters Bank							2,675	78
The Gully							40	1
West of 66° W. longitude								
Browns Bank					8,470	84	375	8
Georges Bank					89,225	907	2,080	33
South Channel					14,680	148		
Shore, general					899,707	33,105		
Total					1,122,362	35,392	36,345	764
LANDED AT PORTLAND								
East of 66° W. longitude								
La Have Bank	1,220	15			910	14	225	5
Western Bank	580	9	1,900	38	67,740	959		
Quereau Bank					200	4	265	5
Grand Bank	8,125	85					215	6
Cape Shore							750	11
West of 66° W. longitude								
Browns Bank	4,455	55			860	11	795	19
Georges Bank	2,260	23	220	4	1,095	21		
Cashes Bank	145,716	1,876			50,815	593		
Fippenies Bank	2,700	215			4,113	88		
Platts Bank	83,575	2,213			29,147	666		
Jeffreys Ledge	408,324	15,371			145,210	4,340		
Seal Island	1,195	23			320	6		
Shore, general	546,691	14,465	1,308	26	266,198	5,152	90	2
Total	1,204,841	34,350	3,428	68	566,608	11,860	2,340	48
Grand total	5,581,986	126,351	4,928	92	4,765,641	151,377	38,685	812

Statement, by fishing grounds, of quantities and values of certain fishery products landed at Boston and Gloucester, Mass., and Portland, Me., by American fishing vessels during the calendar year 1923—Continued

Fishing grounds	Cusk				Halibut			
	Fresh		Salted		Fresh		Salted	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Lbs.*	*Value*
LANDED AT BOSTON								
East of 66° W. longitude								
La Have Bank	43,960	$633	23,000	$690	222,881	$46,171		
Western Bank	20,560	384			401,857	79,440		
Quereau Bank	21,075	239			452,857	81,786		
Green Bank					198,243	31,280		
Grand Bank	3,000	60			904,252	138,257		
St. Peters Bank					239,047	43,792		
Cape Shore	5,480	66						
The Gully	2,725	55			192,597	38,158		
West of 66° W. longitude								
Browns Bank	614,694	11,060			244,617	53,898		
Georges Bank	56,460	1,393			577,990	135,920		
Cashes Bank	60,486	1,288			239	90		
Clark Bank					490	132		
Fippenies Bank	74,950	1,016			1,052	319		
Middle Bank	221,520	6,348			3,436	816		
Jeffreys Ledge	166,175	3,641			3,387	982		
South Channel	125,905	2,487			99,213	23,793		
Nantucket Shoals					3,380	784		
Off Highland Light					289	47		
Off Chatham	19,065	659			6,549	1,404		
Seal Island	61,180	875			3,420	1,154		
Shore, general	19,735	604			4,570	1,036		
Total	1,516,969	31,408	23,000	690	3,560,375	679,259		
LANDED AT GLOUCESTER								
East of 66° W. longitude								
La Have Bank	30,990	399						
Western Bank	43,480	508	7,755	156	15,180	3,230	510	$36
Quereau Bank	35,055	479	7,740	123				
Grand Bank	4,210	56	5,220	100	8,980	1,239	220	18
St. Peters Bank	26,670	310	6,605	167				
The Gully	760	10	1,060	23	69,890	14,906		
West of 66° W. longitude								
Browns Bank	49,985	534	1,575	35				
Georges Bank	81,875	1,010	7,615	139	12,834	2,738	780	54
Middle Bank	8,270	99						
Jeffreys Ledge	6,530	101						
South Channel	1,800	23						
Shore, general	485	7						
Total	290,110	3,545	37,670	743	106,884	22,113	1,510	108
LANDED AT PORTLAND								
East of 66° W. longitude								
La Have Bank	14,015	206	12,920	355	82,159	13,084		
Western Bank	87,105	982	4,125	103	306,781	62,624		
Quereau Bank	8,195	110			127,503	23,176		
Green Bank					44,863	10,840		
Grand Bank	2,165	23	450	11	276,926	38,937		
St. Peters Bank					65,818	9,514		
Gulf of St. Lawrence					23,939	5,179		
The Gully			335	10	8,916	1,579		
West of 66° W. longitude								
Browns Bank	83,415	1,044	8,730	194	209,591	44,041		
Georges Bank	18,100	250			31,047	6,359		
Cashes Bank	185,942	2,670			6,113	997		
Fippenies Bank	3,970	148			1,107	202		
Platts Bank	103,585	2,465			1,262	286		
Jeffreys Ledge	312,015	9,499			4,941	826		
Seal Island	735	22						
Shore, general	284,575	7,248	180	2	14,769	2,630		
Total	1,103,817	24,667	26,740	675	1,205,735	221,174		
Grand total	2,910,896	59,620	87,310	2,108	4,872,994	922,546	1,510	108

Statement, by fishing grounds, of quantities and values of certain fishery products landed at Boston and Gloucester, Mass., and Portland, Me., by American fishing vessels during the calendar year 1923—Continued

Fishing grounds	Mackerel				Miscellaneous			
	Fresh		Salted		Fresh		Salted	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
LANDED AT BOSTON								
East of 66° W. longitude								
La Have Bank					6,016	$1,003		
Western Bank					92,081	4,333		
Quereau Bank					2,830	404		
Grand Bank					2,886	580		
Cape Shore	857,017	$63,049			30,126	6,015		
West of 66° W. longitude								
Browns Bank					112,938	10,685		
Georges Bank	16,794	2,861			2,786,424	404,926		
Middle Bank	904,089	42,739			20,210	1,996		
Jeffreys Ledge	100,959	22,683			21,433	1,450		
South Channel	30	2			1,037,288	57,050	8,600	$258
Nantucket Shoals	175,690	5,148			547,610	29,026		
Off Highland Light					300	6		
Off Chatham	6,700	402			13,649	823		
Shore, general	4,518,787	179,605	187,600	$12,719	1,501,924	82,744		
Total	6,580,066	316,489	187,600	12,719	6,175,724	601,131	8,600	258
LANDED AT GLOUCESTER								
East of 66° W. longitude								
Off Newfoundland							1,219,300	40,861
Cape Shore	3,180	254	10,000	550				
West of 66° W. longitude								
Shore, general	3,184,083	85,170	611,800	38,284	95,946	4,500		
Total	3,187,263	85,424	621,800	38,834	95,946	4,500	1,219,300	40,861
LANDED AT PORTLAND								
East of 66° W. longitude								
Western Bank					1,190	16		
Quereau Bank					1,789	244		
Cape Shore	113,345	9,304	6,275	344				
Gulf of St. Lawrence					170	14		
West of 66° W. longitude								
Browns Bank					4,244	687		
Georges Bank					137,578	23,520		
Cashes Bank					417	7		
Fippenies Bank					125	1		
Platts Bank					300	19		
Jeffreys Ledge					26,918	1,571		
Shore, general	803,749	22,578	65,130	1,945	272,330	4,432		
Total	917,094	31,882	71,405	2,289	445,061	30,511		
Grand total	10,684,423	433,795	880,805	53,842	6,716,731	636,142	1,227,900	41,119

Statement, by fishing grounds, of quantities and values of certain fishery products landed at Boston and Gloucester, Mass., and Portland, Me., by American fishing vessels during the calendar year 1923—Continued

Fishing grounds	Number of trips	Total				Grand total	
		Fresh		Salted			
		Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
LANDED AT BOSTON							
East of 66° W. longitude							
La Have Bank	29	1, 114, 458	$73, 902	23, 000	$690	1, 137, 458	$74, 592
Western Bank	162	10, 368, 848	384, 841	17, 500	700	10, 386, 348	385, 541
Quereau Bank	17	521, 137	84, 012	2, 375	112	523, 512	84, 124
Green Bank	7	198, 243	31, 280			198, 243	31, 280
Grand Bank	27	911, 808	138, 947			911, 808	138, 947
St. Peters Bank	8	246, 347	44, 035			246, 347	44, 035
Cape Shore	26	1, 026, 133	75, 450			1, 026, 133	75, 450
The Gully	8	198, 292	38, 321			198, 292	38, 321
West of 66° W. longitude							
Browns Bank	240	13, 549, 369	552, 109			13, 549, 369	552, 109
Georges Bank	773	34, 855, 287	1, 760, 248	8, 000	360	34, 863, 287	1, 760, 608
Cashes Bank	7	200, 421	8, 741			200, 421	8, 741
Clark Bank	3	167, 160	5, 798			167, 160	5, 798
Fippenies Bank	6	276, 152	5, 649			276, 152	5, 649
Middle Bank	231	3, 366, 237	159, 616			3, 366, 237	159, 616
Jeffreys Ledge	124	2, 046, 972	104, 597			2, 046, 972	104, 597
Ipswich Bay	1	5, 520	386			5, 520	386
South Channel	727	40, 299, 230	1, 367, 039	8, 600	258	40, 307, 830	1, 367, 297
Nantucket Shoals	103	3, 763, 097	125, 889			3, 763, 097	125, 889
Off Highland Light	1	25, 680	1, 066			25, 680	1, 066
Off Chatham	66	1, 797, 826	76, 875			1, 797, 826	76, 875
Seal Island	14	588, 685	19, 332			588, 685	19, 332
Shore, general	788	8, 435, 508	360, 619	193, 140	12, 859	8, 628, 648	373, 478
Total	3, 368	123, 962, 419	5, 418, 752	252, 615	14, 979	124, 215, 034	5, 433, 731
LANDED AT GLOUCESTER							
East of 66° W. longitude							
La Have Bank	8	487, 310	8, 748	15, 535	727	502, 845	9, 475
Western Bank	103	11, 092, 060	195, 944	1, 943, 636	79, 649	13, 035, 696	275, 593
Quereau Bank	39	894, 559	16, 734	897, 015	41, 295	1, 791, 574	58, 029
Misaine Bank	1	13, 915	344			13, 915	344
Grand Bank	42	144, 037	3, 897	557, 145	25, 554	701, 182	29, 451
St. Peters Bank	14	199, 105	4, 136	361, 465	16, 442	560, 570	20, 578
Off Newfoundland	5			1, 219, 300	40, 861	1, 219, 300	40, 861
Cape Shore	2	3, 180	254	10, 000	550	13, 180	804
The Gully	11	163, 415	16, 951	83, 070	3, 832	246, 485	20, 783
West of 66° W. longitude							
Browns Bank	26	1, 065, 545	17, 082	25, 959	1, 146	1, 091, 504	18, 228
Georges Bank	135	6, 083, 594	105, 536	292, 750	13, 462	6, 376, 344	118, 998
Middle Bank	12	159, 675	1, 965			159, 675	1, 965
Jeffreys Ledge	3	37, 660	452			37, 660	452
South Channel	23	1, 766, 185	23, 407			1, 766, 185	23, 407
Nantucket Shoals	2	70, 560	1, 893			70, 560	1, 893
Seal Island	1	60, 760	1, 484			60, 760	1, 484
Shore, general	1, 152	6, 770, 453	250, 102	611, 960	38, 292	7, 382, 413	288, 394
Total	1, 579	29, 012, 013	648, 929	6, 017, 835	261, 810	35, 029, 848	910, 739
LANDED AT PORTLAND							
East of 66° W. longitude							
La Have Bank	4	104, 804	14, 345	54, 645	2, 165	159, 449	16, 510
Western Bank	39	5, 260, 711	163, 791	80, 363	3, 532	5, 341, 074	167, 323
Quereau Bank	5	151, 837	23, 911	17, 000	600	168, 837	24, 511
Green Bank	2	44, 863	10, 840	15, 850	882	60, 713	11, 722
Grand Bank	13	310, 986	40, 110	85, 555	4, 028	396, 541	44, 138
St. Peters Bank	2	77, 443	10, 124	14, 730	696	92, 173	10, 820
Cape Shore	6	113, 345	9, 304	7, 025	355	120, 370	9, 659
Gulf of St. Lawrence	1	24, 109	5, 193			24, 109	5, 193
The Gully	1	19, 646	1, 845	10, 465	488	30, 111	2, 333
West of 66° W. longitude							
Browns Bank	14	451, 490	51, 041	56, 692	2, 630	508, 182	53, 671
Georges Bank	21	336, 420	35, 518	28, 542	1, 248	364, 962	36, 766
Cashes Bank	52	797, 949	19, 946	4, 035	194	801, 984	20, 140
Fippenies Bank	4	35, 398	1, 546			35, 398	1, 546
Platts Bank	45	472, 588	17, 008			472, 588	17, 008
Jeffreys Ledge	239	2, 270, 676	108, 192	5, 370	259	2, 276, 046	108, 451
Seal Island	1	16, 575	786			16, 575	786
Shore, general	1, 139	4, 732, 621	173, 015	94, 854	3, 092	4, 827, 475	176, 107
Total	1, 588	15, 221, 461	686, 515	475, 126	20, 169	15, 696, 587	706, 684
Grand total	6, 535	168, 195, 893	6, 754, 196	6, 745, 576	296, 958	174, 941, 469	7, 051, 154

Statement, by months, of quantities and values of certain fishery products landed at Boston and Gloucester, Mass., and Portland, Me., by American fishing vessels during the calendar year 1923

Months	Cod							
	Large (10 pounds and over)				Market (under 10 and over 2½ pounds)			
	Fresh		Salted		Fresh		Salted	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
LANDED AT BOSTON								
January	881, 997	$74, 776			613, 131	$28, 367		
February	3, 783, 925	176, 072			572, 178	34, 464		
March	3, 773, 046	144, 759	2, 065	$81	590, 173	20, 411		
April	2, 230, 831	77, 487	12, 000	480	678, 595	16, 515		
May	2, 177, 229	75, 617	8, 000	360	1, 518, 761	29, 530		
June	1, 478, 264	64, 582			1, 429, 875	29, 720		
July	1, 848, 295	80, 873	2, 375	112	1, 777, 758	35, 954		
August	1, 686, 499	79, 845			1, 802, 850	36, 282		
September	1, 555, 695	66, 306	5, 500	220	1, 539, 915	34, 726		
October	1, 534, 847	80, 470			1, 598, 017	45, 969		
November	1, 627, 113	75, 271			1, 291, 655	33, 003		
December	937, 028	67, 823			954, 347	34, 771		
Total	23, 514, 769	1, 063, 881	29, 940	1, 253	14, 367, 255	379, 712		
LANDED AT GLOUCESTER								
January	47, 355	3, 025	9, 870	420	412	8	2, 210	$83
February	5, 450	307	4, 340	211			395	17
March	791, 756	24, 038	23, 525	1, 237	16, 105	311	3, 820	184
April	1, 182, 575	38, 309	94, 465	4, 430	206, 295	3, 881	13, 650	499
May	1, 240, 699	31, 083	357, 475	16, 798	721, 845	13, 481	114, 640	4, 187
June	1, 265, 545	28, 099	509, 647	23, 593	1, 360, 440	23, 781	516, 255	18, 929
July	2, 049, 755	45, 933	171, 565	8, 254	1, 509, 780	26, 249	25, 475	700
August	1, 140, 365	25, 833	813, 485	38, 634	1, 152, 755	20, 928	287, 162	10, 704
September	591, 350	14, 904	397, 745	19, 898	590, 450	11, 383	237, 315	9, 455
October	762, 980	32, 115	248, 337	12, 138	478, 890	9, 220	77, 605	4, 448
November	384, 635	23, 493	19, 240	962	51, 755	993	1, 500	60
December	179, 665	11, 328	2, 365	123	59, 915	1, 163	2, 464	111
Total	9, 642, 130	278, 467	2, 652, 059	126, 698	6, 148, 642	111, 308	1, 282, 491	49, 377
LANDED AT PORTLAND								
January	81, 330	6, 609			88, 155	4, 181		
February	78, 057	4, 157			72, 239	2, 973		
March	186, 054	6, 534	20, 672	1, 164	40, 007	1, 756	6, 785	384
April	421, 688	10, 260	27, 585	1, 472	74, 059	1, 937	4, 410	190
May	920, 624	19, 743	33, 260	1, 586	43, 286	903	10, 270	263
June	327, 629	10, 248	32, 230	1, 566	24, 950	607	7, 085	267
July	251, 109	11, 509	67, 737	3, 185	34, 488	822	4, 435	171
August	192, 315	9, 985	90, 852	4, 295	28, 255	843	13, 630	513
September	222, 160	11, 411	22, 845	1, 229	38, 378	1, 101	7, 210	303
October	263, 091	10, 965	465	24	143, 951	3, 426	500	21
November	187, 577	9, 849			110, 065	2, 757		
December	274, 502	13, 099			149, 380	4, 600		
Total	3, 406, 136	124, 369	295, 646	14, 521	847, 222	25, 906	54, 325	2, 112
Grand total	36, 563, 035	1, 466, 717	2, 977, 645	142, 472	21, 363, 119	517, 016	1, 336, 816	51, 489
Grounds east of 66° W. long	10, 238, 456	287, 983	2, 625, 674	125, 377	5, 955, 814	120, 546	1, 266, 812	48, 767
Grounds west of 66° W. long	26, 324, 579	1, 178, 734	351, 971	17, 095	15, 407, 305	396, 470	70, 004	2, 722
Landed at Boston in 1922	17, 718, 297	719, 118	47, 750	1, 671	12, 859, 415	285, 623		
Landed at Gloucester in 1922	8, 705, 914	193, 243	3, 081, 385	122, 244	6, 416, 904	94, 757	1, 645, 358	56, 565
Landed at Portland in 1922	3, 173, 273	132, 183	123, 385	5, 199	580, 603	14, 991	12, 510	485

Statement, by months, of quantities and values of certain fishery products landed at Boston and Gloucester, Mass., and Portland, Me., by American fishing vessels during the calendar year 1923—Continued

Months	Cod—Continued				Haddock			
	Scrod (1 to 2½ pounds)				Large (over 2½ pounds)			
	Fresh		Salted		Fresh		Salted	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
LANDED AT BOSTON								
January	19, 630	$355			4, 038, 944	$244, 078		
February	12, 200	279			5, 592, 545	335, 735		
March	5, 420	91			6, 855, 125	256, 801		
April	1, 600	13			5, 196, 830	135, 091		
May	5, 910	87			4, 339, 415	152, 319		
June	4, 070	24			3, 181, 967	94, 087		
July	2, 675	16			3, 091, 502	103, 719		
August	10, 690	81			4, 003, 687	91, 732		
September	8, 645	80			4, 054, 888	96, 458		
October	20, 775	313			5, 240, 585	157, 971		
November	16, 985	231			5, 352, 980	197, 640		
December	21, 555	267			5, 175, 910	186, 490		
Total	130, 155	1, 837			56, 124, 378	2, 052, 121		
LANDED AT GLOUCESTER								
January					39, 573	3, 354		
February					45, 925	3, 688		
March			330	$8	363, 115	11, 495		
April	100	1			910, 060	12, 123		
May	3, 880	29	1, 410	36	536, 435	5, 637	1, 360	$27
June	7, 120	50	49, 405	1, 514	951, 350	9, 408		
July	11, 670	88	70	2	1, 382, 730	13, 660		
August	7, 940	68	21, 435	541	1, 367, 840	13, 566	36, 885	827
September	380	3	29, 020	984	1, 049, 125	10, 492	3, 135	63
October	1, 000	8	7, 145	133	644, 905	6, 706		
November	720	6			112, 990	3, 247		
December	1, 305	9	20	1	307, 943	4, 945	230	5
Total	34, 115	262	108, 895	3, 219	7, 711, 991	98, 411	41, 610	922
LANDED AT PORTLAND								
January	10, 200	59			258, 786	18, 015		
February	9, 600	52			251, 422	19, 457		
March	5, 289	31			369, 752	16, 982		
April	8, 452	49			1, 220, 651	26, 609		
May	2, 683	16	420	9	1, 265, 565	28, 356		
June	3, 648	19	5, 175	152	593, 869	13, 174		
July	5, 682	38	330	7	65, 056	3, 529		
August	3, 026	19	12, 883	235	38, 210	2, 038		
September	5, 510	30	600	15	43, 490	2, 493		
October	18, 286	109	650	13	182, 871	8, 840		
November	21, 425	119			332, 246	16, 839		
December	27, 635	157			415, 931	20, 910		
Total	121, 436	698	20, 058	431	5, 037, 849	177, 242		
Grand total	285, 706	2, 797	128, 953	3, 650	68, 874, 218	2, 327, 774	41, 610	922
Grounds east of 66° W. long	36, 210	343	121, 978	3, 459	11, 450, 075	234, 983	41, 610	922
Grounds west of 66° W. long	249, 496	2, 454	6, 975	191	57, 424, 143	2, 092, 791		
Landed at Boston in 1922	494, 095	5, 428			52, 664, 489	1, 501, 570		
Landed at Gloucester in 1922	38, 652	364	94, 812	2, 364	12, 453, 416	162, 922	131, 385	2, 736
Landed at Portland in 1922	186, 842	1, 020	970	24	4, 693, 425	137, 911		

Statement, by months, of quantities and values of certain fishery products landed at Boston and Gloucester, Mass., and Portland, Me., by American fishing vessels during the calendar year 1923—Continued

Months	Haddock—Continued				Hake			
	Scrod (1 to 2½ pounds)				Large (6 pounds and over)			
	Fresh		Salted		Fresh		Salted	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
LANDED AT BOSTON								
January	344,145	$15,884			22,081	$1,716		
February	464,620	18,647			30,948	2,281		
March	520,085	11,479			1,800	126		
April	174,060	2,178						
May	85,850	1,627			500	10		
June	138,905	1,454			75	2		
July	174,550	1,643						
August	177,380	1,161	1,975	$35				
September	142,360	1,372						
October	467,415	7,253			4,130	48		
November	919,104	12,552			47,515	1,267		
December	807,794	15,476			15,595	612		
Total	4,416,268	90,726	1,975	35	122,644	6,062		
LANDED AT GLOUCESTER								
January					440	4		
March	360	3					1,620	$45
April							135	2
May					2,425	24	1,065	16
June					1,700	19	5,230	79
July					24,900	249	965	14
August	8,540	69			21,460	216	3,845	62
September	7,500	38			38,860	307	630	12
October	31,140	215			91,300	1,622	2,335	45
November	24,620	109			267,090	3,737	430	9
December	28,425	146			123,720	2,479		
Total	100,585	670			571,985	8,747	16,255	284
LANDED AT PORTLAND								
January	17,509	130			405	30		
February	33,516	309			100	10		
March	21,530	418			1,730	112		
April	10,741	171			2,620	115		
May	2,370	20						
June	5,382	55						
July	23,267	285						
August	9,287	88			8,135	116	1,135	23
September	15,405	151			3,975	51		
October	42,305	380			20,270	342	49	2
November	77,391	579						
December	68,164	455			1,500	30		
Total	326,867	3,050			38,795	806	1,184	25
Grand total	4,843,720	94,446	1,975	35	733,424	15,615	17,439	309
Grounds east of 66° W. long	79,120	834			89,565	940	16,840	298
Grounds west of 66° W. long	4,764,600	93,612	1,975	35	643,859	14,675	599	11
Landed at Boston in 1922	198,425	3,855			97,810	3,330		
Landed at Gloucester in 1922	675	7			838,655	20,556	21,950	342
Landed at Portland in 1922	54,183	399			40,200	1,162	300	5

Statement, by months, of quantities and values of certain fishery products landed at Boston and Gloucester, Mass., and Portland, Me., by American fishing vessels during the calendar year 1923—Continued

Months	Hake—Continued: Small (under 6 pounds): Fresh		Salted		Pollock: Fresh		Salted	
	Pounds	*Value*	*Lbs.*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
LANDED AT BOSTON								
January	89,064	$6,625			177,905	$11,672		
February	150,916	8,962			81,635	5,207		
March	75,040	4,522			131,434	6,345		
April	57,995	2,658			142,118	6,756		
May	37,485	1,685			255,120	7,114		
June	82,804	2,007			192,469	5,323		
July	490,954	6,784	500	$9	221,793	8,071		
August	419,000	8,327			290,678	11,874		
September	530,630	8,863			391,460	10,340		
October	826,188	15,307	1,000	15	402,858	10,569		
November	1,088,240	12,858			493,131	9,422		
December	528,829	13,403			296,070	10,532		
Total	4,377,145	92,001	1,500	24	3,076,671	104,125		
LANDED AT GLOUCESTER								
January					163,912	11,574		
February					10,105	577		
March					16,115	1,000		
April					28,315	1,102	325	$7
May					18,545	213	3,265	65
June					36,660	368	9,040	182
July					36,905	363	995	16
August					21,340	246	8,875	197
September					49,125	492	5,645	134
October					186,520	4,938	7,800	155
November					238,250	5,320		
December					316,570	9,190	400	8
Total					1,122,362	35,392	36,345	764
LANDED AT PORTLAND								
January	84,352	5,067			37,413	1,863		
February	106,044	5,645			27,645	1,320		
March	104,141	4,943			18,358	731	225	6
April	119,040	4,703			29,864	737	250	7
May	82,747	1,543	220	4	39,867	384	215	6
June	56,832	1,101	1,308	26	37,436	395	840	13
July	40,109	517			54,609	846		
August	29,776	363	1,900	38	39,135	858	490	10
September	30,970	642			48,279	700		
October	189,736	2,395			105,198	1,345	320	6
November	190,702	2,763			64,242	978		
December	170,392	4,068			64,602	1,703		
Total	1,204,841	34,350	3,428	68	566,608	11,860	2,340	48
Grand total	5,581,986	126,351	4,928	92	4,765,641	151,377	38,685	812
Grounds east of 66° W. long	56,752	957	1,900	38	681,835	16,746	35,345	750
Grounds west of 66° W. long	5,525,234	125,394	3,028	54	4,083,806	134,631	3,340	62
Landed at Boston in 1922	3,420,536	68,107	1,200	36	3,415,801	78,657	250	5
Landed at Gloucester in 1922					1,058,725	27,181	49,005	932
Landed at Portland in 1922	944,136	17,621	9,460	172	573,259	11,230	45	1

Statement, by months, of quantities and values of certain fishery products landed at Boston and Gloucester, Mass., and Portland, Me., by American fishing vessels during the calendar year 1923—Continued

Months	Cusk				Halibut			
	Fresh		Salted		Fresh		Salted	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
LANDED AT BOSTON								
January	133,705	$4,595			29,955	$9,815		
February	142,995	5,322			90,447	21,430		
March	128,795	3,547			157,971	39,167		
April	54,480	1,093			284,435	58,720		
May	171,405	2,366			496,344	101,019		
June	52,295	776			675,207	100,426		
July	71,215	1,073	23,000	$690	467,496	77,964		
August	36,900	678			518,030	93,551		
September	47,305	654			366,205	72,342		
October	191,605	3,071			382,451	77,109		
November	200,774	3,187			55,449	16,077		
December	285,495	5,016			36,385	11,639		
Total	1,516,969	31,408	23,000	690	3,560,375	679,259		
LANDED AT GLOUCESTER								
February					5,192	1,126		
March	630	8			59,730	12,924		
April	23,335	217	1,160	25	7,160	1,202		
May	36,440	362	7,460	113	25,642	5,611		
June	15,260	215	3,525	82	7,080	1,133	220	$18
July	39,675	559	2,990	59	1,900	106	780	54
August	46,065	583	8,810	105			100	4
September	57,580	700	11,705	230			410	32
October	27,940	350	1,855	38	180	11		
November	18,950	222	65	1				
December	24,235	329						
Total	290,110	3,545	37,570	743	106,881	22,113	1,510	108
LANDED AT PORTLAND								
January	74,329	3,265			1,108	220		
February	112,182	3,907			68	8		
March	111,706	3,584	4,670	93	109,186	27,246		
April	177,099	3,590	300	9	244,217	48,736		
May	136,651	1,899			172,497	35,392		
June	15,316	418	450	11	218,625	32,157		
July	23,460	488	335	10	146,545	23,556		
August	33,542	520	17,045	458	188,763	28,897		
September	59,985	1,020	2,200	61	86,140	17,367		
October	179,918	2,483	1,740	33	32,035	6,465		
November	95,410	1,618			4,269	717		
December	84,219	1,875			2,282	413		
Total	1,103,817	24,667	26,740	675	1,205,735	221,174		
Grand total	2,910,896	59,620	87,310	2,108	4,872,994	922,546	1,510	108
Grounds east of 66° W. long	349,445	4,529	69,210	1,738	3,642,689	644,092	730	54
Grounds west of 66° W. long	2,561,451	55,091	18,100	370	1,230,305	278,454	780	54
Landed at Boston in 1922	1,196,932	18,417			3,948,456	550,735		
Landed at Gloucester in 1922	465,779	4,698	53,030	1,196	42,352	6,781	15,706	915
Landed at Portland in 1922	531,304	10,233	405	8	1,617,635	225,626		

Statement, by months, of quantities and values of certain fishery products landed at Boston and Gloucester, Mass., and Portland, Me., by American fishing vessels during the calendar year 1923—Continued

Months	ackerel				Miscellaneous [1]			
	Fresh		Salted		Fresh		Salted	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
LANDED AT BOSTON								
January					279,166	$17,100		
February					302,303	17,934		
March					384,143	24,483	8,600	$258
April					556,000	23,088		
May	167,770	$27,832			603,946	15,109		
June	917,736	67,285			214,387	11,119		
July	621,143	27,004			1,276,994	194,874		
August	911,387	43,642			1,102,120	180,923		
September	2,387,595	65,960	38,400	$2,678	570,416	65,397		
October	1,161,516	50,140	149,200	10,041	365,682	18,248		
November	342,414	18,362			227,206	13,260		
December	70,505	16,264			293,301	19,596		
Total	6,580,066	316,489	187,600	12,719	6,175,724	601,131	8,600	258
LANDED AT GLOUCESTER								
January					718	72		
February					28,748	3,454		
March					2,480	174		
May							339,100	10,836
June	4,340	347	10,400	574				
July	8,137	244	74,800	4,686				
August	14,298	450						
September	2,304,995	41,741	308,200	16,685	18,000	225		
October	695,615	14,894	211,800	15,644	46,000	575		
November	84,655	10,878	16,600	1,245			114,400	4,004
December	75,223	16,870					765,800	26,021
Total	3,187,263	85,424	621,800	38,834	95,946	4,500	1,219,300	40,861
LANDED AT PORTLAND								
January					7,081	487		
February					14,097	814		
March					7,823	423		
April					4,246	130		
May	2,563	408			1,770	43		
June	121,363	9,867	6,275	344	157,996	2,454		
July	28,476	1,942	390	39	40,348	4,558		
August	1,728	222			120,718	16,609		
September	687,517	16,521	43,870	1,025	27,911	3,994		
October	75,249	2,888	20,870	881	57,800	764		
November	198	34			4,294	104		
December					977	41		
Total	917,094	31,882	71,405	2,289	445,061	30,511		
Grand total	10,684,423	433,795	880,805	53,842	6,716,731	636,142	1,227,900	41,119
Grounds east of 66° W. long	973,542	72,607	16,275	894	137,088	12,699		
Grounds west of 66° W. long	9,710,881	361,188	864,530	52,948	6,579,643	623,443	8,600	258
Landed at Boston in 1922	2,871,000	181,962	65,400	4,109	7,146,947	596,409	43,600	1,073
Landed at Gloucester in 1922	374,545	27,166	370,555	32,029			1,892,420	56,355
Landed at Portland in 1922	1,020,822	29,983	24,425	1,250	2,346,088	42,930	495	41

[1] Includes herring from Newfoundland, 1,219,300 pounds salted, value $40,861.

Statement, by months, of quantities and values of certain fishery products landed at Boston and Gloucester, Mass., and Portland, Me., by American fishing vessels during the calendar year 1923—Continued

Months	Number of trips	Total				Grand total	
		Fresh		Salted			
		Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
LANDED AT BOSTON							
January	175	6,629,723	$414,983			6,629,723	$414,983
February	250	11,224,712	626,333			11,224,712	626,333
March	251	12,623,032	511,731	10,665	$339	12,633,697	512,070
April	228	9,376,944	323,599	12,000	480	9,388,944	324,079
May	289	9,859,735	414,315	8,000	360	9,867,735	414,675
June	228	8,368,054	376,805			8,368,054	376,805
July	362	10,044,375	538,875	25,875	811	10,070,250	539,686
August	394	10,959,221	548,096	1,975	35	10,961,196	548,131
September	324	11,595,114	422,498	43,900	2,898	11,639,014	425,396
October	345	12,196,069	466,468	150,200	10,056	12,346,269	476,524
November	276	11,662,626	393,130			11,662,626	393,130
December	240	9,422,814	381,919			9,422,814	381,919
Total	3,308	123,962,419	5,418,752	252,615	14,979	124,215,034	5,433,731
LANDED AT GLOUCESTER							
January	94	252,410	18,037	12,080	503	264,490	18,540
February	52	95,420	9,152	4,735	228	100,155	9,380
March	162	1,250,291	49,962	29,295	1,474	1,279,586	51,436
April	270	2,357,840	56,835	109,735	4,963	2,467,575	61,798
May	108	2,585,911	56,440	825,775	32,078	3,411,686	88,518
June	59	3,649,495	63,420	1,103,782	44,971	4,753,277	108,391
July	64	5,065,452	87,451	277,640	13,785	5,343,092	101,236
August	72	3,780,603	61,959	1,180,597	51,164	4,961,200	113,123
September	146	4,707,365	80,375	993,805	47,493	5,701,170	127,868
October	235	2,966,560	70,744	556,877	32,601	3,523,437	103,345
November	168	1,183,665	48,095	152,235	6,281	1,335,900	54,376
December	143	1,117,001	46,459	771,279	26,269	1,888,280	72,728
Total	1,579	29,012,013	648,929	6,017,835	261,810	35,029,848	910,739
LANDED AT PORTLAND							
January	90	660,668	39,926			660,668	39,926
February	90	705,030	38,652			705,030	38,652
March	117	975,576	62,760	32,352	1,647	1,007,928	64,407
April	147	2,312,677	97,037	32,545	1,678	2,345,222	98,715
May	185	2,670,623	88,716	44,385	1,868	2,715,008	90,584
June	154	1,563,055	70,495	53,363	2,379	1,616,418	72,874
July	164	713,209	48,090	73,227	3,412	786,436	51,502
August	126	692,890	60,648	137,935	5,572	830,825	66,220
September	163	1,269,720	55,481	76,725	2,633	1,346,445	58,114
October	148	1,310,710	40,402	24,594	980	1,335,304	41,382
November	119	1,087,819	36,357			1,087,819	36,357
December	105	1,259,484	47,951			1,259,484	47,951
Total	1,588	15,221,461	686,515	475,126	20,169	15,696,587	706,684
Grand total	6,535	168,195,893	6,754,196	6,745,576	296,958	174,941,469	7,051,154
Grounds east of 66° W. long	582	33,690,591	1,397,259	5,415,674	223,158	39,106,265	1,620,417
Grounds west of 66° W. long	5,953	134,505,302	5,356,937	1,329,902	73,800	135,835,204	5,430,737
Landed at Boston in 1922	2,893	106,032,203	4,013,211	158,200	6,894	106,190,403	4,020,105
Landed at Gloucester in 1922	1,653	30,395,617	537,675	7,355,606	275,678	37,751,223	813,353
Landed at Portland in 1922	1,803	15,761,770	625,289	171,995	7,185	15,933,765	632,474

The fishery products landed at Boston and Gloucester, Mass., and Portland, Me., by fishing vessels each year are taken chiefly from fishing grounds off the coast of the United States. In the calendar year 1923, 77.26 per cent of the quantity and 76.71 per cent of the value landed by fishing vessels were from these grounds; 2.51 per cent of the quantity and 5.27 per cent of the value, consisting mostly of cod, halibut, and herring, were from fishing banks off the coast of Newfoundland; and 20.23 per cent of the quantity and 18.01 per cent of the value were from fishing grounds off the Canadian Provinces. There was some decrease compared with the previous year in the percentage of products from grounds off the United States and Newfoundland and a small increase in the percentage from grounds off the Canadian Provinces. Newfoundland herring constituted less than 1 per cent of the quantity and value of fishery products landed at these ports during the year. The herring were taken from the treaty coast of Newfoundland, and the cod, haddock, hake, halibut, and other species from that region were obtained from fishing banks on the high seas. All fish caught by American fishing vessels off the coast of the Canadian Provinces were from offshore fishing grounds. The catch from each of these regions is given in detail in the following table:

Quantity and value of fish landed by American fishing vessels at Boston and Gloucester, Mass., and Portland, Me., in 1923, from fishing grounds off the coast of the United States, Newfoundland, and Canadian Provinces

Species	United States		Newfoundland		Canadian Provinces		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Cod:								
Fresh	41, 794, 950	$1, 570, 056	324, 477	$8, 144	16, 092, 433	$408, 330	58, 211, 860	$1, 986, 530
Salted	428, 950	20, 008	1, 007, 330	47, 011	3, 007, 134	130, 592	4, 443, 414	197, 611
Haddock:								
Fresh	61, 794, 563	2, 174, 800	150	2	11, 923, 225	247, 418	73, 717, 938	2, 422, 220
Salted	1, 975	35			41, 610	922	43, 585	957
Hake:								
Fresh	6, 151, 758	139, 787	31, 145	326	132, 507	1, 853	6, 315, 410	141, 966
Salted	3, 627	65	11, 950	209	6, 790	127	22, 367	401
Pollock:								
Fresh	4, 081, 066	134, 567			684, 575	16, 810	4, 765, 641	151, 377
Salted	3, 340	62	2, 970	86	32, 375	664	38, 685	812
Cusk:								
Fresh	2, 499, 536	54, 194	36, 045	458	375, 315	4, 968	2, 910, 896	59, 620
Salted	18, 100	370	12, 275	278	56, 935	1, 460	87, 310	2, 108
Halibut:								
Fresh	1, 226, 885	277, 300	1, 738, 129	273, 859	1, 907, 980	371, 387	4, 872, 994	922, 546
Salted	780	54	220	18	510	36	1, 510	108
Mackerel:								
Fresh	9, 710, 881	361, 188			973, 542	72, 607	10, 684, 423	433, 795
Salted	864, 530	52, 948			16, 275	894	880, 805	53, 842
Herring:								
Fresh	263, 540	3, 657					263, 540	3, 657
Salted			1, 219, 300	40, 861			1, 219, 300	40, 861
Swordfish: Fresh	2, 407, 541	438, 896	2, 886	580	44, 992	8, 643	2, 455, 419	448, 119
Miscellaneous:								
Fresh	3, 908, 562	180, 890			89, 210	3, 476	3, 997, 772	184, 366
Salted	8, 600	258					8, 600	258
Total	135, 169, 184	5, 409, 135	4, 386, 877	371, 832	35, 385, 408	1, 270, 187	174, 941, 469	7, 051, 154

SPECIES

COD

In 1923 there was a decrease of 32 vessels in the fishing fleet landing fish at Boston, Gloucester, and Portland, as compared with 1922. There were 7 vessels in the salt-bank fishery, as compared with 17 in 1922, and 108 in the market fishery, or 14 more than in 1922. These vessels landed their fares of cod and other ground fish at these ports during the year, and large quantities were also landed by vessels fishing on the shore grounds. The catch of cod landed at these ports during the year was 62,655,274 pounds, valued at $2,184,171, of which 58,211,860 pounds, valued at $1,986,530, were landed fresh, and 4,443,414 pounds, valued at $197,611, were landed salted. Cod ranked second in both quantity and value among the various species landed.

HADDOCK

Haddock ranked first in both quantity and value, the catch exceeding that of cod by 11,106,249 pounds in quantity and $239,036 in value. The quantity of haddock landed at these ports by fishing vessels during the year was 73,761,523 pounds, valued at $2,423,177, all landed fresh except 43,585 pounds, valued at $957, landed salted. These fish were taken chiefly from Western Bank, Browns Bank, Georges Bank, and South Channel, and about 48 per cent of the quantity and nearly 42 per cent of the value were taken in the otter-trawl fishery. The greater part of the catch, or 60,542,621 pounds, valued at $2,142,882, was landed at Boston.

HAKE

The catch of hake amounted to 6,337,777 pounds, valued at $142,367, all landed fresh except 22,367 pounds salted, valued at $401. Of this catch, 4,501,289 pounds, valued at $98,087, were landed at Boston, 588,240 pounds, valued at $9,031, at Gloucester, and 1,248,248 pounds, valued at $35,249, at Portland. About half of the catch was taken in South Channel, and about 71 per cent was landed at Boston.

POLLOCK

The catch of pollock amounted to 4,804,326 pounds, valued at $152,189, all landed fresh except 38,685 pounds salted, valued at $812. The greater part of the catch, or 3,076,671 pounds, valued at $104,125, was landed at Boston. The catch was obtained largely from Browns Bank, Georges Bank, South Channel, and shore grounds.

CUSK

The catch of cusk amounted to 2,998,206 pounds, valued at $61,728, all landed fresh except 87,310 pounds salted, valued at $2,108. More than half of the catch was landed at Boston. There was an increase in the catch of cusk of 750,756 pounds in quantity and $27,176 in value as compared with 1922.

HALIBUT

The catch of halibut amounted to 4,874,504 pounds, valued at $922,654, all landed fresh except 1,510 pounds salted, valued at $108. There was a considerable decrease in the quantity, but an increase in the value, as compared with 1922. The quantity landed at Boston was 3,560,375 pounds, valued at $679,259; at Gloucester, 108,394 pounds, valued at $22,221; and at Portland, 1,205,735 pounds, valued at $221,174.

MACKEREL

The total catch of fresh mackerel taken by the American fishing fleet in 1923 was 121,982 barrels, compared with 53,703 barrels in 1922, an increase of 68,279 barrels. The total catch of salted mackerel was 18,864 barrels, compared with 2,749 barrels in 1922, an increase of 16,115 barrels. The quantity of mackerel landed at Boston, Gloucester, and Portland during the year was 11,565,228 pounds, valued at $487,637, of which 10,684,423 pounds, valued at $433,795, were fresh, and 880,805 pounds, valued at $53,842, were salted. There was an increase in the total catch of mackerel landed by fishing vessels at these ports of 6,838,481 pounds in quantity and of $211,138 in value, as compared with 1922.

In 1923 the total catch of mackerel up to July 1 was 22,866 barrels fresh and 217 barrels salted, compared with 25,090 barrels fresh and 2,344 barrels salted for the same period in 1922. The southern mackerel fleet numbered about 25 purse-seine vessels and 136 gill-net vessels. Both seiners and netters had poor success on account of windy weather and scarcity of fish during the spring months. The first catch was landed at Norfolk on April 9, and consisted of 300 pounds of large mackerel, which sold at 75 cents per pound in New York. This was three days earlier than the landing of the first catch the previous year. A considerable quantity of tinker mackerel scattered in small schools was reported in the south. The first catch of mackerel from Cape Shore was landed at Yarmouth, Nova Scotia, on May 29, and consisted of 4,000 pounds of large fish, which were shipped to Boston. The first arrival at Boston, direct from the fleet, was on June 7, and consisted of 20,000 pounds of large fish, which sold at 6½ cents per pound. Fresh mackerel sold during the season at from 6½ to 40 cents per pound, according to market conditions, and salted mackerel from Cape Shore sold at $11 per barrel.

SWORDFISH

The catch of swordfish amounted to 2,455,419 pounds, valued at $448,119. There were 52 vessels engaged in this fishery, or 2 more than in the previous year. There was, however, a decrease in the catch of 25.17 per cent in the quantity, but a slight increase of about a quarter of 1 per cent in the value.

FLOUNDERS

The catch of flounders taken in the vessel fisheries amounted to 3,436,820 pounds, valued at $163,683, an increase of 155,493 pounds, or 4.73 per cent, in quantity and of $28,934, or 21.47 per cent, in value. The catch taken by boats under 5 tons net tonnage is not included in these statistics.

HERRING

The catch of herring amounted to 1,482,840 pounds, valued at $44,518. Of this quantity 263,540 pounds, valued at $3,657, were taken off the coast of the United States and landed fresh, and the remainder, consisting of 1,219,300 pounds salted, valued at $40,861, were Newfoundland herring.

OTTER-TRAWL FISHERY

In 1923 there were 665 trips landed at Boston, Gloucester, and Portland by 33 otter-trawl vessels, amounting to 54,298,289 pounds of fish, valued at $1,696,321, or 31.03 per cent of the quantity and 24.05 per cent of the value of the total catch landed by fishing vessels at these ports during the year. The catch included cod, 14,961,590 pounds, valued at $485,799; haddock, 35,527,297 pounds, valued at $1,011,810; hake, 471,660 pounds, valued at $12,280; pollock, 1,229,361 pounds, valued at $43,312; cusk, 13,195 pounds, valued at $402; halibut, 148,668 pounds, valued at $34,829; mackerel, 59,500 pounds, valued at $5,205; and other species, 1,887,018 pounds, valued at $102,684. The catch by otter trawls consists principally of haddock, which in 1923 amounted to 48.16 per cent of the quantity and 41.75 per cent of the value of the entire catch of this species landed. The catch by otter trawls was taken chiefly from Western Bank, Georges Bank, and South Channel.

The following tables give, by fishing grounds and by months, the catch landed by otter trawlers at these ports in 1923, and also the catch of cod, haddock, and hake landed by them in various years:

Fishery products landed at Boston and Gloucester, Mass., and Portland, Me., by otter trawlers in 1923

	Cod		Haddock		Hake	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
BY FISHING GROUNDS						
East of 66° W. Longitude						
Western Bank	7,836,102	$218,512	10,321,517	$215,246	33,615	$484
Cape Shore						
West of 66° W. Longitude						
Browns Bank	51,380	1,120	444,425	12,693		
Georges Bank	4,348,143	164,113	9,295,985	321,240	49,886	1,581
Middle Bank	4,280	193	17,200	494	8,100	81
South Channel	2,594,460	97,394	14,162,865	423,388	352,679	9,785
Nantucket Shoals	115,120	3,991	1,198,075	34,532	24,810	308
Off Chatham	12,105	467	87,230	4,217	2,570	41
Total	14,961,590	485,799	35,527,297	1,011,810	471,660	12,280
BY MONTHS						
January	666,115	40,706	2,112,180	122,111	21,454	1,816
February	1,526,985	76,400	2,764,410	154,907	6,251	397
March	1,073,020	39,582	3,883,785	120,481	16,270	1,085
April	1,195,008	33,402	4,021,635	91,031	37,405	1,817
May	1,690,905	38,044	3,472,410	91,032	6,210	181
June	1,094,050	24,639	2,915,445	55,138	28,995	702
July	1,363,190	30,803	2,614,515	47,032	21,155	284
August	1,295,180	30,455	2,402,699	36,983	32,870	383
September	941,916	24,517	2,135,183	33,538	54,690	945
October	1,582,540	52,418	2,850,655	63,848	71,140	1,158
November	1,755,103	57,562	2,893,500	81,909	86,745	965
December	777,488	37,271	3,460,880	104,620	88,475	2,547
Total	14,961,590	485,799	35,527,297	1,011,810	471,660	12,280

Fishery products landed at Boston and Gloucester, Mass., and Portland, Me., by otter trawlers in 1923—Continued

	Pollock		Cusk		Halibut	
	Pounds	Value	Pounds	Value	Pounds	Value
BY FISHING GROUNDS						
East of 66° W. Longitude						
Western Bank	615, 940	$15, 765	2, 545	$50	43, 042	$9, 598
West of 66° W. Longitude						
Browns Bank	5, 630	169			1, 970	427
Georges Bank	167, 470	7, 952	4, 100	156	55, 108	13, 387
Middle Bank	1, 100	22	3, 875	78		
South Channel	411, 501	18, 837	2, 040	99	46, 711	10, 942
Nantucket Shoals	24, 585	487			1, 777	466
Off Chatham	3, 135	80	635	19	60	9
Total	1, 229, 361	43, 312	13, 195	402	148, 668	34, 829
BY MONTHS						
January	125, 735	8, 493			7, 196	2, 140
February	39, 500	2, 536			14, 598	3, 805
March	96, 924	4, 918	735	24	16, 182	4, 155
April	97, 770	4, 696	5, 320	202	9, 067	2, 152
May	157, 087	3, 863			18, 357	3, 844
June	47, 550	901			9, 053	1, 869
July	37, 695	838			12, 049	2, 487
August	32, 525	895	2, 275	46	9, 699	1, 814
September	76, 545	1, 787	175	2	10, 367	2, 239
October	78, 360	2, 346	560	43	20, 053	4, 666
November	231, 180	3, 774	4, 040	81	15, 422	3, 957
December	208, 490	8, 265	90	4	6, 625	1, 701
Total	1, 229, 361	43, 312	13, 195	402	148, 668	34, 829

	Mackerel		Miscellaneous		Number of trips	Total	
	Pounds	Value	Pounds	Value		Pounds	Value
BY FISHING GROUNDS							
East of 66° W. Longitude							
Western Bank			87, 835	$3, 431	187	18, 940, 596	$463, 086
Cape Shore	59, 500	$5, 205			1	59, 500	5, 205
West of 66° W. Longitude							
Browns Bank			17, 925	244	4	521, 330	14, 662
Georges Bank			646, 905	37, 499	183	14, 567, 597	545, 928
Middle Bank					1	34, 555	868
South Channel			934, 894	52, 846	268	18, 505, 150	613, 291
Nantucket Shoals			192, 079	8, 221	18	1, 556, 446	48, 005
Off Chatham			7, 380	443	3	113, 115	5, 276
Total	59, 500	5, 205	1, 887, 018	102, 684	665	54, 298, 289	1, 696, 321
BY MONTHS							
January			37, 676	5, 704	55	2, 970, 356	180, 970
February			70, 262	7, 012	57	4, 422, 006	245, 147
March			117, 253	10, 438	62	5, 204, 169	189, 683
April			282, 195	14, 311	58	5, 648, 400	147, 611
May			327, 295	8, 773	59	5, 672, 354	145, 737
June	59, 500	5, 205	85, 445	3, 279	48	4, 240, 038	91, 733
July			48, 793	1, 753	46	4, 097, 397	83, 197
August			147, 932	5, 934	53	3, 923, 180	76, 610
September			167, 455	6, 921	45	3, 386, 331	69, 949
October			276, 821	13, 694	58	4, 880, 129	138, 173
November			184, 710	10, 777	57	5, 170, 700	159, 115
December			141, 181	14, 088	67	4, 683, 229	168, 496
Total	59, 500	5, 205	1, 887, 018	102, 684	665	54, 298, 289	1, 696, 321

Cod, haddock, and hake landed at Boston and Gloucester, Mass., and Portland, Me., by otter trawlers in various years, 1908 to 1923

Year	Trips	Cod	Haddock	Hake	Year	Trips	Cod	Haddock	Hake
	No.	*Pounds*	*Pounds*	*Pounds*		*No.*	*Pounds*	*Pounds*	*Pounds*
1908	44	209,800	1,542,000	46,600	1914	387	1,149,695	15,383,550	259,913
1909	47	159,800	1,719,000	74,400	1920	646	6,311,389	51,962,457	----------
1910	59	125,850	2,775,000	46,600	1921	346	2,482,833	26,734,893	241,650
1911	178	564,500	7,367,100	151,700	1922	578	11,161,947	35,878,524	576,370
1912	295	1,952,950	12,966,700	105,500	1923	665	14,961,590	35,527,297	471,660
1913	326	1,667,806	12,488,992	209,485					

VESSEL FISHERIES AT SEATTLE, WASH.

In the vessel fisheries at Seattle, Wash., there was a decrease, as compared with 1922, in the quantity but an increase in the value of products landed by the fishing fleet and an increase in both the quantity and value of products landed by collecting vessels, which was due chiefly to an increase in the landings of salmon. Statistics of the vessel fisheries at Seattle have been collected by the local agent and published as monthly and annual statistical bulletins, giving the quantity and value of fishery products landed by American fishing and collecting vessels at that port.

In 1923 the fishing fleet at Seattle landed 919 trips, amounting to 10,237,590 pounds of fish, having a value to the fishermen of $1,321,587. The catch was taken chiefly from fishing grounds along the coast from Oregon to Yakutat grounds, Alaska. The fishing areas from which the largest quantities of fish were taken were Flattery Banks, west coast of Vancouver Island, and Hecate Strait. The products included halibut, 7,804,990 pounds, valued at $1,188,878; sablefish, 2,108,600 pounds, valued at $123,514; "lingcod," 194,100 pounds, valued at $4,355; and rockfishes, 129,900 pounds, valued at $4,840. Compared with 1922 there was an increase of 83 trips by fishing vessels but a decrease of 1,094,460 pounds, or 9.66 per cent, in the quantity, and an increase of $71,765, or 5.74 per cent, in the value of the products landed. There was a decrease in the catch of halibut of 2,133,160 pounds, or 21.46 per cent, in quantity, and of $7,512, or 0.63 per cent, in value. There was an increase in the catch of sablefish of 1,094,500 pounds, or 107.93 per cent, in quantity and of $76,862, or 164.76 per cent, in value. The catch of "lingcod" decreased 64,100 pounds, or 24.82 per cent, in quantity, and $154, or 3.42 per cent, in value; and the catch of rockfishes increased 8,300 pounds, or 6.82 per cent, in quantity, and $2,569, or 113.12 per cent, in value.

The fishery products taken in Puget Sound and landed at Seattle by collecting vessels during the year amounted to 17,387,478 pounds, valued at $1,308,731. The products included salmon, 15,711,200 pounds, valued at $1,209,855; herring, 218,000 pounds, valued at $1,900; sturgeon, 5,000 pounds, valued at $500; steelhead trout, 185,400 pounds, valued at $15,020; smelt, 229,500 pounds, valued at $22,284; perch, 60,900 pounds, valued at $4,113; rockfishes, 88,700 pounds, valued at $4,694; "lingcod," 47,300 pounds, valued at $2,998; flounders, 70,500 pounds, valued at $1,556; sole, 231,700 pounds, valued at $8,443; and crabs, 539,278 pounds, valued at $37,368. Compared with 1922 there was an increase in the products landed by collecting vessels of 2,304,088 pounds, or 15.28 per cent, in quantity, and $343,899, or 35.64 per cent, in value.

Statement, by fishing grounds and months, of quantities and values of certain fishery products landed at Seattle, Wash., by American fishing vessels, 1923

	Halibut		Sablefish		"Lingcod"	
	Fresh		Fresh		Fresh	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
BY FISHING GROUNDS						
Oregon Coast	25,000	$3,944	5,000	$250		
Flattery Banks	1,457,780	241,755	1,292,900	75,376	96,300	$1,978
West Coast, Vancouver Island	1,383,400	234,850	386,600	22,675	71,900	1,859
Cape Scott Grounds	76,000	11,131	500	50	3,000	60
Queen Charlotte Islands Grounds	27,000	4,500	16,500	825		
Hecate Strait	4,601,810	660,168	329,100	20,058	22,900	458
Forrester Island Grounds	4,000	520	40,000	2,000		
Coronation Island	65,000	9,285	38,000	2,280		
Yakutat Grounds	165,000	22,725				
Total	7,804,990	1,188,878	2,108,600	123,514	194,100	4,355
BY MONTHS						
January	104,500	15,601	14,300	805		
February	240,600	39,620	51,900	2,665	10,000	200
March	424,300	82,734	52,500	4,165	24,300	926
April	618,700	94,543	50,200	4,110	85,700	1,757
May	1,347,800	186,145	22,000	1,850	30,100	602
June	969,910	144,794	316,400	21,552	17,000	340
July	1,427,850	196,934	635,900	35,530	3,000	20
August	1,006,600	128,859	303,300	15,815	4,000	80
September	788,400	128,841	222,700	12,700	1,000	20
October	520,100	105,036	307,000	16,125	16,000	350
November	259,500	49,422	113,200	7,100	3,000	60
December	96,730	16,349	19,200	1,097		
Total	7,804,990	1,188,878	2,108,600	123,514	194,100	4,355

	Rockfishes		Number of trips	Total	
	Fresh			Fresh	
	Pounds	*Value*		*Pounds*	*Value*
BY FISHING GROUNDS					
Oregon Coast			2	30,000	$4,194
Flattery Banks	55,500	$2,650	335	2,902,480	321,759
West Coast, Vancouver Island	26,900	1,060	219	1,868,800	260,444
Cape Scott Grounds			8	79,500	11,241
Queen Charlotte Islands Grounds	7,000	140	2	50,500	5,465
Hecate Strait	40,500	990	344	4,994,310	681,674
Forrester Island Grounds			1	44,000	2,520
Coronation Island			4	103,000	11,565
Yakutat Grounds			4	165,000	22,725
Total	120,900	4,840	919	10,237,590	1,321,587
BY MONTHS					
January			6	118,800	16,406
February	12,500	250	36	315,000	42,735
March	5,900	260	68	507,000	88,085
April			93	754,600	100,410
May	15,800	556	133	1,415,700	189,153
June	21,500	430	134	1,324,810	167,116
July	9,000	450	124	2,075,750	232,934
August	17,200	729	92	1,331,100	145,483
September	41,500	2,015	86	1,053,600	143,576
October	3,500	90	84	846,600	121,601
November	3,000	60	50	378,700	56,042
December			13	115,930	17,446
Total	120,900	4,840	919	10,237,590	1,321,587

Fishery products, by months, taken in Puget Sound and landed at Seattle, Wash., by collecting vessels, 1923

Species	January		February		March		April		May	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Sturgeon									1,400	$140
Herring	24,000	$600	34,000	$340	32,000	$320	128,000	$640		
Salmon:										
King or spring									420,000	50,400
Sockeye or red									4,000	400
Trout: Steelhead									64,000	2,880
Smelt	35,500	4,200			2,750	2,750	16,000	1,600		
Perch	6,000	360	9,500	665	8,200	492	11,800	690	12,600	882
Rockfishes	5,000	400	4,100	328	7,000	420	6,400	512	6,000	120
"Lingcod"	28,000	1,900	16,300	978						
Flounders	2,600	78	4,000	80	4,100	82	5,000	100		
Sole	24,500	980	17,800	712	26,000	780	32,000	1,280	21,000	840
Crabs	98,000	7,760	68,640	4,680	57,200	3,900	118,804	7,623	20,284	1,333
Total	223,600	16,338	154,340	7,783	162,000	8,744	318,004	12,445	549,284	56,995

Species	June		July		August		September	
	Pounds		*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Sturgeon					3,600	$360		
Salmon:								
Humpback or pink			27,000	$1,080	1,633,400	65,336	86,000	$3,440
Chum or keta			16,300	326	271,200	8,136	22,000	660
King or spring	2,235,200	$268,224	2,777,800	277,780	1,620,000	162,000	237,500	23,750
Coho or silver	88,300	4,415	178,000	8,900	1,015,000	50,750	1,230,000	73,800
Sockeye or red	24,900	2,998	26,400	1,320	36,800	3,680		
Trout: Steelhead	65,600	6,560	19,000	1,900	28,800	2,880		
Smelt			18,400	2,208			31,600	1,476
Rockfishes	8,200	164	8,600	602	8,700	696	7,400	144
"Lingcod"	3,000	60						
Flounders	10,500	210	13,400	268	6,000	120	6,000	120
Sole	6,300	252	7,000	245	20,600	824	12,500	490
Crabs	19,140	1,305						
Total	2,461,140	284,188	3,091,900	294,620	4,644,100	294,782	1,633,000	103,880

Species	October		November		December		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Sturgeon							5,000	$500
Herring							218,000	1,900
Salmon:								
Humpback or pink							1,746,400	69,856
Chum or keta	898,000	$35,920	410,000	$16,400			1,617,500	61,442
King or spring	41,400	4,140	32,000	3,200			7,363,900	789,494
Coho or silver	1,620,000	97,200	760,000	45,600			4,891,300	280,065
Sockeye or red							92,100	8,398
Trout: Steelhead	8,000	800					185,400	15,020
Smelt	17,500	1,750	18,000	1,800	65,000	$6,500	229,500	22,284
Perch					12,800	1,024	60,900	4,113
Rockfishes	6,500	520	11,500	230	9,300	558	88,700	4,694
"Lingcod"							47,300	2,998
Flounders	4,000	80	6,000	240	8,900	178	70,500	1,556
Sole	12,000	480	6,000	180	46,000	1,380	231,700	8,443
Crabs	26,950	1,837	68,000	4,635	62,260	4,295	[1] 539,278	37,368
Total	2,634,350	142,727	1,311,500	72,285	204,260	13,935	17,387,478	1,308,731

[1] 23,459 dozen.

FISHERIES OF CALIFORNIA, 1923

Through the courtesy of the California Fish and Game Commission the bureau has received copies of its monthly sheets showing the catch of fish, by species and by counties, for California, and also the quantity of fish imported into California from Mexico, during the calendar year 1923. These statistics have been compiled by species and by months, as shown in the appended tables.

In 1923 the catch of fish taken in the waters of California amounted to 230,830,942 pounds, an increase of 61,861,209 pounds, or 37 per cent, over the catch of 1922. The species taken in largest quantities were pilchard, 159,197,006 pounds; albacore and tuna, 16,562,351 pounds; flounders, 10,485,431 pounds; barracuda, 5,135,824 pounds;

bonito or skipjack, 5,057,848 pounds; salmon, 7,090,260 pounds; rockfishes, 4,932,350 pounds; mackerel, 3,553,954 pounds; yellowtail, 2,968,596 pounds; white sea bass ors queteague, 1,782,008 pounds; shad, 1,285,383 pounds; crabs, 1,075,800 pounds; shrimp, 1,113,358 pounds; abalones, 1,555,134 pounds; and squid, 1,176,065 pounds.

The imports of fresh fish from Mexico in 1923 amounted to 23,956,962 pounds, an increase of 11,810,896 pounds, or 97 per cent, as compared with 1922. The principal species imported during the year were albacore and tuna, 10,752,864 pounds; bonito or skipjack, 7,519,191 pounds; barracuda, 2,064,751 pounds; yellowtail, 1,011,015 pounds; flounders, 883,263 pounds; white sea bass or squeteague, 591,877 pounds; and sea crawfish or spiny lobster, 708,477 pounds. These products are caught by fishermen having their home ports in California and fishing in Mexican waters a portion of the year.

Products, in pounds, of the fisheries of California, 1923

Species	January	February	March	April	May	June	July
Albacore and tuna	1,064		27,580	8,339	131,467	1,595,647	3,617,461
Anchovies	14,347	1,015	475	6,250	465	6,448	24,743
Barracuda	16,435	37,271	127,466	765,298	1,473,143	966,696	608,849
Bluefish, California, or squeteague	986	1,343	1,631	3,567	4,840	5,160	3,025
Bonito or skipjack	16,645	631	14,168	1,163	3,876	4,123	33,054
Carp	8,739	12,280	14,303	21,509	16,177	7,426	3,133
Catfish	11,121	11,279	15,380	19,197	9,540		
Eels			18,116		53	64	
Flounders	840,277	1,122,805	986,002	686,337	941,997	860,741	860,788
"Hake"	1,250		40	8,631	6,363	8,875	7,800
Hardhead	2,995	2,613					
Herring	118,779	117,774	31,230	800		330	
Kingfish	38,216	27,634	58,564	74,073	49,809	13,667	15,251
"Lingcod"	28,227	55,402	55,306	15,421	16,660	12,436	28,447
Mackerel	212,682	241,445	189,439	184,843	248,237	208,054	249,943
Mullet		5,746	1,411	2,850			
"Perches," surf	14,376	17,151	74,256	28,746	15,601	17,144	38,403
Pike, Sacramento	1,797	233	90	81	122	232	127
Pilchard	21,402,901	36,811,099	16,757,293	5,791,332	928,054	2,136,721	4,909,163
Pompano, California	99	972	1,312	1,206	2,475	3,183	6,501
Rockfishes	557,490	644,820	879,178	402,798	256,467	270,119	299,981
Sablefish	9,105	22,117	27,687	13,604	53,035	49,073	27,126
Salmon	23,849	322,509	50,384	314,994	766,799	1,474,866	1,276,202
Sculpin	3,305	3,020	9,522	8,329	8,215	2,970	300
Sea bass, black	6,244	7,382	3,995	3,458	6,375	15,163	11,690
Sea basses, or "rock bass"	2,438	19,257	22,684	13,137	31,880	73,113	65,505
Sea bass, white or squeteague	40,359	21,670	25,153	178,328	445,564	261,768	197,695
Shad	1,694	822	98,788	637,026	535,419	748	
Sharks	57,535	35,177	30,390	30,695	28,244	19,593	8,392
Sheepshead	9,032	8,042	4,415	1,275	644	53	
Skates	25,042	13,193	15,891	7,372	12,293	3,645	4,268
"Smelt"	57,578	40,804	93,044	67,387	45,290	27,770	39,735
Split-tail	5,380	5,916	1,804	20			
Stingaree or stingary	365						
Striped bass	88,708	41,537	128,507	216,652	197,732	524	69
Suckers	90	183					
Swordfish							2,234
Tomcod	4,727	6,233	2,271		384	2,573	4,150
Whitebait	320	867	2,750	3,688	12,802	22,181	12,573
Whitefish	3,323	2,825	1,998	1,743	2,190	775	1,795
Yellowtail	23,871	3,756	87,322	150,623	94,997	593,288	427,488
Other fish	15,789	35,091	16,895	10,794	16,649	18,627	14,045
Crabs	145,584	100,416	206,496	67,368	68,088	31,392	34,176
Sea crawfish or spiny lobster	65,154	60,233					
Shrimp	72,365	67,509	92,553	60,746	64,691	82,693	136,319
Abalones	2,439		85,603	153,700	241,509	154,370	193,005
Clams	43,992	42,528	45,730	41,341	46,600	43,535	50,338
Cockles	6,169	5,473	5,665	6,416	4,683	2,279	1,877
Mussels	812	1,305	1,383	8,695	4,200	10,310	8,675
Oysters, eastern	60,134	81,354	68,746	51,700	42,735	38,214	29,700
Octopus	9,258	15,213	17,827	8,519	6,203	8,552	11,754
Squid	165	14,830	62,680	103,647	429,369	356,970	78,360
Terrapins						72	336
Turtles							960
Total	24,073,252	40,093,775	20,463,423	10,243,698	7,272,026	9,412,183	13,345,437

Products, in pounds, of the fisheries of California, 1923—Continued

Species	August	September	October	November	December	Total
Albacore and tuna	9, 965, 354	844, 069	146, 554	224, 361	455	16, 562, 351
Anchovies	70, 811	54, 055	81, 758	45, 310	1, 397	307, 074
Barracuda	324, 214	260, 946	484, 469	53, 079	17, 958	5, 135, 824
Bluefish, California, or squeteague	3, 486	2, 491	45, 370	37, 447	37, 032	146, 378
Bonito or skipjack	229, 237	4, 625, 133	80, 741	29, 324	19, 753	5, 057, 848
Carp	4, 023	805	24, 757	16, 560	18, 895	148, 607
Catfish	7, 843	15, 149	10, 559	17, 030	12, 188	129, 286
Eels			16			18, 249
Flounders	855, 740	820, 651	974, 339	804, 167	731, 587	10, 485, 431
"Hake"	5, 600	10, 150	16, 625	8, 460	5, 175	78, 969
Hardhead		34	1, 516	806	1, 599	9, 563
Herring			50	224	114, 763	383, 950
Kingfish	11, 467	14, 308	30, 757	27, 895	41, 794	403, 435
"Lingcod"	60, 060	82, 710	37, 594	39, 197	35, 840	467, 300
Mackerel	239, 541	231, 625	699, 246	517, 274	328, 625	3, 553, 954
Mullet						10, 007
"Perches," surf	27, 378	14, 854	33, 403	17, 406	27, 331	326, 049
Pike, Sacramento	465	136	6	113	1, 222	4, 624
Pilchard	5, 118, 255	18, 767, 887	14, 640, 205	13, 516, 474	18, 417, 622	159, 197, 006
Pompano, California	1, 175	565	436	836	1, 020	19, 780
Rockfishes	185, 376	240, 769	241, 853	454, 721	438, 778	4, 932, 350
Sablefish	35, 242	56, 484	71, 664	84, 036	89, 119	538, 292
Salmon	1, 451, 935	1, 083, 229	74, 405	221, 776	29, 312	7, 090, 260
Sculpin	417	2, 764	7, 267	7, 836	6, 521	60, 466
Sea bass, black	6, 099	3, 300	3, 844	6, 210	1, 979	75, 740
Sea basses, or "rock bass"	45, 700	10, 602	16, 620	16, 026	11, 077	328, 039
Sea bass, white or squeteague	364, 963	102, 850	67, 147	54, 057	22, 454	1, 782, 008
Shad	3, 075	682		4, 393	2, 736	1, 285, 383
Sharks	7, 870	12, 330	39, 260	34, 838	56, 039	360, 363
Sheepshead	50	350	1, 081	3, 861	2, 308	31, 111
Skates	8, 400	7, 100	4, 310	11, 158	21, 316	133, 988
"Smelt"	48, 608	94, 059	105, 780	104, 012	74, 683	798, 840
Split-tail	600	200			36	13, 956
Steelhead trout	2, 675	100	14	222		3, 011
Stingaree or stingary						365
Striped bass	89, 996	41, 617		43, 480	60, 751	909, 573
Suckers				20	49	342
Swordfish	4, 160	2, 706	561	1, 395		11, 056
Tomcod	11, 636	2, 391	3, 972	867	2, 563	41, 767
Whitebait	7, 222	3, 557	1, 351	282	135	67, 818
Whitefish	110	4, 608	5, 029	2, 996	7, 111	34, 503
Yellowtail	303, 231	529, 623	554, 112	198, 722	1, 563	2, 968, 596
Other fish	10, 231	6, 747	13, 263	6, 021	5, 893	170, 045
Crabs				147, 096	275, 184	1, 075, 800
Sea crawfish or spiny lobster			59, 789	126, 967	72, 238	384, 381
Shrimp	120, 296	140, 419	130, 366	81, 144	58, 257	1, 113, 358
Abalones	191, 350	172, 934	88, 092	158, 704	113, 428	1, 555, 134
Clams	51, 427	48, 565	44, 500	46, 223	41, 312	546, 091
Cockles	1, 673	636	341	321	584	36, 117
Mussels	12, 603	4, 540	3, 136	2, 164	2, 203	60, 026
Oysters, eastern	29, 601	58, 784	59, 119	73, 238	94, 778	688, 103
Octopus	6, 327	2, 376	4, 456	8, 178	11, 559	110, 222
Squid	51, 123	6, 218	5, 389	625	66, 689	1, 176, 005
Terrapins	552	72	96			1, 128
Turtles						960
Total	19, 977, 287	28, 392, 180	18, 915, 218	17, 257, 552	21, 384, 911	230, 830, 942

Mexican fishery products, in pounds, imported into California, 1923

Species	January	February	March	April	May	June	July
Albacore and tuna	8,640	198	90,982	104,862	210,414	105,810	
Barracuda	405,924	160,640	390,676	122,189		205	1,517
Bluefish, California, or squeteague						730	
Bonito or skipjack	26,681	20,128	10,862				
Flounders	34,464	41,825	82,929	12,710	27,710	74,561	155,099
Kingfish	70	187		5,900	1,820		57
"Lingcod"	10		21				
Mackerel	8,741	18,845	5,665	200	125	130	
Mullet	5,173	10,686	8,951	5,885	3,918		
"Perches," surf	7,160	15,442	677				
Pompano, California	215	2,361	4,792				
Rockfishes	3,800	5,249			160	5,582	145
Sea bass, black	24,071	25,857	30,295	875	5,580	1,670	1,409
Sea basses or "rock bass"	5,302	1,819	4,181	2,488		20	
Sea bass, white or squeteague	18,806	50,682	61,476	59,895	11,654	18,716	75,617
Sheepshead	40		35				
"Smelt"	1,100	820	25	80			85
Swordfish			70				
Whitefish	1,276	1,180		118			
Yellowtail	101,314	86,271	66,633	11,527	2,283	903	2,371
Other fish	1,486	2,292	1,260	140	2,225	795	286
Sea crawfish or spiny lobster	93,057	115,909	158,087	66,693			
Abalones					2,430	5,145	6,650
Clams		797					
Squid			4,381				
Turtles	1,050	785					
Total	748,280	561,973	921,998	393,562	268,319	214,267	243,236

Species	August	September	October	November	December	Total
Albacore and tuna	37,456	1,532,320	6,047,814	2,550,922	63,446	10,752,864
Barracuda	24,433	48,061	346,908	338,033	216,165	2,064,751
Bluefish, California, or squeteague						730
Bonito or skipjack	27,191	29,800	2,629,321	3,951,665	823,643	7,519,191
Flounders	171,503	132,566	52,223	60,931	46,742	883,263
Kingfish					95	8,129
"Lingcod"				16		47
Mackerel	45	2,344	690	665	1,045	38,495
Mullet			8,435	8,740	12,430	64,218
"Perches," surf				1,835	8,519	33,633
Pompano, California			140		5,630	13,138
Rockfishes			1,260	1,070	628	17,894
Sea bass, black	1,386	1,040	10,684	18,656	29,732	151,255
Sea basses or "rock bass"	363	1,172	213	2,397	11,275	29,230
Sea bass, white or squeteague	142,322	68,848	36,016	32,200	15,645	591,877
Sheepshead			145	297		517
"Smelt"	174	366	277	718	3,895	7,540
Swordfish			565			635
Whitefish				2,681	150	5,405
Yellowtail	12,040	36,071	31,373	294,869	365,360	1,011,015
Other fish	404		397		4,499	13,784
Sea crawfish or spiny lobster			47,464	115,256	112,011	708,477
Abalones	11,954				6,420	32,599
Clams						797
Squid						4,381
Turtles		142			1,120	3,097
Total	429,271	1,852,730	9,223,925	7,370,951	1,728,450	23,956,962

FISHERY PRODUCTS RECEIVED AT MUNICIPAL FISH WHARF AND MARKET, WASHINGTON, D. C.[2]

The receipts of fishery products at the municipal fish wharf and market, Washington, D. C., in 1923 amounted to 5,678,157 pounds, a decrease of 764,506 pounds, or 12 per cent, as compared with 1922. The most important products in quantity were squeteagues or "sea trout," 1,162,927 pounds; oysters, 804,266 pounds; croaker, 645,376 pounds; river herring, 545,845 pounds; and crabs, including crab meat, 327,017 pounds. The species ranking next in importance include bass, butterfish, carp, catfish, flounders, haddock, hake, halibut, mackerel, perch, shad, spot, and striped bass.

Fishery products, in pounds, received at municipal fish wharf and market, Washington, D. C., 1923

Species	January	February	March	April	May	June	July
Bass, black or sea	26,429	5,641	9,895		3,000	13,900	6,950
Bluefish				1,000	2,200	1,812	3,200
Butterfish				1,000	10,200	32,800	30,100
Carp	5,203	3,477	7,834	5,090	17,955	20,712	4,507
Catfish	8,914	4,660	20,667	14,456	14,493	6,172	4,429
Cod	4,700	4,100	3,300			1,800	4,800
Croaker		1,500	74,380	81,500	60,800	81,620	219,828
Eels	625		462	797	72	30	80
Flounders	5,250	4,975	6,315	3,010	9,400	15,900	15,180
Gizzard shad	4,000	11,870	5,100				60
Haddock	9,430	13,675	25,470	13,000	1,500	1,200	5,300
Hake	2,000						500
Halibut	15,050	9,350	4,100	3,400	4,800	6,250	7,000
Herring, river	1,782	10,685	92,738	158,990	279,240	1,200	
Hickory shad or "jacks"	600		6,082	2,907	600		
Kingfish		2,100					
Mackerel	10,700	14,500	9,200	1,150	4,000	9,220	4,250
Mullet	144	1,176	140				
Perch	12,148	10,143	42,221	21,735	13,080	2,065	3,247
Pike or pickerel	1,722	706	2,481	217			
Pollock							1,650
Redfish or red drum					600	200	1,440
Red snapper		400	1,000				
Salmon	3,350			150		150	3,000
Scup or porgy						400	3,700
Shad	600	600	18,300	100,942	72,170	700	
Sheepshead		600					
Smelt	300	450					
Spot				11,800	2,900	650	3,930
Squeteagues or "sea trout"	28,030	21,090	9,380	10,600	63,500	118,500	124,000
Squid							1,200
Striped bass	151	531	32,099	26,858	10,500	5,041	10,262
Sturgeon						69	
Swordfish							300
Tilefish	400	200	1,000	400	1,600	2,100	
Clams	1,728	1,024	544	1,696	1,408	5,888	8,806
Oysters:							
In the shell	46,690	18,200	19,216	3,290	175	98	91
Opened	57,650	35,483	51,356	4,084			
Scallops	400						
Crabs				165	3,300	36,492	128,511
Crab meat	275	275	50	150	6,625	31,560	14,405
Lobster						100	50
Shrimp		1,450	200			400	725
Turtles			205				
Frogs				24			
Total	248,280	178,861	443,734	468,411	584,118	397,029	611,591

NOTE.—The clams have been reduced to pounds on the basis of 8 pounds of meat to a bushel; the oysters on a basis of 7 pounds of meat to a bushel and 8¼ pounds to a gallon.

[2] Daily reports of the quantity of fishery products received at this market are received by the bureau for tabulation through the courtesy of the health department of the District of Columbia.

Fishery products, in pounds, received at municipal fish wharf and market, Washington, D. C., 1923—Continued

Species	August	September	October	November	December	Total
Bass, black or sea	3,200	4,700	6,100	21,000	17,405	118,220
Bluefish	8,572	19,300	16,100	800	710	53,694
Butterfish	27,860	31,000	12,900	7,100	1,000	153,060
Carp	6,140	5,300	9,630	5,175	10,580	101,603
Catfish	4,198	11,895	27,950	26,300	12,150	156,284
Ciscoes				300		300
Cod	3,300	6,100	10,200	4,000	4,000	46,300
Croaker	42,548	43,400	14,800	16,900	8,100	645,376
Eels	25	100	975	1,800	1,560	6,526
Flounders	5,250	6,157	19,400	9,600	10,500	110,937
Gizzard shad	200	1,300	4,500	10,400	8,430	45,860
Haddock	9,350	17,170	20,480	33,000	26,060	175,635
Hake		125	1,400	62,400	34,001	100,426
Halibut	4,350	4,100	7,800	66,000	4,100	136,300
Herring:						
River		100	680	430		545,845
Sea				1,500		1,500
Hickory shad or "jacks"						10,189
Kingfish				1,000	1,400	4,500
Mackerel	5,200	15,550	15,800	4,700	19,900	114,170
Mullet			2,200	900	350	4,910
Perch	1,995	1,960	5,800	16,300	15,400	146,094
Pike or pickerel		400	875	3,800	2,360	12,581
Pollock	800	4,900	16,100	12,201	1,200	36,851
Pompano		250	200			450
Redfish or red drum		200	3,084	1,000		6,524
Red snapper					1,400	2,800
Salmon	4,150	2,300	5,800	10,500	1,000	30,400
Scup or porgy	1,200	400	800		200	6,700
Shad				1,000		194,312
Sheepshead			200	50		850
Smelt					2,080	2,830
Spot	16,275	18,050	48,300	2,500		104,405
Squeteagues or "sea trout"	157,727	282,300	236,000	78,000	32,900	1,162,927
Squid						1,200
Striped bass	28,455	9,745	52,650	34,400	9,900	220,592
Sturgeon			346			415
Swordfish	350					650
Tilefish		500	1,350	2,000	800	10,350
Whitefish			200	600		800
Whiting			1,400	11,800	3,700	16,900
Clams	4,448	4,960	4,000	3,072	2,624	[1] 40,288
Oysters:						
In the shell	308	21,210	127,204	168,602	98,322	[2] 503,405
Opened	297	10,288	43,544	48,914	49,236	[3] 300,861
Scallops		80	160	320	600	1,560
Crabs	47,325	32,304	8,850		300	257,247
Crab meat	6,355	6,445	2,410		1,220	69,770
Lobster		50		50	50	300
Shrimp	900	2,100	3,600	2,088	975	12,438
Terrapin					598	598
Turtles	200	95	20			520
Frogs						24
Total	390,978	504,834	734,708	670,502	385,111	5,678,157

[1] 5,036 bushels [2] 71,915 bushels. [3] 36,468 gallons.

FLORIDA SPONGE FISHERY

The quantity of sponges sold at the Tarpon Springs Exchange in Florida, in 1923, was 490,200 pounds, valued at $734,391. This total included large wool sponges, 243,230 pounds, valued at $604,343; small wool, 54,292 pounds, valued at $59,721; yellow, 87,878 pounds, valued at $46,868; grass, 88,772 pounds, valued at $15,979; wire, 16,028 pounds, valued at $7,480. It is estimated that sponges to the value of $50,000 were sold at Tarpon Springs outside of the exchange.

SHAD AND ALEWIFE FISHERY OF THE POTOMAC RIVER, 1922 AND 1923

The shad and alewife fishery of the Potomac River was canvassed for the calendar years 1922 and 1923. The statistics show that in 1922 this fishery employed 832 fishermen, with a total investment of $190,532, and produced 884,176 shad weighing 3,115,571 pounds, valued at $420,022, and 11,367,000 alewives weighing 4,546,800 pounds, valued at $38,342. The same fishery in 1923 employed 888 fishermen, with an investment of $240,832 and produced 351,546 shad weighing 1,187,382 pounds, valued at $198,619, and 11,428,569 alewives weighing 4,570,828 pounds, valued at $49,421.

Comparing these data with the average for the three previous years (1919, 1920, and 1921), we find that in 1922 there were fewer fishermen by 1 per cent, with an increase of 79 per cent in the number of shad and 22 per cent in the number of alewives caught; and in 1923, with a 5 per cent increase over the three-year average of fishermen employed, there was a 29 per cent decrease in the number of shad and a 23 per cent increase in the number of alewives caught.

The following tables give the detailed statistics of this fishery in 1922 and 1923:

Shad and alewife fishery of the Potomac River, 1922

Items	Maryland			Virginia			Total		
	Number	*Pounds*	*Value*	*Number*	*Pounds*	*Value*	*Number*	*Pounds*	*Value*
Fishermen	292			540			832		
Rowboats	118		$4,550	162		$4,500	280		$9,050
Gasoline boats	46		12,490	186		58,025	232		70,515
Pound nets	82		12,085	216		65,850	298		77,935
Gill nets	114		7,260	135		18,252	249		25,512
Seines	4		720				4		720
Shore and accessory property			2,600			4,200			6,800
Total			39,705			150,827			190,532
Shad caught:									
With pound nets	31,555	110,387	15,154	387,035	1,385,209	188,313	418,590	1,495,596	203,467
With gill nets	168,427	583,664	78,354	293,459	1,023,861	136,569	461,886	1,607,525	214,923
With seines	3,700	12,450	1,632				3,700	12,450	1,632
Total	203,682	706,501	95,140	680,494	2,409,070	324,882	884,176	3,115,571	420,022
Alewives caught:									
With pound nets	1,275,000	510,000	3,613	9,934,500	3,973,800	33,902	11,209,500	4,483,800	37,515
With gill nets	7,500	3,000	37	140,000	56,000	740	147,500	59,000	777
With seines	10,000	4,000	50				10,000	4,000	50
Total	1,292,002	517,000	3,700	10,074,500	4,029,800	34,642	11,367,000	4,546,800	38,342

Shad and alewife fishery of the Potomac River, 1923

Items	Maryland			Virginia			Total		
	Number	*Pounds*	*Value*	*Number*	*Pounds*	*Value*	*Number*	*Pounds*	*Value*
Fishermen	283			605			888		
Rowboats	124		$4,810	208		$7,250	332		$12,060
Gasoline boats	50		12,475	229		70,460	279		82,935
Pound nets	89		12,425	293		102,210	382		114,635
Gill nets	114		10,580	139		12,782	253		23,362
Seines	4		1,200				4		1,200
Shore and accessory property			2,725			3,915			6,640
Total			44,215			196,617			240,832
Shad caught:									
With pound nets	6,936	21,932	3,623	170,389	580,856	95,379	177,325	602,788	99,002
With gill nets	76,183	259,484	44,754	87,538	297,797	50,323	163,721	557,281	95,077
With seines	10,500	27,313	4,540				10,500	27,313	4,540
Total	93,619	308,729	52,917	257,927	878,653	145,702	351,546	1,187,382	198,619
Alewives caught:									
With pound nets	2,009,787	803,916	8,214	8,827,532	3,530,412	37,055	10,837,319	4,334,328	45,269
With gill nets				481,250	192,500	3,602	481,250	192,500	3,602
With seines	110,000	44,000	550				110,000	44,000	550
Total	2,119,787	847,916	8,764	9,308,782	3,722,912	40,657	11,428,569	4,570,828	49,421

PEARL-BUTTON INDUSTRY, 1922

The canvassing of the Mississippi River and tributaries and of the Great Lakes in 1922 permits of a statistical summary of the pearl-button industry of the interior United States.

The fresh-water mussel, which furnishes the raw materials for this industry occurs mainly in the Mississippi River and tributaries, the yield of mussel shells in this region amounting to 51,768,173 pounds valued at $1,050,592, to which may be added 6,245,975 pounds, valued at $218,148, coming from rivers tributary to Lake Michigan and Lake Erie, making a total of 58,014,148 pounds, valued at $1,268,740 in 1922.

The manufacture of pearl buttons takes place principally in the Mississippi River region, Muscatine, Iowa, being the center of the industry, especially in the manufacture of the complete button. There are many factories, scattered over the entire Mississippi Valley, engaged in making button blanks only. Many of these are merely branches of Muscatine or eastern button factories, while others work under contract with these firms or sell the blanks on the open market. One button factory, one blank factory, and one crusher, located in Michigan, are the only establishments in the interior United States outside of the Mississippi region.

Including these and one factory engaged in finishing and grading only, there were, in 1922, 16 factories, with a value of $1,362,280, in the interior United States engaged in making the complete button, and 100 factories, valued at $697,039, engaged in cutting blanks only. Of the above factories 34 had crushers attached, valued at $46,744, for grinding shells into a product sold mainly as poultry grit. There were also four independent crushers, not attached to button or button-blank factories. The total number of persons connected with this industry in 1922 was 4,984, and the amount of wages paid was $3,277,136, which included that paid in the manufacture of button blanks shipped to button factories in the east. The total output of buttons in 1922 was 12,413,984 gross, with a value of $4,725,242. Several million gross of button blanks manufactured in this region were shipped east for use in making the finished button. Among the by-products from shells were 18,276 tons of poultry grit, valued at $146,142, and 2,335 tons of stucco, valued at $33,975.

The following table shows the detailed statistics of this industry. In addition, there were two firms in Muscatine, Iowa, engaged in the manufacture of novelties, not shown below.

Pearl-button industry of the Mississippi River, its tributaries, and the Great Lakes, 1922

Items	Arkansas		Illinois		Indiana and Missouri		Iowa	
	Number	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Persons engaged	209		455		740		2,922	
Wages paid		$86,178		$266,611		$444,746		$2,078,243
Classification of plants:								
Complete button manufacture					3	85,251	[1] 10	1,152,555
Cutting only	5	17,194	[2] 15	92,121	16	103,475	48	360,074
Crushers connected with factories	1	500	3	4,900	6	3,400	14	23,874
Independent crushers			1	1,000			3	28,300
Total separate plants	5	17,694	16	98,021	19	192,126	61	1,564,803
Products manufactured:								
Buttons...gross					573,246	188,484	10,712,597	4,086,100
Button blanks [3]...do	664,667	141,847	2,156,863	454,613	2,985,086	669,716	7,070,850	1,681,599
By-products—								
Poultry grit...tons	9	45	431	3,544	889	7,069	15,200	121,738
Stucco...do					30	300	2,305	33,675
Lime and dust...do			250	250	138	177	2,000	2,000
Waste shells sold...*do*	1,450	2,300			625	1,200	6,728	16,572

Items	Kansas, Kentucky, and Minnesota		Ohio, Tennessee, and West Virginia		Wisconsin [4]		Total	
	Number	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Persons engaged	177		196		285		4,984	
Wages paid		$141,765		$129,042		$130,551		$3,277,136
Classification of plants:								
Complete button manufacture					3	124,474	16	1,362,280
Cutting only	7	48,144	4	49,710	5	26,321	100	697,039
Crushers connected with *factories*	3	3,200	3	5,400	4	5,500	34	46,774
Independent crushers							4	29,300
Total separate plants	7	51,344	4	55,110	8	156,295	120	2,135,393
Products manufactured:								
Buttons...gross					1,128,141	450,658	12,413,984	4,725,242
Button blanks [3]...do	1,177,820	252,066	1,143,702	269,358	504,236	110,559	15,703,224	3,579,758
By-products—								
Poultry grit...tons	243	2,191	902	6,582	602	4,973	18,276	146,142
Stucco...do							2,335	33,075
Lime and dust...tons	23	210	150	600	54	264	2,615	3,501
Waste shells sold...do	498	274	56	140			9,357	20,486

[1] Includes one plant engaged in finishing and grading only.
[2] Includes one plant engaged in grading only.
[3] Includes all blanks except those *made* at *factories* where both blanks and complete buttons are manufactured.
[4] Includes one button factory, one blank factory, and one crusher in Michigan.

FISHERIES OF THE MISSISSIPPI RIVER AND TRIBUTARIES, 1922

The statistics of the fisheries of the Mississippi River and tributaries, presented in this report, are for the calendar year 1922. Excepting for the inclusion of the Atchafalaya River in the canvass for 1922, the area covered and the method of taking the data were so arranged as to make the statistics comparable with those of 1899 and 1903. A summary of these statistics has already been published as Statistical Bulletin No. 607, but the detailed statistics are published herewith for the first time.

COMMON AND SCIENTIFIC NAMES OF FISHES

Following is a list of the common and scientific names of the fishes referred to in the tables and discussions in this report:

Black bass	*Micropterus salmoides.*
Bowfin	*Amiatus calvus.*
Buffalofish	*Ictiobus cyprinella.*
Carp, German	*Cyprinus carpio.*
Catfish and bullheads	Ameiurus (species). Ictalurus (species).
Crappie	*Pomoxis annularis.* *Pomoxis sparoides.*
Drum, fresh-water, or sheepshead	*Aplodinotus grunniens.*
Eels	*Anguilla chrysypa.*
Moon-eye, or toothed herring	Hiodon (species).
Paddlefish, or spoonbill cat	*Polyodon spathula.*
Pike and pickerel	Esox (species).
Pike perch (sauger)	*Stizostedion canadense griseum.* *Stizostedoin canadense.*
Pike perch (wall-eyed)	*Stizostedion vitreum.*
Quillback, or American carp	*Carpiodes velifer.*
Rock bass	*Ambloplites rupestris.*
Sturgeon, lake	*Acipenser rubicundus.*
Sturgeon, shovelnose	*Scaphirhynchus platorhynchus.*
Suckers	Catostomidæ (species).
Sunfish	Centrarchidæ (species).
White bass	*Roccus chrysops.*
Yellow bass	*Morone interrupta.*
Yellow perch	*Perca flavescens.*

GENERAL STATISTICS

The number of persons engaged in the fisheries in this entire region in 1922 was 19,122, as compared with 13,377 in 1903, the year covered by the last canvass of this bureau. Nearly one-third of those engaged were connected either with the pearl-button industry or the wholesale fish trade. The total investment of the entire region amounted to $7,345,034 as compared with $3,555,540 in 1903. As in the case of persons engaged, a large part of the investment was in the pearl-button industry and wholesale fish trade. Other items contributing to the investment were the boats and gear operated by the fishermen. The fyke net was the most widely distributed, except lines, of any form of apparatus, occurring in all States except Pennsylvania and West Virginia. Slightly over one-half the entire number was used in Illinois and Louisiana. Haul seines occurred in all but seven States. Trammel nets and gill nets were not generally used, although in Iowa trammel nets were quite common. Shrimp traps were used only in Louisiana and Mississippi.

The total production of the fisheries of this region in 1922 amounted to 105,733,734 pounds, valued at $4,503,521, as compared with 93,374,159 pounds, valued at $1,841,168, taken in 1903, or an increase of 13 per cent in quantity and 145 per cent in value. The most important product, in terms of value and amount, was mussel shells, of which there were 51,768,173 pounds, valued at $1,050,592, together with $101,504 worth of pearls and slugs found in the mussels. These were taken in all of the States of this region except Louisiana, Mississippi, Texas, and Nebraska. Other important products were buffalo fish, $17,267,177 pounds, valued at $1,013,692; carp, 18,338,371 pounds, valued at $872,128; catfish and bullheads, 8,092,690 pounds, valued at $713,461; drum or sheepshead, 5,260,892 pounds, valued at $290,480; paddlefish or spoonbill cat, 1,398,991 pounds, valued at $132,545; to which might be added 12,398 pounds of caviar worth $29,546. The spoonbill cat, as this species is most commonly known, is in great demand in New York City, the fishermen sometimes receiving as high as 45 cents per pound for it. The caviar usually nets the shipper $3 a pound. The meat is used mainly in smoking. Among other important species might be mentioned suckers, quillback or American carp, and crappie, the combined value of these species being $171,587.

Along the lower portion of the Mississippi Valley the buffalofish is a predominating species and comprises about one-half of the catch taken, while the carp occurs irregularly or not at all in many portions of this region. From the Ohio River northward, however, the proportion of carp to buffalofish steadily increases. In Illinois we find two and one-half times as much carp as buffalofish, and in Wisconsin six times as much carp. In these two States the carp are practically all taken from the Illinois and Mississippi Rivers.

The output of the Mississippi River proper, including a few minor tributaries too unimportant to be shown separately, in 1922 amounted to 28,266,157 pounds, valued at $1,410,265, or about 27 per cent in quantity and 31 per cent in value of that of the Mississippi River and all of its tributaries. Fishing is prosecuted on this river from its mouth to Minneapolis. Mussels, however, are not taken to any extent commercially south of the mouth of the Missouri River, but are taken in some of the minor tributaries 200 miles or more north of Minneapolis. This river has probably been worked longer and more steadily than any other mussel-bearing stream.

The Illinois River was the most important tributary of the Mississippi River. In 1922 the number of persons engaged in the fisheries or related industries of this river and a few minor tributaries was 927. The total investment, including boats, apparatus, shore property, and cash capital, amounted to $332,367, and the entire output was 12,660,512 pounds, valued to the fishermen at $617,254. Carp and buffalo were the leading species making up this total, the catch of the two combined being equal in value to more than two-thirds that of the entire catch.

The White River and tributaries, in Arkansas and Missouri, rank next to the Illinois River. In 1922 there were 1,997 persons engaged in its fisheries or related industries. Its total investment was $190,327. Of this amount $105,060 was invested in boats, $47,470 in apparatus, $36,797 in shore property, and $1,000 in cash capital.

The total output of the White River and tributaries in 1922 amounted to 14,662,413 pounds, valued at $405,860. Buffalofish and catfish were far in the lead in value of catch among the fish, that of the two combined amounting to $95,477. Paddlefish and drum or sheepshead were also important, but the value of all of these species combined was less than one-half of that realized by the fishermen from mussel shells. Included with the White River, as a tributary, is the Black River, which is quite an important mussel stream.

The Ohio and minor tributaries follow the White River and tributaries in importance. The persons engaged numbered 1,720, and the investment was $656,212. The wholesale fish trade of Cincinnati contributed materially to this investment. The total production of this river in 1922 was 7,458,157 pounds, having a value of $379,089. Among the more valuable species, in the order of their importance, were catfish, carp, drum or sheepshead, suckers, quillback, and buffalofish. The total value of these species is about 72 per cent of the river's entire output. The value of the mussel shells, including pearls and slugs, amounted to $97,773, and was greater than that of any single species of fish.

Among other tributaries of the Mississippi River worthy of mention were the Wabash, with an output of 9,112,600 pounds, valued at $275,835, made up mainly both in quantity and value of mussel shells; and the Red River in Arkansas and Louisiana, with a total output in 1922 of 3,286,860 pounds, valued at $152,143, buffalofish contributing more than one-half of this value.

The Atchafalaya River, in Louisiana, was canvassed in 1922 for the first time since 1894. Though not strictly a tributary of the Mississippi, this river was found to have substantial communication with the latter and forms a part of the Mississippi River system. Its products in 1922 amounted to 4,579,220 pounds, valued at $254,651. Catfish and bullheads were the most important contributors to this total, followed in order by buffalofish, drum, and frogs.

Summaries of the statistics, by principal tributaries and by States, are shown in the following tables:

Persons engaged, investment, and products of the fisheries of the Mississippi River and tributaries in 1922, by tributaries

Items	Arkansas River		Atchafalaya River		Cumberland River	
	Number	*Value*	*Number*	*Value*	*Number*	*Value*
Persons engaged	451		1,012		94	
Gasoline boats	66	$7,770	672	$85,300	12	$1,450
Rowboats and scows	334	3,723	1,046	21,160	94	924
House boats	32	6,875	679	64,600		
Fyke nets	1,248	12,041	8,150	119,000	192	1,940
Lines		785		7,300		114
Haul seines	14	1,790	15	4,075		
Trammel nets	8	575				
Crowfoot bars (pairs)					51	690
Forks, tongs, rakes, and dredges	25	80			22	230
Other apparatus				1,373		
Shore and accessory property		29,780		147,820		405
Cash capital		1,000		35,700		
Total		64,419		486,328		5,753
PRODUCTS	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Black bass	2,568	$205				
Buffalofish	655,225	47,368	1,778,412	$85,910	21,850	$2,397
Carp, German	208,948	17,693			6,850	693
Catfish and bullheads	246,834	28,066	1,829,665	121,161	23,200	3,219
Crappie	13,740	845				
Drum, fresh-water, or sheepshead	443,266	34,679	721,727	25,852	10,250	1,041
Paddlefish or spoonbill cat	18,333	1,506			1,500	163
Paddlefish caviar	10	30				
Quillback or "American carp"	6,100	275				
Rock bass	500	40				
Sturgeon, shovelnose					1,400	120
Suckers					7,400	740
White bass	5,300	398				
Crawfish			7,265	500		
Frogs			216,912	17,376		
Turtles			12,867	1,940		
Alligator hides			12,372	1,912		
Mussel shells	432,860	4,962			656,000	5,965
Pearls						50
Slugs		222				289
Total	2,033,684	136,289	4,579,220	254,651	728,450	14,677

Persons engaged, investment, and products of the fisheries of the Mississippi River and tributaries, in 1922, by tributaries—Continued

Items	Illinois River and tributaries		Mississippi River and minor tributaries			
			Mississippi River[1]		Reelfoot Lake	
	Number	*Value*	*Number*	*Value*	*Number*	*Value*
Persons engaged	927		7,964		146	
Gasoline boats	261	$45,681	1,386	$274,470	6	$625
Rowboats and scows	617	20,205	2,139	43,001	156	2,865
House boats	64	24,950	217	42,823		
Fyke nets	9,004	79,130	15,339	182,430	2,223	15,650
Lines		3,259		6,690		838
Haul seines	91	32,175	386	110,457		
Trammel nets			224	17,656	20	2,360
Gill nets	3	900	803	12,348		
Pound nets			3	160		
Crowfoot bars (pairs)	139	2,625	407	4,170		
Forks, tongs, rakes, and dredges	21	73	83	225		
Shrimp traps			4,360	4,163		
Other apparatus		150		1,413		23
Shore and accessory property		105,319		3,409,555		17,970
Cash capital		17,900		196,000		4,600
Total		332,367		4,305,561		44,931
PRODUCTS	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Black bass			6,674	$723	33,962	$6,105
Bowfin	102,065	$4,543	43,135	1,038	4,873	97
Buffalofish	2,336,033	150,532	5,842,828	357,352	206,366	16,509
Carp, German	6,434,539	290,144	9,374,073	392,286	55,111	2,204
Catfish and bullheads	392,844	55,458	3,095,732	280,473	97,360	7,789
Crappie	108,135	8,729	133,630	10,776	84,018	12,603
Drum, fresh-water, or sheepshead	80,710	5,400	2,066,591	100,478	71,294	1,426
Eels	6,500	325	8,482	672	578	35
Paddlefish or spoonbill cat	21,200	1,640	508,076	50,279	1,888	142
Paddlefish caviar			2,338	6,024		
Pike and pickerel			20,100	1,850		
Pike perch (sauger)			2,280	274		
Pike perch (wall-eyed)			15,975	2,280		
Quillback or "American carp"			309,617	10,098		
Rock bass			775	83	863	129
Sturgeon, lake			6,773	1,034		
Sturgeon, shovelnose	2,000	200	122,900	9,834		
Sturgeon, shovelnose, caviar			1,580	2,165		
Sturgeon, shovelnose, eggs			449	764		
Suckers	77,000	3,465	124,886	5,394		
Sunfish	165,117	13,453	69,850	4,285	134,191	6,700
White bass	26,800	2,363	25,004	2,204	1,968	98
Yellow bass	6,100	488	1,400	112		
Yellow perch	18,250	1,584	4,000	320		
Other fish	61,240	3,497	10,000	960		
Shrimp, fresh-water			147,482	14,570		
Frogs	3,289	496	1,830	276	6,000	1,800
Turtles	59,550	444	22,157	345		
Alligator hides			3,244	761		
Mussel shells	2,759,140	68,541	6,294,296	128,029		
Pearls		2,790		11,914		
Slugs		3,162		12,582		
Total	12,660,512	617,254	28,266,157	1,410,265	698,472	55,646

[1] Includes all tributaries not shown separately.

Persons engaged, investment, and products of the fisheries of the Mississippi River and tributaries in 1922, by tributaries—Continued

Items	Mississippi River and minor tributaries—Continued					
	Des Moines River and minor tributaries		Rock River and tributaries		Total	
	Number	*Value*	*Number*	*Value*	*Number*	*Value*
Persons engaged	200		249		8,559	
Gasoline boats	5	$1,450	201	$24,300	1,598	$300,845
Rowboats and scows	72	840	83	1,220	2,450	47,926
House boats					217	42,823
Fyke nets					17,562	198,080
Lines		134				7,662
Haul seines	6	5,125			392	115,582
Trammel nets					244	20,016
Gill nets					803	12,348
Pound nets					3	160
Crowfoot bars (pairs)	5	55	248	2,480	660	6,705
Forks, tongs, rakes, and dredges	39	194			122	419
Shrimp traps					4,360	4,163
Other apparatus						1,436
Shore and accessory property		9,865		940		3,438,330
Cash capital						200,600
Total		17,663		28,940		4,397,095
PRODUCTS	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Black bass	750	$142			41,386	$6,970
Bowfin					48,008	1,135
Buffalofish	116,024	8,290			6,165,218	382,151
Carp, German	721,506	36,058			10,150,690	430,548
Catfish and bullheads	11,200	2,340			3,204,292	290,602
Crappie	1,550	177			219,198	23,556
Drum, fresh-water, or sheepshead					2,137,885	101,904
Eels					9,060	707
Paddlefish or spoonbill cat					509,964	50,421
Paddlefish caviar					2,338	6,024
Pike and pickerel					20,100	1,850
Pike perch (sauger)					2,280	274
Pike perch (wall-eyed)	750	81			16,725	2,361
Quillback or "American carp"					309,617	10,098
Rock bass					1,638	212
Sturgeon, lake					6,773	1,034
Sturgeon, shovelnose					122,900	9,834
Sturgeon, shovelnose, caviar					1,580	2,165
Sturgeon, shovelnose, eggs					449	764
Suckers	141	8			125,027	5,402
Sunfish					204,011	10,994
White bass	100	12			27,072	2,314
Yellow bass					1,400	112
Yellow perch					4,000	320
Other fish					10,000	960
Shrimp, fresh-water					147,482	14,570
Frogs					7,830	2,076
Turtles					22,157	345
Alligator hides					3,244	761
Mussel shells	943,900	10,716	3,184,000	$108,910	10,422,196	247,655
Pearls		76		1,990		14,010
Slugs		3,564		6,997		23,143
Total	1,795,921	61,464	3,184,090	117,897	33,944,550	1,645,272

Persons engaged, investment, and products of the fisheries of the Mississippi River and tributaries in 1922, by tributaries—Continued

Items	Missouri River and tributaries		Ohio River and minor tributaries		Red River and tributaries			
					Red River [1]		Ouachita River and minor tributaries	
	Number	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Persons engaged	557		1,720		409		419	
Gasoline boats	33	$4,095	391	$42,720	95	$20,955	109	$16,570
Rowboats and scows	254	5,434	795	11,878	289	4,037	353	3,631
House boats	17	3,865	81	8,725	54	16,325	59	12,230
Fyke nets	914	7,532	2,649	27,193	2,061	19,301	1,458	12,063
Lines		986		2,545		998		2,764
Haul seines	40	5,449	18	1,775	25	4,000	15	3,290
Trammel nets	144	5,805			22	910	4	230
Gill nets	6	230			20	1,065	22	1,026
Pound nets					5	125		
Crowfoot bars (pairs)			726	14,410			2	8
Forks, tongs, rakes, and dredges	16	29	8	10			67	370
Other apparatus						1		
Shore and accessory property		548,686		495,956		28,610		15,920
Cash capital		36,000		51,000		5,000		500
Total		618,111		656,212		101,387		68,602
PRODUCTS	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Black bass	125	$25	65	$11	11,078	$1,317	6,250	$1,072
Buffalofish	271,206	22,895	318,130	35,370	1,068,188	81,702	876,766	48,310
Carp, German	512,583	45,872	482,898	53,298	27,922	1,908	1,200	36
Catfish and bullheads	143,831	24,824	455,938	54,016	320,267	19,476	294,284	24,188
Crappie	3,225	473	480	40	55,136	6,542	20,650	2,726
Drum, fresh-water, or sheepshead	12,675	1,133	388,578	46,976	385,938	19,809	175,083	8,922
Mooneye or toothed herring	2,450	116						
Paddlefish or spoonbill cat	31,500	2,091	3,835	536	99,288	8,411	145,879	21,510
Paddlefish caviar			150	225	1,399	3,657	4,737	10,422
Pike perch (sauger)			2,465	494				
Pike perch (wall-eyed)	200	40	5,625	1,019				
Quillback or "American carp"	35,372	3,775	347,800	40,269				
Sturgeon, lake	3,600	250	580	85				
Sturgeon, shovelnose			52,475	5,239				
Sturgeon, shovelnose, caviar			300	450				
Suckers	4,490	437	373,642	43,247	400	28	5,000	498
Sunfish	50	8	25	4			1,000	200
White bass			171	37				
Other fish	1,000	400			845	9	25	1
Crawfish	625	250						
Frogs					230	26		
Turtles					169	3		
Mussel shells	208,610	2,505	5,025,000	88,162	716,000	8,990	790,000	10,664
Pearls		50		2,180		65		25
Slugs		80		7,431		200		61
Total	1,231,542	105,224	7,458,157	379,089	3,286,800	152,143	2,320,874	128,035

[1] Includes all tributaries not shown separately.

Persons engaged, investment, and products of the fisheries of the Mississippi River and tributaries in 1922, by tributaries—Continued

Items	Red River and tributaries—Con.				St. Francis River and tributaries		Tennessee River and tributaries	
	Black River (La.)		Total					
	Number	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Persons engaged	140		968		510		253	
Gasoline boats	37	$5, 050	241	$42, 575	89	$9, 595	79	$8, 985
Rowboats and scows	109	1, 655	751	9, 323	364	3, 549	240	2, 711
House boats	13	4, 400	104	32, 955	57	11, 775	42	4, 885
Fyke nets	684	5, 610	4, 203	36, 974	1, 189	11, 327	615	5, 370
Lines		487		4, 249		528		627
Haul seines	8	1, 900	48	9, 250	28	4, 054		
Trammel nets			26	1, 140	8	442		
Gill nets			42	2, 091	1	40		
Pound nets			5	125	3	193		
Crowfoot bars (pairs)					77	780	127	1, 268
Forks, tongs, rakes, and dredges					160	704		
Other apparatus				1		33		
Shore and accessory property		10, 410		54, 940		54, 805		29, 030
Cash capital		4, 000		9, 500		1, 000		
Total		33, 512		203, 123		98, 825		52, 876
PRODUCTS	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Black bass			17, 328	$2, 389	3, 150	$457		
Bowfin					40, 000	400		
Buffalofish	489, 801	$16, 416	3, 034, 758	146, 428	544, 157	35, 398	17, 350	$2, 339
Carp, German			29, 122	1, 944	99, 850	3, 227	23, 100	2, 741
Catfish and bullheads	182, 764	9, 210	797, 315	52, 874	123, 671	10, 579	125, 800	17, 255
Crappie			75, 786	9, 268	3, 150	382		
Drum, fresh-water, or sheepshead	166, 252	3, 323	727, 273	32, 054	129, 840	5, 420	88, 600	10, 179
Eels					500	25		
Mooneye or toothed herring					1, 000	50		
Paddlefish or spoonbill cat	229, 054	12, 079	474, 221	42, 000	81, 769	6, 254	730	102
Paddlefish caviar	1, 019	2, 736	7, 155	16, 815	3	9		
Pike perch (wall-eyed)					500	40		
Quillback or "American carp"							4, 000	458
Rock bass					600	60		
Sturgeon, shovelnose							640	96
Suckers			5, 400	526			48, 250	5, 148
Sunfish			1, 000	200	3, 600	230		
White bass					750	75		
Other fish			870	10				
Frogs			230	26	3, 500	445		
Turtles			169	3	2, 000	40		
Mussel shells			1, 506, 000	19, 654	2, 646, 000	44, 761	4, 682, 000	57, 933
Pearls				90		200		550
Slugs				261		850		1, 499
Total	1, 068, 893	43, 764	6, 676, 627	324, 542	3, 684, 040	108, 902	4, 990, 470	98, 300

Persons engaged, investment, and products of the fisheries of the Mississippi River and tributaries in 1922, by tributaries—Continued

Items	Wabash River and tributaries					
	Wabash River[1]		White River, including East Fork and West Fork		Total	
	Number	*Value*	*Number*	*Value*	*Number*	*Value*
Persons engaged	1,457		508		1,965	
Gasoline boats	574	$43,925	115	$11,500	689	$55,425
Rowboats and scows	918	9,770	362	3,620	1,280	13,390
House boats	18	1,750	3	300	21	2,050
Fyke nets	805	8,050			805	8,050
Lines		976		217		1,193
Crowfoot bars (pairs)	967	19,340	254	5,080	1,221	24,420
Forks, tongs, rakes, and dredges	615	2,421	254	1,270	869	3,691
Shore and accessory property		48,780		30,156		78,936
Total		135,012		52,143		187,155
PRODUCTS	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Buffalofish	108,300	$8,246	15,600	$1,720	123,900	$9,966
Carp, German	210,200	17,266	28,600	3,080	238,800	20,346
Catfish and bullheads	173,600	13,816	28,400	3,200	202,000	17,016
Drum, fresh-water, or sheepshead	119,000	9,366	17,800	1,940	136,800	11,306
Quillback or "American carp"	62,500	4,346			62,500	4,346
Sturgeon, shovelnose	38,000	2,932	4,550	519	42,550	3,451
Suckers	55,300	3,832			55,300	3,832
Sunfish	700	66			700	66
Mussel shells	8,345,000	199,635	2,855,000	63,120	11,200,000	262,755
Pearls		7,134		5,370		12,504
Slugs		9,196		3,049		12,245
Total	9,112,600	275,835	2,949,950	81,998	12,062,550	357,833

[1] Includes all tributaries not shown separately.

Persons engaged, investment, and products of the fisheries of the Mississippi River and tributaries in 1922, by tributaries—Continued

Items	White River (Mo. and Ark.) and tributaries		Yazoo River		Grand total	
	Number	*Value*	*Number*	*Value*	*Number*	*Value*
Persons engaged	1,997		109		19,122	
Gasoline boats	419	$58,770	60	$8,670	[1] 4,610	$671,881
Rowboats and scows	1,011	9,075	72	1,151	9,308	150,449
House boats	262	37,215	35	9,240	1,633	249,958
Fyke nets	1,641	25,302	1,480	14,675	49,652	546,014
Lines		3,301		1,654		34,203
Haul seines	45	10,836	17	5,115	708	160,101
Trammel nets	29	1,771			459	29,749
Gill nets	8	280	3	295	866	16,184
Pound nets					11	478
Crowfoot bars (pairs)	487	2,030			3,490	53,830
Forks, tongs, rakes, and dredges	500	3,050			1,810	8,656
Shrimp traps					4,3[illegible]0	4,163
Other apparatus						2,993
Shore and accessory property		36,797		8,965		5,029,769
Cash capital		1,000		2,300		356,000
Total		190,327		52,065		7,345,034
PRODUCTS	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Black bass	8,812	$805	120	$12	73,554	$10,874
Bowfin					190,073	6,078
Buffalofish	1,331,918	64,003	669,020	28,935	17,267,177	1,013,692
Carp, German	148,806	5,551	2,185	71	18,338,371	872,128
Catfish and bullheads	429,743	31,474	117,557	6,917	8,092,690	713,461
Crappie	80,130	5,445	8,579	600	512,423	49,338
Drum, fresh-water, or sheepshead	285,535	10,942	97,753	3,594	5,260,892	290,480
Eels					16,060	1,057
Mooneye or toothed herring					3,450	166
Paddlefish or spoonbill cat	135,370	14,360	120,569	13,472	1,398,901	132,545
Paddlefish caviar	1,637	4,722	1,105	1,721	12,308	29,546
Pike and pickerel					20,100	1,850
Pike perch (sauger)					4,745	768
Pike perch (wall-eyed)	1,600	290			24,650	3,750
Quillback or "American carp"					765,389	59,221
Rock bass					2,738	312
Sturgeon, lake					10,953	1,309
Sturgeon, shovelnose	5,100	380	300	3	227,365	19,323
Sturgeon, shovelnose, caviar					1,880	2,615
Sturgeon, shovelnose, eggs					449	764
Suckers	3,030	231			699,539	63,028
Sunfish					374,533	24,955
White bass	200	10	4,331	303	64,624	5,500
Yellow bass					7,500	600
Yellow perch					22,250	1,904
Other fish	165	50			73,275	4,917
Shrimp, fresh-water					147,482	14,570
Crawfish					7,890	759
Frogs					231,761	20,410
Turtles					96,743	2,772
Alligator hides					15,616	2,673
Mussel shells	12,230,367	247,690			51,768,173	1,050,592
Pearls		13,700				46,124
Slugs		6,198				55,380
Total	14,602,413	405,860	1,021,519	55,628	105,733,734	4,503,521

[1] Includes 13 transporting vessels of 214 net tons, valued at $35,200.

Persons engaged and investment in the fisheries of the Mississippi River and tributaries, by States, in 1922

States	Persons engaged	Gasoline boats		Rowboats and scows		House boats		Fyke nets	
	Number	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Alabama	101	30	$4,085	95	$1,030	23	$2,960	362	$2,820
Arkansas	3,153	645	84,755	1,903	18,593	369	56,940	4,556	54,284
Illinois	2,484	948	118,693	1,277	32,697	103	31,700	14,552	130,418
Indiana	2,189	675	55,725	1,375	15,190	27	2,625	1,149	11,780
Iowa	3,930	328	59,223	529	10,652	48	9,085	5,342	66,916
Kansas	180	2	135	101	1,425	4	175	288	2,623
Kentucky	496	109	16,300	307	4,540	34	3,550	1,488	15,805
Louisiana	2,252	969	149,765	1,958	33,864	816	100,685	11,946	151,970
Minnesota	[1] 736	132	28,675	258	5,729	1	150	354	5,225
Mississippi	434	186	39,725	232	4,587	101	16,763	2,962	29,619
Missouri	1,023	78	11,215	235	4,255	23	5,515	1,422	12,248
Nebraska	89	5	510	40	1,084			44	369
Ohio	252	17	4,945	72	1,173	12	1,675	110	1,228
Oklahoma	109	10	1,050	106	1,170	15	3,400	465	4,350
Pennsylvania	40			2	25				
South Dakota	17	2	200	13	265	1	600	55	434
Tennessee	562	113	17,525	437	6,480	48	12,775	3,182	30,075
Texas	57	10	2,250	45	855			275	2,750
West Virginia	129	8	850	51	700	6	625		
Wisconsin	889	343	76,255	272	6,135	2	735	1,100	23,700
Total	19,122	[2] 4,610	671,881	9,308	150,449	1,633	249,958	49,652	546,614

States	Haul seines		Trammel nets		Gill nets		Pound nets		Crowfoot bars (pairs)	
	Number	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Alabama									42	$418
Arkansas	90	$19,615	88	$6,016	38	$2,136	3	$193	566	3,718
Illinois	124	36,235	9	860	238	3,250			830	13,765
Indiana	8	775							1,296	25,820
Iowa	76	16,753	181	13,863					109	963
Kansas	18	992	12	378	6	230				
Kentucky	12	1,200							156	2,955
Louisiana	102	19,008								
Minnesota	99	43,580			24	1,840	3	160	67	745
Mississippi	42	15,960	10	583	26	1,058				
Missouri	37	3,238	85	3,630					1	7
Nebraska	3	314	35	1,269						
Ohio									47	930
Pennsylvania									2	40
South Dakota			3	95						
Tennessee	10	3,556	22	2,495					117	1,325
Texas			14	560	16	740	5	125		
West Virginia									8	160
Wisconsin	87	28,875			518	6,930			249	2,990
Total	708	190,101	459	29,749	866	16,184	11	478	3,490	53,836

States	Forks, tongs, rakes, and dredges		Shrimp traps		Lines	Other apparatus	Shore and accessory property	Cash capital	**Total** investment
	Number	*Value*	*Number*	*Value*	*Value*	*Value*	*Value*	*Value*	*Value*
Alabama					$500		$1,070		$12,883
Arkansas	717	$4,104			5,955	$36	133,457	$3,500	393,302
Illinois	160	761			5,438	150	223,244	20,900	618,111
Indiana	732	3,006			1,662		96,117		212,700
Iowa	84	266			203	12	1,781,834	21,800	1,981,570
Kansas	25	80			250		19,505		25,793
Kentucky	9	90			1,214		185,792	19,000	250,446
Louisiana			4,060	$3,963	12,116	2,755	193,445	47,500	715,071
Minnesota	9	21			155		386,436	73,000	[3] 545,716
Mississippi			300	200	3,315		75,676	15,800	203,286
Missouri	40	159			1,186		1,027,754	82,800	1,152,007
Nebraska					3		171,115	10,000	184,664
Ohio	8	10			105		148,580	15,000	173,646
Oklahoma	1	3			278		2,010		12,261
Pennsylvania							109,315	17,000	126,380
South Dakota	12	16			46		545		2,201
Tennessee	13	140			1,311	23	174,407	18,600	208,712
Texas					32		3,350	1,000	11,662
West Virginia					145		9,193		11,673
Wisconsin					289	17	286,924	10,100	442,950
Total	1,810	8,656	4,360	4,163	34,203	2,993	5,029,769	356,000	7,345,034

[1] Includes 17 men connected with the wholesale fishery trade of North Dakota.
[2] Includes 13 transporting vessels, with a net tonnage of 214 and value of $35,200.
[3] Includes $5,000 cash capital and $23,300 worth of shore property connected with the wholesale fishery trade of North Dakota.

Yield of the fisheries of the Mississippi River and tributaries, by States, in 1922

States	Black bass		Bowfin		Buffalofish		Carp	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Alabama					11,100	$1,680	9,200	$1,329
Arkansas	20,980	$2,560	40,000	$400	3,452,873	199,693	538,096	27,326
Illinois	4,800	480	107,165	4,797	3,051,608	215,261	7,734,264	367,554
Indiana					174,650	17,841	356,700	37,654
Iowa	1,150	194	4,000	80	834,556	59,474	2,001,171	92,530
Kansas					48,967	4,831	79,852	7,754
Kentucky	60	10			278,765	26,972	298,203	25,033
Louisiana					4,938,777	222,944	41,630	2,555
Minnesota			15,709	422	761,370	46,748	2,948,230	122,881
Mississippi	767	92			2,096,288	105,188	23,110	1,275
Missouri	802	123			287,474	21,536	551,536	35,160
Nebraska					16,445	1,551	82,300	8,258
Ohio	5	1			11,045	2,017	9,805	1,849
Oklahoma					86,550	7,723	61,050	5,646
South Dakota					5,675	568	5,875	587
Tennessee	33,962	6,105	5,373	127	561,138	38,232	200,261	9,653
Texas	11,028	1,309			57,145	4,421	8,100	486
West Virginia					3,370	650	2,790	526
Wisconsin			17,736	252	589,381	36,362	3,386,198	124,072
Total	73,554	10,874	190,073	6,078	17,267,177	1,013,692	18,338,371	872,128

States	Catfish and bullheads		Crappie		Drum, fresh-water, or sheepshead		Eels	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Alabama	42,400	$6,380			26,500	$3,915		
Arkansas	1,014,621	88,637	135,770	$11,458	934,135	52,472		
Illinois	959,399	116,467	123,710	10,056	504,760	39,296	10,500	$540
Indiana	284,700	30,519			233,700	26,204		
Iowa	768,142	78,685	54,995	3,669	332,143	16,331		
Kansas	33,447	6,213			990	118		
Kentucky	293,528	33,639	475	39	269,528	24,605		
Louisiana	3,229,056	207,350			1,439,368	52,633	1,100	100
Minnesota	84,351	10,158			204,235	7,877	540	48
Mississippi	448,690	27,566	51,589	4,141	329,109	11,636	29	2
Missouri	194,371	24,745	4,725	593	82,888	5,950	3,000	325
Nebraska	25,395	4,728			100	10		
Ohio	17,420	3,154	5	1	18,320	3,226		
Oklahoma	55,425	7,172			110,725	10,076		
South Dakota	9,900	2,120						
Tennessee	302,910	30,536	86,018	12,839	265,066	14,409	578	35
Texas	16,361	1,780	55,136	6,542	9,369	628		
West Virginia	32,490	4,880			6,030	1,200		
Wisconsin	280,084	28,732			493,026	19,804	313	7
Total	8,092,690	713,401	512,423	49,338	5,260,892	290,480	16,060	1,057

States	Garfish		Minnows		Mooneye, or toothed herring		Paddlefish, or spoonbill cat		Paddlefish caviar	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Alabama							500	$75		
Arkansas							338,612	31,594	4,077	$10,603
Illinois							61,700	5,185		
Indiana							1,500	195		
Iowa							48,930	3,136		
Kentucky							15,015	1,176	150	225
Louisiana	3,370	$60					422,478	36,560	5,908	13,956
Mississippi							352,260	36,672	1,563	3,037
Missouri			1,165	$450	3,450	$166	36,850	2,133		
Nebraska							10,800	890		
Oklahoma							550	55		
Tennessee			500	500			54,015	10,929	200	600
Texas							26,310	2,256	500	1,125
Wisconsin							29,471	1,689		
Total	3,370	60	1,665	950	3,450	166	1,398,991	132,545	12,398	29,546

Yield of the fisheries of the Mississippi River and tributaries, by States, in 1922—Continued

States	Pike and pickerel		Pike perch, sauger		Pike perch, wall-eyed		Quillback, or American carp		Rock bass	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Alabama							400	$80		
Arkansas					1,100	$165	2,100	115	1,600	$150
Illinois					500	25	90,800	7,216		
Indiana							178,000	20,675		
Iowa	20,100	$1,850	2,280	$274	16,150	2,331	127,700	3,683		
Kansas							14,880	1,891		
Kentucky			1,765	329	5,395	962	123,450	13,467		
Minnesota							19,080	758		
Missouri					1,275	210	20,492	1,884	275	33
Ohio			700	165	230	57	20,450	3,515		
Oklahoma							4,000	160		
Tennessee							23,500	1,003	863	129
Wisconsin							140,537	4,774		
Total	20,100	1,850	4,745	768	24,650	3,750	765,389	59,221	2,738	312

States	Sturgeon, lake		Sturgeon, shovelnose		Sturgeon, shovelnose, caviar		Sturgeon, shovelnose, eggs	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Alabama			640	$96				
Arkansas			5,750	413				
Illinois			91,000	7,224	95	$185	449	$764
Indiana			47,250	4,508	250	375		
Iowa			31,100	2,340	795	905		
Kentucky	580	$85	14,250	1,458	50	75		
Louisiana			280	25				
Minnesota	6,173	983	3,255	448				
Mississippi			1,411	92				
Missouri	4,200	301	30,504	2,519	690	1,075		
Ohio			460	70				
Tennessee			1,400	120				
West Virginia			65	10				
Total	10,953	1,369	227,365	19,323	1,880	2,615	449	764

States	Suckers		Sunfish		White bass		Yellow bass		Yellow perch	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Alabama	5,800	$895								
Arkansas	6,530	579	4,100	$485	6,250	$483				
Illinois	210,900	13,929	176,817	14,463	31,700	2,737	7,500	$600	22,250	$1,904
Indiana	156,100	18,050	200	16						
Iowa			57,650	3,225	6,800	677				
Kentucky	142,847	16,646	25	4	133	26				
Louisiana	400	28								
Minnesota	45,261	1,222								
Mississippi					16,085	1,301				
Missouri	10,790	989	1,550	53						
Nebraska	400	40								
Ohio	26,345	4,114			38	11				
Tennessee	47,900	4,770	134,191	6,709	3,618	265				
Wisconsin	46,266	1,766								
Total	699,539	63,028	374,533	24,955	64,624	5,500	7,500	600	22,250	1,904

States	Other fish		Shrimp		Crawfish		Frogs		Turtles	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Arkansas							5,100	$695	300	$6
Illinois	68,240	$3,907					3,289	496	71,550	484
Louisiana			142,182	$13,870	7,265	$509	217,372	17,419	20,786	2,181
Minnesota									65	2
Mississippi			5,000	400					1,600	47
Missouri					625	250			2,000	40
Tennessee			300	300			6,000	1,800		
Wisconsin									442	12
Total	68,240	3,907	147,482	14,570	7,890	759	231,761	20,410	96,743	2,772

Yield of the fisheries of the Mississippi River and tributaries, by States, in 1922—Continued

States	Alligator hides		Mussel shells		Pearls	Slugs	Total	
	Pounds	*Value*	*Pounds*	*Value*	*Value*	*Value*	*Pounds*	*Value*
Alabama			1, 146, 000	$12, 898	$100	$181	1, 242, 540	$27, 629
Arkansas			16, 282, 367	310, 614	13, 990	7, 309	22, 794, 361	759, 747
Illinois			9, 265, 000	237, 597	10, 895	15, 903	22, 597, 996	1, 077, 965
Indiana			11, 144, 000	260, 116	9, 849	11, 409	12, 577, 050	437, 411
Iowa			2, 453, 000	44, 895	3, 931	7, 967	6, 760, 662	326, 177
Kansas			437, 100	5, 033		222	615, 236	26, 062
Kentucky			1, 449, 000	21, 312	95	1, 202	2, 893, 219	167, 360
Louisiana	15, 616	$2, 673					10, 485, 588	672, 863
Minnesota			1, 571, 196	36, 427	1, 456	995	5, 659, 555	230, 425
Mississippi							3, 327, 501	191, 449
Missouri			327, 500	4, 042	368	810	1, 566, 162	103, 755
Nebraska							135, 440	15, 477
Ohio			597, 500	10, 765	380	795	702, 323	30, 120
Oklahoma			44, 870	359		24	363, 170	31, 215
Pennsylvania			49, 000	1, 593	5	160	49, 000	1, 758
South Dakota			80, 000	1, 080	50	6	101, 450	4, 411
Tennessee			3, 766, 000	46, 455	500	1, 545	5, 493, 793	187, 561
Texas							183, 949	18, 547
West Virginia			50, 500	631		68	95, 245	7, 965
Wisconsin			3, 105, 140	56, 775	4, 505	6, 784	8, 089, 494	285, 624
Total	15, 616	2, 673	51, 768, 173	1, 050, 592	46, 124	55, 380	105, 733, 734	4, 503, 521

PRODUCTS BY APPARATUS

The most important forms of apparatus employed in the fisheries of the Mississippi River and tributaries, as determined by the value of the products secured, are fyke nets, haul seines, and the crowfoot bars, forks, tongs, etc., used in the capture of mussels. The yield of fyke nets totaled 18,668,868 pounds, valued at $1,205,421, and haul seines brought in 22,877,569 pounds, valued at $1,195,776. The following table shows the production of each of the various types of apparatus by species:

Yield of the fisheries of the Mississippi River and tributaries in 1922, by apparatus and species

Species	Fyke nets		Haul seines		Crowfoot bars	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Black bass	11, 335	$1, 188	5, 207	$468		
Bowfin	55, 436	1, 156	125, 614	4, 774		
Buffalofish	8, 235, 022	487, 036	7, 199, 078	402, 220		
Carp, German	4, 539, 155	248, 050	11, 517, 073	497, 275		
Catfish and bullheads	1, 545, 071	167, 211	1, 004, 237	96, 452		
Crapple	181, 688	16, 332	185, 060	14, 196		
Drum, fresh-water, or sheepshead	2, 046, 066	150, 706	1, 406, 006	60, 147		
Eels	2, 336	277	283	8		
Mooneye, or toothed herring	200	16	1, 200	81		
Paddlefish, or spoonbill cat	120, 485	9, 649	725, 103	626, 121		
Paddlefish caviar	659	1, 749	4, 704	11, 956		
Pike and pickerel			15, 000	1, 380		
Pike perch (sauger)	2, 865	542	150	18		
Pike perch (wall-eyed)	6, 865	1, 211	13, 400	1, 865		
Quillback, or American carp	476, 030	45, 305	225, 059	11, 823		
Rock bass	2, 063	219	275	33		
Sturgeon, lake	5, 851	907	708	106		
Sturgeon, shovelnose	79, 241	6, 565	9, 000	927		
Sturgeon, shovelnose, caviar	345	560	340	510		
Sturgeon, shovelnose, eggs	449	764				
Suckers	508, 040	49, 850	141, 399	9, 756		
Sunfish	177, 463	10, 947	128, 667	10, 301		
White bass	25, 253	2, 201	36, 550	3, 104		
Yellow bass	3, 600	288	3, 900	312		
Yellow perch	10, 600	911	11, 600	988		
Other fish	29, 000	1, 685	43, 535	3, 180		
Shrimp			300	300		
Crawfish			625	250		
Frogs			560	221		
Turtles	3, 750	96	72, 936	501		
Mussel shells					31, 546, 966	$631, 338
Pearls						27, 306
Slugs						37, 454
Total	18, 668, 868	1, 205, 421	22, 877, 569	1, 195, 776	31, 546, 966	696, 098

Yield of the fisheries of the Mississippi River and tributaries in 1922, by apparatus and species—Continued

Species	Lines		Forks, tongs, rakes, dredges, etc.		Trammel nets		Gill nets	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Black bass	55,550	$9,067			1,462	$151		
Bowfin	5,600	69			1,873	37	1,150	$30
Buffalofish	514,967	39,372			895,102	57,619	384,799	24,881
Carp, German	668,399	49,484			799,897	43,255	770,430	32,426
Catfish and bullheads	5,128,590	406,394			376,489	40,633	35,506	2,509
Crappie	113,110	15,754			32,145	3,011	420	45
Drum, fresh-water, or sheepshead	887,783	66,955			155,189	7,248	157,603	5,033
Eels	13,441	772						
Mooneye, or toothed herring					2,050	69		
Paddlefish, or spoonbill cat	441,763	50,679			44,318	3,010	65,686	6,533
Paddlefish caviar	5,020	11,242			223	546	1,792	4,053
Pike and pickerel					5,100	470		
Pike perch (sauger)	30	4			1,700	204		
Pike perch (wall-eyed)	1,310	219			3,075	455		
Quillback, or American carp	2,495	207			32,205	1,164	29,600	722
Rock bass	400	60						
Sturgeon, lake	1,294	121			2,300	123	800	112
Sturgeon, shovelnose	89,324	7,780			49,800	4,051		
Sturgeon, shovelnose, caviar					1,195	1,545		
Suckers	23,350	2,388			565	56	15,735	447
Sunfish	47,183	2,559			21,020	1,128	200	20
White bass	2,200	143			300	15	321	37
Yellow perch							50	5
Other fish	600	42					140	10
Frogs			2,729	$272				
Turtles	17,342	523					75	2
Alligator hides	1,242	291						
Mussel shells			20,221,207	419,254				
Pearls				18,818				
Slugs				17,926				
Total	8,020,993	664,125	20,223,936	456,270	2,426,008	164,790	1,464,307	76,865

Species	Shrimp traps		Pound nets		Other apparatus		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Black bass							73,554	$10,874
Bowfin			400	$12			190,073	6,078
Buffalofish			29,810	1,839	8,399	$716	17,267,177	1,013,692
Carp, German			16,825	761	26,592	877	18,338,371	872,128
Catfish and bullheads			2,200	210	597	52	8,092,690	713,461
Crappie							512,423	49,338
Drum, fresh-water, or sheepshead			7,600	365	645	26	5,260,892	290,480
Eels							16,060	1,057
Mooneye, or toothed herring							3,450	166
Paddlefish, or spoonbill cat			1,000	30	636	32	1,398,991	132,545
Paddlefish caviar							12,398	29,546
Pike and pickerel							20,100	1,850
Pike perch (sauger)							4,745	768
Pike perch (wall-eyed)							24,650	3,750
Quillback, or American carp							765,389	59,221
Rock bass							2,738	312
Sturgeon, lake							10,953	1,369
Sturgeon, shovelnose							227,365	19,323
Sturgeon, shovelnose, caviar							1,880	2,615
Sturgeon, shovelnose, eggs							449	764
Suckers					10,450	531	699,539	63,028
Sunfish							374,533	24,955
White bass							64,624	5,500
Yellow bass							7,500	600
Yellow perch							22,250	1,904
Other fish							73,275	4,917
Shrimp	147,182	$14,270					147,482	14,570
Crawfish					7,265	509	7,800	759
Frogs					228,472	19,914	231,761	20,410
Turtles					2,640	1,650	96,743	2,772
Alligator hides					14,374	2,382	15,616	2,673
Mussel shells							51,768,173	1,050,592
Pearls								46,124
Slugs								55,380
Total	147,182	14,270	57,835	3,217	300,070	26,689	105,733,734	4,503,521

COMPARISON WITH PREVIOUS STATISTICS

The literature does not provide many references from which to draw material for the comparison of the present industry with that of past years. A canvass of interior waters for 1894[3] provides material on the Mississippi River and tributaries, but the published compilations are so arranged as to make it impossible to clearly separate the statistics of this river system from those of other interior waters The separation was attempted, however, and it is believed that the resulting figures, though not strictly comparable, give at least an approximately correct summary of the production in 1894. For the year 1899 there is a canvass of the Mississippi River and tributaries,[4] which is believed to be entirely comparable to the 1922 canvass, as is also the canvass for 1903. The latter has been published only as a summary in Bureau of Fisheries Statistical Bulletin No. 175. Figures for 1908 were the result of a canvass of fisheries made by the Bureau of the Census in cooperation with the Bureau of Fisheries.[5] The scheme of collection and compilations differed somewhat from the other canvasses, and therefore may be only approximately comparable to the 1922 figures.

The following table shows the yield of the fisheries by species. As pointed out above, the figures for 1899, 1903, and 1922 are probably strictly comparable; the others are only approximately so.

Products of the fisheries of the Mississippi River and tributaries for various years, 1894 to 1922

Products	1894	1899	1903	1908	1922
Fishes:	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Bass, black	754, 219	948, 184	431, 170	1, 459, 000	73, 554
Bass, rock, yellow and white	510, 763	278, 457	104, 557	83, 000	74, 862
Bowfin	173, 330	811, 000	1, 105, 250	1, 449, 000	190, 073
Buffalofish	15, 924, 810	14, 215, 975	11, 491, 663	15, 040, 000	15, 468, 765
Carp	1, 294, 843	11, 868, 840	12, 270, 346	30, 670, 000	18, 328, 371
Catfish and bullheads	9, 689, 034	7, 648, 179	5, 191, 850	8, 073, 000	6, 2 3, 025
Crappie	814, 859	1, 318, 832	1, 116, 770	2, 563, 000	512, 423
Drum, fresh-water, or sheepshead	4, 478, 620	3, 149, 232	2, 748, 743	4, 737, 000	4, 539, 165
Eels	133, 223	93, 905	74, 210	61, 000	16, 060
Mooneye, or toothed herring	60, 021	17, 366	8, 850	----------	3, 450
Paddlefish, or spoonbill cat	1, 028, 445	2, 473, 250	1, 421, 086	1, 439, 000	1, 398. 991
Pike and pickerel	354, 063	216, 952	707, 093	367, 000	20, 100
Pike perch, wall-eyed and sauger	910, 075	249, 435	398, 668	133, 000	20, 395
Quillback	----------	----------	----------	----------	765, 389
Sturgeon, lake and shovelnose	1, 015, 009	945, 838	941, 497	845, 000	238, 318
Suckers	2, 178, 608	2, 243, 934	1, 109, 276	892, 000	699, 539
Sunfish	445, 119	910, 963	1, 221, 752	2, 821, 000	374, 533
Yellow perch	177, 909	65, 006	73, 447	36, 000	22, 250
Other fish	37, 005	193, 750	84, 011	70, 900	73, 275
Total	39, 979, 955	47, 649, 098	40, 502, 239	70, 738, 900	49, 121, 538
Miscellaneous:					
Caviar	----------	70, 700	11, 171	25, 000	14, 727
Shrimp, fresh-water	90, 562	200, 058	190, 884	306, 000	147, 482
Crawfish	6, 700	----------	----------	9, 400	625
Frogs	237, 718	440, 996	336, 049	103, 000	14, 849
Turtles and terrapin	360, 704	782, 015	477, 370	713, 000	83, 876
Alligator hides	[1] 25, 397	4, 950	----------	----------	3, 244
Other hides	[1] 850	1, 620	16	32, 600	----------
Mussel shells	[1] 195, 500	47, 648, 000	51, 856, 430	76, 266, 000	51, 768, 173

[1] Represents the number of hides instead of weight of hides.

NOTE.—The above figures do not include the statistics for the Atchafalaya River.

[3] Hugh M. Smith, Statistics of the Fisheries of the Interior Waters of the United States. Appendix 11 to the Report of the Commissioner for the year ended June 30, 1896 (1898).

[4] C. H. Townsend, Statistics of the Mississippi River and Tributaries. Appendix 15 to Report of the Commissioner of Fisheries for 1901 (1902).

[5] Fisheries of the United States, 1908. Special Report of the Bureau of the Census, 1911.

From the above table it may be seen that the buffalofish and paddlefish are the only species of which the total catch is being maintained, as compared to former years. Carp, catfish, and drum are being taken in considerably lesser amounts than formerly, though still approaching their former importance. The commercial catch of all other species has declined in no uncertain fashion.

The appearance of quillback in the statistics of 1922 for the first time does not necessarily indicate the beginning of a new fishery for this species. It may have been reported previously under a different name, most probably among the suckers.

FISHERIES OF LAKE PEPIN AND LAKE KEOKUK

In view of the rather extensive biological and ecological experiments and investigations to which the aquatic life of Lake Pepin and Lake Keokuk has been subjected in recent years, especial significance is attached to the statistics of the fisheries of these lakes. There are presented herewith the detailed statistics for the year 1922 and comparative statistics for the years 1914, 1917, and 1922.

Fisheries of Lake Pepin and Lake Keokuk, 1922

Items	Lake Pepin		Lake Keokuk	
	Number	*Value*	*Number*	*Value*
Fishermen	219		122	
Gasoline boats	109	$25,110	58	$6,218
Rowboats	134	3,530	102	2,180
House boats	2	735	9	1,950
Fyke nets	95	15,300	1,301	12,250
Seines	33	24,100	2	650
Set gill nets	351	4,340	235	2,350
Trammel nets			17	1,620
Dip nets			1	12
Spears	7	17		
Trot and hand lines		82		280
Shore and accessory property		39,220		4,190
Total		112,434		31,700
PRODUCTS				
With seines:	*Pounds*	*Value*	*Pounds*	*Value*
Bowfin	14,650	$199		
Buffalofish	198,324	8,474	225	$18
Carp, German	1,869,386	60,006	3,700	285
Catfish and bullheads	55,292	4,776	8,000	872
Crappie			100	10
Drum, freshwater, or sheepshead	182,126	5,907	4,850	243
Eels	263	6		
Paddlefish, or spoonbill cat	15,585	597	5,625	332
Pike perch, sauger			150	18
Quillback, or American carp	11,957	254		
Sturgeon, lake	108	11		
Sturgeon, shovelnose	1,080	129	400	40
Suckers	22,351	762		
Turtles	367	10		
Total	2,371,489	81,131	23,050	1,818
With fyke nets:				
Black bass			5,400	452
Bowfin	736	11		
Buffalofish	68,059	3,190	83,396	6,993
Carp, German	255,414	9,527	199,341	7,647
Catfish and bullheads	14,440	1,116	111,349	10,277
Crappie			11,720	937
Drum, freshwater, or sheepshead	81,504	2,551	34,820	1,744
Eels	136	18		
Paddlefish, or spoonbill cat	100	3	13,680	748
Pike perch, sauger			400	48
Quillback, or American carp	14,000	215		
Sturgeon, lake	3,471	649		
Sturgeon, shovelnose			100	10
Suckers	8,250	181		
Sunfish			10,590	756
Total	446,110	17,461	470,796	29,612

Fisheries of Lake Pepin and Lake Keokuk, 1922—Continued

Items	Lake Pepin		Lake Keokuk	
	Pounds	*Value*	*Pounds*	*Value*
With set gill nets:				
Bowfin	750	$10		
Buffalofish	70,441	3,166	18,000	$2,700
Carp, German	420,105	14,707	12,000	1,320
Catfish and bullheads	11,100	311		
Drum, freshwater, or sheepshead	129,143	3,656		
Paddlefish, or spoonbill cat	250	7		
Quillback, or American carp	21,300	324		
Sturgeon, lake	800	112		
Suckers	12,635	279		
Turtles	75	2		
Total	660,599	22,574	30,000	4,020
With trammel nets:				
Buffalofish			7,025	561
Carp, German			37,890	1,771
Catfish and bullheads			26,470	2,749
Crappie			1,150	72
Drum, freshwater, or sheepshead			19,070	941
Paddlefish, or spoonbill cat			7,300	390
Pike perch, sauger			1,700	204
Sunfish			500	20
Total			101,105	6,708
With dip nets:				
Carp, German			1,500	75
Catfish and bullheads			250	30
Drum, freshwater, or sheepshead			150	8
Paddlefish, or spoonbill cat			600	30
Total			2,500	143
With spears:				
Buffalofish	1,309	46		
Carp, German	25,092	802		
Catfish and bullheads	347	22		
Drum, freshwater, or sheepshead	495	18		
Paddlefish, or spoonbill cat	36	2		
Suckers	50	3		
Total	27,419	893		
With trot and hand lines:				
Black bass			800	80
Buffalofish	2,086	94	5,300	432
Carp, German	8,919	290	22,000	705
Catfish and bullheads	46,205	4,980	37,250	3,660
Crappie			800	80
Drum, freshwater, or sheepshead	2,324	80	6,150	355
Eels	142	12		
Paddlefish, or spoonbill cat			200	10
Pike perch, sauger			30	4
Quillback, or American carp	120	4		
Sturgeon, lake	874	71		
Sturgeon, shovelnose			100	10
Suckers	180	12		
Sunfish			500	50
Total	60,850	5,543	73,130	5,386
Products, by species:				
Black bass			6,200	532
Bowfin	16,136	220		
Buffalofish	340,309	14,970	113,946	10,704
Carp, German	2,578,916	85,332	276,431	11,803
Catfish and bullheads	127,384	11,205	183,919	17,588
Crappie			13,770	1,099
Drum, freshwater, or sheepshead	395,592	12,212	65,040	3,291
Eels	541	36		
Paddlefish, or spoonbill cat	15,971	609	27,405	1,510
Pike perch, sauger			2,280	274
Quillback, or American carp	47,377	797		
Sturgeon, lake	5,253	843		
Sturgeon, shovelnose	1,080	129	600	60
Suckers	43,466	1,237		
Sunfish			11,590	826
Turtles	442	12		
Total	3,572,467	127,602	701,181	47,687

Comparative statistics of the fisheries of Lakes Pepin and Keokuk for the years 1914, 1917, and 1922

LAKE PEPIN

Items	1914		1917		1922	
PERSONS ENGAGED	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Fishermen	135		126		219	
Shoresmen	2		5			
Total	137		131		219	
INVESTMENT						
Gasoline boats	28	$7,625	35	$6,810	109	$25,110
Rowboats and barges [1]	53	1,300	52	1,395	134	3,530
House boats	1	100	3	250	2	735
Fyke nets	295	24,995	262	37,472	95	15,300
Seines	14	3,340	17	6,460	33	24,100
Anchored gill nets	664	4,421	371	2,350	351	4,340
Trap nets	8	480	14	450		
Spears					7	17
Trot and hand lines		3		[2] 13		82
Shore and accessory property		1,335		3,851		39,220
Total		43,599		59,051		112,434
PRODUCTS	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Bowfin	1,534	$16	24,021	$312	16,136	$220
Buffalofish	261,250	19,728	300,808	25,009	340,309	14,970
Carp, German	237,517	7,623	467,588	23,277	2,578,916	85,332
Catfish and bullheads	26,830	1,745	254,249	24,437	127,384	11,205
Eels					541	36
Fresh-water drum or sheepshead	131,785	2,450	118,301	3,508	395,592	12,212
Mooneye, fresh	9,300	88	7,656	77		
Mooneye, smoked	1,465	70	7,250	855		
Pike	50	5				
Quillback or American carp	60,605	864	14,238	259	47,377	797
Spoonbill cat or paddlefish	8,877	557	2,923	215	15,971	609
Sturgeon lake	1,067	129	512	104	5,253	843
Sturgeon, shovelnose					1,080	129
Suckers	18,340	439	15,260	472	43,466	1,237
Sunfish	50	5				
Turtles					442	12
Total	758,670	33,719	1,212,809	78,555	3,572,467	127,602

LAKE KEOKUK

Items	1914		1917		1922	
PERSONS ENGAGED	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Fishermen	105		118		122	
INVESTMENT						
Gasoline boats	36	$3,870	52	$4,730	58	$6,218
Rowboats	84	1,250	64	810	102	2,180
House boats	10	1,075	16	3,975	9	1,950
Fyke nets	1,378	6,693	1,368	8,929	1,301	12,250
Seines			1	800	2	650
Anchored gill nets			12	180	235	2,350
Trammel nets	14	304	17	472	17	1,620
Trap nets			81	221		
Dip nets					1	12
Trot and hand lines		153		[2] 132		280
Shore and accessory property		3,845		1,630		4,190
Total		16,190		21,879		31,700
PRODUCTS	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Black bass	15	$1	4,163	$418	6,200	$532
Bowfin			26,000	390		
Buffalofish	249,900	9,252	696,543	40,563	113,946	10,704
Carp, German	302,365	7,823	762,259	28,800	276,431	11,803
Catfish and bullheads	71,535	4,855	109,904	8,192	183,919	17,588
Crappie	70	4	17,560	1,103	13,770	1,009
Eels	3,800	250	2,087	318		
Fresh-water drum or sheepshead	26,860	827	160,554	8,130	65,040	3,291
Pike			20	3		
Pike perch, sauger					2,280	274
Quillback or American carp			5,936	244		
Spoonbill cat or paddlefish			927	68	27,405	1,510
Sturgeon, sand [3]	1,900	121	454	37		
Sturgeon, shovelnose					600	60
Suckers	4,640	164	700	38		
Sunfish	50	3	13,879	813	11,590	826
Total	661,135	23,300	1,800,986	89,117	701,181	47,687

[1] No barges were reported in 1914 and 1922.
[2] No hand lines were reported for 1917.
[3] Reported as lake sturgeon in 1914.

WHOLESALE FISH TRADE

In the region of the Mississipi River and tributaries there were 142 establishments engaged in the wholesale fish trade. These employed 1,216 persons and represented an investment of $3,956,072. The distribution of this business among the several States may be seen from the following table:

Wholesale fish trade

State	Establishments		Persons engaged		Cash capital	Total investment
	Number	*Value*	*Number*	*Wages paid*		
Arkansas	4	$45,025	14	$3,903	$3,500	$52,428
Illinois	16	68,038	90	45,868	20,900	134,806
Iowa	16	135,337	120	59,395	15,800	210,532
Kentucky	8	148,300	72	78,900	17,000	2 4,200
Louisiana and Texas	30	138,135	150	105,300	48,500	291,935
Missouri	23	888,651	331	381,727	82,800	1,353,178
Minnesota	12	323,874	140	162,294	73,000	559,168
Mississippi	9	69,014	47	39,711	15,800	124,525
Nebraska and North Dakota	3	192,665	54	70,386	15,000	278,051
Ohio and Pennsylvania	7	221,300	113	148,364	32,000	401,664
Tennessee	7	135,352	63	47,091	18,600	201,043
Wisconsin	7	83,100	22	11,342	10,100	104,542
Total	142	2,448,791	1,216	1,151,281	353,000	3,956,072

SMOKED-FISH INDUSTRY

The smoking of fish is not extensively practiced in the Mississippi River region and consists largely of the smoking of fish that have been shipped there from the Great Lakes region and elsewhere. In 1922 there were 10 establishments engaged in this business, located as follows: Iowa, 5; Missouri, 2; Minnesota, 1; Pennsylvania, 1; Ohio, 1. The total number of persons engaged was 183; the capital invested, including wages paid, amounted to $667,097. Since most of these plants also engage in the wholesale fresh fish business, the figures on persons engaged and investment are not accurately indicative of the importance of the smoking industry. The products in 1922 amounted to 695,283 pounds, valued at $141,067. Most of these were ciscoes, the sturgeon being next in importance. The following table presents the statistics of this business:

Smoked-fish industry

Items	Number	Value	Items	Pounds	Value
Establishments	10	$380,937	Smoked fish—Continued.		
Persons engaged	183		Ciscoes	451,283	$79,442
Wages paid		208,400	Sablefish	10,000	1,000
Cash capital		71,700	Salmon, kippered	18,000	4,800
	Pounds	Value	Salmon, mild-cured	45,000	18,000
			Sturgeon	147,000	29,590
Smoked fish:			Trout	1,000	360
Buffalofish	11,500	3,875	Whitefish	500	130
Carp, German	10,000	3,600	Total	695,283	141,067
Catfish	1,000	270			

ALABAMA

The commercial fisheries of Alabama, connected with the Mississippi River and its tributaries, are confined entirely to the Tennessee River. In 1922 101 persons, including 4 shoresmen, were engaged. The total investment, including boats, apparatus, and shore property, amounted to $12,883. The mussel fishery was the most important, the value of the output, including pearls and slugs, amounting to $13,179; the output of fish proper amounted to 96,540 pounds, valued at $14,450, the most important species being catfish and drum, or sheepshead.

Persons engaged and investment in the fisheries of Alabama, 1922

Items	Number	Value	Items	Number	Value
Persons engaged:			Investment—Continued.		
Fishermen	97		House boats	23	$2,960
Shoresmen	4		Crowfoot bars (pairs)	42	418
			Fyke nets	362	2,820
Total	101		Set lines	220	500
Investment:			Shore property		1,070
Gasoline boats	30	$4,085	Total		12,883
Rowboats	95	1,030			

Yield, by apparatus, of the fisheries of Alabama, 1922

Species	Crowfoot bars		Fyke nets		Set lines		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Buffalofish			9,300	$1,395	1,800	$285	11,100	$1,680
Carp			7,300	1,065	1,900	264	9,200	1,329
Catfish			15,100	2,235	27,300	4,145	42,400	6,380
Drum, fresh-water, or sheepshead			21,700	3,190	4,800	725	26,500	3,915
Paddlefish or spoonbill cat			500	75			500	75
Quillback or American carp			400	80			400	80
Sturgeon, shovelnose			640	96			640	96
Suckers			4,800	745	1,000	150	5,800	895
Mussel shells	1,146,000	$12,898					1,146,000	12,898
Pearls		100						100
Slugs		181						181
Total	1,146,000	13,179	59,740	8,881	36,800	5,569	1,242,540	27,629

ARKANSAS

The fisheries of Arkansas are confined entirely to the Mississippi River and its tributaries. The White River ranks first in importance, due to its extensive mussel fisheries. Beginning near Brandon, Mo., shells are taken at intervals along the entire length of this river to within a few miles of its mouth, where fishing proper prevails. The fish in the latter region are purchased by "buy-boats" from Rosedale, Miss., which make regular trips for a distance of 75 miles up the river from its mouth two or three times weekly. Among other important streams contributing to the output of Arkansas were the Arkansas, St. Francis, Ouachita, Black, and Mississippi Rivers. Of these, the St. Francis, Black, and Ouachita Rivers supported important mussel fisheries, but no shells were taken from the Arkansas and Mississippi Rivers.

In 1922 Arkansas ranked second among the Mississippi River States in the total value of its fishery products and first in the value of its mussel-shell yield. During that year 2,493 fishermen, 650 shoresmen, and 10 men on transporting vessels were engaged. The total investment, including boats, apparatus, shore property, and cash capital, amounted to $393,302, with a yield in fishery products amounting to 22,794,361 pounds, having a value to the fishermen of $759,747, of which mussels contributed 16,282,367 pounds, valued at $331,913, including the pearls and slugs. The most important species of true fish taken in the State was the buffalofish, with a total catch of 3,452,873 pounds, valued at $199,693, followed by the catfish, with a catch of 1,014,621 pounds, valued at $88,637, and the drum, or sheepshead, with a catch of 934,135 pounds, valued at $52,472. The paddlefish, with an output of 338,612 pounds ,valued at $31,594, together with 4,077 pounds of caviar worth $10,603, are also worthy of notice. Fyke nets, set lines, and haul seines were most important in the capture of the above fish; the first two named are usually found in every fishing locality.

In the following tables are shown the detailed statistics of the fisheries of this State:

Persons engaged and investment in the fisheries of Arkansas, 1922

Waters	Persons engaged			Gasoline boats		Rowboats		House boats		Fyke nets	
	Fishermen	Shoresmen	Total								
	No.	No.	No.	No.	Val.	No.	Val.	No.	Val.	No.	Val.
Arkansas River	228	2	230	55	$6,570	180	$2,035	16	$3,350	747	$7,377
Black River	209	180	389	71	9,415	192	2,483	45	6,775	114	963
Cache River	30	2	32	8	675	25	208	3	425	106	850
Little River and Big Lake	113	6	119	20	1,985	90	773	12	2,975	305	4,376
Mississippi River	106	-------	106	28	4,380	85	768	10	1,800	383	4,084
Ouachita River	173	8	181	34	3,615	164	1,209	18	1,900	350	2,484
Red River	18	1	19	------	------	12	130	------	------	58	580
St. Francis River	312	25	337	63	6,835	220	2,373	42	8,475	609	5,634
White River	1,047	425	[1] 1,482	[2] 337	48,155	735	5,940	212	20,700	1,327	22,745
Horseshoe Lake	37	-------	37	3	325	28	1,195	------	------	------	------
Miscellaneous waters	220	1	221	26	2,800	103	1,479	11	1,450	557	5,191
Total	2,493	650	3,153	645	84,755	1,903	18,593	369	56,940	4,556	54,284

Waters	Set lines		Haul seines			Trammel nets			Gill nets			Pound nets		Hand lines
	No.	Val.	No	Yds.	Val.	No.	Yds.	Val.	No.	Yds.	Val.	No.	Val.	Val.
Arkansas River	462	$423	9	2,800	$1,625	4	570	$175	----	------	------	----	----	------
Black River	136	456	3	350	210	3	270	136	----	------	------	----	----	$6
Cache River	18	31	----	------	------	2	200	120	----	------	------	----	----	------
Little River and Big Lake	101	97	7	950	670	3	250	170	1	100	$40	----	----	7
Mississippi River	267	341	4	700	400	16	2,650	1,121	----	------	------	----	----	10
Ouachita River	295	828	----	------	------	4	425	230	18	2,050	708	----	----	53
Red River	------	------	2	650	225	5	425	230	3	625	285	----	----	------
St. Francis River	126	345	13	2,640	2,249	5	480	272	----	------	------	3	$193	24
White River	630	2,427	40	13,535	10,615	23	2,725	1,465	8	830	280	----	----	1
Horseshoe Lake	25	75	1	800	1,500	13	2,950	1,455	3	950	465	----	----	------
Miscellaneous waters	165	692	11	2,720	2,115	10	1,290	642	5	500	268	----	----	130
Total	2,225	5,715	90	25,145	19,615	88	12,235	6,016	38	5,055	2,136	3	193	240

[1] Includes 10 men on 5 transporting vessels.
[2] Includes 5 transporting vessels with a net tonnage of 22 and value of $16,000.

Persons engaged and investment in the fisheries of Arkansas, 1922—Continued

Waters	Gigs		Crowfoot bars, pairs		Tongs		Rakes		Forks		Dredges		Shore property	Cash capital	Total investment
	No.	*Val.*	*No.*	*Val.*	*No.*	*Val.*	*No.*	*Val.*	*No.*	*Val.*	*No.*	*Val.*	*Val.*	*Val.*	*Val.*
Arkansas River													$12,030	$1,000	$34,585
Black River			35	$325	105	$655	30	$100			1	$100	12,510		34,140
Cache River			8	80	4	27							873		3,289
Little River and Big Lake			1	20	18	110			36	$95			3,175		14,493
Mississippi River	5	$3											1,095		14,002
Ouachita River			2	8	31	258	8	15	28	97			9,195	500	21,190
Red River													905		2,355
St. Francis River	22	33	76	760	58	364			36	100			49,890	1,000	78,547
White River			444	2,525	210	1,811			120	287			21,974	1,000	149,015
Horseshoe Lake													12,445		17,460
Miscellaneous waters									32	85			9,365		24,226
Total	27	36	566	3,718	426	3,225	38	115	252	664	1	100	133,457	3,500	393,302

Yield, by apparatus and waters, of the fisheries of Arkansas, 1922

Apparatus and species	Arkansas River		Black River		Cache River		Little River and Big Lake	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Black bass	2,000	$160			150	$23	1,000	$150
Bowfin							35,000	350
Buffalofish	386,450	24,871	22,525	$1,897	12,905	1,084	65,000	4,340
Carp, German	37,898	2,933	4,091	372	100	8	29,000	1,030
Catfish and bullheads	48,600	5,577	1,585	172	250	26	8,100	653
Crappie	13,440	818			150	22		
Drum, fresh-water	179,605	11,991	6,720	489	4,475	374	15,000	450
Paddlefish or spoonbill cat	3,250	252	50	3				
Quillback or American carp	2,100	115						
Rock bass	500	40						
Suckers			200	16				
Sunfish							500	25
White bass	4,600	351						
Total	678,443	47,108	35,171	2,949	18,030	1,537	153,600	6,998
Set lines:								
Black bass	568	45						
Bowfin							5,000	50
Buffalofish	37,735	3,142	3,625	307	100	10		
Carp, German	30,550	2,456						
Catfish and bullheads	83,877	7,796	20,363	2,203	2,770	285	28,150	1,952
Drum, fresh-water	63,501	5,435	14,100	1,349	1,225	102	7,200	205
Paddlefish or spoonbill cat	1,033	102	5,000	500				
Paddlefish caviar	10	30	50	125				
White bass	400	32						
Total	217,674	19,038	43,138	4,544	4,095	397	40,350	2,225
Haul seines:								
Buffalofish	96,000	7,410	14,250	1,130			19,335	1,300
Carp, German	51,600	4,112	4,750	380			20,670	515
Catfish and bullheads	42,400	5,050	550	55				
Drum, fresh-water	75,400	6,020	550	44			1,665	25
Paddlefish or spoonbill cat	13,500	1,097	2,000	80				
White bass	300	15						
Total	279,200	23,704	22,100	1,689			41,670	1,840
Trammel nets:								
Buffalofish	6,700	446	7,125	570	5,625	450	6,000	480
Carp, German	400	26	4,250	340			5,000	250
Catfish and bullheads	1,100	80	250	25				
Crappie	300	27						
Drum, fresh-water			400	32	835	50	2,000	100
Paddlefish or spoonbill cat			500	25				
Total	8,500	579	12,525	992	6,460	500	13,000	830

Yield, by apparatus and waters, of the fisheries of Arkansas, 1922—Continued

Apparatus and species	Arkansas River		Black River		Cache River		Little River and Big Lake	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Hand lines:								
Black bass			402	$57				
Drum, fresh-water			650	100				
Total			1,052	157				
Crowfoot bars:								
Mussel shells			560,000	11,480	120,000	$1,800		
Pearls				1,000		30		
Slugs				400		30		
Total			560,000	12,880	120,000	1,860		
Tongs, rakes, forks, etc.:								
Mussel shells			948,000	18,627	21,000	325		
Pearls				3,000		5		
Slugs				1,140		8		
Total			948,000	22,767	21,000	338		
Total by species:								
Black bass	2,568	$205	402	57	150	23	1,000	$150
Bowfin							40,000	400
Buffalofish	526,885	35,869	47,525	3,964	18,630	1,544	90,335	6,120
Carp, German	120,448	9,527	13,091	1,092	100	8	54,670	1,795
Catfish and bullheads	175,977	18,503	22,748	2,455	3,020	311	36,250	2,578
Crappie	13,740	845			150	22		
Drum, fresh-water	318,508	23,446	22,420	2,014	6,535	526	25,865	825
Paddlefish or spoonbill cat	17,783	1,451	7,550	608				
Paddlefish caviar	10	30	50	125				
Quillback or American carp	2,100	115						
Rock bass	500	40						
Suckers			200	16				
Sunfish							500	25
White bass	5,300	398						
Mussel shells			1,508,000	30,107	141,000	2,125		
Pearls				4,000		35		
Slugs				1,540		38		
Total	1,183,817	90,429	1,621,986	45,978	169,585	4,632	248,620	11,983

Yield, by apparatus and waters, of the fisheries of Arkansas, 1922—Continued

Apparatus and species	Mississippi River		Ouachita River		Red River		St. Francis River	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Black bass							800	$112
Buffalofish	113,750	$8,391	162,000	$9,051	25,900	$1,675	244,610	16,752
Carp, German	93,800	4,737			1,900	109	8,260	525
Catfish and bullheads	8,150	603	20,750	1,706	1,000	103	27,915	2,515
Crappie	200	30	50	8			1,400	217
Drum, fresh-water	25,975	1,430	36,300	1,813	4,400	254	41,085	1,794
Paddlefish or spoonbill cat	4,000	140	2,900	220	3,400	358	150	7
Paddlefish caviar			181	403	88	282		
Rock bass	500	50					600	60
Suckers			4,100	410				
Sunfish	500	50					1,600	160
Turtles	300	6						
Total	247,175	15,437	226,281	13,611	36,688	2,781	326,420	22,142
Set lines:								
Buffalofish	5,175	311	200	22			4,247	345
Catfish and bullheads	86,275	8,661	79,200	8,063			35,296	3,386
Drum, fresh-water	13,750	590	31,650	2,928			23,010	1,276
Paddlefish or spoonbill cat	20,000	1,000	4,600	925			18,224	1,910
Paddlefish caviar	100	150	260	775			3	9
Sturgeon, shovelnose	650	33						
Total	125,950	10,745	115,910	12,713			80,780	6,926
Haul seines:								
Black bass	100	15						
Buffalofish	14,000	770			13,000	1,280	113,435	5,770
Carp, German	7,000	200			500	32	9,740	216
Catfish and bullheads	3,000	380			950	110	3,000	240
Crappie	500	75						
Drum, fresh-water	6,500	195			800	50	15,580	305
Paddlefish or spoonbill cat	10,800	440			4,000	500	55,360	3,805
Paddlefish caviar	50	75			55	150		
Total	41,950	2,150			19,305	2,122	197,115	10,336
Trammel nets:								
Buffalofish	93,400	4,309	11,700	816	12,300	890	18,000	1,160
Carp, German	17,000	658			1,700	131		
Catfish and bullheads	7,950	608			600	62	2,000	200
Drum, fresh-water	3,600	192			1,850	130	200	6
Paddlefish or spoonbill cat	400	24			400	50		
Paddlefish caviar					5	13		
Total	122,350	5,791	11,700	816	16,855	1,276	20,200	1,366
Gill nets:								
Buffalofish			41,500	2,235	13,000	960		
Carp, German					1,000	62		
Catfish and bullheads			200	26	160	18		
Drum, fresh-water			200	25	850	53		
Paddlefish or spoonbill cat			23,900	2,503				
Paddlefish caviar			1,250	2,625				
Suckers			100	13				
Total			67,150	7,427	15,000	1,093		
Pound nets:								
Buffalofish							1,560	105
Carp, German							200	16
Catfish and bullheads							200	30
Drum, fresh-water							3,550	120
Total							5,510	271
Hand lines:								
Black bass	350	53	1,250	186			850	120
Crappie	3,700	555	12,900	1,603			50	5
Sunfish	500	50						
Total	4,550	658	14,150	1,789			900	125
Gigs: Frogs	1,600	250					3,500	445
Crowfoot bars:								
Mussel shells							1,200,000	21,000
Pearls								150
Slugs								420
Total							1,200,000	21,570

Yield, by apparatus and waters, of the fisheries of Arkansas, 1922—Continued

Apparatus and species	Mississippi River		Ouachita River		Red River		St. Francis River	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Tongs, rakes, forks, etc.:								
Mussel shells			790,000	$10,664			1,286,000	$21,761
Pearls				25				50
Slugs				61				390
Total			790,000	10,750			1,286,000	22,201
Total by species:								
Black bass	450	$68	1,250	186			1,650	232
Buffalofish	226,325	13,781	215,400	12,124	64,200	$4,805	381,852	24,132
Carp, German	117,800	5,595			5,100	334	18,200	757
Catfish and bullheads	105,375	10,252	100,150	9,795	2,700	203	68,411	6,371
Crappie	4,400	660	12,950	1,611			1,450	222
Drum, fresh-water	49,825	2,407	68,150	4,766	7,900	487	83,425	3,501
Paddlefish or spoonbill cat	35,200	1,604	31,400	3,648	7,800	908	73,734	5,722
Paddlefish caviar	150	225	1,691	3,803	148	445	3	9
Rock bass	500	50					600	60
Sturgeon, shovelnose	650	33						
Suckers			4,200	423				
Sunfish	1,000	100					1,600	160
Frogs	1,600	250					3,500	445
Turtles	300	6						
Mussel shells			790,000	10,664			2,486,000	42,761
Pearls				25				200
Slugs				61				810
Total	543,575	35,031	1,225,101	47,106	87,848	7,272	3,120,425	85,382

Yield, by apparatus and waters, of the fisheries of Arkansas, 1922—Continued

Apparatus and species	White River		Horseshoe Lake		Miscellaneous waters		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Black bass	2,200	$180			120	$15	6,270	$640
Bowfin							35,000	350
Buffalofish	741,700	32,645			222,108	15,491	1,996,948	116,197
Carp, German	73,310	2,552			16,312	1,105	264,671	13,371
Catfish and bullheads	32,700	2,337			20,715	2,254	169,765	15,946
Crappie	17,800	1,100			360	60	33,400	2,255
Drum, fresh-water	106,050	2,905			58,279	3,939	477,889	25,439
Paddlefish or spoonbill cat	2,400	274			17,190	1,746	33,340	3,000
Paddlefish caviar	26	78			144	470	439	1,233
Pike perch, wall-eyed					1,100	165	1,100	165
Quillback or American carp							2,100	115
Rock bass							1,600	150
Suckers	500	15			1,630	125	6,430	566
Sunfish							2,600	235
White bass					750	75	5,350	426
Turtles							300	6
Total	976,686	42,086			338,708	25,445	3,037,202	180,004
Set lines:								
Black bass	200	16					768	61
Bowfin							5,000	50
Buffalofish	26,913	1,541	9,650	$519	4,250	346	91,895	6,603
Carp, German	10,070	323					40,620	2,779
Catfish and bullheads	312,275	22,132	13,150	1,048	45,880	4,926	707,236	60,425
Crappie	100	6					100	6
Drum, fresh-water	32,200	1,447			19,670	1,793	206,306	15,170
Paddlefish or spoonbill cat	88,980	10,374			17,300	2,028	155,137	16,839
Paddlefish caviar	858	2,504			475	1,420	1,756	5,013
Sturgeon, shovelnose	5,100	380					5,750	413
White bass							400	32
Total	476,696	38,723	22,800	1,567	87,575	10,513	1,214,968	107,391
Haul seines:								
Black bass	4,200	340			200	20	4,500	375
Buffalofish	332,400	16,184	60,000	3,000	131,875	8,020	794,295	44,864
Carp, German	27,900	827	16,625	500	1,400	56	140,185	6,838
Catfish and bullheads	35,570	2,264	1,500	225	5,500	430	92,470	8,754
Crappie	55,600	3,566	15,000	1,500	200	20	71,300	5,161
Drum, fresh-water	78,725	2,023	5,000	85	7,600	261	191,820	9,008
Paddlefish or spoonbill cat	9,300	602			11,335	845	106,295	7,369
Paddlefish caviar	121	361					228	586
White bass	200	10					500	25
Total	544,016	26,177	98,125	5,310	158,110	9,652	1,401,591	82,980
Trammel nets:								
Black bass	1,300	124					1,300	124
Buffalofish	114,350	5,080	111,800	6,318	39,675	2,860	426,675	23,379
Carp, German	13,000	407	15,475	710	13,945	1,053	70,770	3,575
Catfish and bullheads	13,900	997	7,800	546	4,900	482	38,500	3,000
Crappie	5,600	581					5,900	608
Drum, fresh-water	20,985	558	6,650	399	11,650	920	48,170	2,387
Paddlefish or spoonbill cat	1,540	79			3,000	300	5,840	478
Paddlefish caviar	50	150					55	163
Total	170,725	7,976	141,725	7,973	73,170	5,615	597,210	33,714
Gill nets:								
Buffalofish	38,000	2,020	19,000	950	30,000	2,380	141,500	8,545
Carp, German	11,000	325	8,650	300	1,000	60	21,050	747
Catfish and bullheads	5,000	330			100	8	5,450	382
Drum, fresh-water	3,650	108			600	40	5,300	226
Paddlefish or spoonbill cat	13,100	1,305			1,000	100	38,000	3,908
Paddlefish caviar	298	824			53	159	1,601	3,608
Suckers							100	13
Total	71,048	4,912	27,650	1,250	32,753	2,747	213,601	17,429

Yield, by apparatus and waters, of the fisheries of Arkansas, 1922—Continued

Apparatus and species	White River		Horseshoe Lake		Miscellaneous waters		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets:								
Buffalofish							1,560	$105
Carp, German							200	16
Catfish and bullheads							200	30
Drum, fresh-water							3,550	120
Total							5,510	271
Hand lines:								
Black bass	240	$50			5,050	$894	8,142	1,060
Catfish and bullheads					1,000	100	1,000	100
Crappie	720	150			7,700	1,115	25,070	3,428
Drum, fresh-water					450	22	1,100	122
Sunfish					1,000	200	1,500	250
Total	960	200			15,200	2,331	36,812	5,260
Gigs: Frogs							5,100	695
Crowfoot bars:								
Mussel shells	5,880,000	116,605			20,000	150	7,780,000	151,035
Pearls		5,320						6,500
Slugs		3,980				25		4,855
Total	5,880,000	125,905			20,000	175	7,780,000	162,390
Tongs, rakes, forks, etc.:								
Mussel shells	4,528,667	96,190			928,700	12,012	8,502,367	159,579
Pearls		4,220				190		7,490
Slugs		620				235		2,454
Total	4,528,667	101,030			928,700	12,437	8,502,367	169,523
Total by species:								
Black bass	8,140	710			5,370	929	20,980	2,560
Bowfin							40,000	400
Buffalofish	1,253,363	57,470	200,450	$10,787	427,908	29,097	3,452,873	109,693
Carp, German	135,280	4,434	40,750	1,510	32,657	2,274	538,096	27,326
Catfish and bullheads	399,445	28,060	22,450	1,819	78,095	8,200	1,014,621	88,637
Crappie	79,820	5,403	15,000	1,500	8,260	1,195	135,770	11,458
Drum, fresh-water	241,610	7,041	11,650	484	98,249	6,975	934,135	52,472
Paddlefish or spoonbill cat	115,320	12,634			49,825	5,019	338,612	31,594
Paddlefish caviar	1,353	3,917			672	2,049	4,077	10,603
Pike perch, wall-eyed					1,100	165	1,100	165
Quillback or American carp							2,100	115
Rock bass							1,600	150
Sturgeon, shovelnose	5,100	380					5,750	413
Suckers	500	15			1,630	125	6,530	579
Sunfish					1,000	200	4,100	485
White bass	200	10			750	75	6,250	483
Frogs							5,100	695
Turtles							300	6
Mussel shells	10,408,667	212,795			948,700	12,162	16,282,367	310,614
Pearls		9,540				190		13,990
Slugs		4,600				260		7,309
Total	12,648,798	347,009	290,300	16,100	1,654,216	68,915	22,794,361	759,747

ILLINOIS

Illinois ranks first among the Mississippi River States in the extent of its fisheries on the Mississippi River and tributaries. In 1922 there were 1,905 fishermen and 575 shoresmen engaged, most of the latter being connected either with the mussel fishery or in factories where button blanks were made. The total investment in boats, apparatus, shore property, and cash capital amounted to $618,111. There were 948 gasoline boats, with a value of $118,693; 1,277 row-boats and scows, valued at $32,697; and 103 houseboats, worth $31,700. The most important forms of apparatus were haul seines and fyke nets, there being 124 of the former, valued at $38,065, and 14,552 of the latter, valued at $130,418. Set lines were also quite commonly used. The products of Illinois amounted to 22,597,996 pounds, valued at $1,077,965. Of these mussel shells contributed 9,265,000 pounds, valued at (including pearls and slugs) $264,395, giving Illinois third rank among mussel-producing States. Among the fish proper, carp was the most valuable species, with a catch of 7,734,264 pounds, valued at $367,554; other important species were buffalofish, 3,051,608 pounds, valued at $215,261; catfish and bullheads, 919,399 pounds, worth $113,267; and drum or sheepshead, 504,760 pounds, valued at $39,296.

The Illinois River, with its valuable carp and buffalofish, ranks first among the rivers of the State. Its total output in 1922 amounted to 10,607,372 pounds, valued at $551,013. The Mississippi River ranks second, with a catch of 3,033,524 pounds, valued at $212,574. The Rock River ranks next in importance, with a total output of 2,872,000 pounds, valued at $109,820, consisting entirely of mussel shells, pearls, and slugs. It is one of the most prolific mussel streams in the country. Both the Wabash and the Ohio Rivers contribute considerably to the value of the fishery resources of the State, mussel shells, pearls, and slugs furnishing about one-half of the value of their products.

The following tables give the detailed statistics of the fisheries of this State in 1922:

Persons engaged and investment in the fisheries of Illinois, 1922

Waters	Persons engaged			Gasoline boats		Rowboats, etc.		House boats		Haul seines		
	Fishermen	Shoresmen	Total	No.	Val.	No.	Val.	No.	Val.	No.	Yds.	Val.
Big Muddy River	3		3			3	$35					
Embarras River	10		10	1	$100	10	110					
Fox River	119		119			119	1,890					
Illinois River	478	159	[1] 641	[2] 235	43,236	367	16,830	64	$24,950	91	32,890	$32,175
Iroquois River	15		15			15	150					
Kankakee River	93		93			93	930					
Kaskaskia River	23	2	25	1	150	20	225					
Little Vermillion River	3		3			3	30					
Little Wabash River	8		8			8	80					
Mississippi River	387	301	688	220	27,782	250	7,147	14	4,250	33	5,175	4,060
Ohio River	329	31	360	182	14,175	159	2,145	14	1,400			
Pecatonica River	28		28	27	4,050	10	150					
Rock River	214		214	170	19,650	71	1,030					
Wabash River	195	82	277	112	9,550	149	1,945	11	1,100			
Total	1,905	575	2,484	948	118,693	1,277	32,697	103	31,700	124	38,065	36,235

Waters	Fyke nets		Crowfoot bars, pairs		Set lines		Gill nets			Forks	
	No.	Val.	No.	Val.	No.	Val.	No.	Yds.	Val.	No.	Val.
Big Muddy River	15	$150			16	$16					
Embarras River	8	80	2	$40	6	6				2	$10
Fox River	20	60	34	680						16	48
Illinois River	8,984	79,070	57	1,140	448	3,259	3	1,500	$900		
Kaskaskia River	72	550									
Mississippi River	4,301	39,308	41	395	620	1,311	235	11,750	2,350	2	3
Ohio River	618	5,860	280	5,600	492	492					
Pecatonica River			27	270							
Rock River			214	2,140							
Wabash River	534	5,340	175	3,500	340	340				135	675
Total	14,552	130,418	830	13,765	1,922	5,424	238	13,250	3,250	155	736

[1] Includes 4 men on two transporting vessels.
[2] Includes two transporting vessels with a net tonnage of 18 and a value of $4,200.

Persons engaged and investment in the fisheries of Illinois, 1922—Continued

Waters	Trammel nets			Dredges		Dip nets		Hand lines	Shore property	Cash capital	Total investment
	No.	*Yds.*	*Val.*	*No.*	*Val.*	*No.*	*Val.*	*Val.*	*Val.*	*Val.*	*Val.*
Big Muddy River									$35		$236
Embarras River									200		546
Fox River									1,570		4,248
Illinois River				5	$25	15	$150		98,239	$17,900	317,874
Iroquois River									300		450
Kankakee River									1,860		2,790
Kaskaskia River								$14	520		1,459
Little Vermillion River									60		90
Little Wabash River									160		240
Mississippi River	9	900	$860						93,245	3,000	183,711
Ohio River									10,915		40,587
Pecatonica River									125		4,595
Rock River									800		23,620
Wabash River									15,215		37,665
Total	9	900	860	5	25	15	150	14	223,244	20,900	618,111

Yield, by apparatus and waters, of the fisheries of Illinois, 1922

Apparatus and waters	Black bass		Bowfin		Buffalofish		Carp	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Haul seines:								
Illinois River			85,965	$3,808	1,764,103	$113,988	4,976,939	$224,314
Mississippi River			5,100	254	102,000	9,600	249,000	15,080
Total			91,065	4,062	1,866,103	123,588	5,225,939	239,394
Fykes:								
Big Muddy River					4,500	450	7,000	420
Embarras River					800	80	2,000	200
Illinois River			15,700	715	469,330	29,812	1,166,600	52,330
Kaskaskia River					7,700	840	7,900	865
Mississippi River	4,000	$400			424,275	38,381	737,100	40,344
Ohio River					46,300	4,174	55,500	5,050
Wabash River					38,500	2,634	43,000	2,932
Total	4,000	400	15,700	715	991,405	76,371	2,019,100	102,141
Set lines:								
Embarras River					400	40	1,000	100
Illinois River					36,600	2,112	93,000	3,600
Mississippi River	800	80			32,200	2,684	88,400	4,102
Ohio River					15,400	1,344	39,700	3,590
Wabash River					16,800	1,148	37,400	2,546
Total	800	80			101,400	7,328	259,500	13,938
Gill nets:								
Illinois River			400	20	65,000	4,550	198,000	9,900
Mississippi River					18,000	2,700	12,000	1,320
Total			400	20	83,000	7,250	210,000	11,220
Trammel nets: Mississippi River					8,200	594	19,025	791
Dip nets: Illinois River					1,000	70		
Hand lines: Kaskaskia River					500	60	700	70
Total by waters:								
Big Muddy River					4,500	450	7,000	420
Embarras River					1,200	120	3,000	300
Illinois River			102,065	4,543	2,336,033	150,532	6,434,539	290,144
Kaskaskia River					8,200	900	8,600	935
Mississippi River	4,800	480	5,100	254	584,675	53,959	1,105,525	61,637
Ohio River					61,700	5,518	95,200	8,640
Wabash River					55,300	3,782	80,400	5,478
Total	4,800	480	107,165	4,707	3,051,608	215,261	7,734,264	367,554

Yield, by apparatus and waters, of the fisheries of Illinois, 1922—Continued

Apparatus and waters	Catfish and bullheads		Crappie		Drum, fresh-water, or sheepshead		Eels	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Haul seines:								
Illinois River	205,344	$30,948	57,248	$4,731	40,800	$2,771		
Mississippi River	24,000	3,170	5,000	440	30,000	2,690		
Total	229,344	34,118	62,248	5,171	70,800	5,461		
Fykes:								
Big Muddy River					2,000	120		
Embarras River	2,000	200			1,000	100		
Illinois River	140,500	19,490	50,767	3,974	28,100	1,880		
Kaskaskia River	6,800	1,120			5,100	620		
Mississippi River	142,700	16,865	8,700	742	187,900	14,958		
Ohio River	42,500	3,860			40,300	3,594		
Wabash River	36,800	2,508			29,800	2,044		
Total	371,300	44,043	59,467	4,716	294,200	23,316		
Set lines:								
Big Muddy River	6,000	825			2,000	120		
Embarras River	1,000	100			1,000	100		
Illinois River	45,000	4,820			11,600	735	6,500	$325
Mississippi River	202,300	23,748	800	80	70,400	5,462	4,000	215
Ohio River	43,000	3,870			24,100	2,108		
Wabash River	42,000	2,922			25,100	1,740		
Total	339,300	36,285	800	80	134,200	10,265	10,500	540
Gill nets: Illinois River	2,000	200	120	24	210	14		
Trammel nets: Mississippi River	16,955	1,696	1,075	65	5,250	220		
Hand lines: Kaskaskia River	500	125			100	20		
Total by waters:								
Big Muddy River	6,000	825			4,000	240		
Embarras River	3,000	300			2,000	200		
Illinois River	352,844	52,258	108,135	8,729	80,710	5,400	6,500	325
Kaskaskia River	7,300	1,245			5,200	640		
Mississippi River	385,955	45,479	15,575	1,327	293,550	23,330	4,000	215
Ohio River	85,500	7,730			64,400	5,702		
Wabash River	78,800	5,430			54,900	3,784		
Total	919,399	113,267	123,710	10,056	504,760	39,296	10,500	540

Apparatus and waters	Paddlefish or spoonbill cat		Pike perch, wall-eyed		Quillback, or American carp		Sturgeon, shovelnose	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Haul seines:								
Illinois River	21,200	$1,640						
Mississippi River	29,500	2,715	500	$25			2,000	$100
Total	50,700	4,355	500	25			2,000	100
Fykes:								
Embarras River					1,000	$100		
Mississippi River	11,000	830					48,000	3,680
Ohio River					49,500	4,390	4,800	432
Wabash River					40,300	2,726		
Total	11,000	830			90,800	7,216	52,800	4,112
Set lines:								
Embarras River							100	10
Illinois River							2,000	200
Mississippi River							6,000	600
Ohio River							10,200	974
Wabash River							17,900	1,228
Total							36,200	3,012
Total by waters:								
Embarras River					1,000	100	100	10
Illinois River	61,200	4,840					2,000	200
Mississippi River	40,500	3,545	500	25			56,000	4,380
Ohio River					49,500	4,390	15,000	1,406
Wabash River					40,300	2,726	17,900	1,228
Total	101,700	8,385	500	25	90,800	7,216	91,000	7,224

Yield, by apparatus and waters, of the fisheries of Illinois, 1922—Continued

Apparatus and waters	Sturgeon, shovelnose, caviar		Sturgeon, shovelnose, eggs		Suckers		Sunfish	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Haul seines:								
Illinois River					38,500	$1,710	100,217	$8,542
Mississippi River					9,000	620	2,500	200
Total					47,500	2,330	102,717	8,742
Fykes:								
Embarras River					2,000	200		
Illinois River					26,500	1,155	64,700	4,891
Mississippi River	95	$185	449	$764	19,300	1,352	8,175	734
Ohio River					54,200	4,824		
Wabash River					35,600	2,412		
Total	95	185	449	764	137,600	9,943	72,875	5,625
Set lines:								
Ohio River					9,000	720		
Wabash River					4,800	336	500	50
Total					13,800	1,056	500	50
Gill nets: Illinois River					2,000	100	200	20
Trammel nets: Mississippi River							525	26
Dip nets: Illinois River					10,000	500		
Total by waters:								
Embarras River					2,000	200		
Illinois River					77,000	3,465	165,117	13,453
Mississippi River	95	185	449	764	28,300	1,972	11,200	960
Ohio River					63,200	5,544		
Wabash River					40,400	2,748	500	50
Total	95	185	449	764	210,900	13,929	176,817	14,463

Apparatus and waters	White bass		Yellow bass		Yellow perch		Other fish		Frogs	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Haul seines:										
Illinois River	14,100	$1,240	3,200	$256	9,100	$788	38,000	$2,050	560	$224
Mississippi River	2,900	214	700	56	2,500	200	3,000	170		
Total	17,000	1,454	3,900	312	11,600	988	41,000	2,220	560	224
Fykes:										
Illinois River	12,600	1,113	2,900	232	9,100	791	22,500	1,395		
Mississippi River	2,000	160	700	56	1,500	120	4,000	240		
Total	14,600	1,273	3,600	288	10,600	911	26,500	1,635		
Set lines: Illinois River							600	42		
Gill nets: Illinois River	100	10			50	5	140	10		
Forks, dredges, etc.: Illinois River									2,729	272
Total by waters:										
Illinois River	26,800	2,363	6,100	488	18,250	1,584	61,240	3,497	3,289	496
Mississippi River	4,900	374	1,400	112	4,000	320	7,000	410		
Total	31,700	2,737	7,500	600	22,250	1,904	68,240	3,907	3,289	496

Yield, by apparatus and waters, of the fisheries of Illinois, 1922—Continued

Apparatus and waters	Turtles		Mussel shells		Pearls	Slugs	Total	
	Pounds	*Value*	*Pounds*	*Value*	*Value*	*Value*	*Pounds*	*Value*
Haul seines:								
Illinois River	58,900	$418					7,414,176	$397,428
Mississippi River	12,000	40					479,700	35,574
Total	70,900	458					7,893,876	433,002
Fykes:								
Big Muddy River							13,500	990
Embarras River							8,800	880
Illinois River	650	26					2,009,947	117,804
Kaskaskia River							27,500	3,445
Mississippi River							1,599,894	119,811
Ohio River							293,100	26,324
Wabash River							224,000	15,256
Total	650	26					4,176,741	284,510
Crowfoot bars:								
Embarras River			8,000	$160	$25	$16	8,000	201
Fox River			238,000	9,520	420	260	238,000	10,200
Illinois River			596,000	5,906	675	386	596,000	6,967
Mississippi River			342,000	8,180	755	615	342,000	9,550
Ohio River			1,806,000	32,045	1,050	3,100	1,806,000	36,195
Pecatonica River			210,000	5,150	100	177	210,000	5,427
Rock River			2,828,000	99,890	1,845	6,655	2,828,000	108,390
Wabash River			911,000	16,255	1,515	1,820	911,000	19,590
Total			6,939,000	177,106	6,385	13,029	6,939,000	196,520
Set lines:								
Big Muddy River							8,000	945
Embarras River							3,500	350
Illinois River							195,300	11,834
Mississippi River							404,900	36,971
Ohio River							141,400	12,606
Wabash River							144,500	9,970
Total							897,600	72,676
Gill nets:								
Illinois River							268,220	14,853
Mississippi River							30,000	4,020
Total							298,220	18,873
Trammel nets: Mississippi River							51,030	3,392
Dip nets: Illinois River							11,000	570
Hand lines: Kaskaskia River							1,800	275
Forks, dredges, etc.:								
Embarras River			88,000	2,560	65	116	88,000	2,741
Fox River			400,000	13,530	645	419	400,000	14,594
Illinois River			110,000	1,210		75	112,729	1,557
Iroquois River			150,000	4,500	150	152	150,000	4,802
Kankakee River			726,000	21,780	620	920	726,000	23,320
Kaskaskia River			104,000	1,560	1,285	35	104,000	2,880
Little Vermillion River			44,000	660	25	44	44,000	729
Little Wabash River			30,000	900	25	40	30,000	965
Mississippi River			126,000	3,256			126,000	3,256
Rock River			44,000	1,320	45	65	44,000	1,430
Wabash River			504,000	9,215	1,650	1,008	504,000	11,873
Total			2,326,000	60,491	4,510	2,874	2,328,729	68,147
Total by waters:								
Big Muddy River							21,500	1,935
Embarras River			96,000	2,720	90	132	108,300	4,172
Fox River			638,000	23,050	1,065	679	638,000	24,794
Illinois River	59,550	444	706,000	7,116	675	461	10,607,372	551,013
Iroquois River			150,000	4,500	150	152	150,000	4,802
Kankakee River			726,000	21,780	620	920	726,000	23,320
Kaskaskia River			104,000	1,560	1,285	35	133,300	6,600
Little Vermillion River			44,000	660	25	44	44,000	729
Little Wabash River			30,000	900	25	40	30,000	965
Mississippi River	12,000	40	468,000	11,436	755	615	3,033,524	212,574
Ohio River			1,806,000	32,045	1,050	3,100	2,240,500	75,125
Pecatonica River			210,000	5,150	100	177	210,000	5,427
Rock River			2,872,000	101,210	1,890	6,720	2,872,000	109,820
Wabash River			1,415,000	25,470	3,165	2,828	1,783,500	56,689
Total	71,550	484	9,205,000	237,597	10,895	15,903	22,597,996	1,077,965

INDIANA

In 1922 there were 1,821 fishermen and 568 shoresmen engaged in the fisheries of the Mississippi River and its tributaries in Indiana. Practically all of the shoresmen were connected with the pearl-button or allied industries. The total investment was $212,700. Some of the more important items of this investment were 675 gasoline boats, 1,375 rowboats, and 27 house boats, with a combined value of $73,540; 1,296 pairs of crowfoot bars, valued at $25,820, and 1,149 fyke nets, valued at $11,780; and shore property valued at $96,117. The total production of the State amounted to 12,577,050 pounds, valued at $437,411. Of this total, mussel shells contributed 11,144,000 pounds, valued at $281,374, including pearls and slugs. This State ranked second, or next to Arkansas, in the value of its mussel fisheries. Among the more important species of fish taken were carp, with a production of 356,700 pounds, valued at $37,654; catfish, 284,700 pounds, valued at $30,519; drum or sheepshead, 233,700 pounds, valued at $26,204; quillback or American carp, 178,000 pounds, valued at $20,675; suckers, 156,100 pounds, valued at $18,050; and buffalofish, 174,650 pounds, valued at $17,841.

The more important rivers of the State, due to their mussel fisheries, are the Wabash, Ohio, East Fork of the White, and the Tippecanoe. Several rivers in the State produced shells only, no fish being taken commercially.

The following tables show in detail the statistics of the fisheries of this State in 1922:

Persons engaged and investment in the fisheries of Indiana, 1922

Waters	Persons engaged			Gasoline boats		Rowboats	
	Fishermen	Shoresmen	Total				
	Number	*Number*	*Number*	*No.*	*Value*	*No.*	*Value*
Blackwater River	2		2			2	$20
Driftwood River	6		6			6	60
East Fork of White River	270	95	365	87	$8,700	245	2,450
Eel River	16		16			16	160
Mississinnewa River	5		5			5	50
Muscatook River	2		2			2	20
Ohio River	324	194	518	99	9,050	261	3,925
Tippecanoe River	303		303			303	3,030
Wabash River	798	53	851	461	34,275	440	4,525
West Fork of White River	31		31			31	310
White River	60	26	86	28	2,800	60	600
Yellow River	4		4			4	40
Total	1,821	368	2,189	675	55,725	1,375	15,190

Waters	House boats		Crowfoot bars, pairs		Fyke nets		Forks	
	No.	*Value*	*No.*	*Value*	*No.*	*Value*	*No.*	*Value*
East Fork of White River			194	$3,880			182	$910
Ohio River	17	$1,675	252	4,940	886	$9,150		
Wabash River	7	650	790	15,800	263	2,630	448	1,646
White River	3	300	60	1,200			60	300
Total	27	2,625	1,296	25,820	1,149	11,780	690	2,856

Persons engaged and investment in the fisheries of Indiana, 1922—Continued

Water	Set lines		Haul seines			Tongs		Shore property	Total investment
	No.	*Value*	*No.*	*Yards*	*Value*	*No.*	*Value*	*Value*	*Value*
Blackwater River								$40	$60
Driftwood River								120	180
East Fork of White River	262	$132				12	$60	20,246	36,378
Eel River								320	480
Mississinnewa River								100	150
Muscatook River								40	60
Ohio River	815	815	8	800	$775			32,736	63,966
Tippecanoe River								4,060	7,090
Wabash River	630	630				30	90	28,985	89,231
West Fork of White River								600	910
White River	115	85						8,790	14,075
Yellow River								80	120
Total	1,822	1,662	8	800	775	42	150	96,117	212,700

Yield, by apparatus, of the fisheries of Indiana, 1922

Apparatus	Buffalofish		Carp		Catfish		Drum, fresh-water, or sheepshead	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Ohio River	75,700	$8,160	128,700	$14,794	78,300	$9,266	90,000	$10,848
Wabash River	19,600	1,408	27,800	2,052	22,100	1,608	16,900	1,236
Total	95,300	9,568	156,500	16,846	100,400	10,874	106,900	12,084
Set lines:								
East Fork of White River	10,600	1,220	21,600	2,380	21,400	2,500	12,800	1,440
Ohio River	25,550	2,797	63,600	7,062	81,700	9,372	44,800	5,504
Wabash River	32,200	2,936	99,000	9,436	69,700	6,478	45,200	4,146
White River	5,000	500	7,000	700	7,000	700	5,000	500
Total	73,350	7,453	191,200	19,578	179,800	19,050	107,800	11,590
Haul seines: Ohio River	6,000	820	9,000	1,230	4,500	595	19,000	2,530
Total by waters:								
East Fork of White River	10,600	1,220	21,600	2,380	21,400	2,500	12,800	1,440
Ohio River	107,250	11,777	201,300	23,086	164,500	19,233	153,800	18,882
Wabash River	51,800	4,344	126,800	11,488	91,800	8,086	62,100	5,382
White River	5,000	500	7,000	700	7,000	700	5,000	500
Total	174,650	17,841	356,700	37,654	284,700	30,519	233,700	26,204

Apparatus	Paddlefish or spoonbill cat		Quillback or American carp		Sturgeon, shovelnose		Sturgeon, shovelnose, caviar		Suckers	
	Lbs.	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:										
Ohio River			133,800	$16,105	8,950	$913			112,200	$12,916
Wabash River			21,200	1,520	4,800	384			12,900	884
Total			155,000	17,625	13,750	1,297			125,100	13,800
Set lines:										
East Fork of White River					3,300	394				
Ohio River					12,650	1,233			6,000	900
Wabash River					15,200	1,310				
White River					1,250	125				
Total					32,400	3,062			6,000	900
Haul seines: Ohio River	1,500	$195	23,000	3,050	1,100	149	250	$375	25,000	3,350
Total by waters:										
East Fork of White River					3,300	394				
Ohio River	1,500	195	156,800	19,155	22,700	2,295	250	375	143,200	17,166
Wabash River			21,200	1,520	20,000	1,694			12,900	884
White River					1,250	125				
Total	1,500	195	178,000	20,675	47,250	4,508	250	375	156,100	18,050

Yield, by apparatus, of the fisheries of Indiana, 1922—Continued

Apparatus	Sunfish		Mussel shells		Pearls	Slugs	Total	
	Pounds	*Value*	*Pounds*	*Value*	*Value*	*Value*	*Pounds*	*Value*
Crowfoot bars:								
East Fork of White River			910,000	$18,200	$1,040	$972	910,000	$21,112
Ohio River			1,499,000	26,361	650	2,168	1,499,000	29,179
Wabash River			2,441,000	56,710	1,882	2,948	2,441,000	61,540
White River			176,000	3,520	200	176	176,000	3,896
Total			5,026,000	104,791	4,672	6,264	5,026,000	115,727
Fyke nets:								
Ohio River							627,650	73,002
Wabash River	200	$16					125,500	9,108
Total	200	16					753,150	82,110
Forks:								
East Fork of White River			912,000	18,240	2,370	972	912,000	21,582
Wabash River			1,629,000	33,525	1,337	1,992	1,629,000	36,854
White River			178,000	3,560	300	176	178,000	4,036
Total			2,719,000	55,325	4,007	3,140	2,719,000	62,472
Set lines:								
East Fork of White River							69,700	7,934
Ohio River							234,300	26,868
Wabash River							261,300	24,306
White River							25,250	2,525
Total							590,550	61,633
Haul seines: Ohio River							89,350	12,204
Tongs: Wabash River			60,000	1,050	25	120	60,000	1,195
By hand:								
Blackwater River			4,000	120		4	4,000	124
Driftwood River			58,000	1,170	50	56	58,000	1,276
East Fork of White River			332,000	9,960	275	390	332,000	10,625
Eel River			134,000	4,020	125	132	134,000	4,277
Mississinewa River			62,000	1,560	50	50	62,000	1,660
Muscatook River			20,000	400		20	20,000	420
Tippecanoe River			1,490,000	44,700			1,490,000	44,700
Wabash River			1,078,000	32,340	535	1,042	1,078,000	33,917
West Fork of White River			131,000	3,930	110	151	131,000	4,191
Yellow River			30,000	750		40	30,000	790
Total			3,339,000	98,950	1,145	1,885	3,339,000	101,980
Total by waters:								
Blackwater River			4,000	120		4	4,000	124
Driftwood River			58,000	1,170	50	56	58,000	1,276
East Fork of White River			2,154,000	46,400	4,585	2,334	2,223,700	61,253
Eel River			134,000	4,020	125	132	134,000	4,277
Mississinewa River			62,000	1,560	50	50	62,000	1,660
Muscatook River			20,000	400		20	20,000	420
Ohio River			1,499,000	26,361	650	2,168	2,450,300	141,343
Tippecanoe River			1,490,000	44,700			1,490,000	44,700
Wabash River	200	16	5,208,000	123,625	3,779	6,102	5,594,800	166,920
West Fork of White River			131,000	3,930	110	151	131,000	4,191
White River			354,000	7,080	500	352	379,250	10,457
Yellow River			30,000	750		40	30,000	790
Total	200	16	11,144,000	260,116	9,849	11,409	12,577,050	437,411

IOWA

In 1922 there were 794 fishermen, 3,131 shoresmen, and 5 men on transporting vessels engaged in the fisheries and related industries of Iowa, and an investment in boats, apparatus, shore property, and cash capital of $1,981,570, giving the State first place among those in the Mississippi Valley both in number of persons engaged and investment. This is due to its pearl-button industry, centered at Muscatine, where it was first established in 1891. The total fishery production of the State amounted to 6,760,662 pounds, valued at $326,177, of which 2,453,000 pounds, valued at $56,793, belong to the mussel industry. The more important species of fish were carp, catfish, buffalofish, and drum or sheepshead.

The most important fisheries in this State are located on the Mississippi River, where the production in 1922 amounted to 77 per cent in amount and 82 per cent in value of the total output of fish and mussel shells in this State. Some fishing of lesser importance was done in various lakes and rivers under supervision of game wardens.

The following tables show in detail the statistics of the fisheries of this State in 1922:

Persons engaged and investment in the fisheries of Iowa, 1922

Waters	Persons engaged			Gasoline boats		Rowboats		House boats	
	Fishermen	Shoresmen	Total						
	Number	*Number*	*Number*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Cedar River	2	2	4			1	$10		
Des Moines River	96	24	120	3	$450	60	600		
Iowa River	9	33	42			8	90		
Mississippi River	580	2,901	[1] 3,486	[2] 321	57,573	400	8,088	48	$9,085
Missouri River	36		36	2	350	31	849		
Skunk River	7	149	156			5	75		
Wapsipinicon River	24	11	35	1	150	21	215		
Miscellaneous lakes	40	11	51	1	700	3	125		
Total	794	3,131	3,930	328	59,223	529	10,652	48	9,085

Waters	Fyke nets		Haul seines			Set lines		Trammel nets		
	No.	*Value*	*No.*	*Yards*	*Value*	*No.*	*Value*	*No.*	*Yards*	*Value*
Des Moines River						35	$70			
Mississippi River	5,139	$65,720	65	13,485	$10,545	47	65	160	17,875	$12,906
Missouri River	203	1,196	5	580	458	3	4	21	1,478	958
Wapsipinicon River			1	400	1,000					
Miscellaneous lakes			5	4,416	4,750					
Total	5,342	66,916	76	18,881	16,753	85	139	181	19,353	13,863

Waters	Crowfoot bars, pairs		Forks		Hand lines	Dip nets		Shore property	Cash capital	Total investment
	No.	*Value*	*No.*	*Value*	*Value*	*No.*	*Value*	*Value*	*Value*	*Value*
Cedar River	1	$10						$10		$30
Des Moines River			38	$190	$64			2,240		3,014
Iowa River	9	90						12,303		12,483
Mississippi River	82	693	46	76		1	$12	1,606,965	$21,800	1,794,127
Missouri River								2,331		6,146
Skunk River								156,010		156,085
Wapsipinicon River	17	170						325		1,860
Miscellaneous lakes								1,650		7,225
Total	109	963	84	266	64	1	12	1,781,834	21,800	1,981,570

[1] Includes crew of one transporting vessel.
[2] Includes one transporting vessel of 14 net tonnage, valued at $4,000.

Yield, by apparatus and waters, of the fisheries of Iowa, 1922

Apparatus and waters	Black bass		Bowfin		Buffalofish		Carp	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Mississippi River	400	$52			355,016	$25,155	693,806	$28,369
Missouri River					2,475	223	16,900	1,475
Total	400	52			357,491	25,378	710,706	29,844
Haul seines:								
Mississippi River			4,000	$80	180,875	11,744	520,075	19,328
Missouri River					4,350	526	41,450	4,934
Wapsipinicon River					24,840	1,440	40,000	1,632
Miscellaneous lakes					60,165	5,081	164,450	12,971
Total			4,000	80	270,230	18,791	765,975	38,865
Trammel nets:								
Mississippi River					187,765	13,059	451,510	17,676
Missouri River					11,270	1,374	34,180	3,595
Total					199,035	14,433	485,690	21,271
Set lines:								
Des Moines River	200	24			4,900	560	23,800	1,600
Mississippi River					600	48	4,500	195
Total	200	24			5,500	608	28,300	1,795
Hand lines: Des Moines River	550	118			2,300	264	9,000	680
Dip nets: Mississippi River							1,560	75
Total by waters:								
Des Moines River	750	142			7,200	824	32,800	2,280
Mississippi River	400	52	4,000	80	724,256	50,006	1,671,391	65,643
Missouri River					18,095	2,123	92,530	10,004
Wapsipinicon River					24,840	1,440	40,000	1,632
Miscellaneous lakes					60,165	5,081	164,450	12,971
Total	1,150	194	4,000	80	834,556	59,474	2,001,171	92,530

Apparatus and waters	Catfish and bullheads		Crappie		Drum, fresh-water, or sheepshead		Paddlefish, or spoonbill cat	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Mississippi River	389,239	$37,755	22,425	$1,454	169,888	$8,390	24,095	$1,550
Missouri River	13,083	2,255						
Total	402,322	40,010	22,425	1,454	169,888	8,390	24,095	1,550
Haul seines:								
Mississippi River	101,050	9,895	15,500	1,085	83,450	4,160	10,460	688
Missouri River	200	40						
Total	101,250	9,935	15,500	1,085	83,450	4,160	10,460	688
Trammel nets:								
Mississippi River	234,420	23,565	15,520	953	77,205	3,700	13,575	858
Missouri River	6,050	1,250						
Total	240,470	24,815	15,520	953	77,205	3,700	13,575	858
Set lines:								
Des Moines River	7,200	1,440	150	18				
Mississippi River	12,250	1,475			1,450	73	200	10
Missouri River	400	80						
Total	19,850	2,995	150	18	1,450	73	200	10
Hand lines: Des Moines River	4,000	900	1,400	159				
Dip nets: Mississippi River	250	30			150	8	600	30
Total by waters:								
Des Moines River	11,200	2,340	1,550	177				
Mississippi River	737,209	72,720	53,445	3,492	332,143	16,331	48,930	3,136
Missouri River	19,733	3,625						
Total	768,142	78,685	54,995	3,669	332,143	16,331	48,930	3,136

Yield, by apparatus and waters, of the fisheries of Iowa, 1922—Continued

Apparatus and waters	Pike perch, sauger		Pike perch, wall-eyed		Pike and pickerel		Quillback or American carp	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets: Mississippi River	400	$48					28,000	$810
Haul seines:								
Mississippi River	150	18	12,400	$1,800	15,000	$1,380	73,000	2,150
Wapsipinicon River							500	50
Total	150	18	12,400	1,800	15,000	1,380	73,500	2,200
Trammel nets: Mississippi River	1,700	204	3,000	450	5,100	470	26,200	673
Set lines:								
Des Moines River			350	35				
Mississippi River	30	4						
Total	30	4	350	35				
Hand lines: Des Moines River			400	46				
Total by waters:								
Des Moines River			750	81				
Mississippi River	2,280	274	15,400	2,250	20,100	1,850	127,200	3,633
Wapsipinicon River							500	50
Total	2,280	274	16,150	2,331	20,100	1,850	127,700	3,683

Apparatus and waters	Sturgeon, shovelnose		Sturgeon, shovelnose, caviar		Sunfish		White bass	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets: Mississippi River	100	$10			15,255	$772		
Haul seines: Missouri River	400	40			25,950	1,559	6,700	$665
Trammel nets: Mississippi River	30,500	2,280	795	$905	16,445	894		
Set lines:								
Des Moines River							100	12
Mississippi River	100	10						
Total	100	10					100	12
Total by waters:								
Des Moines River							100	12
Mississippi River	31,100	2,340	795	905	57,650	3,225	6,700	665
Total	31,100	2,340	795	905	57,650	3,225	6,800	677

Yield, by apparatus and waters, of the fisheries of Iowa, 1922—Continued

Apparatus and waters	Mussel shells		Pearls	Slugs	Total	
	Pounds	*Value*	*Value*	*Value*	*Pounds*	*Value*
Fyke nets:						
Mississippi River					1,698,624	$104,365
Missouri River					32,458	3,953
Total					1,731,082	108,318
Haul seines:						
Mississippi River					1,049,010	54,592
Missouri River					46,000	5,500
Wapsipinicon River					65,340	3,122
Miscellaneous lakes					224,615	18,052
Total					1,384,965	81,266
Trammel nets:						
Mississippi River					1,063,735	65,687
Missouri River					51,500	6,219
Total					1,115,235	71,906
Crowfoot bars:						
Cedar River	4,000	$80		$12	4,000	92
Iowa River	104,000	1,965	$90	215	104,000	2,270
Mississippi River	1,042,000	25,105	3,531	2,360	1,042,000	30,996
Wapsipinicon River	196,000	3,048	150	400	196,000	3,598
Total	1,346,000	30,198	3,771	2,987	1,346,000	36,956
Forks:						
Des Moines River	706,000	5,095		3,530	706,000	8,625
Mississippi River	212,000	6,245		1,240	212,000	7,485
Total	918,000	11,340		4,770	918,000	16,110
Set lines:						
Des Moines River					36,700	3,689
Mississippi River					19,130	1,815
Missouri River					400	80
Total					56,230	5,584
Hand lines: Des Moines River					17,650	2,167
Dip nets: Mississippi River					2,500	143
Hand:						
Mississippi River	154,000	2,620	150	150	154,000	2,920
Skunk River	35,000	737	10	60	35,000	807
Total	189,000	3,357	160	210	189,000	3,727
Total by waters:						
Cedar River	4,000	80		12	4,000	92
Des Moines River	706,000	5,095		3,530	760,350	14,481
Iowa River	104,000	1,965	90	215	104,000	2,270
Mississippi River	1,408,000	33,970	3,681	3,750	5,240,999	268,003
Missouri River					130,358	15,752
Skunk River	35,000	737	10	60	35,000	807
Wapsipinicon River	196,000	3,048	150	400	261,340	6,720
Miscellaneous lakes					224,615	18,052
Total	2,453,000	44,895	3,931	7,967	6,760,662	326,177

KANSAS

In the commercial fisheries of Kansas there were engaged 124 fishermen and 56 shoresmen, most of the latter being connected with the pearl-button industry. The investment of $25,793 was also mainly in the latter business. The total output of fishery products amounted to 615,236 pounds, valued at $26,062. The production of the more important species was as follows: 79,852 pounds of carp, valued at $7,754; 33,447 pounds of catfish, valued at $6,213; 48,967 pounds of buffalofish, valued at $4,831; and 437,100 pounds of mussel shells, valued, together with the slugs, at $5,255. Fyke nets, haul seines, set lines, and forks for mussels were the most important forms of apparatus used. The Kansas, Neosho, and Missouri Rivers were the main fishery streams.

The following tables show in detail the statistics of the fisheries of this State:

Persons engaged and investment in the fisheries of Kansas, 1922

Waters	Persons engaged			Gasoline boats		Rowboats		House boats	
	Fishermen	Shoresmen	Total						
	Number	*Number*	*Number*	*No.*	*Value*	*No.*	*Value*	*No.*	*Value*
Blue River	12		12			11	$155		
Cottonwood River	1		1			1	10		
Fall River	2		2			1	10		
Kansas River	40	1	41			31	595	3	$125
Missouri River	19		19	2	$135	15	205	1	50
Neosho River	49	55	104			41	438		
Osage River	1		1			1	12		
Total	124	56	180	2	135	101	1,425	4	175

Waters	Fyke nets		Haul seines			Set lines		Trammel nets		
	No.	*Value*	*No.*	*Yards*	*Value*	*No.*	*Value*	*No.*	*Yards*	*Value*
Blue River	57	$456	6	425	$207	47	$75			
Kansas River	146	1,443	4	335	190	101	87	4	170	$90
Missouri River	55	470	3	430	430	2	4	8	410	288
Neosho River	30	254	5	275	165	59	81			
Total	288	2,623	18	1,465	992	209	247	12	580	378

Waters	Gill nets			Forks		Hand lines	Shore property	Total investment
	No.	*Yards*	*Value*	*No.*	*Value*	*Value*	*Value*	*Value*
Blue River							$1,455	$2,348
Cottonwood River				1	$3		50	63
Fall River				2	7		50	67
Kansas River							1,885	4,415
Missouri River	6	500	$230				775	2,587
Neosho River				21	67	$3	15,240	16,248
Osage River				1	3		50	65
Total	6	500	230	25	80	3	19,505	25,793

Yield, by apparatus and waters, of the fisheries of Kansas, 1922

Apparatus and waters	Buffalofish		Carp		Catfish		Drum, fresh-water, or sheepshead	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Blue River	1,350	$196			2,450	$445		
Kansas River	3,905	577	22,210	$2,701	1,865	334	75	$10
Missouri River	1,430	143	7,620	762	600	120		
Neosho River	3,340	361	4,350	435	2,162	397	150	17
Total	10,025	1,277	34,180	3,898	7,077	1,296	225	27
Haul seines:								
Blue River	5,800	290			100	20		
Kansas River	5,300	625	3,000	300	2,600	520		
Missouri River	7,500	525	10,000	300	1,700	170		
Neosho River	13,400	1,360	9,400	940	1,200	240		
Total	32,000	2,800	22,400	1,540	5,600	950		
Set lines:								
Blue River	550	65			4,050	780		
Kansas River	125	17	1,730	209	9,200	1,750	80	8
Missouri River			100	10	200	40		
Neosho River	1,550	175	2,300	230	5,670	1,109	535	65
Total	2,225	257	4,130	449	19,120	3,679	615	73
Trammel nets:								
Kansas River	1,242	179	1,867	244	450	83	50	3
Missouri River	2,600	230	10,200	915	1,000	170		
Total	3,842	409	12,067	1,159	1,450	253	50	3
Gill nets: Missouri River	875	88	6,925	693	100	20		
Hand lines: Neosho River			150	15	100	15	100	15
Total by waters:								
Blue River	7,700	551			6,600	1,245		
Kansas River	10,572	1,398	28,807	3,454	14,115	2,687	205	21
Missouri River	12,405	986	34,845	2,680	3,600	520		
Neosho River	18,290	1,896	16,200	1,620	9,132	1,761	785	97
Total	48,967	4,831	79,852	7,754	33,447	6,213	990	118

Yield, by apparatus and waters, of the fisheries of Kansas, 1922—Continued

Apparatus and waters	Quillback, or American carp		Mussel shells		Slugs	Total	
	Pounds	*Value*	*Pounds*	*Value*	*Value*	*Pounds*	*Value*
Fyke nets:							
Blue River	3,050	$448				6,850	$1,089
Kansas River	2,855	425				30,910	4,047
Missouri River	1,375	138				11,025	1,163
Neosho River						10,002	1,210
Total	7,280	1,011				58,787	7,509
Haul seines:							
Blue River	2,100	135				7,600	445
Kansas River	3,300	555				14,600	2,000
Missouri River	400	8				19,600	1,003
Neosho River						24,000	2,540
Total	5,800	698				65,800	5,988
Set lines:							
Blue River						4,600	845
Kansas River						11,135	1,984
Missouri River						300	50
Neosho River						10,055	1,579
Total						26,090	4,458
Trammel nets:							
Kansas River	200	30				3,809	539
Missouri River	500	42				14,300	1,357
Total	700	72				18,109	1,896
Gill nets: Missouri River	1,100	110				9,000	911
Forks:							
Cottonwood River			95,945	$1,679	$50	95,945	1,729
Fall River			83,455	838	40	83,455	878
Neosho River			208,590	2,086	108	208,590	2,194
Osage River			49,110	430	24	49,110	454
Total			437,100	5,033	222	437,100	5,255
Hand lines: Neosho River						350	45
Total by waters:							
Blue River	5,150	583				19,050	2,379
Cottonwood River			95,945	1,679	50	95,945	1,729
Fall River			83,455	838	40	83,455	878
Kansas River	6,355	1,010				60,454	8,570
Missouri River	3,375	298				54,225	4,484
Neosho River			208,590	2,086	108	252,997	7,568
Osage River			49,110	430	24	49,110	454
Total	14,880	1,891	437,100	5,033	222	615,236	26,062

KENTUCKY

In 1922 there were 496 persons engaged in the fisheries and fishery industries of Kentucky, about one-third being shoresmen connected with the wholesale fish trade of Louisville and the pearl-button blank factories. Of the total investment of $250,446 a similar portion was employed in the above-mentioned industries. The total production amounted to 2,893,219 pounds, valued at $167,360, comprised mainly of catfish, buffalofish, carp, drum, suckers, and quillback, with mussels ranking between drum and suckers in value. Of the total output, 1,777,679 pounds, valued at $113,293, were taken in the Ohio River, and 490,500 pounds, valued at $32,850, in the comparatively small portion of the State bordering on the Mississippi River. The other rivers were of comparative unimportance.

The following tables show in detail the statistics of the fisheries of this State:

Persons engaged and investment in the fisheries of Kentucky, 1922

Waters	Persons engaged			Gasoline boats		Rowboats	
	Fishermen	Shoresmen	Total				
	Number	*Number*	*Number*	*Number*	*Value*	*Number*	*Value*
Big Barren River	2		2			2	$25
Big Sandy River	2		2			2	70
Cumberland River	24		24	3	$350	24	240
Green River	30		30			30	450
Mississippi River	41		41	12	2,250	23	240
Ohio River	259	128	387	85	12,800	216	3,365
Tennessee River	10		10	9	900	10	150
Total	368	128	496	109	16,300	307	4,540

Waters	House boats		Fyke nets		Set lines		Haul seines		
	Number	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Yards*	*Value*
Big Sandy River			12	$300					
Cumberland River			106	1,060	30	$43			
Green River			180	1,800	180	180			
Mississippi River			310	3,400	140	140	2	200	$200
Ohio River	32	$3,350	843	8,855	808	808	10	1,000	1,000
Tennessee River	2	200	37	390	43	43			
Total	34	3,550	1,488	15,805	1,201	1,214	12	1,200	1,200

Waters	Crowfoot bars, pairs		Tongs		Shore property	Cash capital	Total investment
	Number	*Value*	*Number*	*Value*	*Value*	*Value*	*Value*
Big Barren River					$25		$50
Big Sandy River					10		380
Cumberland River	9	$115	9	$90	150		2,048
Green River					360		2,790
Mississippi River					325		6,555
Ohio River	137	2,740			184,822	$19,000	236,740
Tennessee River	10	100			100		1,883
Total	156	2,955	9	90	185,792	19,000	250,446

Yield, by apparatus and waters, of the fisheries of Kentucky, 1922

Apparatus and waters	Black bass		Buffalofish		Carp		Catfish	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Big Sandy River			20	$4	367	$69	1,735	$325
Cumberland River			11,500	1,475	1,600	195	2,600	360
Green River			13,800	1,104	15,000	1,200	4,500	360
Mississippi River			110,000	8,300	102,500	4,625	50,000	5,000
Ohio River	60	$10	95,245	11,428	111,336	12,821	52,593	6,733
Tennessee River			2,400	258	2,300	248	2,700	405
Total	60	10	232,965	22,569	233,103	19,158	114,128	13,183
Set lines:								
Cumberland River			2,000	245	500	64	5,500	775
Green River			3,000	240	4,200	336	15,000	1,200
Mississippi River			12,000	860	12,000	500	68,000	6,800
Ohio River			17,700	1,982	37,900	4,121	78,200	9,801
Tennessee River			1,100	126	500	54	8,200	1,230
Total			35,800	3,453	55,100	5,075	174,900	19,806
Haul seines:								
Mississippi River			5,000	300	5,000	150	500	50
Ohio River			5,000	650	5,000	650	4,000	600
Total			10,000	950	10,000	800	4,500	650
Total by waters:								
Big Sandy River			20	4	367	69	1,735	325
Cumberland River			13,500	1,720	2,100	259	8,100	1,135
Green River			16,800	1,344	19,200	1,536	19,500	1,560
Mississippi River			127,000	9,400	119,500	5,275	118,500	11,850
Ohio River	60	10	117,945	14,060	154,236	17,592	134,793	17,134
Tennessee River			3,500	384	2,800	302	10,900	1,635
Grand total	60	10	278,765	26,972	298,203	25,033	293,528	33,639

Apparatus and waters	Crappie		Drum		Paddlefish or spoonbill cat		Paddlefish caviar	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Big Sandy River	33	$6	3,400	$637				
Cumberland River			1,900	235	450	$68		
Green River			4,800	384				
Mississippi River			79,500	3,905	10,000	600		
Ohio River	442	33	86,528	10,448	1,135	175		
Tennessee River			5,100	546	230	27		
Total	475	39	181,228	16,155	11,815	870		
Set lines:								
Cumberland River			700	85				
Green River			3,000	240				
Mississippi River			34,000	1,620				
Ohio River			36,300	4,757				
Tennessee River			2,300	248				
Total			76,300	6,950				
Haul seines:								
Mississippi River					2,000	140		
Ohio River			12,000	1,500	1,200	166	150	$225
Total			12,000	1,500	3,200	306	150	225
Total by waters:								
Big Sandy River	33	6	3,400	637				
Cumberland River			2,600	320	450	68		
Green River			7,800	624				
Mississippi River			113,500	5,525	12,000	740		
Ohio River	442	33	134,828	16,705	2,335	341	150	225
Tennessee River			7,400	794	230	27		
Grand total	475	39	269,528	24,605	15,015	1,176	150	225

Yield, by apparatus and waters, of the fisheries of Kentucky, 1922—Continued

Apparatus and waters	Pike perch, sauger		Pike perch, wall-eyed		Quillback, or American carp		Sturgeon, lake	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Big Sandy River			670	$125	600	$113		
Cumberland River			450	68				
Green River					3,000	240		
Ohio River	1,765	$329	4,275	769	107,450	11,556	580	$85
Tennessee River					2,400	258		
Total	1,765	329	5,395	962	113,450	12,167	580	85
Haul seines: Ohio River					10,000	1,300		
Total by waters:								
Big Sandy River			670	125	600	113		
Green River			450	68	3,000	240		
Ohio River	1,765	329	4,275	769	117,450	12,856	580	85
Tennessee River					2,400	258		
Grand total	1,765	329	5,395	962	123,450	13,467	580	85

Apparatus and waters	Sturgeon, shovelnose		Sturgeon, shovelnose, caviar		Suckers		Sunfish	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Big Sandy River					935	$175		
Cumberland River					750	95		
Green River	200	$16			28,200	2,256		
Ohio River	5,850	637	50	$75	97,762	12,172	25	$4
Tennessee River					1,200	128		
Total	6,050	653	50	75	128,847	14,826	25	4
Set lines:								
Green River	100	8						
Ohio River	7,600	732						
Total	7,700	740						
Haul seines: Ohio River	500	65			14,000	1,820		
Total by waters:								
Big Sandy River					935	175		
Cumberland River					750	95		
Green River	300	24			28,200	2,256		
Ohio River	13,950	1,434	50	75	111,762	13,992	25	4
Tennessee River					1,200	128		
Grand total	14,250	1,458	50	75	142,847	16,646	25	4

Yield, by apparatus and waters, of the fisheries of Kentucky, 1922—Continued

Apparatus and waters	White bass		Mussel shells		Pearls	Slugs	Total	
	Pounds	*Value*	*Pounds*	*Value*	*Value*	*Value*	*Pounds*	*Value*
Fyke nets:								
Big Sandy River	100	$19					7,860	$1,473
Cumberland River							19,250	2,496
Green River							69,500	5,560
Mississippi River							352,000	22,430
Ohio River	33	7					565,129	67,282
Tennessee River							16,330	1,870
Total	133	26					1,030,069	101,111
Set lines:								
Cumberland River							8,700	1,169
Green River							25,300	2,024
Mississippi River							126,000	9,780
Ohio River							177,700	21,393
Tennessee River							12,100	1,658
Total							349,800	36,024
Haul seines:								
Mississippi River							12,500	640
Ohio River							51,850	6,976
Total							64,350	7,616
Crowfoot bars:								
Cumberland River			170,000	$1,275		$28	170,000	1,303
Ohio River			939,000	16,077	$95	1,140	939,000	17,312
Tennessee River			216,000	2,970		28	216,000	2,998
Total			1,325,000	20,322	95	1,196	1,325,000	21,613
Tongs, etc.:								
Big Barren River			40,000	360			40,000	360
Cumberland River			40,000	300		6	40,000	306
Ohio River			44,000	330			44,000	330
Total			124,000	990		6	124,000	996
Total by waters:								
Big Barren River			40,000	360			40,000	360
Big Sandy River	100	19					7,860	1,473
Cumberland River			210,000	1,575		34	237,500	5,206
Green River							95,250	7,652
Mississippi River							490,500	32,850
Ohio River	33	7	983,000	16,407	95	1,140	1,777,679	113,293
Tennessee River			216,000	2,970		28	244,430	6,526
Grand total	133	26	1,449,000	21,312	95	1,202	2,893,219	167,360

LOUISIANA

In 1922 there were 2,088 fishermen, 157 shoresmen, and 7 men engaged in transporting vessels in Louisiana. Out of a total investment of $715,071 there were 969 gasoline boats, valued at $149,765, 1,958 rowboats, with a value of $33,864; 816 houseboats, valued at $100,685; 11,946 fyke nets, valued at $151,970; 102 haul seines, valued at $19,008; lines of all kinds, valued at $12,116; and shore property and cash capital, valued at $193,445 and $47,500, respectively, the remainder of the investment being divided among apparatus of lesser importance. Nearly one-half of the persons engaged and more than one-half of the investment are credited to the Atchafalaya River. Of a total catch from the Mississippi and all of its tributaries in the State, of 10,485,588 pounds, valued at $572,863, 4,579,220 pounds, valued at $254,651, were taken from the Atchafalaya River. Among other important fishery streams, in the order of their importance, were the Mississippi River with a catch of 915,011 pounds, valued at $67,569; Ouachita River, 818,354 pounds, valued at $58,284; Black River, 977,493 pounds, valued at $39,329;

and Lake Larto, with a catch of 1,096,504 pounds, valued at $38,234. The more important species, with the amount of each taken, were as follows: Buffalofish, 4,938,777 pounds, valued at $222,944; catfish, 3,229,056 pounds, valued at $207,350; drum or sheepshead, 1,439,368 pounds, valued at $52,633; and paddlefish or spoonbill cat, 422,478 pounds, valued at $36,560. To the paddlefish may be added 5,908 pounds of caviar, having a value to the fishermen of $13,956. Most of the paddlefish meat and caviar was shipped to New York City.

The following tables show in detail the statistics of the fisheries of this State:

Persons engaged and investment in the fisheries of Louisiana, 1922

Waters	Persons engaged			Gasoline boats		Rowboats, etc.	
	Fishermen	Shoresmen	Total				
	Number	*Number*	*Number*	*Number*	*Value*	*Number*	*Value*
Atchafalaya River	920	88	1,012	672	$85,300	1,046	$21,160
Black River	112	13	125	35	4,650	107	1,615
Little River and Catahoula Lake	162	4	166	29	4,445	125	1,036
Mississippi River	313	6	319	61	17,710	263	3,906
Ouachita River	156	6	162	65	11,805	133	1,865
Red River	214	25	242	58	14,575	180	2,437
Tensas River	13	3	16	2	175	3	60
Lake Allemands	98	12	110	23	6,500	55	1,210
Lake Larto	46		46	18	3,455	22	270
Miscellaneous waters	54		54	6	1,150	18	305
Total	2,088	157	[1] 2,252	[2] 909	149,765	1,958	33,864

Waters	House boats		Fyke nets		Haul seines			Lines	Spears and gigs	
	Number	*Value*	*Number*	*Value*	*Number*	*Yards*	*Value*	*Value*	*Number*	*Value*
Atchafalaya River	679	$64,600	8,150	$119,000	15	3,200	$4,075	$7,300	398	$373
Black River	13	4,400	684	5,610	6	1,800	1,650	487		
Little River and Catahoula Lake	17	2,615	408	3,396	22	4,475	3,375	346	2	1
Mississippi River	17	3,100	170	1,404	6	1,225	1,358	1,174		
Ouachita River	37	9,855	987	8,566	10	2,050	1,940	1,452		
Red River	53	16,025	1,410	12,656	9	1,232	810	849		
Tensas River			26	238	2	400	400	7		
Lake Allemands					12	1,900	1,500	110		
Lake Larto			45	450	14	3,225	3,025	104	2	1
Miscellaneous waters			66	650	6	815	875	287		
Total	816	100,685	11,946	151,970	102	20,322	19,008	12,116	402	375

Waters	Shrimp traps		Guns		Dip nets		Shore property	Cash capital	Total investment
	Number	*Value*	*Number*	*Value*	*Number*	*Value*	*Value*	*Value*	*Value*
Atchafalaya River			30	$900	50	$100	$147,820	$35,700	$486,328
Black River							10,385	4,000	32,797
Little River and Catahoula Lake							2,655	800	18,669
Mississippi River	4,060	$3,963	40	1,200			3,295	500	37,700
Ouachita River							3,025		38,508
Red River							21,300	4,000	72,652
Tensas River							1,180		2,060
Lake Allemands			6	180			1,775	2,500	13,775
Lake Larto							735		8,040
Miscellaneous waters							1,275		4,542
Total	4,060	3,963	76	2,280	50	100	193,445	47,500	715,071

[1] Includes 7 men on three transporting vessels.
[2] Includes three transporting vessels with a net tonnage of 32 and value of $7,400.

Yield, by apparatus and waters, of the fisheries of Louisiana, 1922

Apparatus and waters	Buffalofish		Carp, German		Catfish		Drum, fresh-water or sheepshead	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Atchafalaya River	783,412	$38,390					356,727	$12,902
Black River	283,104	9,117			4,600	$256	94,452	1,902
Little River and Catahoula Lake	219,934	7,939			2,333	140	38,918	714
Mississippi River	115,150	5,286	200	$20	29,500	2,233	25,250	1,198
Ouachita River	374,534	17,706			3,950	248	76,905	2,958
Red River	562,325	30,621	430	35	15,400	1,528	153,511	9,442
Tensas River	14,026	700					1,458	30
Lake Larto	34,200	1,200			500	22	4,000	100
Miscellaneous waters	22,950	1,970			2,600	260	4,550	333
Total	2,409,635	112,929	630	55	58,883	4,687	755,831	29,579
Haul seines:								
Atchafalaya River	995,000	47,520					365,000	12,950
Black River	120,000	3,600					20,000	300
Little River and Catahoula Lake	159,219	4,816			1,371	40	19,171	226
Mississippi River	87,725	5,143	41,000	2,500	12,950	877	8,500	252
Ouachita River	86,400	4,643			8,600	677	7,150	266
Red River	32,200	2,596			1,155	87	3,850	355
Lake Allemands	29,992	909			200,153	10,007	5,136	108
Lake Larto	733,905	24,300			88,359	4,149	99,055	1,975
Miscellaneous waters	157,456	8,459			650	43	3,630	641
Total	2,401,897	101,986	41,000	2,500	313,238	15,880	531,492	17,073
Lines:								
Atchafalaya River					1,829,665	121,161		
Black River	7,700	260			177,714	8,930	51,000	1,109
Little River and Catahoula Lake	4,000	120			66,485	3,960	8,676	130
Mississippi River	43,395	2,011			365,200	28,553	11,925	505
Ouachita River	3,600	138			145,011	9,972	8,500	178
Red River	1,250	50			74,179	4,295	65,944	3,896
Tensas River	60,100	4,803			3,323	236	500	18
Lake Allemands					95,000	4,750		
Lake Larto	1,000	35			95,358	4,476	5,000	120
Miscellaneous waters	200	12			5,000	450	500	25
Total	121,245	7,429			2,856,935	186,783	152,045	5,981
Dipnets, etc: Miscellaneous waters	6,000	600						
Total by waters:								
Atchafalaya River	1,778,412	85,910			1,829,665	121,161	721,727	25,852
Black River	510,804	12,977			182,314	9,186	165,452	3,311
Little River and Catahoula Lake	383,153	12,875			70,189	4,140	66,795	1,070
Mississippi River	246,270	12,440	41,200	2,520	407,650	31,663	45,675	1,955
Ouachita River	464,534	22,487			157,561	10,897	92,555	3,402
Red River	595,775	33,267	430	35	90,734	5,910	223,335	13,693
Tensas River	74,126	5,503			3,323	236	1,958	48
Lake Allemands	29,992	909			295,153	14,757	5,136	108
Lake Larto	769,105	25,535			184,217	8,647	108,055	2,195
Miscellaneous waters	186,606	11,041			8,250	753	8,680	999
Grand total	4,938,777	222,944	41,630	2,555	3,229,056	207,350	1,439,368	52,633

Yield, by apparatus and waters, of the fisheries of Louisiana, 1922—Continued

Apparatus and waters	Eels		Garfish		Paddlefish or spoonbill cat		Paddlefish caviar	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Black River					2,500	$100		
Mississippi River			2,500	$50				
Ouachita River					3,500	350		
Red River					450	59	50	$141
Total			2,500	50	6,450	509	50	141
Haul seines:								
Black River					202,554	10,664	769	2,136
Little River and Catahoula Lake					6,637	477	375	658
Mississippi River					5,420	688	595	1,780
Ouachita River					30,900	4,385	1,430	3,544
Red River					6,850	998	200	605
Lake Larto			845	9	33,700	1,485	183	334
Miscellaneous waters			25	1	14,176	1,301	168	348
Total			870	10	300,237	19,998	3,720	9,405
Lines:								
Black River					13,000	655	100	300
Little River and Catahoula Lake					5,000	255	50	135
Mississippi River	1,100	$100			18,800	1,618	50	135
Ouachita River					66,554	11,051	1,320	2,168
Red River					4,088	639	218	657
Tensas River					2,349	235		
Miscellaneous waters					6,000	1,600	400	1,000
Total	1,100	100			115,791	16,053	2,138	4,410
Total by waters:								
Black River					218,054	11,419	869	2,436
Little River and Catahoula Lake					11,637	732	425	793
Mississippi River	1,100	100	2,500	50	24,220	2,306	645	1,930
Ouachita River					100,954	15,786	2,750	5,712
Red River					11,388	1,696	468	1,403
Tensas River					2,349	235		
Lake Larto			845	9	33,700	1,485	183	334
Miscellaneous waters			25	1	20,176	2,901	568	1,348
Grand total	1,100	100	3,370	60	422,478	36,560	5,908	13,956

Apparatus and waters	Sturgeon, shovelnose		Suckers		Shrimp		Crawfish	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets: Mississippi River	100	$10						
Lines: Mississippi River	180	15						
Shrimp traps: Mississippi River					142,182	$13,870		
Dip nets, etc:								
Atchafalaya River							7,265	$509
Red River			400	$28				
Total			400	28			7,265	509
Total by waters:								
Atchafalaya River							7,265	509
Mississippi River	280	25			142,182	13,870		
Red River			400	28				
Grand total	280	25	400	28	142,182	13,870	7,265	509

Yield, by apparatus and waters, of the fisheries of Louisiana, 1922—Continued

Apparatus and waters	Frogs		Turtles		Alligator hides		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Atchafalaya River							1,140,139	$51,292
Black River							384,656	11,375
Little River and Catahoula Lake							261,215	8,793
Mississippi River							172,700	8,797
Ouachita River							458,889	21,262
Red River							732,196	41,826
Tensas River							15,484	730
Lake Larto							38,700	1,322
Miscellaneous waters							30,100	2,563
Total							3,234,079	147,960
Haul seines:								
Atchafalaya River							1,300,000	60,470
Black River							343,323	16,700
Little River and Catahoula Lake			1,500	$30			188,273	6,247
Mississippi River							156,190	11,240
Ouachita River							134,480	13,515
Red River							44,255	4,641
Lake Allemands							235,281	11,024
Lake Larto			169	3			956,216	32,255
Miscellaneous waters							176,105	10,793
Total			1,669	33			3,594,123	166,885
Lines:								
Atchafalaya River			10,227	290			1,839,892	121,451
Black River							249,514	11,254
Little River and Catahoula Lake			5,950	200			90,161	4,800
Mississippi River			300	8	1,242	$291	442,192	33,251
Ouachita River							224,985	23,507
Red River							145,679	9,537
Tensas River							66,272	5,292
Lake Allemands							95,000	4,750
Lake Larto							101,358	4,631
Miscellaneous waters							12,100	3,087
Total			16,477	498	1,242	291	3,267,153	221,560
Spears and gigs:								
Atchafalaya River	216,912	$17,367					216,912	17,367
Little River and Catahoula Lake	230	26					230	26
Lake Larto	230	26					230	26
Total	217,372	17,419					217,372	17,419
Shrimp traps: Mississippi River							142,182	13,870
Guns:								
Atchafalaya River					12,372	1,912	12,372	1,912
Mississippi River					1,747	411	1,747	411
Lake Allemands					255	59	255	59
Total					14,374	2,382	14,374	2,382
Dip nets, etc.:								
Atchafalaya River			2,640	1,650			9,905	2,159
Red River							400	28
Miscellaneous waters							6,000	600
Total			2,640	1,650			16,305	2,787
Total by waters:								
Atchafalaya River	216,912	17,367	12,867	1,940	12,372	1,912	4,579,220	254,651
Black River							977,493	39,329
Little River and Catahoula Lake	230	26	7,450	230			539,879	19,866
Mississippi River			300	8	2,989	702	915,011	67,569
Ouachita River							818,354	58,284
Red River							922,530	56,032
Tensas River							81,756	6,022
Lake Allemands					255	59	330,536	15,833
Lake Larto	230	26	169	3			1,096,504	38,234
Miscellaneous waters							224,305	17,043
Grand total	217,372	17,419	20,786	2,181	15,616	2,673	10,485,588	572,863

MINNESOTA

In 1922 a total of 514 fishermen and 205 shoresmen were engaged in the fisheries of the Mississippi River and its tributaries in Minnesota. Most of the shoresmen were connected with the wholesale fish trade of Minneapolis and St. Paul and the pearl-button industry. The same may be said of the shore property and cash capital, amounting, respectively, to $363,136 and $68,000. The total output of the State amounted to 5,659,555 pounds, valued at $230,425. Among the more valuable species were the carp, with a catch of 2,948,230 pounds, valued at $122,881, and buffalofish, 761,370 pounds, valued at $46,748. The output of mussel shells amounted to 1,571,196 pounds, valued at $36,427, together with $2,451 worth of pearls and slugs. Mussel shells were taken in various streams throughout the State, but about one-third of them were from the Mississippi River.

Important fisheries are conducted in many of the lakes throughout the State, under the supervision of State game wardens. The total catch from these amounted to 2,076,682 pounds, valued at $93,346, or more than one-third, in pounds and value, of the State's entire output from the Mississippi and its tributaries.

The following tables show in detail the statistics of the fisheries of this State:

Persons engaged and investment in the fisheries of Minnesota, 1922

Waters	Persons engaged			Gasoline boats		Row boats and scows		House boats	
	Fishermen	Shoresmen	Total						
	Number	*Number*	*Number*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Blue Earth River	2		2			3	$50		
Cedar River	2		2						
Cottonwood River	1		1			1	10		
Crow Wing River	10		10			10	150		
Des Moines River	6		6			6	60		
Minnesota River	54	1	55	7	$1,275	37	641		
Mississippi River	208	209	417	104	22,750	144	3,475	1	$150
Shell River	10		10	2	550	8	135		
St. Croix River	38		38	10	2,200	26	533		
Vermillion River	4		4	1	200	2	75		
White Water River	1		1			1	10		
Miscellaneous lakes	178	12	190	8	1,700	20	590		
Total	514	222	[1] 736	132	28,675	258	5,729	1	150

Waters	Haul seines			Crowfoot bars (pairs)		Fyke nets		Set lines	
	Number	*Yards*	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Blue Earth River				2	$25				
Cottonwood River				1	10				
Crow Wing River				10	150				
Des Moines River				2	20				
Minnesota River	9	1,262	$1,970	16	165	1	$35	9	$29
Mississippi River	49	13,100	16,890	30	300	353	5,190	43	56
Shell River				3	40				
St. Croix River	10	3,916	4,500					12	65
Vermillion River	1	235	225						
White Water River								1	5
Miscellaneous lakes	30	16,592	19,995	3	35				
Total	90	35,105	43,580	67	745	354	5,225	65	155

[1] Includes 17 men connected with the wholesale fishery trade of North Dakota.

Persons engaged and investment in the fisheries of Minnesota, 1922—Continued

Waters	Gill nets			Pound nets		Forks		Rakes		Shore property	Cash capital	Total investment
	No.	*Yards*	*Value*	*No.*	*Value*	*No.*	*Value*	*No.*	*Value*	*Value*	*Value*	*Value*
Blue Earth River										$150		$225
Cedar River								2	$3			3
Cottonwood River										25		45
Crow Wing River										200		500
Des Moines River								1	4	100		184
Minnesota River				3	$160	1	$3			4,435		8,713
Mississippi River	10	6,730	$1,630							343,316	$73,000	466,757
Shell River						5	11			345		1,081
St. Croix River	14	650	210							4,180		11,088
Vermillion River										300		800
White Water River										15		30
Miscellaneous lakes										33,370		55,690
Total	24	7,380	1,840	3	160	6	14	3	7	386,436	73,000	[1] 545,716

[1] Includes $5,000 cash capital and $23,300 worth of shore property connected with the wholesale fishery trade of North Dakota.

Yield, by apparatus and waters, of the fisheries of Minnesota, 1922

Apparatus and waters	Bowfin		Buffalofish		Carp	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Haul seines:						
Minnesota River	200	$10	15,024	$1,364	377,738	$14,475
Mississippi River	5,309	137	162,017	10,350	644,037	29,698
St. Croix River	2,658	45	54,596	2,428	304,020	7,001
Vermillion River					67,018	4,315
Miscellaneous lakes	5,632	179	494,747	29,511	1,385,722	58,294
Total	13,799	371	726,384	43,653	2,778,535	113,783
Fykes:						
Minnesota River			1,000	30	19,000	570
Mississippi River	1,000	20	21,900	2,195	98,500	6,445
St. Croix River			4,274	243		
Total	1,000	20	27,174	2,468	117,500	7,015
Set lines:						
Minnesota River			550	42	3,350	153
Mississippi River	600	19	82	5	12,445	485
St. Croix River					1,175	83
White Water River					500	50
Total	600	19	632	47	17,470	771
Gill nets:						
Mississippi River			3,430	296	23,100	867
St. Croix River			500	50	1,000	60
Total			3,930	346	24,100	927
Pound nets:						
Minnesota River	400	12	1,050	110	6,375	185
Mississippi River			2,200	124	4,250	200
Total	400	12	3,250	234	10,625	385
Total by waters:						
Minnesota River	600	22	17,624	1,546	406,463	15,383
Mississippi River	6,909	176	189,629	12,970	782,332	37,695
St. Croix River	2,658	45	59,370	2,721	306,195	7,144
Vermillion River					67,018	4,315
White Water River					500	50
Miscellaneous lakes	5,632	179	494,747	29,511	1,385,722	58,294
Total	15,799	422	761,370	46,748	2,948,230	122,881

Yield, by apparatus and waters, of the fisheries of Minnesota, 1922—Continued

Apparatus and waters	Catfish and bullheads		Drum, fresh-water, or sheepshead		Eels		Quillback or American carp	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Haul seines:								
Minnesota River	1,000	$100	4,030	$292			335	$19
Mississippi River	23,920	2,961	121,205	4,411			12,265	514
St. Croix River	5,918	669	36,154	1,119	20	$2	2,330	83
Miscellaneous lakes			22,067	1,044				
Total	30,838	3,730	183,456	6,866	20	2	14,930	616
Fykes:								
Minnesota River	100	5						
Mississippi River	39,227	4,643	7,952	493	86	17		
St. Croix River	860	86	9,282	252				
Total	40,187	4,734	17,234	745	86	17		
Set lines:								
Minnesota River	2,600	230	400	40			50	5
Mississippi River	7,620	1,148	2,295	189	400	23	1,400	40
St. Croix River	991	114	50	5	34	6		
White Water River	100	15	50	5			200	20
Total	11,311	1,507	2,795	239	434	29	1,650	65
Gill nets: Mississippi River	1,015	87	700	22			2,500	77
Pound nets: Minnesota River	1,000	100	50	5				
Total by waters:								
Minnesota River	4,700	435	4,480	337			385	24
Mississippi River	71,782	8,839	132,152	5,115	486	40	16,165	631
St. Croix River	7,769	869	45,486	1,376	54	8	2,330	83
White Water River	100	15	50	5			200	20
Miscellaneous lakes			22,067	1,044				
Total	84,351	10,158	204,235	7,877	540	48	19,080	758

Apparatus and waters	Sturgeon, lake		Sturgeon, shovelnose		Suckers		Turtles	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Haul seines:								
Minnesota River					500	$25		
Mississippi River	608	$101	1,580	$219	26,670	879		
St. Croix River			1,120	171	1,859	37		
Miscellaneous lakes					714	32		
Total	608	101	2,700	390	29,743	973		
Fykes:								
Mississippi River	3,471	649			2,868	92		
St. Croix River					11,820	123		
Total	3,471	649			14,688	215		
Set lines:								
Mississippi River	1,294	121	500	50	230	13	65	$2
St. Croix River			20	3				
White Water River			35	5				
Total	1,204	121	555	58	230	13	65	2
Gill nets: Mississippi River	800	112			600	21		
Total by waters:								
Minnesota River					500	25		
Mississippi River	6,173	983	2,080	269	30,368	1,005	65	2
St. Croix River			1,140	174	13,679	160		
White Water River			35	5				
Miscellaneous lakes					714	32		
Total	6,173	983	3,255	448	45,261	1,222	65	2

Yield, by apparatus and waters, of the fisheries of Minnesota, 1922—Continued

Apparatus and waters	Mussel shells		Pearls	Slugs	Total	
	Pounds	*Value*	*Value*	*Value*	*Pounds*	*Value*
Haul seines:						
Minnesota River					398,827	$16,285
Mississippi River					997,611	49,270
St. Croix River					408,675	11,555
Vermillion River					67,018	4,315
Miscellaneous lakes					1,908,882	89,060
Total					3,781,013	170,485
Crowfoot bars:						
Blue Earth River	86,000	$1,320	$25	$15	86,000	1,360
Cottonwood River	36,000	630		9	36,000	639
Crow Wing River	252,065	6,699	150	84	252,065	6,933
Des Moines River	37,000	689	45	13	37,000	747
Minnesota River	196,200	5,145	408	187	196,200	5,740
Mississippi River	549,961	12,104	590	522	549,961	13,216
Shell River	149,800	3,479		51	149,800	3,530
Miscellaneous lakes	167,800	4,286			167,800	4,286
Total	1,474,826	34,352	1,218	881	1,474,826	36,451
Fykes:						
Minnesota River					20,100	605
Mississippi River					175,004	14,554
St. Croix River					26,236	704
Total					221,340	15,863
Set lines:						
Minnesota River					6,950	470
Mississippi River					26,931	2,095
St. Croix River					2,270	211
White Water River					885	95
Total					37,036	2,871
Gill nets:						
Mississippi River					32,145	1,482
St. Croix River					1,500	110
Total					33,645	1,592
Pound nets:						
Minnesota River					8,875	412
Mississippi River					6,450	324
Total					15,325	736
Forks, rakes, etc.:						
Cedar River			100	50		150
Des Moines River	33,100	646	31	21	33,100	698
Minnesota River	30,270	735	47	17	30,270	799
Mississippi River	10,000	175	35	9	10,000	219
St. Croix River	10,000	169	25		10,000	194
Shell River	13,000	350		17	13,000	367
Total	96,370	2,075	238	114	96,370	2,427
Total by waters:						
Blue Earth River	86,000	1,320	25	15	86,000	1,360
Cedar River			100	50		150
Cottonwood River	36,000	630		9	36,000	639
Crow Wing River	252,065	6,699	150	84	252,065	6,933
Des Moines River	70,100	1,335	76	34	70,100	1,445
Minnesota River	226,470	5,880	455	204	661,222	24,311
Mississippi River	559,961	12,279	625	531	1,798,102	81,160
Shell River	162,800	3,829		68	162,800	3,897
St. Croix River	10,000	169	25		448,681	12,774
Vermillion River					67,018	4,315
White Water River					885	95
Miscellaneous lakes	167,800	4,286			2,076,682	93,346
Total	1,571,196	36,427	1,456	995	5,659,555	230,425

MISSISSIPPI

The fisheries of the Mississippi River and its tributaries, in Mississippi, gave employment in 1922 to 379 fishermen and 55 shoresmen, most of the latter being connected with the wholesale trades. The total investment in boats, apparatus, shore property, and cash capital amounted to $203,286. Based on the value of the catch, the more important forms of apparatus used were fyke nets, haul seines, and set lines. The total output of the State amounted to 3,327,501 pounds, valued at $191,449. The leading species taken were the buffalofish, with a catch of 2,096,288 pounds, valued at $105,188; paddlefish, 352,260 pounds, valued at $36,672, and paddlefish caviar, 1,563 pounds, valued at $3,037; catfish, 448,690 pounds, valued at $27,566; and drum or sheepshead, 329,109 pounds, valued at $11,636.

The Mississippi and Yazoo were the most productive of the rivers, the value of the catch of these two being about 70 per cent of that of the Mississippi River and all of its tributaries combined. Besides the Big Sunflower and Homochitto Rivers, several lakes tributary to the Mississippi were quite productive.

The following tables show in detail the statistics of the fisheries of this State.

Persons engaged and investment in the fisheries of Mississippi, 1922

Waters	Persons engaged			Gasoline boats		Rowboats		House boats	
	Fishermen	Shoresmen	Total						
	No.	*No.*	*No.*	*No.*	*Value*	*No.*	*Value*	*No.*	*Value*
Big Sunflower River	25		25	16	$1,625	18	$340	10	$1,700
Homochitto River	24		24	9	1,135	13	124	2	200
Mississippi River	178	34	212	94	25,395	107	1,842	53	4,823
Yazoo River	99	10	109	60	8,670	72	1,151	35	9,240
Beulah Lake	12	1	13	2	450	2	40		
Flower Lake	5		5			6	90		
Lake Lee	6	6	12	3	1,750	3	150	1	800
Moon Lake	15	2	17	1	100	6	100		
Washington Lake	15	2	17	1	600	5	750		
Total	379	55	434	186	39,725	232	4,587	101	16,763

Waters	Fyke nets		Haul seines			Set lines		Gill nets		
	No.	*Value*	*No.*	*Yards*	*Value*	*No.*	*Value*	*No.*	*Yards*	*Value*
Big Sunflower River	170	$1,700	5	1,055	$870	62	$90	8	640	$115
Homochitto River	34	328	1	450	450	820	115			
Mississippi River	1,235	12,406	8	1,940	1,525	697	1,248	7	1,150	308
Yazoo River	1,480	14,675	17	5,789	5,115	318	1,654	3	700	295
Beulah Lake			2	1,600	1,600					
Flower Lake	13	150	1	700	200	5	8	1	100	40
Lake Lee	30	300	1	735	500	10	20	7	700	300
Moon Lake			2	2,000	1,800	76	180			
Washington Lake			5	3,100	3,900					
Total	2,962	29,619	42	17,369	15,960	1,088	3,315	26	3,290	1,058

Waters	Trammel nets			Shrimp traps		Shore property	Cash capital	Total investment
	No.	*Yards*	*Value*	*No.*	*Value*	*Value*	*Value*	*Value*
Big Sunflower River						$425		$6,865
Homochitto River						150		2,502
Mississippi River	8	1,110	$483	300	$200	49,820	$11,000	109,110
Yazoo River						8,965	2,300	52,065
Beulah Lake						100		2,190
Flower Lake						80		568
Lake Lee						14,736	2,500	21,056
Moon Lake	2	240	100			1,000		3,280
Washington Lake						400		5,650
Total	10	1,350	583	300	200	75,676	15,800	203,286

Yield, by apparatus and waters, of the fisheries of Mississippi, 1922

Apparatus and waters	Black bass		Buffalofish		Carp	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:						
Big Sunflower River			76,000	$5,410	2,000	$90
Homochitto River			49,500	1,570		
Mississippi River	100	$10	674,470	32,751	8,896	562
Yazoo River			490,808	21,206	1,785	59
Flower Lake			4,000	320	500	15
Lake Lee			30,000	1,200		
Total	100	10	1,324,778	62,457	13,181	726
Haul seines:						
Big Sunflower River			24,000	1,580		
Homochitto River			1,000	40		
Mississippi River	447	60	92,881	5,479	5,345	330
Yazoo River	120	12	141,659	6,248		
Beulah Lake			40,000	2,400	100	4
Flower Lake			8,000	480	1,000	30
Lake Lee			70,000	4,200		
Moon Lake			60,000	3,000		
Lake Washington			193,729	11,836	1,084	33
Total	567	72	631,269	35,263	7,529	397
Set lines:						
Big Sunflower River			500	25		
Mississippi River	100	10	16,500	705		
Yazoo River			11,353	507	400	12
Total	100	10	28,353	1,237	400	12
Gill nets:						
Big Sunflower River			2,000	100		
Mississippi River			13,688	877	1,000	80
Yazoo River			25,200	974		
Flower Lake			2,000	160		
Lake Lee			5,000	300		
Total			47,888	2,411	1,000	80
Trammel nets:						
Mississippi River			14,000	1,320	1,000	60
Moon Lake			50,000	2,500		
Total			64,000	3,820	1,000	60
Total by waters:						
Big Sunflower River			102,500	7,115	2,000	90
Homochitto River			50,500	1,610		
Mississippi River	647	80	811,539	41,132	16,241	1,032
Yazoo River	120	12	669,020	28,935	2,185	71
Beulah Lake			40,000	2,400	100	4
Flower Lake			14,000	960	1,500	45
Lake Lee			105,000	5,700		
Moon Lake			110,000	5,500		
Washington Lake			193,729	11,836	1,084	33
Total	767	92	2,096,288	105,188	23,110	1,275

Yield, by apparatus and waters, of the fisheries of Mississippi, 1922—Continued

Apparatus and waters	Catfish		Crappie		Drum, fresh-water or sheepshead	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:						
Big Sunflower River	500	$30			21,010	$845
Homochitto River	1,000	50			5,760	140
Mississippi River	24,476	1,474	14,003	$1,230	116,625	3,843
Yazoo River	14,549	874	400	28	67,300	2,562
Flower Lake					1,000	30
Lake Lee			300	30	2,000	40
Total	40,525	2,428	14,703	1,288	213,695	7,460
Haul seines:						
Big Sunflower River					5,000	175
Homochitto River	3,000	150			2,000	60
Mississippi River	11,688	948	25,008	1,864	35,612	1,086
Yazoo River	17,322	1,051	7,679	537	16,803	589
Beulah Lake	4,000	320			500	20
Flower Lake	1,000	80			1,000	30
Lake Lee	1,000	80	1,200	144	12,000	480
Lake Washington	3,155	238			447	13
Total	41,165	2,867	33,887	2,545	73,362	2,453
Set lines:						
Big Sunflower River	20,000	1,490			2,500	93
Homochitto River	33,000	1,662				
Mississippi River	208,003	12,422	2,349	258	17,452	726
Yazoo River	84,106	4,908	200	14	9,450	310
Flower Lake	3,000	240			500	15
Lake Lee	9,000	720				
Moon Lake	2,000	160				
Total	359,109	21,602	2,549	272	29,902	1,144
Gill nets:						
Mississippi River	3,311	305			950	76
Yazoo River	1,580	84	300	21	4,200	133
Flower Lake					1,000	30
Lake Lee	2,000	160			3,000	120
Total	6,891	549	300	21	9,150	359
Trammel nets: Mississippi River	1,000	120	150	15	3,000	220
Total by waters:						
Big Sunflower River	20,500	1,520			28,510	1,113
Homochitto River	37,000	1,862			7,760	200
Mississippi River	248,478	15,269	41,510	3,307	173,639	5,951
Yazoo River	117,557	6,917	8,579	600	97,753	3,594
Beulah Lake	4,000	320			500	20
Flower Lake	4,000	320			3,500	105
Lake Lee	12,000	960	1,500	174	17,000	640
Moon Lake	2,000	160				
Washington Lake	3,155	238			447	13
Total	448,690	27,566	51,589	4,141	329,109	11,636

Yield, by apparatus and waters, of the fisheries of Mississippi, 1922—Continued

Apparatus and waters	Eels		Paddlefish, or spoonbill cat		Paddlefish caviar		Sturgeon, shovelnose	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Mississippi River			3,129	$320			311	$9
Yazoo River			3,300	361				
Total			6,429	681			311	9
Haul seines:								
Big Sunflower River			27,300	3,863				
Homochitto River			20,000	2,000				
Mississippi River			21,640	2,528	15	$15		
Yazoo River			34,122	3,815	75	138	300	3
Beulah Lake			10,000	600	50	150		
Lake Lee			10,000	1,500	50	150		
Moon Lake			5,000	250	3	8		
Lake Washington			25,022	1,674	215	679		
Total			153,084	16,230	408	1,140	300	3
Set lines:								
Big Sunflower River			10,100	1,240	30	90		
Homochitto River			3,800	272				
Mississippi River	29	$2	62,100	6,415	60	130	800	80
Yazoo River			81,747	9,128	1,030	1,583		
Lake Lee			1,000	80				
Moon Lake			10,000	500	6	16		
Total	29	2	168,747	17,635	1,126	1,819	800	80
Gill nets:								
Big Sunflower River			5,000	650				
Mississippi River			10,600	758	26	70		
Yazoo River			1,400	168				
Lake Lee			2,000	300				
Total			19,000	1,876	26	70		
Trammel nets: Moon Lake			5,000	250	3	8		
Total by waters:								
Big Sunflower River			42,400	5,753	30	90		
Homochitto River			23,800	2,272				
Mississippi River	29	2	97,469	10,021	101	215	1,111	89
Yazoo River			120,569	13,472	1,105	1,721	300	3
Beulah Lake			10,000	600	50	150		
Lake Lee			13,000	1,880	50	150		
Moon Lake			20,000	1,000	12	32		
Washington Lake			25,022	1,674	215	679		
Total	29	2	352,260	36,672	1,503	3,037	1,411	92

Yield, by apparatus and waters, of the fisheries of Mississippi, 1922—Continued

Apparatus and waters	White bass		Shrimp		Turtles		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Big Sunflower River							99,510	$6,375
Homochitto River							56,200	1,760
Mississippi River	2,433	$227			800	$24	845,243	40,450
Yazoo River	331	23					578,473	25,113
Flower Lake							5,500	365
Lake Lee	300	30					32,600	1,300
Total	3,064	280			800	24	1,617,586	75,363
Haul seines:								
Big Sunflower River							56,300	5,618
Homochitto River							26,000	2,250
Mississippi River	7,100	545					199,736	12,855
Yazoo River	4,000	280					222,080	12,673
Beulah Lake							54,650	3,494
Flower Lake							11,000	620
Lake Lee	1,000	120					95,250	6,674
Moon Lake							65,003	3,258
Lake Washington							223,652	14,473
Total	12,100	945					953,671	61,915
Set lines:								
Big Sunflower River							33,130	2,938
Homochitto River					300	8	37,100	1,942
Mississippi River	700	49			500	15	308,593	20,812
Yazoo River							188,286	16,462
Flower Lake							3,500	255
Lake Lee							10,000	800
Moon Lake							12,006	676
Total	700	49			800	23	592,615	43,885
Gill nets:								
Big Sunflower River							7,000	750
Mississippi River	221	27					29,796	2,193
Yazoo River							32,680	1,380
Flower Lake							3,000	190
Lake Lee							12,000	880
Total	221	27					84,476	5,393
Trammel nets:								
Mississippi River							19,150	1,735
Moon Lake							55,003	2,758
Total							74,153	4,493
Shrimp traps: Mississippi River			5,000	$400			5,000	400
Total by waters:								
Big Sunflower River							195,940	15,681
Homochitto River					300	8	119,360	5,952
Mississippi River	10,454	848	5,000	400	1,300	39	1,407,518	78,445
Yazoo River	4,331	303					1,021,519	55,628
Beulah Lake							54,650	3,494
Flower Lake							23,000	1,430
Lake Lee	1,300	150					149,850	9,654
Moon Lake							132,012	6,692
Washington Lake							223,652	14,473
Total	16,085	1,301	5,000	400	1,600	47	3,327,501	191,449

MISSOURI

The fisheries of Missouri are confined entirely to the Mississippi River and tributaries, including the Missouri River. In 1922 there were 1,023 persons engaged in the fisheries or fishery industries of this State, more than two-thirds of this number being connected with the wholesale fish trade of St. Louis and Kansas City and the pearl-button industry in factories located at various places in the State. The total investment amounted to $1,152,007, most of which is credited to the wholesale fish trade and the button industry already mentioned. Also contributing to the investment were 78 gas boats, valued at

$11,215; 235 rowboats, valued at $4,255; 23 houseboats, valued at $5, 515; 1,422 fyke nets, valued at $12, 248; 85 trammel nets, valued at $3, 630; 434 set lines, valued at $1,186; 37 haul seines, valued at $3,238; and a few minor forms of apparatus. Based on the catch, the fyke net was the most important form of apparatus.

The total production of the State amounted to 1,566,162 pounds, valued at $103,755. Some of the more important species contributing to this output were 551,536 pounds of carp, valued at $35,160; 194,-371 pounds of catfish and bullheads, valued at $24,745; and 287,474 pounds of buffalofish, valued at $21,536. The Mississippi and Missouri Rivers furnished the greater part of the State's output. The production of mussel shells amounted to 327,500 pounds, valued at $4,042, together with $1,178 worth of pearls and slugs. The shell catch was divided among the White, Maramec, Osage, and Mississippi Rivers.

The following tables show in detail the statistics of the fisheries of this State:

Persons engaged and investment in the fisheries of Missouri, 1922

Waters	Persons engaged			Gasoline boats		Rowboats		House boats	
	Fishermen	Shoresmen	Total						
	Number	*Number*	*Number*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Black River	10		10			4	$40		
Gasconade River	6		6	3	$755	8	190	2	$1,000
Little River	15		15	1	300	15	150		
Maramec River	9		9			8	76	1	200
Mississippi River	113	551	664	55	8,015	87	1,645	10	2,225
Missouri River	108	130	238	15	1,445	73	1,394	9	2,010
Osage River	18	26	44	4	700	14	280		
Platte River	1		1			1	15	1	80
White River	10		10			10	100		
Miscellaneous lakes	26		26			15	365		
Total	316	707	1,023	78	11,215	235	4,255	23	5,515

Waters	Fyke nets		Set lines		Trammel nets			Haul seines		
	Number	*Value*	*Number*	*Value*	*Number*	*Yards*	*Value*	*Number*	*Yards*	*Value*
Black River			8	$4				2	10	$5
Gasconade River	15	$109	28	32	1	60	$80	1	67	30
Little River	204	770	45	45				4	600	500
Maramec River			6	6						
Mississippi River	864	8,314	240	364	12	1,620	525	16	4,429	608
Missouri River	223	2,057	63	111	52	2,468	1,450	11	1,814	1,665
Osage River	102	870	19	24	6	540	245			
Platte River	8	80			1	40	35	1	45	30
Miscellaneous lakes	6	48	25	600	13	1,960	1,295	2	500	400
Total	1,422	12,248	434	1,186	85	6,688	3,630	37	7,465	3,238

Waters	Crowfoot bars, pairs		Rakes		Forks		Shore property	Cash capital	Total investment
	Number	*Value*	*Number*	*Value*	*Number*	*Value*	*Value*	*Value*	*Value*
Black River							$15		$64
Gasconade River							100		2,296
Little River							159		1,915
Maramec River					9	$16	198		496
Mississippi River	1	$7	9	$68	9	45	658,571	$56,800	737,187
Missouri River							362,625	26,000	398,757
Osage River					3	10	4,955		7,084
Platte River							200		440
White River					10	20	40		160
Miscellaneous lakes							900		3,008
Total	1	7	9	68	31	91	1,027,754	82,800	1,152,007

Yield, by apparatus and waters, of the fisheries of Missouri, 1922

Apparatus and waters	Black bass		Buffalofish		Carp		Catfish and bullheads	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Gasconade River			650	$65	725	$73	1,600	$320
Little River	500	$75	5,000	250	7,000	140	3,000	240
Mississippi River			88,875	6,453	236,840	14,721	47,849	5,489
Missouri River			11,055	1,074	57,780	5,248	6,840	1,117
Osage River			15,400	1,554	2,400	199	600	120
Platte River			500		2,000	200	500	100
Total	500	75	121,480	9,446	306,745	20,581	60,389	7,386
Set lines:								
Black River			200	30			1,500	225
Gasconade River			100	10	100	10	3,600	660
Little River							7,500	585
Maramec River					1,280	204	414	83
Mississippi River			12,300	1,003	37,770	1,945	45,770	5,661
Missouri River			420	53	2,425	278	6,679	1,144
Osage River			200	30	350	36	3,100	620
Miscellaneous lakes			16,000	960	4,000	200		
Total			29,220	2,086	45,925	2,673	68,563	8,978
Trammel nets:								
Gasconade River			700	70	700	70		
Mississippi River	37	2	10,825	393	36,950	687	10,825	1,093
Missouri River			24,217	2,158	71,334	6,861	39,524	5,418
Osage River			11,950	1,346	1,200	90	1,145	220
Platte River			300	30	2,000	200	400	80
Miscellaneous lakes	125	25	56,900	3,688	14,100	765		
Total	162	27	104,892	7,686	126,284	8,673	51,894	6,811
Haul seines:								
Gasconade River			50	5	75			
Little River			2,000	100	15,000	300		
Mississippi River	140	21	21,180	1,654	40,620	1,643	13,025	1,470
Missouri River			8,652	559	15,387	1,133	500	100
Platte River					1,500	150		
Total	140	21	31,882	2,318	72,582	3,233	13,525	1,570
Total by waters:								
Black River			200	30			1,500	225
Gasconade River			1,500	150	1,600	160	5,200	980
Little River	500	75	7,000	350	22,000	440	10,500	825
Maramec River					1,280	204	414	83
Mississippi River	177	23	133,180	9,503	352,180	18,996	117,469	13,713
Missouri River			44,344	3,844	146,926	13,520	53,543	7,779
Osage River			27,550	2,930	3,950	325	4,845	960
Platte River			800	80	5,500	550	900	180
Miscellaneous lakes	125	25	72,900	4,649	18,100	965		
Grand total	802	123	287,474	21,536	551,536	35,160	194,371	24,715

Yield, by apparatus and waters, of the fisheries of Missouri, 1922—Continued

Apparatus and waters	Crappie		Drum		Eels		Minnows	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Gasconade River			625	$63				
Little River	1,500	$120	4,000	120	200	$10		
Mississippi River			41,797	3,008	2,000	249		
Missouri River	200	40	2,020	212				
Osage River	600	120	4,500	328				
Total	2,300	280	52,912	3,731	2,200	259		
Set lines:								
Gasconade River			200	20				
Little River			1,000	30	300	15		
Maramec River			256	41				
Mississippi River			7,765	744	500	51		
Missouri River			340	42				
Osage River			525	78				
Total			10,086	955	800	66		
Trammel nets:								
Gasconade River			700	70				
Mississippi River			4,570	140				
Missouri River			1,300	110				
Osage River			1,100	76				
Miscellaneous lakes	1,200	190	150	15				
Total	1,200	190	7,820	411				
Haul seines:								
Black River							165	$50
Gasconade River			50	5				
Mississippi River			11,130	765				
Missouri River	1,225	123	860	83			1,000	400
Total	1,225	123	12,040	853			1,165	450
Total by waters:								
Black River							165	50
Gasconade River			1,575	158				
Little River	1,500	120	5,000	150	500	25		
Maramec River			256	41				
Mississippi River			65,262	4,657	2,500	300		
Missouri River	1,425	163	4,520	447			1,000	400
Osage River	600	120	6,125	482				
Miscellaneous lakes	1,200	190	150	15				
Grand total	4,725	593	82,888	5,950	3,000	325	1,165	450

Apparatus and waters	Mooneye		Paddlefish or spoonbill cat		Pike perch, wall-eyed		Quillback or American carp	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Mississippi River			10,170	$567				
Missouri River	200	$16	600	44	150	$30	12,425	$1,245
Osage River			1,300	186	50	10	750	73
Platte River							500	50
Total	200	16	12,070	797	200	40	13,675	1,368
Set lines:								
Black River					500	125		
Missouri River							100	13
Total					500	125	100	13
Trammel nets:								
Mississippi River			1,600	160	75	5		
Missouri River	2,050	69	9,665	498			5,155	406
Osage River			100	19			50	3
Platte River			100	5			100	10
Total	2,050	69	11,465	682	75	5	5,305	419
Haul seines:								
Little River	1,000	50	500	35	500	40		
Mississippi River			3,880	170				
Missouri River	200	31	8,935	449			1,312	74
Platte River							100	10
Total	1,200	81	13,315	654	500	40	1,412	84
Total by waters:								
Black River					500	125		
Little River	1,000	50	500	35	500	40		
Mississippi River			15,650	897	75	5		
Missouri River	2,450	116	19,200	991	150	30	18,992	1,738
Osage River			1,400	205	50	10	800	76
Platte River			100	5			700	70
Grand total	3,450	166	36,850	2,133	1,275	210	20,492	1,884

Yield, by apparatus and waters, of the fisheries of Missouri, 1922—Continued

Apparatus and waters	Rock bass		Sturgeon, lake		Sturgeon, shovelnose		Sturgeon, shovelnose, caviar	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Mississippi River			600	$51	3,960	$238	200	$300
Missouri River			300	20				
Osage River			900	102				
Total			1,800	173	3,960	238	200	300
Set lines: Mississippi River					5,244	330		
Trammel nets:								
Mississippi River					19,300	1,771	400	640
Missouri River			2,200	118				
Osage River			100	5				
Total			2,300	123	19,300	1,771	400	640
Haul seines:								
Mississippi River	275	$33			2,000	180	90	135
Missouri River			100	5				
Total	275	33	100	5	2,000	180	90	135
Total by waters:								
Mississippi River	275	33	600	51	30,504	2,519	690	1,075
Missouri River			2,600	143				
Osage River			1,000	107				
Grand total	275	33	4,200	301	30,504	2,519	690	1,075

Apparatus and waters	Suckers		Sunfish		Crawfish		Turtles	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Little River			1,500	$45			2,000	$40
Mississippi River	4,500	$330						
Missouri River	1,100	96						
Osage River	2,400	243						
Total	8,000	669	1,500	45			2,000	40
Set lines:								
Black River	1,500	150						
Maramec River	700	112						
Total	2,200	262						
Trammel nets:								
Missouri River	315	33						
Osage River	250	23						
Miscellaneous lakes			50	8				
Total	565	56	50	8				
Haul seines:								
Gasconade River	25	2						
Miscellaneous lakes					625	$250		
Total	25	2			625	250		
Total by waters:								
Black River	1,500	150						
Gasconade River	25	2						
Little River			1,500	45			2,000	40
Maramec River	700	112						
Mississippi River	4,500	330						
Missouri River	1,415	129						
Osage River	2,650	266						
Miscellaneous lakes			50	8	625	250		
Grand total	10,790	989	1,550	53	625	250	2,000	40

Yield, by apparatus and waters, of the fisheries of Missouri, 1922—Continued

Apparatus and waters	Mussel shells		Pearls	Slugs	Total	
	Pounds	*Value*	*Value*	*Value*	*Pounds*	*Value*
Fyke nets:						
Gasconade River					3,600	$521
Little River					24,700	1,040
Mississippi River					436,791	31,406
Missouri River					92,670	9,142
Osage River					28,900	2,935
Platte River					3,500	400
Total					590,161	45,444
Set lines:						
Black River					3,700	530
Gasconade River					4,000	700
Little River					8,800	630
Maramec River					2,650	440
Mississippi River					109,349	9,734
Missouri River					9,964	1,530
Osage River					4,175	764
Miscellaneous lakes					20,000	1,160
Total					162,638	15,488
Trammel nets:						
Gasconade River					2,100	210
Mississippi River					84,582	4,891
Missouri River					155,760	15,671
Osage River					15,895	1,782
Platte River					2,900	325
Miscellaneous lakes					72,525	4,692
Total					333,762	27,571
Haul seines:						
Black River					165	50
Gasconade River					200	19
Little River					19,000	525
Mississippi River					92,340	6,071
Missouri River					38,171	2,957
Platte River					1,600	160
Miscellaneous lakes					625	250
Total					152,101	10,032
Crowfoot bars: Mississippi River	6,000	$157			6,000	157
Rakes and forks:						
Maramec River	124,000	1,000	$368	$760	124,000	2,128
Mississippi River	18,000	390			18,000	390
Osage River	79,500	995		50	79,500	1,045
White River	100,000	1,500			100,000	1,500
Total	321,500	3,885	368	810	321,500	5,063
Total by waters:						
Black River					3,865	580
Gasconade River					9,900	1,450
Little River					52,500	2,195
Maramec River	124,000	1,000	368	760	126,650	2,568
Mississippi River	24,000	547			747,062	52,649
Missouri River					296,565	29,300
Osage River	79,500	995		50	128,470	6,526
Platte River					8,000	885
White River	100,000	1,500			100,000	1,500
Miscellaneous lakes					93,150	6,102
Grand total	327,500	4,042	368	810	1,566,162	103,755

NEBRASKA

The fisheries of Nebraska were conducted entirely in the Missouri River. In 1922 there were 89 fishermen engaged, a total investment (represented mainly in the wholesale trade of Omaha) of $184,664, and a total catch of 135,440 pounds, valued at $15,477, consisting mainly of carp, catfish, and buffalofish.

The following tables show in detail the statistics of the fisheries of this State:

Persons engaged and investment in the fisheries of Nebraska, 1922

Items	Number	Value	Items	Number	Value
Persons engaged:			Investment—continued:		
Fishermen	52		Trammel nets	[1] 35	$1,269
Shoresmen	37		Haul seines	[2] 3	314
			Fyke nets	44	369
Total	89		Set lines	2	3
			Shore property		171,115
Investment:			Cash capital		10,000
Gasoline boats	5	$510			
Rowboats	40	1,084	Total		184,664

[1] 1,900 yards in length.
[2] 650 yards in length.

Yield, by apparatus, of the fisheries of Nebraska, 1922

Species	Trammel nets		Haul seines		Fyke nets		Set lines		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Buffalofish	7,180	$716	8,165	$737	1,100	$98			16,445	$1,551
Carp	63,500	6,606	10,500	950	8,300	702			82,300	8,258
Catfish	17,460	3,222	2,085	350	4,850	956	1,000	$200	25,395	4,728
Drum, fresh-water, or sheepshead					100	10			100	10
Paddlefish, or spoonbill cat			10,000	850	800	40			10,800	890
Suckers					400	40			400	40
Total	88,140	10,544	30,750	2,887	15,550	1,846	1,000	200	135,440	15,477

OHIO

In 1922 there were engaged in the fisheries of Ohio 75 fishermen, 173 shoresmen, and 4 men on transporting vessels. Most of the shoresmen were connected with the wholesale fish trade of Cincinnati and button-blank factories at Manchester and Marietta. The total investment amounted to $173,646, mainly connected with the wholesale fish and button-blank industries mentioned above. The apparatus, in the order of their importance, consisted of fyke nets, crowfoot bars, set lines, and forks.

The total production was 702,323 pounds, valued at $30,120, consisting of 597,500 pounds of mussel shells, with a value of $11,940, including pearls and slugs; 26,345 pounds of suckers, valued at $4,114; 20,450 pounds of quillbacks, valued at $3,515; 18,320 pounds of drum or sheepshead, valued at $3,226; 17,420 pounds of catfish, valued at $3,154; 11,045 pounds of buffalofish, valued at $2,017, and several species of minor importance.

The following tables show in detail the statistics of the fisheries of this State:

Persons engaged and investment in the fisheries of Ohio, 1922

Waters	Persons engaged: Fishermen	Persons engaged: Shoresmen	Persons engaged: Total	Gasoline boats		Rowboats		House boats		Fyke nets	
	No.	*No.*	*No.*	*No.*	*Value*	*No.*	*Value*	*No.*	*Value*	*No.*	*Value*
Muskingum River	6		6	2	$125	5	$90				
Ohio River	51	173	[1] 228	[2] 15	4,820	49	753	12	$1,675	110	$1,228
Tuscarawas River	6		6			7	170				
Killbuck Creek	4		4			4	60				
Mohican Creek	6		6			6	90				
Wills Creek	2		2			1	10				
Total	75	173	252	17	4,945	72	1,173	12	1,675	110	1,228

Waters	Set lines		Crowfoot bars, pairs		Forks		Shore property	Cash capital	Total investment
	Number	*Value*	*Number*	*Value*	*Number*	*Value*	*Value*	*Value*	*Value*
Muskingum River			6	$120	5	$6	$35		$376
Ohio River	71	$105	25	490			148,455	$15,000	172,526
Tuscarawas River			6	120	3	4	25		319
Killbuck Creek			4	80			20		160
Mohican Creek			6	120			35		245
Wills Creek							10		20
Total	71	105	47	930	8	10	148,580	15,000	173,646

[1] Includes 4 men on two transporting vessels.
[2] Includes two transporting vessels with a net tonnage of 28 and value of $3,600.

Yield, by apparatus and waters, of the fisheries of Ohio, 1922

Apparatus and waters	Black bass		Buffalofish		Carp		Catfish		Crappie	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets: Ohio River	5	$1	8,150	$1,445	7,750	$1,480	3,720	$744	5	$1
Set lines: Ohio River			2,895	572	2,055	369	13,700	2,410		
Total, by waters: Ohio River	5	1	11,045	2,017	9,805	1,849	17,420	3,154	5	1

Apparatus and waters	Drum, fresh-water, or sheepshead		Pike perch, sauger		Pike perch, wall-eyed		Quillback, or American carp		Sturgeon, shovelnose	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets: Ohio River	10,550	$1,905	700	$165	170	$44	19,825	$3,390	130	$20
Set lines: Ohio River	7,770	1,321			60	13	625	125	330	50
Total, by waters: Ohio River	18,320	3,226	700	165	230	57	20,450	3,515	460	70

Yield, by apparatus and waters, of the fisheries of Ohio, 1922—Continued

Apparatus and waters	Suckers		White bass		Mussel shells		Pearls	Slugs	Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Value*	*Value*	*Pounds*	*Value*
Fyke nets: Ohio River	26,225	$4,107	38	$11					77,268	$13,313
Set lines: Ohio River	120	7							27,555	4,867
Crowfoot bars:										
Muskingum River					56,000	$1,440	$55	$115	56,000	1,610
Ohio River					261,500	3,465	35	214	261,500	3,714
Tuscarawas River					28,000	730	30	38	28,000	798
Killbuck Creek					80,000	1,800	100	180	80,000	2,080
Mohican Creek					20,000	400	150	200	20,000	750
Total					445,500	7,835	370	747	445,500	8,952
Forks, etc.:										
Muskingum River					16,000	420	10	28	16,000	458
Tuscarawas River					8,000	205			8,000	205
Killbuck Creek					30,000	675			30,000	675
Mohican Creek					60,000	1,200			60,000	1,200
Wills Creek					38,000	430		20	38,000	450
Total					152,000	2,930	10	48	152,000	2,988
Total, by waters:										
Muskingum River					72,000	1,860	65	143	72,000	2,068
Ohio River	26,345	4,114	38	11	261,500	3,465	35	214	366,323	21,894
Tuscarawas River					36,000	935	30	38	36,000	1,003
Killbuck Creek					110,000	2,475	100	180	110,000	2,755
Mohican Creek					80,000	1,600	150	200	80,000	1,950
Wills Creek					38,000	430		20	38,000	450
Total	26,345	4,114	38	11	597,500	10,765	380	795	702,323	30,120

OKLAHOMA

The fisheries of Oklahoma were confined mainly to the Arkansas, Poteau, and Grand, or Neosho, Rivers, though some mussel shells were taken from the Verdigris River, and a few catfish and drum or sheepshead from the Illinois River.

The total number of persons engaged on all of the rivers in 1922 was 109, the investment was $12,261, and the output 363,170 pounds, valued at $31,215 to the fishermen. Fyke nets, set lines, and forks were the only forms of apparatus used. The catch consisted of 110,725 pounds of drum or sheepshead, valued at $10,076; 86,550 pounds of buffalofish, valued at $7,723; 55,425 pounds of catfish, valued at $7,172; 61,050 pounds of carp, valued at $5,646; small quantities of a few other species; and 44,870 pounds of mussel shells, valued at $383, including slugs.

The following tables show in detail the statistics of the fisheries of this State:

Persons engaged and investment in the fisheries of Oklahoma, 1922

Waters	Persons engaged			Gasoline boats		Rowboats		House boats	
	Fishermen	Shoresmen	Total						
	Number	*Number*	*Number*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Arkansas River	53		53	7	$700	51	$610	5	$900
Grand River	27		27	1	100	27	270	6	1,500
Illinois River	6		6			6	60		
Poteau River	21	1	22	2	250	21	220	4	1,000
Verdigris River	1		1			1	10		
Total	108	1	109	10	1,050	106	1,170	15	3,400

Persons engaged and investment in the fisheries of Oklahoma, 1922—Continued

Waters	Fyke nets		Set lines		Forks		Shore property	Total investment
	Number	*Value*	*Number*	*Value*	*Number*	*Value*	*Value*	*Value*
Arkansas River	238	$2,380	163	$172			$1,150	$5,912
Grand River	100	700	75	75			300	2,945
Illinois River			12	6			10	76
Poteau River	127	1,270	34	25			525	3,290
Verdigris River					1	$3	25	38
Total	465	4,350	284	278	1	3	2,010	12,261

Yield, by apparatus and waters, of the fisheries of Oklahoma, 1922

Apparatus and waters	Buffalofish		Carp		Catfish		Drum, fresh-water, or sheepshead	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Arkansas River	55,300	$4,800	56,500	$5,258	15,025	$2,123	20,500	$1,826
Grand River	5,100	408	2,600	208	4,200	504	625	50
Poteau River	25,000	2,400	1,450	140	1,200	180	9,100	898
Total	85,400	7,608	60,550	5,606	20,425	2,807	30,225	2,774
Set lines:								
Arkansas River					6,400	880	46,200	4,372
Grand River			500	40	26,000	3,120	20,000	1,600
Illinois River					500	50	2,500	150
Poteau River	1,150	115			2,100	315	11,800	1,180
Total	1,150	115	500	40	35,000	4,365	80,500	7,302
Total by waters:								
Arkansas River	55,300	4,800	56,500	5,258	21,425	3,003	66,700	6,198
Grand River (Neosho River)	5,100	408	3,100	248	30,200	3,624	20,625	1,650
Illinois River					500	50	2,500	150
Poteau River	26,150	2,515	1,450	140	3,300	495	20,900	2,078
Total	86,550	7,723	61,050	5,646	55,425	7,172	110,725	10,076

Apparatus and waters	Paddlefish or spoonbill cat		Quillback, or American carp		Mussel shells		Slugs	Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Value*	*Pounds*	*Value*
Fyke nets:									
Arkansas River	550	$55						147,875	$14,062
Grand River			4,000	$160				16,525	1,330
Poteau River								36,750	3,618
Total	550	55	4,000	160				201,150	10,010
Set lines:									
Arkansas River								52,600	5,252
Grand River								45,500	4,760
Illinois River								3,000	200
Poteau River								15,050	1,610
Total								117,150	11,822
Forks: Verdigris River					44,870	$359	$24	44,870	383
Total by waters:									
Arkansas River	550	55						200,475	19,314
Grand River (Neosho River)			4,000	160				63,025	6,090
Illinois River								3,000	200
Poteau River								51,800	5,228
Verdigris River					44,870	359	24	44,870	383
Total	550	55	4,000	160	44,870	359	24	363,170	31,215

PENNSYLVANIA

No fishing was prosecuted in tributaries of the Mississippi River in Pennsylvania during 1922, except that a few tons of mussel shells, together with a few dollars worth of pearls and slugs, were taken from the Shenango River. All of the persons shown as shoremen were connected with the wholesale fish trade of Pittsburgh. Comparatively few of the fish handled at the latter city were from the Mississippi River and its tributaries, but were mainly Great Lakes and salt-water species. The investment of $126,380 was practically all in the wholesale trade just mentioned.

The following tables show in detail the statistics of the fisheries of this State:

Persons engaged and investment in the fisheries of Pennsylvania, 1922

Items	Number	Value	Items	Number	Value
Persons engaged:			Investment:		
Fishermen	2		Rowboats	2	$25
Shoremen (wholesale trade)	38		Crowfoot bars (pairs)	2	40
			Shore property		109,315
Total	40		Cash capital (wholesale trade)		17,000
			Total		126,380

Yield, by apparatus, of the fisheries of Pennsylvania, 1922

Species	Crowfoot bars		By hand		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Mussel shells	25,000	$813	24,000	$780	49,000	$1,593
Pearls		5				5
Slugs		80		80		160
Total	25,000	898	24,000	860	49,000	1,758

SOUTH DAKOTA

The fisheries of South Dakota were confined to the James and Missouri Rivers. On the former river the output consisted of 80,000 pounds of mussle shells, valued at $1,136, including the value of a few pearls and slugs. On the Missouri River the catch consisted of 9,900 pounds of catfish, valued at $2,120; 5,875 pounds of carp, valued at $587; and 5,675 pounds of buffalofish, valued at $568. The apparatus used were fyke nets, trammel nets, and set lines for the fish, and forks and rakes for taking the mussels.

The following tables show in detail the statistics of the fisheries of this State:

Persons engaged and investment in the fisheries of South Dakota, 1922

Items	James River		Missouri River		Total	
	Number	*Value*	*Number*	*Value*	*Number*	*Value*
Persons engaged: Fishermen	6		11		17	
Investment:						
Gasoline boats	1	$50	1	$150	2	$200
Rowboats	6	50	7	215	13	265
House boats			1	600	1	600
Fyke nets			55	434	55	434
Trammel nets			[1] 3	95	3	95
Forks	6	8			6	8
Rakes	6	8			6	8
Set lines			22	46	22	46
Shore property		35		510		545
Total		151		2,050		2,201

[1] 150 yards.

Yield, by apparatus and waters, of the fisheries of South Dakota, 1922

Items	James River		Missouri River		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:						
Buffalofish			2,875	$288	2,875	$288
Carp			3,175	317	3,175	317
Catfish			7,400	1,580	7,400	1,580
Total			13,450	2,185	13,450	2,185
Trammel nets:						
Buffalofish			2,800	280	2,800	280
Carp			2,700	270	2,700	270
Total			5,500	550	5,500	550
Forks and rakes:						
Mussel shells	80,000	$1,080			80,000	1,080
Pearls		50				50
Slugs		6				6
Total	80,000	1,136			80,000	1,136
Set lines: Catfish			2,500	540	2,500	540
Total, by species:						
Buffalofish			5,675	568	5,675	568
Carp			5,875	587	5,875	587
Catfish			9,900	2,120	9,900	2,120
Mussel shells	80,000	1,080			80,000	1,080
Pearls		50				50
Slugs		6				6
Total	80,000	1,136	21,450	3,275	101,450	4,411

TENNESSEE

The total number of persons engaged in the fisheries of Tennessee in 1922 was 562, of which number 468 were fishermen and 94 shoresmen, most of the latter being connected with the wholesale trade. The total investment amounted to $268,712, made up of 113 gasoline boats, valued at $17,525; 437 rowboats, valued at $6,480; 48 houseboats, valued at $12,775; 3,182 fyke nets, valued at $30,075; 10 haul seines, valued at $3,556; 22 trammel nets, valued at $2,495; 117 pairs of crowfoot bars, valued at $1,325; and several other less important forms of apparatus, together with $174,407 worth of shore property and $18,600 cash capital. Based on the catch, the fyke net is the leading form of apparatus used, followed in importance by the crowfoot bars for mussels.

The total output of 5,493,793 pounds, valued at $187,561, included 3,766,000 pounds of mussel shells, valued (including pearls and slugs) at $48,500. The more important fish products were buffalofish, catfish, drum or sheepshead, crappie, paddlefish or spoonbill cat, and carp.

Owing to its important mussel fishery, the Tennessee River, with its total production of 3,143,500 pounds, valued at $59,195, ranked first among the waters of the State, followed in importance by Reelfoot Lake, with a production of 698,472 pounds of fish, valued to the fishermen at $55,646. The Mississippi River ranked third, with a catch of 533,121 pounds, valued at $34,791. The combined output of several lakes tributary to the Mississippi River amounted to 101,850 pounds, valued at $13,302. Mussels were taken in the Cumberland, Holston, and Clinch Rivers, as well as in the Tennessee River.

The following tables show in detail the statistics of the fisheries of this State:

Persons engaged and investment in the fisheries of Tennessee, 1922

Waters	Persons engaged			Gasoline boats		Rowboats		House boats	
	Fishermen	Shoresmen	Total						
	No.	*No.*	*No.*	*No.*	*Value*	*No.*	*Value*	*No.*	*Value*
Clinch River	20		20			20	$120		
Cumberland River	70		70	9	$1,100	70	684		
Hatchee River	8		8	4	650	4	60		
Holston River	25		25			25	150		
Obion River	27	7	34	10	2,000	15	255	8	$2,500
Mississippi River	105	42	147	43	8,950	52	995	23	8,550
Tennessee River	76	21	97	40	4,000	90	1,261	17	1,725
Reelfoot Lake	125	21	146	6	625	156	2,865		
Miscellaneous lakes	12	3	15	1	200	5	90		
Total	468	94	562	113	17,525	437	6,480	48	12,775

Waters	Fyke nets		Crowfoot bars, pairs		Set lines		Haul seines			Hand lines
	No.	*Value*	*No.*	*Value*	*No.*	*Value*	*No.*	*Yards*	*Value*	*Value*
Cumberland River	86	$880	42	$575	47	$71				
Hatchee River	50	1,250			6	9				
Obion River	155	2,175			36	85	1	1,200	$1,000	
Mississippi River	446	7,900			110	224	7	2,400	2,056	
Tennessee River	216	2,160	75	750	94	84				
Reelfoot Lake	2,223	15,050			53	698				$140
Miscellaneous lakes	6	60					2	600	500	
Total	3,182	30,075	117	1,325	346	1,171	10	4,200	3,556	140

Waters	Trammel nets			Gigs		Tongs		Shore property	Cash capital	Total investment
	No.	*Yards*	*Value*	*No.*	*Value*	*No.*	*Value*			
Clinch River								$30		$150
Cumberland River						13	$140	255		3,705
Hatchee River								50		2,019
Holston River								25		175
Obion River								3,900	$1,000	12,915
Mississippi River	1	100	$60					123,072	13,000	164,807
Tennessee River								27,805		37,785
Reelfoot Lake	20	2,964	2,360	30	$23			17,970	4,600	44,931
Miscellaneous lakes	1	150	75					1,300		2,225
Total	22	3,214	2,495	30	23	13	140	174,407	18,600	268,712

Yield, by apparatus and waters, of the fisheries of Tennessee, 1922

Apparatus and waters	Black bass		Bowfin		Buffalofish		Carp	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Cumberland River					6,800	$540	3,250	$293
Hatchee River					13,000	650	36,000	1,800
Obion River					21,000	1,280	10,000	490
Mississippi River					186,222	10,865	64,000	2,610
Tennessee River					2,200	220	9,600	960
Reelfoot Lake			3,000	$60	150,000	12,000	41,000	1,640
Miscellaneous lakes					2,000	160	500	35
Total			3,000	60	381,222	25,715	164,350	7,828
Set lines:								
Cumberland River					1,550	137	1,500	141
Obion River					1,000	60		
Mississippi River					2,600	156		
Tennessee River					550	55	1,500	150
Reelfoot Lake					3,353	284		
Total					9,253	692	3,000	291
Haul seines:								
Mississippi River					56,100	3,300	7,500	320
Obion River					25,000	1,500	5,000	250
Miscellaneous lakes			500	30	20,800	1,630	2,150	150
Total			500	30	101,900	6,430	14,650	720
Trammel nets:								
Mississippi River					3,500	175	2,000	100
Reelfoot Lake			1,873	37	52,813	4,225	14,111	564
Miscellaneous lakes					12,450	995	2,150	150
Total			1,873	37	68,763	5,395	18,261	814
Hand lines: Reelfoot Lake	33,962	$6,105						
Total by waters:								
Cumberland River					8,350	677	4,750	434
Hatchee River					13,000	650	36,000	1,800
Obion River					47,000	2,840	15,000	740
Mississippi River					248,422	14,496	73,500	3,030
Tennessee River					2,750	275	11,100	1,110
Reelfoot Lake	33,962	6,105	4,873	97	206,366	16,509	55,111	2,204
Miscellaneous lakes			500	30	35,250	2,785	4,800	335
Grand total	33,962	6,105	5,373	127	561,138	38,232	200,261	9,653

Yield, by apparatus and waters, of the fisheries of Tennessee, 1922—Continued

Apparatus and waters	Catfish		Crappie		Drum, fresh-water, or sheepshead	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:						
Cumberland River	3,300	$459			6,150	$580
Hatchee River	1,700	119			1,500	75
Obion River	2,000	200	50	$5	6,800	392
Mississippi River	25,500	2,525	750	75	46,722	2,557
Tennessee River	49,700	6,220			50,700	5,070
Reelfoot Lake	3,000	240	16,231	2,435	60,000	1,200
Miscellaneous lakes	200	20			300	6
Total	85,400	9,783	17,031	2,515	172,172	9,880
Set lines:						
Cumberland River	11,800	1,625			1,500	141
Hatchee River	4,000	280				
Obion River	16,000	1,600			5,200	308
Mississippi River	57,200	5,595			36,100	1,951
Tennessee River	22,800	3,020			4,000	400
Reelfoot Lake	86,000	6,880	1,000	150	1,500	30
Total	197,800	19,000	1,000	150	48,300	2,830
Haul seines:						
Mississippi River	3,250	323	300	31	11,500	628
Obion River	1,500	150	200	20	10,000	600
Miscellaneous lakes	5,200	484	400	60	10,000	200
Total	9,950	957	900	111	31,500	1,428
Trammel nets:						
Mississippi River	300	20			300	15
Reelfoot Lake	7,360	589	6,000	900	9,794	196
Miscellaneous lakes	1,100	107	300	45	3,000	60
Total	8,760	716	6,300	945	13,094	271
Hand lines: Reelfoot Lake	1,000	80	60,787	9,118		
Total by waters:						
Cumberland River	15,100	2,084			7,650	721
Hatchee River	5,700	399			1,500	75
Obion River	19,500	1,950	250	25	22,000	1,300
Mississippi River	86,250	8,463	1,050	106	94,622	5,151
Tennessee River	72,500	9,240			54,700	5,470
Reelfoot Lake	97,360	7,789	84,018	12,603	71,294	1,426
Miscellaneous lakes	6,500	611	700	105	13,300	266
Grand total	302,910	30,536	86,018	12,839	265,066	14,409

Apparatus and waters	Eels		Minnows		Paddlefish or spoonbill cat		Paddlefish caviar	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Cumberland River					1,050	$95		
Obion River					100	20		
Mississippi River					1,750	222		
Total					2,900	337		
Set lines: Reelfoot Lake	200	$12			1,888	142		
Haul seines:								
Mississippi River			500	$500	8,227	1,800		
Obion River					400	80		
Miscellaneous lakes					40,600	8,570	200	$600
Total			500	500	49,227	10,450	200	600
Hand lines: Reelfoot Lake	378	23						
Total by waters:								
Cumberland River					1,050	95		
Obion River					500	100		
Mississippi River			500	500	9,977	2,022		
Reelfoot Lake	578	35			1,888	142		
Miscellaneous lakes					40,600	8,570	200	600
Grand total	578	35	500	500	54,015	10,929	200	600

Yield, by apparatus and waters, of the fisheries of Tennessee, 1922—Continued

Apparatus and waters	Quillback or American carp		Rock bass		Sturgeon, shovelnose		Suckers	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Cumberland River					1,400	$120	6,650	$645
Obion River	2,000	$120						
Mississippi River	14,300	508						
Tennessee River	1,200	120					41,250	4,125
Reelfoot Lake			463	$69				
Total	17,500	748	463	69	1,400	120	47,900	4,770
Haul seines:								
Mississippi River	3,000	75						
Obion River	3,000	180						
Total	6,000	255						
Hand lines: Reelfoot Lake			400	60				
Total by waters:								
Cumberland River					1,400	120	6,650	645
Obion River	5,000	300						
Mississippi River	17,300	583						
Tennessee River	1,200	120					41,250	4,125
Reelfoot Lake			863	129				
Grand total	23,500	1,003	863	129	1,400	120	47,900	4,770

Apparatus and waters	Sunfish		White bass		Shrimp		Frogs	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Obion River			200	$12				
Mississippi River			1,200	140				
Reelfoot Lake	85,008	$4,250	668	33				
Total	85,008	4,250	2,068	185				
Set lines: Reelfoot Lake	183	9						
Haul seines:								
Mississippi River					300	$300		
Obion River			250	15				
Total			250	15	300	300		
Trammel nets: Reelfoot Lake	4,000	200	300	15				
Gigs: Reelfoot Lake							6,000	$1,800
Hand lines: Reelfoot Lake	45,000	2,250	1,000	50				
Total by waters:								
Obion River			450	27				
Mississippi River			1,200	140	300	300		
Reelfoot Lake	134,191	6,709	1,968	98			6,000	1,800
Grand total	134,191	6,709	3,618	265	300	300	6,000	1,800

Yield, by apparatus and waters, of the fisheries of Tennessee, 1922—Continued

Apparatus and waters	Mussel shells		Pearls	Slugs	Total	
	Pounds	*Value*	*Value*	*Value*	*Pounds*	*Value*
Fyke nets:						
Cumberland River					28,600	$2,732
Hatchee River					52,200	2,644
Obion River					42,150	2,519
Mississippi River					340,444	19,502
Tennessee River					154,650	16,715
Reelfoot Lake					359,370	21,927
Miscellaneous lakes					3,000	221
Total					980,414	66,260
Crowfoot bars:						
Cumberland River	374,000	$3,825	$50	$249	374,000	4,124
Tennessee River	2,960,000	38,465		390	2,960,000	38,855
Total	3,334,000	42,290	50	639	3,334,000	42,979
Set lines:						
Cumberland River					16,350	2,044
Hatchee River					4,000	280
Obion River					22,200	1,968
Mississippi River					95,900	7,702
Tennessee River					28,850	3,625
Reelfoot Lake					94,324	7,507
Total					261,624	23,126
Haul seines:						
Mississippi River					90,677	7,277
Obion River					45,350	2,795
Miscellaneous lakes					79,850	11,724
Total					215,877	21,796
Trammel nets:						
Mississippi River					6,100	310
Reelfoot Lake					96,251	6,726
Miscellaneous lakes					19,000	1,357
Total					121,351	8,393
Gigs: Reelfoot Lake					6,000	1,800
Tongs, etc.:						
Clinch River	160,000	1,600	200	400	160,000	2,200
Cumberland River	72,000	565		6	72,000	571
Holston River	200,000	2,000	250	500	200,000	2,750
Total	432,000	4,165	450	906	432,000	5,521
Hand lines: Reelfoot Lake					142,527	17,686
Total by waters:						
Clinch River	160,000	1,600	200	400	160,000	2,200
Cumberland River	446,000	4,390	50	255	490,950	9,471
Hatchee River					56,200	2,924
Holston River	200,000	2,000	250	500	200,000	2,750
Obion River					109,700	7,282
Mississippi River					533,121	34,791
Tennessee River	2,960,000	38,465		390	3,143,500	59,195
Reelfoot Lake					698,472	55,646
Miscellaneous lakes					101,850	13,302
Grand total	3,766,000	46,455	500	1,545	5,493,793	187,561

TEXAS

The only waters in Texas tributary to the Mississippi River in which fisheries were prosecuted in 1922 were the Sulphur River and Caddo Lake, in which 50 fishermen and 7 shoresmen were engaged. The total investment amounted to $11,662, with a total production of 183,949 pounds, valued at $18,547. Based on the catch, the fyke net was the most important form of apparatus used, followed by hand lines, trammel nets, pound nets, gill nets, and set lines. The most important species taken were crappie, buffalofish, paddlefish or spoonbill cat, catfish, and black bass.

The following tables show in detail the statistics of the fisheries of this State:

Persons engaged and investment in the fisheries of Texas, 1922

Items	Sulphur River			Caddo Lake			Total		
	Number	*Yards*	*Value*	*Number*	*Yards*	*Value*	*Number*	*Yards*	*Value*
Persons engaged:									
Fishermen	12			38			50		
Shoresmen				7			7		
Total	12			45			57		
Investment:									
Gasoline boats				10		$2,250	10		$2,250
Rowboats	7		$95	38		760	45		855
Fyke nets	15		150	260		2,600	275		2,750
Gill nets	1	100	40	15	1,275	700	16	1,375	740
Trammel nets	2	200	80	12	1,020	480	14	1,220	560
Pound nets	5		125				5		125
Hand lines						28			28
Set lines	2		4				2		4
Shore property			100			3,250			3,350
Cash capital						1,000			1,000
Total			594			11,068			11,662

Yield, by apparatus and waters, of the fisheries of Texas, 1922

Apparatus and Waters	Black bass		Buffalofish		Carp		Catfish		Crappie	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:										
Sulphur River			6,000	$360	1,000	$60	300	$24		
Caddo Lake			5,715	667			2,000	220	31,882	$3,784
Total			11,715	1,027	1,000	60	2,300	244	31,882	3,784
Gill nets:										
Sulphur River			3,000	180	500	30				
Caddo Lake			5,715	667						
Total			8,715	847	500	30				
Trammel nets:										
Sulphur River			4,000	240	600	36				
Caddo Lake			5,715	667					2,000	235
Total			9,715	907	600	36			2,000	235
Pound nets: Sulphur River			25,000	1,500	6,000	360	1,000	80		
Set lines: Sulphur River							2,000	240		
Hand lines: Caddo Lake	11,028	$1,309	2,000	140			11,061	1,216	21,254	2,523
Total by waters:										
Sulphur River			38,000	2,280	8,100	486	3,300	344		
Caddo Lake	11,028	1,309	19,145	2,141			13,061	1,436	55,136	6,542
Total	11,028	1,309	57,145	4,421	8,100	486	16,361	1,780	55,136	6,542

Yield, by apparatus and waters, of the fisheries of Texas, 1922—Continued

Apparatus and waters	Drum, fresh-water, or sheepshead		Paddlefish or spoonbill cat		Paddlefish caviar		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Sulphur River	1,500	$90					8,800	$534
Caddo Lake	1,669	166	8,436	$742	170	$375	49,872	5,954
Total	3,169	256	8,436	742	170	375	58,672	6,488
Gill nets:								
Sulphur River	600	36					4,100	246
Caddo Lake			8,436	742	165	375	14,316	1,784
Total	600	36	8,436	742	165	375	18,416	2,030
Trammel nets:								
Sulphur River	600	36					5,200	312
Caddo Lake			8,438	742	165	375	16,318	2,019
Total	600	36	8,438	742	165	375	21,518	2,331
Pound nets: Sulphur River	4,000	240	1,000	30			37,000	2,210
Set lines: Sulphur River	1,000	60					3,000	300
Hand lines: Caddo Lake							45,343	5,188
Total by waters:								
Sulphur River	7,700	462	1,000	30			58,100	3,602
Caddo Lake	1,669	166	25,310	2,226	500	1,125	125,849	14,945
Total	9,369	628	26,310	2,256	500	1,125	183,949	18,547

WEST VIRGINIA

In 1922 there were 129 persons engaged in the fishing and related industries of West Virginia. The total investment in boats, apparatus, and shore property amounted to $11,673. The fishery was confined to the Kanawa and Ohio rivers, the total output being 37,200 pounds, valued at $5,976, from the Kanawa River and 58,045 pounds, valued at $1,989, from the Ohio River. Of the latter 50,500 pounds were mussel shells, valued (including slugs) at $699.

The following tables show in detail the statistics of the fisheries of this State:

Persons engaged and investment in the fisheries of West Virginia, 1922

Items	Kanawa River		Ohio River		Total	
	Number	*Value*	*Number*	*Value*	*Number*	*Value*
Persons engaged:						
Fishermen	38		14		52	
Shoresmen			77		77	
Total	38		91		129	
Investment:						
Gasoline boats	2	$200	6	$650	8	$850
Rowboats	38	475	13	225	51	700
House boats			6	625	6	625
Set lines	46	132	9	13	55	145
Crowfoot bars, (pairs)			8	160	8	160
Shore property		128		9,065		9,193
Total		935		10,738		11,673

Yield, by apparatus and waters, of the fisheries of West Virginia, 1922

Apparatus and species	Kanawa River		Ohio River		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Set lines:						
Buffalofish	2,380	$450	990	$200	3,370	$650
Carp	2,250	426	540	100	2,790	526
Catfish	28,150	4,225	4,340	655	32,490	4,880
Drum, fresh-water, or sheepshead	4,420	875	1,610	325	6,030	1,200
Sturgeon, shovelnose			65	10	65	10
Total	37,200	5,976	7,545	1,290	44,745	7,266
Crowfoot bars:						
Mussel shells			50,500	631	50,500	631
Slugs				68		68
Total			50,500	699	50,500	699
Total, by species:						
Buffalofish	2,380	450	990	200	3,370	650
Carp	2,250	426	540	100	2,790	526
Catfish	28,150	4,225	4,340	655	32,490	4,880
Drum, fresh-water, or sheepshead	4,420	875	1,610	325	6,030	1,200
Sturgeon, shovelnose			65	10	65	10
Mussel shells			50,500	631	50,500	631
Slugs				68		68
Total	37,200	5,976	58,045	1,989	95,245	7,965

WISCONSIN

The fisheries of Wisconsin, prosecuted on the Mississippi River and tributaries in 1922, gave employment to 587 fishermen and 302 shoresmen, most of the latter being connected with the pearl-button industry. The total investment amounted to $442,950, most of which was also represented in the pearl-button industry. Other important items were 343 gasoline boats, valued at $76,255; 87 haul seines, valued at $28,875; 1,100 fyke nets, valued at $23,700; and 518 gill nets, valued at $6,930.

The products of the State amounted to 8,089,494 pounds, valued at $285,624. Of this total mussel shells contributed 3,105,140 pounds, valued at $68,064, including pearls and slugs. The carp fishery in Wisconsin has increased in importance within recent years, and in 1922 the value of the catch was nearly one-half that of all the products of the State taken from the Mississippi River and tributaries. Other important species worthy of mention were buffalofish, catfish, and drum or sheepshead. Based on the catch, the most important form of apparatus was the haul seine, followed by the crowfoot bar for taking mussels, the fyke net, gill net, set line, and spear. Large quantities of mussels were taken by hand while wading. Mussels were taken from several of the rivers, including the Mississippi and St. Croix, but the latter two were the only ones from which fish were taken commercially.

The following tables show in detail the statistics of the fisheries of this State:

Persons engaged and investment in the fisheries of Wisconsin, 1922

Waters	Persons engaged			Gasoline boats		Rowboats		House boats	
	Fishermen	Shoresmen	Total						
	Number	*Number*	*Number*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Baraboo River	7		7	2	$300	5	$75		
Fox River	50	5	55	26	2,445	19	365		
Mississippi River	490	277	767	306	71,310	231	5,175	2	$735
Rock River	7		7	4	600	2	40		
St. Croix River	26		26	3	1,100	9	365		
Wisconsin River	7	20	27	2	500	6	115		
Total	587	302	889	343	76,255	272	6,135	2	735

Waters	Haul seines			Crowfoot bars, pairs		Fyke nets		Gill nets		
	Number	*Yards*	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Yards*	*Value*
Baraboo River				4	$40					
Fox River				48	805					
Mississippi River	84	27,025	$25,675	187	2,040	1,100	$23,700	434	12,700	$5,670
Rock River				7	70					
St. Croix River	3	1,935	3,200	1	15			84	4,025	1,260
Wisconsin River				2	20					
Total	87	28,960	28,875	249	2,990	1,100	23,700	518	16,725	6,930

Waters	Set lines		Spears		Shore property	Cash capital	Total investment
	Number	*Value*	*Number*	*Value*	*Value*	*Value*	*Value*
Baraboo River					$75		$490
Fox River					3,270		6,885
Mississippi River	159	$280	7	$17	272,709	$10,100	417,420
Rock River					15		725
St. Croix River					4,000		9,940
Wisconsin River					6,855		7,490
Total	159	280	7	17	286,924	10,100	442,950

Yield, by apparatus and waters, of the fisheries of Wisconsin, 1922

Apparatus and waters	Bowfin		Buffalofish		Carp		Catfish and bullheads	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Haul seines:								
Mississippi River	16,250	$231	299,953	$18,804	2,254,278	$80,019	155,572	$16,066
St. Croix River			19,000	1,225	164,500	7,006	200	30
Total	16,250	231	318,953	20,029	2,418,778	87,025	155,772	16,096
Fyke nets: Mississippi River	736	11	168,059	10,800	430,414	17,357	40,900	4,275
Gill nets:								
Mississippi River	750	10	96,191	5,228	469,855	17,067	20,050	1,271
St. Croix River			2,700	166	36,400	1,662		
Total	750	10	98,891	5,394	506,255	18,729	20,050	1,271
Set lines: Mississippi River			2,079	93	5,650	159	63,015	7,068
Spears: Mississippi River			1,399	46	25,092	802	347	22
Total by waters:								
Mississippi River	17,736	252	567,681	34,971	3,185,298	115,404	279,884	28,702
St. Croix River			21,700	1,391	200,900	8,668	200	30
Grand total	17,736	252	589,381	36,362	3,386,198	124,072	280,084	28,732

Yield, by apparatus and waters, of the fisheries of Wisconsin, 1922—Continued

Apparatus and waters	Drum, fresh-water, or sheepshead		Eels		Paddlefish or spoonbill cat		Quillback, or American carp		Suckers	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Haul seines:										
Mississippi River	197,086	$8,815	263	$6	27,085	$1,517	87,417	$3,470	24,431	$1,241
St. Croix River							3,000	150	700	40
Total	197,086	8,815	263	6	27,085	1,517	90,417	3,620	25,131	1,281
Fyke nets: Mississippi River	138,118	5,765	50	1	2,100	163	24,000	615	8,050	169
Gill nets: Mississippi River	141,643	4,376			250	7	26,000	585	13,035	313
Set lines: Mississippi River	16,584	920					120	4		
Spears: Mississippi River	495	18			36	2			50	3
Total by waters:										
Mississippi River	493,926	19,894	313	7	29,471	1,689	137,537	4,624	45,566	1,726
St. Croix River							3,000	150	700	40
Grand total	493,926	19,894	313	7	29,471	1,689	140,537	4,774	46,266	1,766

Apparatus and waters	Turtles		Mussel Shells		Pearls	Slugs	Total	
	Pounds	*Value*	*Pounds*	*Value*	*Value*	*Value*	*Pounds*	*Value*
Haul seines:								
Mississippi River	367	$10					3,062,702	$130,179
St. Croix River							187,400	8,451
Total	367	10					3,250,102	138,630
Crowfoot bars:								
Baraboo River			44,000	$660	$20	$75	44,000	755
Fox River			481,140	10,545	195	890	481,140	11,630
Mississippi River			2,000,000	34,840	3,900	5,405	2,000,000	44,145
Rock River			102,000	2,550		100	102,000	2,650
St. Croix River			6,000	75		7	6,000	82
Wisconsin River			16,000	240	25	50	16,000	315
Total			2,649,140	48,910	4,140	6,527	2,649,140	59,577
Fyke nets: Mississippi River							812,427	39,156
Gill nets:								
Mississippi River	75	2					767,849	28,809
St. Croix River							39,100	1,828
Total	75	2					806,949	30,637
Set lines: Mississippi River							87,457	8,244
Spears: Mississippi River							27,419	893
By hand:								
Baraboo River			60,000	900	30	75	60,000	1,005
Fox River			28,000	800	85	20	28,000	905
Mississippi River			336,000	5,685	250	125	336,000	6,060
St. Croix River			8,000	120		12	8,000	132
Wisconsin River			24,000	360		25	24,000	385
Total			456,000	7,865	365	257	456,000	8,487
Total by waters:								
Baraboo River			104,000	1,560	50	150	104,000	1,760
Fox River			509,140	11,345	280	910	509,140	12,535
Mississippi River	442	12	2,336,000	40,525	4,150	5,530	7,093,854	257,486
Rock River			102,000	2,550		100	102,000	2,650
St. Croix River			14,000	195		19	240,500	10,493
Wisconsin River			40,000	600	25	75	40,000	700
Grand total	442	12	3,105,140	56,775	4,505	6,784	8,089,494	285,624

FISHERIES OF THE GREAT LAKES, LAKE OF THE WOODS, AND RAINY LAKE, 1922

The statistics of the fisheries of the Great Lakes, Lake of the Woods, and Rainy Lake, presented herewith, are the result of a statistical canvass covering the calender year 1922. The canvass was so planned and conducted as to make its results comparable with the statistics for the year 1917, with the exception that the mussel fisheries of certain rivers tributary to Lake Michigan and Lake Erie were included, although they had not heretofore been covered by statistical canvasses of the Great Lakes. The statistics obtained have already been published in condensed form in Statistical Bulletin No. 618. The detailed statistics are published for the first time in the present report.

EARLIER PUBLICATIONS

Earlier publications relating to the fisheries of the Great Lakes, published in Washington, D. C., follow:

1887. The fisheries of the Great Lakes. By Frederick W. True. Elaborated from notes gathered by Mr. Ludwig Kumlien. *In* The Fisheries and Fishery Industries of the United States, by George Brown Goode and associates, 1880 (1887), Section II, Part XVII, pp. 631–673.

1887. The fisheries of the Great Lakes. By Ludwig Kumlien. *In* The Fisheries and Fishery Industries of the United States, by George Brown Goode and associates, 1880 (1887), Section V, Vol. I, Part XIV, pp. 757–769.

1891. Review of the fisheries of the Great Lakes in 1885, compiled by Hugh M. Smith and Merwin-Marie Snell, with introduction and description of fishing vessels and boats by J. W. Collins. Appendix, Report of the Commissioner, United States Commission of Fish and Fisheries, 1887 (1891), pp. 1–133.

1892. Report on an investigation of the fisheries of Lake Ontario. By Hugh M. Smith. Bulletin, United States Fish Commission, Vol. X. 1890 (1892), pp. 177–215.

1894. The fisheries of the Great Lakes. By Hugh M. Smith. Report of the Commissioner, United States Commission of Fish and Fisheries, 1892 (1894), pp. 363–462.

1896. Report of the Division of Statistics and Methods of the Fisheries. By Hugh M. Smith. Report of the Commissioner, United States Commission of Fish and Fisheries, 1895 (1896), pp. 93–103.

1898. Report of the Joint Commission relative to the preservation of the fisheries in waters contiguous to Canada and the United States. By Richard Rathbun and William Wakeham. House Executive Document No. 315, Fifty-fourth Congress, second session, 1897, pp. 1–178.

1899. Fisheries of Lake Ontario. Report of the Commissioner, United States Commission of Fish and Fisheries, 1898 (1899), pp. clii–clvi.

1899. Statistics of certain fisheries of the New England and Middle Atlantic States and the Great Lakes. Report of the Commissioner, United States Commission of Fish and Fisheries, 1898 (1899), pp. clxvi–clxxv. [In this report the figures presented relate to the fiscal year 1897.]

1902. Statistics of the fisheries of the Great Lakes. By C. H. Townsend. Report of the Commissioner, United States Commission of Fish and Fisheries, 1901 (1902), pp. 575–657.

1905. Statistics of the fisheries of the Great Lakes in 1903. By A. B. Alexander. Report of the Bureau of Fisheries, 1904 (1905), pp. 643–731.

1911. Fisheries of the United States, 1908. Special Report, Bureau of the Census, 1911.

1917. Fresh-water mussel fishery. *In* Report, United States Commission of Fisheries, 1915 (1917), Document No. 827, pp. 63–69.

1920. Fisheries of the Great Lakes, Lake of the Woods, and Rainy Lake in 1917. *In* Fishery Industries of the United States. Report of the Division of Statistics and Methods of the Fisheries for 1919, by Lewis Radcliffe. Appendix X, Report, United States Commissioner of Fisheries, 1919 (1921), pp. 52–128. Bureau of Fisheries Document No. 892.

COMMON AND SCIENTIFIC NAMES OF THE FISHES OF THE GREAT LAKES

For the sake of clarity as to the species referred to in the tables and discussions of the fisheries of the Great Lakes, the following list of common and scientific names of fishes is appended:

Black bass	*Micropterus salmoides.*
Bowfin	*Amiatus calvus.*
Buffalofish	*Ictiobus cyprinella.*
Burbot	*Lota maculosa.*
Carp, German	*Cyprinus carpio.*
Catfish and bullheads	Ameiurus (species). *Ictalurus punctatus.*
Ciscoes [6]	Leucichthys (species).
Eel	*Anguilla chrysypa.*
Goldeye	*Hiodon alosoides.*
Mooneye	*Hiodon tergisus.*
Muskellunge	*Esox masquinongy.*
Pike	*Esox lucius.* *Esox vermiculatus.*
Pike perch (blue perch)	*Stizostedion vitreum.*
Pike perch (sauger)	*Stizostedion vitreum.*
Pike perch (wall-eyed)	*Stizostedion canadense griseum.*
Rock bass	*Ambloplites rupestris.*
Sheepshead or drum	*Aplodinotus grunniens.*
Sturgeon	*Acipenser rubicundus.*
Suckers	Catostomidæ (species).
Sunfishes	Centrarchidæ (species).
Trout, lake	*Cristivomer namaycush.*
Trout, steelhead	*Salmo gairdneri.*
White bass	*Roccus chrysops.*
Whitefish, common	*Coregonus clupeiformis.* *Coregonus albus.*
Whitefish, Menominee	*Coregonus quadrilateralis.*
Yellow perch	*Perca flavescens.*

GENERAL STATISTICS

The number of persons engaged in the fisheries of the entire region covered by this canvass in 1922 was 8,162, the investment amounted to $12,186,413, and the products, 110,410,442 pounds, were valued at $6,799,633.

In the fisheries of the Great Lakes, not including the Lake of the Woods and Rainy Lake Region, the number of persons engaged was 8,039, of whom 1,777 were on vessels fishing, 4,357 in the shore or boat fisheries, and 1,905 employed on boats transporting and as shoresmen in the fisheries and wholesale fishery trade. In the fisheries of the various lakes, the number of persons engaged was as follows: Superior, 773; Michigan, 3,107; Huron, 1,001; St. Clair and the St. Clair River, 90; Erie, 2,628; and Ontario, including the St. Lawrence and Niagara Rivers, 440. Compared with the statistics for 1917, there were decreases in the number of persons employed in all but the St. Clair and the Lake Ontario regions. The total decrease amounted to 1,182 persons.

The investment in the fisheries and related industries amounted to $12,046,458, apportioned among the lakes as follows: Superior, $697,572; Michigan, $4,333,451; Huron, $1,648,767; St. Clair and St. Clair River, $17,857; Erie, $5,166,531; and Ontario, $182,280. The investment, as compared with 1917, has increased in all the fisheries excepting those of Lake Superior.

[6] Includes lake herring, chub, longjaw, bluefin and blackfin, and tullibee.

The products of the fisheries amounted to 108,732,443 pounds, having a value to the fishermen of $6,689,611. The yields of the various lakes were as follows: Superior, 10,988,020 pounds, valued at $484,273; Michigan, 26,128,199 pounds, valued at $2,133,849; Huron, 13,942,115 pounds, valued at $945,259; St. Clair and St. Clair River, 310,012 pounds, valued at $17,365; Erie, 56,338,298 pounds, valued at $2,977,064; and Ontario, 1,025,799 pounds, valued at $131,801.

The principal species taken, in order of value, including fresh, salted, and smoked fish, were lake trout, 13,726,039 pounds, valued at $1,647,638; pike perch, all species, 23,967,086 pounds, valued at $1,516,332; ciscoes, all species, 36,009,659 pounds, valued at $1,377,055; whitefish, all species, 4,378,128 pounds, valued at $710,280; carp 8,119,441 pounds, valued at $330,874; yellow perch, 4,902,250 pounds, valued at $314,928; suckers, 5,395,213 pounds, valued at $263,575; catfish and bullheads, 1,662,298 pounds, valued at $117,417; and other fishes, 4,242,182 pounds, valued at $174,639. The production of shellfish totaled 6,330,147 pounds, valued at $236,873, of which mussel shells from rivers tributary to lakes Michigan and Erie constituted the largest item, 6,245,975 pounds, valued (together with the pearls and slugs) at $233,873.

The following table presents, by lakes, the number of persons engaged, the amount of capital invested, and the quantity and value of the products of the fisheries of the Great Lakes in 1922.

Persons engaged, investment, and products of the fisheries of the Great Lakes in 1922

Items	Lake Superior		Lake Michigan[1]		Lake Huron		Lake St. Clair[2]	
	Number	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
PERSONS ENGAGED								
On vessels fishing	53		1,011		131			
On vessels transporting	10		115		9			
In shore or boat fisheries	640		1,146		705		90	
Shoresmen	70		835		156			
Total	773		3,107		1,001		90	
INVESTMENT								
Vessels, fishing, steam	6	$19,150	87	$341,100	18	$84,500		
Tonnage	115		1,709		443			
Outfit		12,545		65,282		25,100		
Vessels, fishing, gasoline	7	8,800	269	348,850	11	9,400		
Tonnage	64		2,442		89			
Outfit		5,030		60,346		2,385		
Vessels, transporting, steam					1	1,000		
Tonnage					8			
Outfit						65		
Vessles, transporting, gasoline	4	12,500	62	56,100	13	25,950		
Tonnage	35		528		110			
Outfit		2,700		6,410		2,000		
Sail and row boats	319	9,475	807	18,155	224	11,825	52	$2,770
Power boats	267	78,310	312	70,221	248	118,225	30	6,900
Apparatus, vessel fisheries:								
Gill nets	1,510	25,225	35,930	357,653	4,043	78,885		
Lines		2,830		23,525		7,275		
Apparatus, shore fisheries:								
Pound nets and trap nets	303	43,475	704	174,815	1,474	366,300		
Gill nets	8,087	94,257	10,453	51,102	2,900	30,139		
Fyke nets	28	1,200	1,196	27,655	425	26,290		
Seines, haul	7	420	40	7,945	75	18,290	3	2,700
Lines		6,070		430		1,070		87
Crawfish pots			5,255	1,409				
Other apparatus				4,968				
Shore and accessory property		291,557		1,889,033		644,388		5,400
Cash capital		84,028		828,452		189,500		
Total		697,572		4,333,451		1,648,767		17,857

[1] Includes mussel fisheries of the St. Joseph, Grand, Kalamazoo, Maple, Muskegon, Pigeon, Thornapple, and Wolf Rivers.
[2] Includes St. Clair River.

Persons engaged, investment, and products of the fisheries of the Great Lakes in 1922—Continued

Items	Lake Superior		Lake Michigan		Lake Huron		Lake St. Clair	
PRODUCTS	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Black bass							2,000	$200
Buffalofish			892	$50	63	$3		
Burbot	829	$16	14,241	519	3,075	62		
Carp, German			754,027	25,222	1,065,116	41,256	260,000	10,400
Catfish and bullheads			148,629	7,520	64,826	4,518	1,005	148
Ciscoes:								
Fresh	5,158,254	99,259	5,435,013	202,461	2,775,403	90,176		
Frozen	936,151	18,981						
Salted	1,292,200	39,839	1,290,105	35,933	2,721,060	63,437		
Smoked	7,500	375	38,415	5,908				
Pike	16,201	2,063	46,388	5,421	39,473	2,985	4,040	404
Pike perch:								
Wall-eyed or yellow pike	23,298	3,268	132,948	21,185	1,260,374	171,102	38,620	5,741
Sheepshead or drum			4,472	107	46,760	1,400	16	1
Sturgeon	343	123	9,203	3,581	2,374	928	231	61
Sturgeon caviar			670	314	126	269		
Suckers, fresh	284,330	11,721	1,513,907	88,972	1,889,129	104,204		
Suckers, salted	11,800	413	5,760	147				
Trout, lake, fresh	2,807,490	252,685	8,735,585	1,171,801	2,108,249	215,501		
Trout, lake, salted	26,000	1,652	120	5				
Trout, steelhead			11,165	2,233				
White bass	6,900	207	1,005	38				
Whitefish, common, fresh	380,400	51,488	1,547,049	263,935	1,300,621	199,503		
Whitefish, common, salted	50	35						
Whitefish, common, caviar					1,289	1,009		
Whitefish, Menominee, fresh	10,827	478	107,163	7,977	30,029	1,708		
Whitefish, Menominee, salted	8,100	405	14,480	677	960	60		
Yellow perch	17,347	1,265	1,244,768	85,748	633,188	47,138	4,100	410
Crawfish			82,764	2,887				
Mussel shells			4,986,805	187,568				
Pearls				7,906				
Slugs				5,449				
Oil			2,625	105				
Total	10,988,020	484,273	26,128,199	2,133,849	13,942,115	945,259	310,012	17,365

Items	Lake Erie [3]		Lake Ontario [4]		Total	
PERSONS ENGAGED	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
On vessels fishing	582				1,777	
On vessels transporting	26				160	
In shore or boat fisheries	1,350		426		4,357	
Shoresmen	670		14		1,745	
Total	2,628		440		8,039	
INVESTMENT						
Vessels, fishing, steam	69	$438,100			180	$882,850
Tonnage	1,601				3,868	
Outfit		102,506				205,523
Vessels, fishing, gasoline	37	113,900			324	480,950
Tonnage	473				3,068	
Outfit		30,397				98,158
Vessels, transporting, steam	5	21,500			6	22,500
Tonnage	118				126	
Outfit		5,198				5,263
Vessels, transporting, gasoline	17	44,750			96	139,300
Tonnage	147				820	
Outfit		5,583				16,693
Sail and row boats	679	22,060	232	$7,498	2,313	71,783
Power boats	380	167,540	111	35,745	1,348	476,941
Apparatus, vessel fisheries:						
Gill nets	36,555	260,999			78,038	722,762
Lines						33,630
Apparatus, shore fisheries:						
Pound nets and trap nets	3,931	554,510	419	33,589	6,831	1,172,779
Gill nets	5,849	36,905	2,319	24,215	29,668	242,708
Fyke nets	752	35,190	204	3,362	2,605	93,697
Seines, haul	213	29,685	25	1,479	363	60,519
Lines		87		2,045		9,789
Crawfish pots					5,255	1,409
Fishing machines			9	1,175	9	1,175
Other apparatus		44		272		5,284
Shore and accessory property		2,148,230		47,900		5,026,508
Cash capital		1,149,257		25,000		2,276,237
Total		5,166,631		182,280		12,046,458

[3] Includes mussel fisheries of the Anglaize, Moumee, Sandusky, Tiffin, St. Marys, St. Joseph of the Moumee, Huron, and Raisin Rivers, and also men and investment in the wholesale fish trade of Detroit.
[4] Includes St. Lawrence and Niagara Rivers.

Persons engaged, investment, and products of the fisheries of the Great Lakes in 1922—Continued

Items	Lake Erie		Lake Ontario		Total	
PRODUCTS	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Black bass					2,000	$200
Bowfin			1,558	$86	1,558	86
Buffalofish					955	53
Burbot	354,004	$6,089	15,641	1,587	387,790	8,273
Carp, German	5,890,181	242,937	141,117	11,059	8,119,441	330,874
Catfish and bullheads	1,337,519	96,883	110,319	8,348	1,662,298	117,417
Ciscoes:						
Fresh	16,158,239	804,601	194,319	15,545	29,721,228	1,212,042
Frozen					936,151	18,981
Salted			3,000	450	5,306,365	139,659
Smoked					45,915	6,373
Eels			55,323	4,931	55,323	4,931
Goldeye and mooneye	13,438	140			13,438	140
Muskellunge	85	9			85	9
Pike	65,095	3,878	19,448	2,304	190,645	17,055
Pike perch:						
Blue pike	14,542,195	720,070	47,540	4,247	14,589,735	725,217
Sauger	6,002,378	295,337			6,002,378	295,337
Wall-eyed or yellow pike	1,813,423	269,092	106,310	25,390	3,374,973	495,778
Rock bass			5,974	308	5,974	308
Sheepshead or drum	2,362,343	56,952			2,413,591	58,460
Shiner			13,450	10,088	13,450	10,088
Sturgeon	15,475	4,293	68,698	17,130	96,324	26,116
Sturgeon caviar	127	256	935	2,796	1,858	3,635
Suckers, fresh	1,598,171	49,586	92,118	8,532	5,377,653	263,015
Suckers, salted					17,560	560
Sunfishes			13,687	636	13,687	636
Trout, lake, fresh	1,897	168	46,698	5,826	13,699,919	1,645,981
Trout, lake, salted					26,120	1,657
Trout, steelhead					11,165	2,233
White bass	1,022,609	42,006			1,030,514	42,251
Whitefish, common, fresh	922,209	173,402	54,951	9,603	4,205,230	697,931
Whitefish, common, salted					50	35
Whitefish, common, caviar					1,289	1,009
Whitefish, Menominee, fresh					148,019	10,163
Whitefish, Menominee, salted					23,540	1,142
Yellow perch	2,969,332	177,492	33,515	2,875	4,902,250	314,928
Other fish			1,200	60	1,200	60
Crawfish					82,764	2,887
Turtles	1,408	113			1,408	113
Mussel shells	1,259,170	30,580			6,245,975	218,148
Pearls		816				8,812
Slugs		1,464				6,913
Oil					2,625	105
Total	56,338,298	2,977,064	1,025,799	131,801	108,732,443	6,689,611

NOTE.—Ciscoes include lake herring, chub, longjaw, bluefin or blackfin, and tullibee. The mussel fisheries of the rivers tributary to Lake Michigan and Lake Erie have not previously been included in the statistics of the fisheries of the Great Lakes.

COMPARISON WITH PREVIOUS STATISTICS

An examination of the available statistics for previous years shows that there was a marked increase in all phases of the Great Lakes fisheries during the years 1880 to 1885; the number of persons employed doubled, the number of vessels and boats more than doubled, the number of pound nets, gill nets, and seines doubled, the investment more than tripled, and the catch of fish increased 45 per cent.

Subsequent to 1885 we find a general decline in most aspects of the fishery. The number of persons employed has never exceeded the 10,355 reported in 1885, and the number in 1922 (8,039) is the lowest reported in any canvass since 1880. Similarly, the number of vessels and boats reported in 1885 exceeds that of any later canvass, although not much in excess of the number reported in 1922. The number of pound nets reported has increased with each canvass until in 1917, when the maximum number, 8,433, was reported, but in 1922 the number dropped to 6,809. Gill nets also increased in number, until in 1917 there were 153,277. In 1922 the number dropped to 107,706. The history of the seines is somewhat different. After 1885 there was a distinct decline in the numbers reported, until in 1893 a minimum was reached, which was even below the number reported in 1880. Since then the number again increased, reaching 446 in 1917, but it declined to 363 in 1922. The investment in the fishery has constantly increased, the amount reported in 1922 being $11,720,821, which is greater than that of any previous report, and is almost nine times as great as that of 1880.

The total yield of the fisheries of the Great Lakes since 1885 has fluctuated between 86,000,000 and 114,000,000 pounds, the catch in 1922, amounting to 108,732,443 pounds, not being conspicuously greater or smaller than those of previous reports. The same is not true of the catches of individual species. The lake sturgeon has suffered the most serious decline, the catch in 1922 being less than 1.3 per cent that of 1880. The yield of whitefish was also considerably reduced in 1922, being less than 20 per cent that of 1880, though above that of 1903. The confusion existing in the early nomenclature of the fishes of the Great Lakes, and the various conditions in which they were reported (fresh, salted, smoked, etc.), prevent one from venturing too far in definite comparisons; but it is safe to say that the production of some of the most highly prized species has seriously declined, their places being taken by hitherto undesired species and the total yield thus sustained.

The following tables present summary statistics of the Great Lakes for various years, 1880 to 1922. The figures in the table on products include the fresh, frozen, salted, and smoked fish, none of which have been converted to a fresh basis and for that reason do not represent accurately comparable amounts. They may be useful, however, in indicating the general trend of the yield.

Comparative statistics of the fisheries of the Great Lakes for various years, from 1880 to 1922

PERSONS ENGAGED

Lakes	1880	1885	1890	1893	1899	1903	1908	1917	1922
Superior	414	914	653	916	613	918	792	1,348	773
Michigan	1,578	3,379	2,877	3,928	3,255	3,241	2,706	3,313	[4] 3,107
Huron	470	892	726	944	1,241	1,704	1,382	1,348	1,001
St. Clair [1]	356	272	611	529	442	355	221	64	90
Erie [2]	1,620	4,298	4,482	3,622	3,728	2,727	3,142	2,770	[4] 2,628
Ontario [3]	612	600	389	241	391	388	296	378	440
Total	5,050	10,355	9,738	10,180	9,670	9,333	8,539	9,221	8,039

[1] Includes St. Clair and Detroit Rivers. There was no fishing in Detroit River in 1917 and 1922.
[2] Includes persons in wholesale trade of Detroit, Mich.
[3] Includes St. Lawrence and Niagara Rivers.
[4] Includes persons engaged in the mussel fisheries of tributary rivers not shown in previous canvasses.

Comparative statistics of the fisheries of the Great Lakes for various years, from 1880 to 1922—Continued

APPARATUS AND CAPITAL EMPLOYED

Lakes and years	Vessels and boats [1]		Pound nets and trap nets		Gill nets		Seines		Other apparatus [2]	Shore property and cash capital	Total
	No.	*Value*	*No.*	*Value*	*No.*	*Value*	*No.*	*Value*	*Value*	*Value*	*Value*
Superior:											
1880	161	$26, 240	43	$14, 950	4, 630	$25, 280	32	$2, 010	$200	$12, 700	$81, 380
1885	519	100, 735	230	67, 520	7, 557	78, 082	43	2, 920	1, 155	177, 521	427, 933
1890	328	85, 275	140	34, 435	5, 974	63, 476	19	955	2, 763	179, 778	306, 682
1893	447	139, 035	276	63, 415	8, 899	87, 680	14	500	1, 565	209, 512	520, 024
1899	315	69, 045	162	25, 820	7, 229	90, 283	1	50	1, 058	167, 023	372, 083
1903	378	141, 109	218	27, 793	10, 169	127, 238	8	335	815	299, 032	596, 322
1908	-----	149, 000	-----	-----	-----	-----	-----	-----	159, 000	83, 000	391, 000
1917	724	241, 425	204	26, 262	11, 117	144, 986	5	325	5, 773	383, 810	802, 581
1922	603	128, 235	303	43, 475	9, 597	110, 482	7	420	10, 100	375, 585	677, 297
Michigan: [3]											
1880	836	133, 375	476	185, 425	24, 599	124, 740	19	2, 040	1, 455	104, 100	551, 135
1885	1, 402	368, 326	715	253, 840	58, 516	326, 902	87	6, 950	13, 457	788, 356	1, 757, 831
1890	1, 102	266, 331	844	244, 880	40, 896	215, 914	30	3. 480	13, 460	693, 159	1, 437, 224
1893	1, 549	357, 987	785	181, 385	54, 232	352, 084	28	2, 520	27, 863	1, 092, 219	2, 063, 497
1899	1, 178	281, 968	805	186, 349	49, 857	288, 395	11	510	29, 285	2, 087, 829	2, 915, 241
1903	1, 363	386, 396	980	198, 960	48, 645	269, 754	44	2, 384	37, 743	2, 593, 950	3, 480, 187
1908	-----	692, 000	-----	-----	-----	-----	-----	-----	753, 000	519, 000	1, 964, 000
1917	1, 131	771, 723	1, 134	242, 570	83, 807	645, 074	61	18, 120	69, 263	2, 108, 141	3, 854, 891
1922	1, 536	834, 426	704	174, 815	46, 383	408, 755	40	7, 945	57, 987	2, 717, 485	4, 201, 413
Huron:											
1880	111	20, 905	189	49, 425	3, 360	20, 600	28	5, 600	3, 500	3, 700	103, 730
1885	561	72, 946	586	113, 350	3, 444	35, 333	-----	-----	23, 100	140, 620	385, 349
1890	417	36, 898	651	88, 515	2, 206	21, 665	6	600	7, 155	254, 025	408, 858
1893	520	87, 645	731	108, 508	4, 923	53, 071	1	75	3, 807	230, 285	503, 700
1899	539	87, 585	996	111, 839	5, 676	54, 384	9	673	8, 188	203, 989	474, 953
1903	643	126, 418	1, 685	176, 495	6, 129	51, 526	18	608	13, 977	482, 615	851, 639
1908	-----	185, 000	-----	-----	-----	-----	-----	-----	281, 000	267, 000	733, 000
1917	617	228, 980	1, 731	207, 904	10, 610	102, 835	77	7, 990	19, 594	588, 192	1, 155, 465
1922	515	250, 900	1, 474	366, 390	7, 003	115, 024	75	18, 290	34, 635	833, 888	1, 619, 127
St. Clair: [4]											
1880	52	8, 000	-----	-----	180	1, 080	42	6, 000	1, 500	24, 000	40, 580
1885	215	7, 457	57	12, 550	23	160	34	8, 825	3, 819	218, 270	251, 081
1890	166	28, 775	34	9, 450	814	9, 418	28	6, 240	5, 580	150, 682	210, 145
1893	211	13, 728	91	7, 400	380	4, 260	20	3, 025	2, 340	206, 672	240, 076
1899	188	3, 770	5	1, 050	60	600	13	1, 255	915	46, 945	54, 535
1903	150	3, 150	-----	-----	-----	-----	6	890	961	234, 884	239, 885
1908	-----	10, 000	-----	-----	-----	-----	-----	-----	8, 000	28, 000	46, 000
1917	64	2, 540	-----	-----	-----	-----	6	1, 365	50	12, 000	"15, 955
1922	82	9, 670	-----	-----	-----	-----	3	2, 700	87	5, 400	17, 857
Erie: [3]											
1880	602	83, 880	758	233, 600	5, 775	22, 500	18	2, 800	8, 645	163, 675	515, 100
1885	1, 536	298, 757	1, 028	259, 785	22, 644	75, 507	71	8, 320	72, 205	847, 564	1, 562, 138
1890	1, 449	520, 033	1, 893	548, 100	49, 320	169, 513	44	5, 305	70, 601	1, 502, 750	2, 816, 302
1893	1, 146	424, 227	1, 783	439, 060	35, 369	164, 683	47	4, 440	23, 339	1, 423, 017	2, 506, 842
1899	980	435, 566	1, 724	329, 500	41, 678	229, 182	104	8, 390	19, 362	1, 614, 677	2, 720, 554
1903	608	490, 236	1, 469	172, 805	35, 150	180, 581	110	8, 040	18, 350	1, 326, 385	2, 196, 397
1908	-----	603, 000	-----	-----	-----	-----	-----	-----	615, 000	426, 000	1, 644, 000
1917	1, 133	780, 683	5, 011	681, 060	47, 578	329, 632	285	38, 867	45, 154	2, 341, 051	4, 216, 447
1922	1, 187	807, 850	3, 909	554, 510	42, 404	297, 094	213	29, 685	35, 321	3, 297, 487	5, 022, 847
Ontario: [5]											
1880	167	13, 100	34	14, 000	6, 000	20, 000	9	1, 950	-----	5, 000	54, 050
1885	467	20, 448	350	19, 445	4, 722	23, 952	69	3, 177	12, 627	56, 100	135, 749
1890	376	31, 162	288	24, 577	2, 345	18, 110	27	656	10, 361	38, 667	123, 533
1893	177	9, 619	77	2, 310	1, 185	8, 794	7	175	2, 240	32, 250	56, 131
1899	289	9, 482	145	5, 850	1, 187	18, 074	24	420	7, 194	38, 640	80, 350
1903	234	15, 457	176	9, 945	1, 796	13, 862	8	205	9, 303	52, 220	100, 992
1908	-----	11, 000	-----	-----	-----	-----	-----	-----	16, 000	7, 900	34, 900
1917	270	24, 395	353	21, 460	165	15, 175	12	610	6, 349	70, 235	138, 224
1922	343	43, 243	419	33, 589	2, 319	24, 215	25	1, 479	6, 854	72, 900	182, 280
All lakes:											
1880	1, 929	285, 500	1, 500	497, 400	44, 544	214, 200	148	20, 400	15, 300	313, 175	1, 345, 975
1885	4, 700	868, 669	2, 966	726, 490	96, 906	539, 936	304	30, 192	126, 363	2, 228, 431	4, 520, 081
1890	3, 838	968, 474	3, 750	949, 957	101, 555	498, 606	154	17, 236	109, 920	2, 819, 061	5, 362, 774
1893	4, 050	1, 032, 241	3, 743	802, 078	104, 988	670, 572	117	10, 735	61, 160	3, 199, 955	5, 899, 270
1899	3, 489	887, 416	3, 837	660, 408	105, 087	690, 518	162	11, 298	66, 002	4, 159, 103	6, 617, 716
1903	3, 376	1, 162, 766	4, 528	585, 998	101, 889	642, 961	194	12, 462	81, 149	4, 989, 086	7, 474, 422
1908	-----	1, 651, 000	-----	-----	-----	-----	-----	-----	1, 831, 000	1, 332, 000	4, 814, 000
1917	3, 939	2, 049, 746	8, 433	1, 179, 256	153, 277	1, 237, 702	446	67, 247	115, 580	5, 503, 429	10, 183, 563
1922	4, 266	2, 074, 324	6, 809	1, 172, 779	107, 706	965, 470	363	60, 519	144, 984	7, 302, 745	11, 720, 821

[1] In 1908 the outfit of the vessels is included in the value.
[2] Includes all forms of apparatus in 1908.
[3] Includes investment in the vessel fisheries of tributary rivers not shown in previous canvasses.
[4] Includes St. Clair and Detroit Rivers. There was no fishing in Detroit River in 1917 and 1922.
[5] Includes St. Lawrence and Niagara Rivers.

Comparative statistics of the fisheries of the Great Lakes for various years, 1880 to 1922—Continued

PRODUCTS [1]

Lakes and years	Whitefish	Trout	Ciscoes	Sturgeon	All other fish	Total	
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Value*
Superior:							
1880	2,257,000	1,464,750	34,000		60,875	3,816,625	$118,370
1885	4,571,947	3,488,177	324,680	182,760	258,416	8,825,980	291,523
1890	3,213,176	2,613,378	199,121	47,482	42,835	6,115,992	220,968
1893	2,732,270	4,342,122	660,272	62,052	300,211	8,096,927	252,107
1899	693,191	3,118,169	1,125,478	4,415	488,401	5,429,654	150,862
1903	794,022	4,954,830	4,742,805	13,137	2,700,219	13,205,013	343,671
1908	910,100	2,752,200	5,587,600	67,600	878,000	10,195,500	342,000
1917	302,210	2,588,353	12,258,482		398,387	15,547,432	726,674
1922	380,450	2,833,490	7,394,105	343	379,632	10,988,020	484,273
Michigan:							
1880	12,030,400	2,659,450	3,050,400	3,839,600	1,562,025	23,141,875	668,400
1885	8,682,986	6,431,298	3,312,493	1,406,678	3,684,693	23,518,148	878,788
1890	5,455,079	8,364,167	6,082,082	946,897	5,586,041	26,434,266	830,465
1893	2,330,060	8,216,920	11,580,895	311,780	8,308,100	30,747,755	828,611
1899	1,510,364	5,488,947	21,573,716	108,279	5,818,690	34,499,996	876,743
1903	1,972,594	9,049,299	13,863,617	56,420	8,637,568	33,579,498	1,090,550
1908	2,490,900	7,892,000	21,842,000	70,500	7,521,900	39,817,300	1,554,000
1917	3,047,393	8,650,715	18,259,354	10,805	5,492,361	35,460,628	2,270,859
1922 [2]	1,547,049	8,735,705	6,763,633	9,203	9,072,709	26,128,199	2,133,849
Huron:							
1880	2,700,778	2,084,500	246,800	204,000	1,969,195	7,205,273	195,277
1885	1,425,380	2,539,780	1,265,650	215,500	6,010,860	11,457,170	276,397
1890	1,004,094	1,505,619	2,514,551	365,718	4,666,399	10,056,381	221,067
1893	1,178,271	3,439,575	2,758,628	79,553	4,608,311	12,064,338	306,381
1899	592,308	1,887,101	3,699,807	30,497	6,208,614	12,418,327	308,078
1903	692,863	2,108,632	4,640,967	34,343	6,978,404	14,455,209	450,318
1908	719,000	1,358,800	4,791,000	9,900	6,053,300	12,932,000	486,000
1917	996,851	2,079,455	5,381,365	4,886	4,900,650	13,363,207	857,478
1922	1,300,621	2,108,249	5,496,463	2,374	5,034,408	13,942,115	945,259
St. Clair: [3]							
1880	77,922		250,700	998,500	523,805	1,850,927	36,273
1885	41,125		1,208,150	227,780	708,740	2,185,795	40,193
1890	238,764	244,847	490,334	309,003	1,711,623	2,994,571	73,577
1893	50,950	72,000	140,112	54,106	1,497,143	1,814,311	46,030
1899	69,902	69,915		7,600	431,650	579,067	23,864
1903	25,591			8,800	487,550	521,941	21,594
1908				13,000	724,700	737,700	32,000
1917					133,330	133,330	11,852
1922				231	309,781	310,012	17,365
Erie:							
1880	3,333,800	26,200	11,774,400	1,970,000	11,982,900	29,087,300	474,880
1885	3,531,855	106,900	19,354,900	4,727,950	23,734,912	51,456,517	1,109,096
1890	2,341,451	121,420	38,868,283	2,078,907	21,440,812	64,850,873	1,000,905
1893	1,292,410	203,132	20,931,076	793,800	19,747,907	42,968,325	805,979
1899	2,066,314	32,024	33,427,797	789,402	22,078,327	58,393,864	1,150,895
1903	302,805	15,127	8,788,625	300,103	13,781,896	23,188,556	780,015
1908	1,503,000	6,900	10,599,100	63,900	29,733,600	41,906,500	1,280,000
1917	1,755,947	1,922	17,160,852	28,384	19,763,133	38,710,238	2,327,299
1922 [2]	922,209	1,897	16,158,239	15,475	39,240,478	56,338,298	2,977,064
Ontario: [4]							
1880	1,064,000	569,700	611,217	545,283	849,800	3,640,000	159,700
1885	90,711	20,510	403,585	386,974	1,496,686	2,398,466	95,869
1890	148,771	41,010	598,978	541,752	2,115,937	3,446,448	124,786
1893	45,380	6,204	164,998	125,293	586,140	928,015	31,510
1899	161,935	15,432	86,778	189,155	1,953,032	2,406,332	100,997
1903	25,384	4,050	121,315	226,095	867,756	1,244,600	59,353
1908	56,000	14,000	35,000	37,000	679,800	821,800	74,000
1917	88,347	23,694	469,272	51,141	421,934	1,054,388	100,857
1922	54,951	46,698	197,319	68,698	658,133	1,025,799	131,801
All lakes:							
1880	21,463,900	6,804,600	15,967,617	7,557,383	16,948,600	68,742,000	1,652,900
1885	18,344,004	12,586,665	25,869,458	7,147,642	35,894,307	99,842,076	2,691,866
1890	12,401,335	12,890,441	48,753,349	4,289,759	35,563,647	113,898,531	2,471,768
1893	7,629,341	16,279,953	36,235,981	1,426,584	35,047,812	96,619,671	2,270,618
1899	5,004,014	10,611,588	59,913,576	1,129,348	36,978,714	113,727,240	2,611,439
1903	3,813,259	16,131,938	32,157,319	638,898	33,453,393	86,194,817	2,745,501
1908	5,679,000	12,023,900	42,854,700	261,900	45,591,300	106,410,800	3,768,000
1917	6,190,748	13,344,139	53,529,325	95,216	31,109,795	104,269,223	6,295,019
1922	4,205,280	13,726,039	36,009,659	96,324	54,695,141	108,732,443	6,689,611

NOTE.—The statistics for 1908 in these tables are from data published by the Bureau of the Census.

[1] In this table caviar and other secondary products are omitted in 1880, 1885, and 1890. In 1880, 1885, and 1890 bluefin, longjaw, and Menominee in Lake Michigan, and Menominee in Lake Huron are included with whitefish. In 1893 and 1899 bluefin in Lake Superior, bluefin and Menominee in Lake Michigan, and Menominee in Lake Huron are included with "*all other fish*" and longjaw in Lake Michigan with ciscoes. In 1903, bluefin, Menominee, longjaw, and steelhead trout are included with "all other fish." In 1908, 1917, and 1922 ciscoes (herring) include longjaw, bluefin or blackfin, and tullibee.

[2] Includes the mussel fisheries of tributary rivers not shown in previous canvasses.

[3] Includes St. Clair and Detroit Rivers. There was no fishing in Detroit River in 1917 and 1922.

[4] Includes St. Lawrence and Niagara Rivers.

FISHERIES OF LAKE SUPERIOR

The number of persons engaged in the fisheries of Lake Superior in 1922 was 773, of whom 53 were on fishing vessels, 640 in the shore and boat fisheries, and 80 on transporting vessels, in the wholesale trade and related industries.

The investment amounted to $697,572. This included 13 steam and gasoline vessels, with a total net tonnage of 179, valued, together with their outfits, at $45,525; 4 gasoline transporting vessels, with a total net tonnage of 35, valued, together with their outfits, at $15,200; 586 power and row boats, valued at $87,785; fishing apparatus employed on vessels to a value of $28,055; fishing apparatus employed in the shore and boat fisheries to the value of $145,422; shore and accessory property valued at $291,557; and cash capital amounting to $84,028.

The products of the fisheries of Lake Superior amounted to 10,988,020 pounds, valued at $484,273. Among the species of importance were the following: Ciscoes, 7,394,105 pounds, valued at $158,454; lake trout, 2,833,490 pounds, valued at $254,337; common whitefish, 380,450 pounds, valued at $51,523; and suckers, 296,130 pounds, valued at $12,134.

Compared with the other lakes, Lake Superior ranked fourth in persons engaged, investment, and quantity and value of products. Compared with 1917, there was a decrease in the number of persons employed, investment, and quantity and value of products. The number of persons employed and the investment approximate that of 1903, and the quantity and value of products somewhat exceed those of 1903.

FISHERIES BY STATES AND COUNTIES

The following tables show, by States and counties, the number of persons employed, investment, and quantity and value of the products of the fisheries of Lake Superior in 1922:

Statistics of the fisheries of Lake Superior in 1922, by States and counties

PERSONS ENGAGED

State and county	On vessels fishing	On vessels transporting	In shore or boat fisheries	Shoresmen	Total
Michigan:					
Alger	8		48	4	60
Baraga			40		40
Chippewa			40	4	44
Gogebic			9		9
Houghton		3	75		78
Keweenaw			34		34
Marquette	18		35	7	60
Ontonagon	8		7		15
Total	34	3	288	15	340
Wisconsin:					
Ashland			8	4	12
Bayfield	13		100	14	127
Douglas	2		2	12	16
Iron			1		1
Total	15		111	30	156
Minnesota:					
Cook			63		63
Lake		2	131		133
St. Louis	4	5	47	25	81
Total	4	7	241	25	277
Grand total	53	10	640	70	773

Statistics of the fisheries of Lake Superior in 1922, by States and counties—Continued

INVESTMENT

State and county	Vessels fishing: Steam				Vessels fishing: Gasoline			
	Number	*Tonnage*	*Value*	*Outfit*	*Number*	*Tonnage*	*Value*	*Outfit*
Michigan:								
Alger	1	6	$1,000	$350	1	12	$700	$1,500
Marquette	2	76	11,500	8,250	1	7	1,000	500
Ontonagon	2	18	1,650	370	1	5	800	700
Total	5	100	14,150	8,970	3	24	2,500	2,700
Wisconsin:								
Bayfield	1	15	5,000	3,575	1	14	1,500	1,700
Douglas					1	5	800	130
Total	1	15	5,000	3,575	2	19	2,300	1,830
Minnesota: St. Louis					2	21	4,000	500
Grand total	6	115	19,150	12,545	7	64	8,800	5,030

State and county	Vessels transporting (gasoline)				Rowboats		Power boats	
	Number	*Tonnage*	*Value*	*Outfit*	*Number*	*Value*	*Number*	*Value*
Michigan:								
Alger					11	$280	21	$6,560
Baraga					21	605	10	2,700
Chippewa					17	545	14	5,150
Gogebic					1	30	7	2,450
Houghton	1	10	$1,500	$300	15	370	39	10,575
Keweenaw					7	190	17	4,400
Marquette					2	55	[1]8	2,750
Ontonagon					4	170	2	1,800
Total	1	10	1,500	300	78	2,245	118	36,385
Wisconsin:								
Ashland					4	115	5	775
Bayfield					20	605	46	13,900
Douglas							2	150
Iron							1	300
Total					24	720	54	15,125
Minnesota:								
Cook					64	1,890	26	6,350
Lake	1	7	1,500	300	111	3,345	42	10,950
St. Louis	2	18	9,500	2,100	42	1,275	27	9,500
Total	3	25	11,000	2,400	217	6,510	95	26,800
Grand total	4	35	12,500	2,700	319	9,475	267	78,310

[1] Includes one small steamer, valued at $500.

Statistics of the fisheries of Lake Superior in 1922, by States and counties—Continued

INVESTMENT—Continued

State and county	Apparatus of capture, vessel fisheries			Apparatus of capture, shore fisheries			
	Gill nets		Lines	Pound nets and trap nets		Gill nets	
	Number	*Value*	*Value*	*Number*	*Value*	*Number*	*Value*
Michigan:							
Alger	230	$3,000	$300	34	$6,675	424	$6,102
Baraga				39	3,575	121	1,182
Chippewa				178	21,550	501	6,250
Gogebic						57	570
Houghton				6	2,400	1,400	14,798
Keweenaw				7	525	546	5,566
Marquette	760	15,100	2,200	4	1,000	90	1,620
Ontonagon	165	2,025	330	3	750	110	1,100
Total	1,155	20,125	2,830	271	36,475	3,249	37,188
Wisconsin:							
Ashland				1	250	75	750
Bayfield	195	3,300		27	5,950	1,256	14,574
Douglas	40	400				8	80
Iron						6	60
Total	235	3,700		28	6,200	1,345	15,464
Minnesota:							
Cook						1,024	11,740
Lake						1,592	18,400
St. Louis	120	1,400		4	800	877	11,465
Total	120	1,400		4	800	3,493	41,605
Grand total	1,510	25,225	2,830	303	43,475	8,087	94,257

State and county	Apparatus of capture, shore fisheries—Con.					Shore and accessory property	Cash capital	Total investment
	Fyke nets		Seines (hand)		Lines			
	Number	*Value*	*Number*	*Value*	*Value*	*Value*	*Value*	*Value*
Michigan:								
Alger					$1,750	$8,690		$36,907
Baraga	8	$200			300	1,790		10,352
Chippewa					375	12,540	$5,000	51,410
Gogebic					50	1,700		4,800
Houghton			7	$420	575	6,450		37,388
Keweenaw					1,125	250		12,056
Marquette					600	7,650		52,225
Ontonagon					160	800		10,655
Total	8	200	7	420	4,935	39,870	5,000	215,793
Wisconsin:								
Ashland	6	300				11,075	25,000	39,165
Bayfield	14	700			15	42,400	18,528	111,747
Douglas						27,500	11,500	40,660
Iron								360
Total	20	1,000			15	81,875	55,028	191,832
Minnesota:								
Cook					500	8,450		28,930
Lake					420	7,600		42,515
St. Louis					200	153,762	24,000	218,502
Total					1,120	169,812	24,000	289,947
Grand total	28	1,200	7	420	6,070	291,557	84,028	697,572

Statistics of the fisheries of Lake Superior in 1922, by States and counties—Continued

YIELD, BY SPECIES

State and county	Burbot		Ciscoes					
			Fresh		Frozen		Salted	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Michigan:								
Alger			8,457	$340				
Baraga			44,092	1,327				
Chippewa	575	$10	77,776	3,373				
Gogebic			33,093	839				
Houghton	115	1	83,736	1,999				
Keweenaw	139	5	26,814	894				
Marquette			21,278	634				
Ontonagon			36,267	833				
Total	829	16	332,413	10,239				
Wisconsin:								
Ashland			2,985	79				
Bayfield			1,103,609	16,955	110,400	$2,302	3,000	$97
Douglas			63,705	994				
Iron			805	14				
Total			1,171,101	18,042	110,400	2,302	3,000	97
Minnesota:								
Cook			1,273,972	25,478	37,000	740	479,400	15,565
Lake			1,635,497	31,698	511,203	10,168	521,200	14,797
St. Louis			745,268	13,802	277,548	5,771	288,600	9,380
Total			3,654,737	70,978	825,751	16,679	1,289,200	39,742
Grand total	829	16	5,158,254	99,259	936,151	18,981	1,292,200	39,839

State and county	Ciscoes, smoked		Pike		Pike perch (wall-eyed) or yellow pike		Sturgeon	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Michigan:								
Alger			25	$3	2,297	$251		
Baraga			1,098	134	675	36		
Chippewa			8,489	1,132	6,124	805	318	$115
Houghton			100	18			25	8
Keweenaw			345	27	2,215	250		
Ontonagon			115	15				
Total			10,172	1,329	11,311	1,342	343	123
Wisconsin:								
Ashland			2,120	297	1,875	339		
Bayfield			2,462	250	10,112	1,587		
Douglas			875	86				
Total			5,457	633	11,987	1,926		
Minnesota:								
Lake	4,500	$225	155	80				
St. Louis	3,000	150	417	21				
Total	7,500	375	572	101				
Grand total	7,500	375	16,201	2,063	23,298	3,268	343	123

Statistics of the fisheries of Lake Superior in 1922, by States and counties—Continued

YIELD, BY SPECIES—Continued

State and county	Suckers				Trout			
	Fresh		Salted		Fresh		Salted	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Michigan:								
Alger	17,422	$576			216,088	$17,178		
Baraga	34,972	1,372			14,919	1,577		
Chippewa	121,881	5,563			42,931	4,020		
Gogebic	2,070	72			36,045	3,329		
Houghton	6,154	165			224,038	20,988		
Keweenaw	4,629	220			132,406	9,352		
Marquette	7,041	107			586,778	60,593		
Ontonagon	4,782	250			103,026	11,738		
Total	198,951	8,325			1,356,231	128,775		
Wisconsin:								
Ashland	6,354	251			8,070	894		
Bayfield	46,050	2,425	11,800	$413	700,738	70,656	8,900	$496
Douglas	31,000	600			3,900	360		
Total	83,404	3,276	11,800	413	712,708	71,910	8,900	496
Minnesota:								
Cook					175,033	17,372	3,400	204
Lake					271,973	25,160	6,800	408
St. Louis	1,975	120			291,545	9,468	6,900	544
Total	1,975	120			738,551	52,000	17,100	1,156
Grand total	284,330	11,721	11,800	413	2,807,490	252,685	26,000	1,652

State and county	White bass		Whitefish, common			
			Fresh		Salted	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Michigan:						
Alger			102,797	$10,504		
Baraga			29,616	4,233		
Chippewa			92,918	18,030		
Gogebic			2,100	182		
Houghton			17,453	2,184		
Keweenaw			6,780	680		
Marquette			24,767	3,978		
Ontonagon			13,224	774		
Total			289,654	40,565		
Wisconsin:						
Ashland			886	125		
Bayfield			54,935	6,693		
Douglas	6,900	$207				
Total	6,900	207	55,821	6,818		
Minnesota:						
Cook			8,777	887		
Lake			4,613	532	50	$35
St. Louis			21,535	2,686		
Total			34,925	4,105	50	35
Grand total	6,900	207	380,400	51,488	50	35

Statistics of the fisheries of Lake Superior in 1922, by States and counties—Continued

YIELD, BY SPECIES—Continued

State and county	Whitefish, Menominee				Yellow perch		Total	
	Fresh		Salted					
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Michigan								
Alger	60	$5					347, 146	$28, 857
Baraga					2, 942	$275	128, 313	8, 954
Chippewa					13, 844	949	364, 856	33, 997
Gogebic	400	14					74, 608	4, 436
Houghton							331, 621	25, 363
Keweenaw							173, 328	11, 428
Marquette							639, 864	65, 312
Ontonagon							157, 414	13, 610
Total	460	19			16, 786	1, 224	2, 217, 150	191, 957
Wisconsin:								
Ashland					61	6	22, 351	1, 991
Bayfield	1, 599	89			500	35	2, 054, 105	101, 998
Douglas							106, 380	2, 247
Iron							805	14
Total	1, 599	89			561	41	2, 183, 641	106, 250
Minnesota:								
Cook	1, 000	50					1, 978, 582	60, 296
Lake	300	30	2, 300	$115			2, 958, 591	83, 248
St. Louis	7, 468	290	5, 800	290			1, 650, 066	42, 522
Total	8, 768	370	8, 100	405			6, 587, 229	186, 066
Grand total	10, 827	478	8, 10 0	405	17, 347	1, 265	10, 988, 020	484, 273

FISHERIES BY APPARATUS

The catch of the vessel fisheries amounted to 1,454,461 pounds, valued at $83,893, and of the shore and boat fisheries to 9,533,559 pounds, valued at $400,380. In the vessel fisheries the catch of ciscoes, suckers, lake trout, and whitefish, with gill nets, amounted to 1,359,981 pounds, valued at $72,159; the balance of the catch, consisting of lake trout, was taken on lines. In the shore and boat fisheries 8,610,155 pounds, consisting of burbot, ciscoes, pike, pike perch, suckers, lake trout, white bass, whitefish, and yellow perch, valued at $310,532, were taken with gill nets; the pound-net fishery yielded 633,999 pounds of ciscoes, pike, pike perch, sturgeon, suckers, lake trout, whitefish, and yellow perch, valued at $65,287; fyke nets took 42,966 pounds of pike, pike perch, suckers and yellow perch, valued at $2,485; 26,587 pounds of burbot, ciscoes and suckers, valued at $427, were taken with seines; and 219,852 pounds of lake trout, valued at $21,649, were taken on lines.

The following tables give the statistics of the yield of the vessel, and the shore and boat fisheries of Lake Superior in 1922:

Yield of the vessel fisheries of Lake Superior in 1922, by States, counties, apparatus, and species

Apparatus and species	Michigan							
	Alger		Marquette		Ontonagon		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Gill nets:								
Ciscoes, fresh			12, 963	$335	30, 000	$600	42, 963	$935
Suckers			6, 981	104	2, 300	100	9, 281	204
Trout	108, 391	$6, 775	462, 743	45, 842	23, 000	2, 500	594, 134	55, 117
Whitefish	349	45	2, 754	478	4, 600	400	7, 703	923
Total	108, 740	6, 820	485, 441	46, 759	59, 900	3, 600	654, 081	57, 179
Lines: Trout	14, 915	1, 297	50, 995	6, 812	28, 570	3, 625	94, 480	11, 734
Grand total	123, 655	8, 117	536, 436	53, 571	88, 470	7, 225	748, 561	68, 913

Yield of the vessel fisheries of Lake Superior in 1922, by States, counties, apparatus, and species—Continued

Apparatus and species	Wisconsin						Minnesota		Grand total	
	Bayfield		Douglas		Total		St. Louis			
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Gill nets:										
Ciscoes, fresh	525,000	$10,500	56,000	$800	581,000	$11,300			623,963	$12,235
Ciscoes, frozen							80,000	$1,820	80,000	1,820
Suckers			31,000	600	31,000	600			40,281	804
Trout			3,900	360	3,900	360	10,000	900	608,034	56,377
Whitefish									7,703	923
Total	525,000	10,500	90,900	1,760	615,900	12,260	90,000	2,720	1,359,081	72,159
Lines: Trout									94,480	11,734
Grand total	525,000	10,500	90,900	1,760	615,900	12,260	90,000	2,720	1,454,461	83,893

Yield of the shore fisheries of Lake Superior in 1922, by States, counties, apparatus, and species

Apparatus and species	Michigan					
	Alger		Baraga		Chippewa	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets and trap nets:						
Ciscoe			560	$22	4,025	$115
Pike	25	$3	230	20	8,489	1,132
Pike perch (wall-eyed) or yellow pike	2,297	251	215	28	6,124	805
Sturgeon					318	115
Suckers	15,363	504	30,662	1,128	101,348	4,683
Trout, lake, fresh	14,684	1,520	4,600	510	23,466	2,199
Whitefish, common	57,791	5,957	25,324	3,693	85,951	17,121
Yellow perch			742	48	12,600	853
Total	90,160	8,235	62,333	5,449	242,321	27,023
Gill nets:						
Burbot					575	10
Ciscoe, fresh	8,457	340	43,532	1,305	73,751	3,258
Pike			868	114		
Suckers, fresh	2,059	72	4,310	244	20,533	880
Trout, fresh	51,194	4,989	5,719	667	9,920	867
Whitefish, common, fresh	44,657	4,502	4,291	540	6,967	909
Whitefish, Menominee, fresh	60	5				
Yellow perch			2,200	227	1,244	96
Total	106,427	9,908	60,920	3,097	112,990	6,020
Fyke nets: Pike perch (wall-eyed) or yellow pike			400	8		
Lines: Trout, lake	26,904	2,597	4,000	400	9,545	954
Grand total	223,491	20,740	128,313	8,954	364,856	33,99[illegible]

Yield of shore fisheries of Lake Superior in 1922, by States, counties, apparatus, and species—Continued

Apparatus and species	Michigan—Continued					
	Gogebic		Houghton		Keweenaw	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets and trap nets:						
Pike			100	$18	345	$27
Pike perch (wall-eyed) or yellow pike					2,215	250
Sturgeon			25	8		
Suckers	2,070	$72	950	25	4,200	207
Trout, lake, fresh			34,183	3,023		
Whitefish, common	2,100	182	1,429	296		
Total	4,170	254	36,687	3,370	6,760	484
Gill nets:						
Burbot					139	5
Ciscoes, fresh	33,993	839	59,736	1,599	26,814	894
Suckers, fresh			2,732	114	429	13
Trout, fresh	36,045	3,329	157,742	15,213	101,592	6,673
Whitefish, common, fresh			16,024	1,888	6,780	680
Whitefish, Menominee, fresh	400	14				
Total	70,438	4,182	236,234	18,814	135,754	8,265
Seines:						
Burbot			115	1		
Ciscoe			24,000	400		
Suckers			2,472	26		
Total			26,587	427		
Lines: Trout, lake			32,113	2,752	30,814	2,679
Grand total	74,608	4,436	331,621	25,363	173,328	11,428

Apparatus and species	Michigan—Continued					
	Marquette		Ontonagon		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets and trap nets:						
Ciscoe	7,740	$249			12,325	$386
Pike					9,189	1,200
Pike perch (wall-eyed) or yellow pike					10,851	1,334
Sturgeon					343	123
Suckers			1,241	$75	155,834	6,694
Trout, lake, fresh	16,435	1,786	17,152	1,871	110,520	10,909
Whitefish, common	12,726	2,215	8,624	374	193,945	29,838
Yellow perch					13,342	901
Total	36,901	4,250	27,017	2,320	506,349	51,385
Gill nets:						
Burbot					714	15
Ciscoes, fresh	575	50	6,267	233	253,125	8,518
Pike			115	15	983	129
Suckers, fresh	60	3	1,241	75	31,364	1,401
Trout, fresh	46,715	5,078	17,152	1,871	426,079	38,687
Whitefish, common, fresh	9,287	1,285			88,006	9,804
Whitefish, Menominee, fresh					460	19
Yellow perch					3,444	323
Total	56,637	6,416	24,775	2,194	804,175	58,896
Fyke nets: Pike perch (wall-eyed) or yellow pike					460	8
Seines:						
Burbot					115	1
Ciscoe					24,000	400
Suckers					2,472	26
Total					26,587	427
Lines: Trout, lake	9,890	1,075	17,152	1,871	131,018	12,328
Grand total	103,428	11,741	68,944	6,385	1,468,589	123,044

Yield of shore fisheries of Lake Superior in 1922, by States, counties, apparatus, and species—Continued

Apparatus and species	Wisconsin					
	Ashland		Bayfield		Douglas	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets and trap nets:						
Ciscoe			85	$7		
Pike			1,373	131		
Pike perch (wall-eyed) or yellow pike			6,020	892		
Suckers			7,196	94		
Trout, lake, fresh	1,344	$116	68,212	7,540		
Trout, lake, salted			1,500	90		
Whitefish, common			14,593	1,997		
Whitefish, Menominee			535	32		
Total	1,344	116	99,514	10,783		
Gill nets:						
Ciscoes, fresh	2,985	79	578,524	6,448	7,705	$194
Ciscoes, frozen			110,400	2,302		
Ciscoes, salted			3,000	97		
Pike	1,500	210	1,089	119	875	86
Pike perch (wall-eyed) or yellow pike	1,875	339	4,092	695		
Suckers, fresh			3,883	233		
Suckers, salted			11,800	413		
Trout, fresh	6,726	778	601,064	59,341		
Trout, salted			7,400	406		
White bass					6,900	207
Whitefish, common, fresh	886	125	40,342	4,696		
Whitefish, Menominee, fresh			1,064	57		
Total	13,972	1,531	1,362,658	74,807	15,480	487
Fyke nets:						
Pike	620	87				
Suckers	6,354	251	34,971	2,098		
Yellow perch	61	6	500	35		
Total	7,035	344	35,471	2,133		
Lines: Trout, lake			31,462	3,775		
Grand total	22,351	1,991	1,529,105	91,498	15,480	487

Apparatus and species	Wisconsin—Continued				Minnesota			
	Iron		Total		Cook		Lake	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets and trap nets:								
Ciscoe			85	$7				
Pike			1,373	131				
Pike perch (wall-eyed) or yellow pike			6,020	892				
Suckers			7,196	94				
Trout, lake, fresh			69,556	7,656				
Trout, lake, salted			1,500	90				
Whitefish, common			14,593	1,997				
Whitefish, Menominee			535	32				
Total			100,858	10,899				
Gill nets:								
Ciscoes, fresh	805	$14	590,019	6,735	1,273,972	$25,478	1,635,497	$31,698
Ciscoes, frozen			110,400	2,302	37,000	740	511,203	10,168
Ciscoes, salted			3,000	97	479,400	15,565	521,200	14,797
Ciscoes, smoked							4,500	225
Pike			3,464	415			155	80
Pike perch (wall-eyed) or yellow pike			5,967	1,034				
Suckers, fresh			3,883	233				
Suckers, salted			11,800	413				
Trout, fresh			607,790	60,119	147,506	14,752	253,128	23,834
Trout, salted			7,400	406	3,400	204	6,800	408
White bass			6,900	207				
Whitefish, common, fresh			41,228	4,821	8,777	887	4,613	532
Whitefish, common, salted							50	35
Whitefish, Menominee, fresh			1,064	57	1,000	50	300	30
Whitefish, Menominee, salted							2,300	115
Total	805	14	1,392,915	76,839	1,951,055	57,676	2,939,746	81,422
Fyke nets:								
Pike			620	87				
Suckers			41,325	2,349				
Yellow perch			561	41				
Total			42,506	2,477				
Lines: Trout, lake			31,462	3,775	27,527	2,620	18,845	1,826
Grand total	805	14	1,567,741	93,990	1,978,582	60,296	2,958,591	83,248

Yield of shore fisheries of Lake Superior in 1922, by States, counties, apparatus, and species—Continued

Apparatus and species	Minnesota—Continued				Grand total	
	St. Louis		Total			
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets and trap nets:						
Ciscoe					12, 410	$393
Pike	392	$19	392	$19	10, 954	1, 350
Pike perch (wall-eyed) or yellow pike					16, 871	2, 226
Sturgeon					343	123
Suckers					163, 030	6, 788
Trout, lake, fresh	8, 000	800	8, 000	800	188, 076	19, 365
Trout, lake, salted	400	24	400	24	1, 900	114
Whitefish, common	18, 000	2, 160	18, 000	2, 160	226, 538	33, 995
Whitefish, *Menominee*					535	32
Yellow perch					13, 342	901
Total	26, 792	3, 003	26, 792	3, 003	633, 999	65, 287
Gill nets:						
Burbot					714	15
Ciscoes, fresh	745, 268	13, 802	3, 654, 737	70, 978	4, 497, 881	86, 231
Ciscoes, frozen	197, 548	3, 951	745, 751	14, 859	856, 151	17, 161
Ciscoes, salted	288, 600	9, 380	1, 289, 200	39, 742	1, 292, 200	39, 839
Ciscoes, smoked	3, 000	150	7, 500	375	7, 500	375
Pike	25	2	180	82	4, 627	626
Pike perch (wall-eyed) or yellow pike					5, 967	1, 034
Suckers, fresh	1, 975	120	1, 975	120	37, 222	1, 754
Suckers, salted					11, 800	413
Trout, fresh	262, 545	6, 668	663, 179	44, 754	1, 697, 048	143, 560
Trout, salted	6, 500	520	16, 700	1, 132	24, 100	1, 538
White bass					6, 900	207
Whitefish, common, fresh	3, 535	526	16, 925	1, 945	146, 159	16, 570
Whitefish, common, salted			50	35	50	35
Whitefish, Menominee, fresh	7, 468	290	8, 768	370	10, 292	446
Whitefish, Memoninee, salted	5, 800	200	8, 100	405	8, 100	405
Yellow perch					3, 444	323
Total	1, 522, 264	35, 699	6, 413, 065	174, 797	8, 610, 155	310, 532
Fyke nets:						
Pike					620	87
Pike perch (wall-eyed) or yellow pike					460	8
Suckers					41, 325	2, 349
Yellow perch					561	41
Total					42, 966	2, 485
Seines:						
Burbot					115	1
Ciscoe					24, 000	400
Suckers					2, 472	26
Total					26, 587	427
Lines: Trout, lake	11, 000	1, 100	57, 372	5, 546	219, 852	21, 649
Grand total	1, 560, 056	39, 802	6, 497, 229	183, 346	9, 533, 559	400, 380

WHOLESALE FISHERY TRADE

The wholesale fishery trade of Lake Superior in 1922 was conducted by 11 establishments, of which 6 were in Duluth, Minn., and 5 in Ashland, Bayfield, and Superior, Wis. The total number of persons employed in these establishments was 55; wages paid, $51,568; investment in shore and accessory property, $212, 912; and cash capital, $79,028.

Compared with 1917, there was a decrease of 4 in the number of establishments, a decrease of 194 in the number of persons employed, and an increase of $25,255 in the total investment.

The following table shows the statistics of the wholesale trade of Lake Superior in 1922:

Wholesale fishery trade of Lake Superior in 1922

Localities	State	Number of firms	Persons engaged	Wages paid	Shore and accessory property	Cash capital
Duluth	Minnesota	6	25	$24,968	$142,812	$24,000
Ashland, Bayfield, and Superior	Wisconsin	5	30	26,600	70,100	55,028
Total		11	55	51,568	212,912	79,028

FISHERIES OF LAKE MICHIGAN

In 1922 Lake Michigan ranked first among the Great Lakes in the number of persons employed and second only to Lake Erie in the amount of invested capital and quantity and value of products.

The total number of persons employed was 2,617, of whom 1,011 were on vessels fishing, 707 in the shore and boat fisheries, and 899 employed as shoresmen and on vessels transporting. Comparing the total number with previous statistics, it is seen that there were fewer men reported in this canvass than in any previous one except that of 1880.

The total investment in the fisheries of the lake amounted to $4,247,964, of which $947,838 was invested in vessels and boats, $644,599 in gear, and $2,655,527 in shore and accessory property and cash capital. There were 356 vessels above 5 tons net engaged in the fishery, 87 of them being operated by steam and 269 by gasoline. The gear employed by these vessels consisted of 35,930 gill nets, valued at $357,653, and lines to the value of $23,525. The principal gear in the shore and boat fisheries consisted of pound nets and gill nets, 704 of the former valued at $174,815, and 10,453 of the latter, valued at $51,102. There was a very distinct decrease in the number of all types of gear as compared to 1917.

The fishery products of Lake Michigan amounted to 21,141,394 pounds, valued at $1,932,836. The more important species taken in this lake were ciscoes, 6,763,533 pounds, valued at $244,392; lake trout, 8,735,705 pounds, valued at $1,171,806; common whitefish, 1,547,049 pounds, valued at $263,935; yellow perch, 1,244,768 pounds, valued at $85,748; and suckers, 1,519,667 pounds, valued at $89,119.

Compared with previous years, this is a distinct decrease in the yield of ciscoes and whitefish and an ordinary production of lake trout. The 1922 catch of sturgeon, amounting to 9,203 pounds, was the lowest on record. In 1880 the yield of this species from Lake Michigan amounted to 3,839,600 pounds.

FISHERIES BY STATES AND COUNTIES

The following tables present in detail the statistics of the fisheries of Lake Michigan in 1922:

Statistics of the fisheries of Lake Michigan in 1922, by States and counties

PERSONS ENGAGED

State and county	On vessels fishing	On vessels transporting	In shore or boat fisheries	Shoresmen	Total
Michigan:					
Allegan	2		6		8
Antrim			9		9
Benzie	31		4	6	41
Berrien	24		23	11	58
Charlevoix	99	2	15	21	137
Delta	53	10	69	7	139
Emmet		3	23		26
Grand Traverse	6	8	17		31
Leelanau	36		24	6	66
Mackinac	16	16	46		78
Manistee	17		7		24
Mason	30	2	5	4	41
Menominee	13		39	15	67
Muskegon	13		16	2	31
Oceana	4		1		5
Ottawa	20	2	13	22	57
Schoolcraft	33	2	10	7	52
Van Buren	20		2	6	28
Total	417	45	329	107	898
Indiana:					
Lake			5		5
Laporte	22		11	11	44
Porter			6		6
Total	22		22	11	55
Illinois:					
Cook	14		9	413	436
Lake	24		3	13	40
Total	38		12	426	476
Wisconsin:					
Brown	44	30	81	69	224
Door	142	24	113	24	303
Kenosha	24		2	7	33
Kewaunee	31	2	19		52
Manitowoc	42		26	19	87
Marinette	46	1	38	14	99
Milwaukee	61		1	35	97
Oconto	55	13	28	11	107
Ozaukee	25		4	23	52
Racine	31		4	8	43
Sheboygan	33		28	30	91
Total	534	70	344	240	1,188
Grand total	1,011	115	707	784	2,617

Statistics of the fisheries of Lake Michigan in 1922, by States and counties—Con.

INVESTMENT

State and county	Vessels fishing							
	Steam				Gasoline			
	Number	*Tonnage*	*Value*	*Outfit*	*Number*	*Tonnage*	*Value*	*Outfit*
Michigan:								
Allegan	1	7	$2,000	$100				
Benzie	4	79	17,000	3,500	4	38	$4,900	$780
Berrien	3	111	16,500	3,500	3	21	1,700	360
Charlevoix	5	55	13,000	5,700	28	226	32,800	8,375
Delta	3	55	7,500	1,525	20	123	8,800	1,155
Grand Traverse	1	6	600	125	2	18	3,000	90
Leelanau	5	52	7,400	3,900	9	67	7,600	1,840
Mackinac	1	30	2,000	2,250	7	48	3,150	720
Manistee					7	48	5,250	1,253
Mason	2	40	5,000	400	11	99	10,150	1,600
Menominee	1	15	2,500	1,820	3	30	2,700	698
Muskegon	2	23	2,500	200	4	22	2,600	220
Oceana					2	17	1,400	140
Ottawa	5	78	14,500	2,870				
Schoolcraft	1	7	800	120	9	135	17,950	7,580
Van Buren	6	98	12,800	2,650				
Total	40	656	104,100	28,660	109	892	102,000	24,811
Indiana: Laporte	4	92	14,000	3,700	1	8	500	20
Illinois:								
Cook	1	24	7,000	25	3	16	6,000	2,100
Lake	1	19	5,000	900	5	67	14,000	3,445
Total	2	43	12,000	925	8	83	20,000	5,545
Wisconsin:								
Brown	1	8	1,500	300	19	159	14,050	1,665
Door	2	19	6,500	750	56	538	98,250	11,805
Kenosha	1	32	5,000	150	6	79	23,000	1,000
Kewaunee	1	19	9,000	1,400	11	105	15,300	4,250
Manitowoc	3	54	10,500	2,700	10	146	32,700	4,065
Marinette	1	13	4,000	627	18	144	14,250	3,215
Milwaukee	12	240	52,500	8,870	4	33	4,800	340
Oconto					26	206	17,000	2,380
Ozaukee	6	138	29,500	4,550				
Racine	8	195	55,500	5,450				
Sheboygan	6	200	37,000	7,200	1	49	7,000	1,250
Total	41	918	211,000	31,997	151	1,459	226,350	29,970
Grand total	87	1,709	341,100	65,282	269	2,442	348,850	60,346

Statistics of the fisheries of Lake Michigan in 1922, by States and counties—Con.

INVESTMENT—Continued

State and county	Vessels transporting (gasoline)				Sail and row boats		Power boats	
	Number	*Tonnage*	*Value*	*Outfit*	*Number*	*Value*	*Number*	*Value*
Michigan:								
Allegan					3	$110	3	$550
Antrim					7	175	2	200
Benzie					2	50	1	500
Berrien					11	290	10	2,950
Charlevoix	1	11	$2,500	$300	9	265	7	2,350
Delta	5	34	1,650	385	58	1,910	27	4,750
Emmet	1	7	400	100	9	350	8	1,975
Grand Traverse	7	52	5,450	610	16	610	6	1,100
Leelanau					18	525	7	1,100
Mackinac	8	52	5,550	580	23	675	21	5,150
Manistee					7	240	1	300
Mason	1	5	300	40	4	115	1	150
Menominee					34	925	3	700
Muskegon					12	455	5	1,700
Oceana					1	80		
Ottawa	1	8	800	145	13	455	2	400
Schoolcraft	1	5	500	80	9	435	2	650
Van Buren					2	50		
Total	25	174	17,150	2,240	238	7,715	106	24,525
Indiana:								
Lake					1	40	2	1,800
Laporte					5	150	4	1,150
Porter					1	25	2	950
Total					7	215	8	3,900
Illinois:								
Cook					4	110	3	2,600
Lake					1	25	1	200
Total					5	135	4	2,800
Wisconsin:								
Brown	16	100	8,700	565	85	2,400	22	4,250
Door	12	191	24,150	3,210	27	1,105	38	7,160
Kenosha					2	50		
Kewaunee	1	9	300	45	1	30	2	575
Manitowoc					17	775	9	5,250
Marinette	1	10	1,000	50	7	200	5	850
Milwaukee					1	25		
Oconto	7	44	4,800	300	30	925	10	2,200
Ozaukee							1	300
Racine					4	100		
Sheboygan					21	1,065	8	3,200
Total	37	354	38,950	4,170	195	6,675	95	23,785
Grand total	62	528	56,100	6,410	445	14,740	213	55,010

Statistics of the fisheries of Lake Michigan in 1922, by States and counties—Con.

INVESTMENT—Continued

State and county	Apparatus of capture, vessel fisheries			Apparatus of capture, shore fisheries					
	Gill nets		Lines	Pound nets and trap nets		Gill nets		Fyke nets	
	Number	*Value*	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Michigan:									
Allegan	40	$320		3	$800	125	$980		
Antrim				5	1,100	39	260		
Benzie	1,246	10,884	$300			109	930		
Berrien	1,150	16,150	3,000	8	3,300	338	2,025		
Charlevoix	3,204	29,720	2,100	20	5,800	177	1,250		
Delta	1,273	9,428	1,150	87	15,950	1,354	5,665	63	$4,675
Emmet				8	5,500	383	1,871		
Grand Traverse	100	800	150	94	13,390	45	280		
Leelanau	1,909	15,400	300	26	3,700	260	2,025		
Mackinac	490	5,255		93	13,700	139	795		
Manistee	886	8,185	925	3	750	35	345		
Mason	1,482	15,560	350	28	1,540	10	120		
Menominee	414	6,760		37	4,450	106	1,060	2	40
Muskegon	345	3,840	200	18	4,400	261	2,770		
Oceana	164	1,600				30	240		
Ottawa	987	4,650	2,000	19	5,110	156	760		
Schoolcraft	1,105	16,600	1,200	40	5,200	26	262		
Van Buren	615	4,360	1,500			6	30		
Total	15,590	149,512	13,175	489	84,690	3,599	21,668	65	4,715
Indiana:									
Lake				3	1,500	106	530		
Laporte	1,206	22,120	800	5	3,000	27	115		
Porter				5	3,100	16	80		
Total	1,206	22,120	800	13	7,600	149	725		
Illinois:									
Cook	342	1,658				155	477		
Lake	1,368	13,560				35	165		
Total	1,710	15,218				190	642		
Wisconsin:									
Brown	988	4,880		21	2,300	907	4,185	896	17,255
Door	7,738	54,940	3,720	61	20,400	1,649	8,220		
Kenosha	351	2,270	350						
Kewaunee	545	3,745	2,200			930	4,640		
Manitowoc	1,546	36,150		36	16,250	10	110	27	500
Marinette	1,820	21,631		10	1,950	2,252	6,756	11	370
Milwaukee	826	7,914	560	1	100				
Oconto	1,882	12,943		38	9,225	706	3,896	197	4,815
Ozaukee	821	7,970	480	4	2,000				
Racine	472	4,060	1,120			50	150		
Sheboygan	435	14,300	1,120	31	30,300	11	110		
Total	17,424	170,803	9,550	202	82,525	6,515	28,067	1,131	22,940
Grand total	35,930	357,653	23,625	704	174,815	10,453	51,102	1,196	27,655

Statistics of the fisheries of Lake Michigan in 1922, by States and counties—Con.

INVESTMENT—Continued

State and county	Apparatus of capture, shore fisheries—Continued							Shore and accessory property	Cash capital	Total investment
	Seines (haul)		Trammel nets		Lines	Crawfish pots				
	Number	*Value*	*Number*	*Value*	*Value*	*Number*	*Value*	*Value*	*Value*	*Value*
Michigan:										
Allegan										$4,860
Antrim								$500		2,235
Benzie								8,900		47,744
Berrien								4,825	$3,000	57,000
Charlevoix								58,800	23,000	185,960
Delta								17,855	2,300	84,698
Emmet								2,175		12,371
Grand Traverse					$75			400		26,680
Leelanau					150			4,325		48,205
Mackinac								4,650		44,475
Manistee								1,245		18,493
Mason								5,800	1,500	42,625
Menominee								39,580	70,000	131,233
Muskegon								5,225		24,110
Oceana								250		3,710
Ottawa								37,175	36,257	105,122
Schoolcraft								2,350		53,727
Van Buren								1,000		22,300
Total					225			195,055	136,057	916,298
Indiana:										
Lake								1,000		4,870
Laporte								7,010	1,000	53,565
Porter								1,400		5,555
Total								9,410	1,000	63,990
Illinois:										
Cook								992,487	518,000	1,530,457
Lake								12,500		49,795
Total								1,004,987	518,000	1,580,252
Wisconsin:										
Brown	31	$7,300				4,450	$1,187	149,832	90,000	310,369
Door					195			68,160	6,000	314,565
Kenosha					10			4,500	1,000	37,330
Kewaunee								6,205		47,690
Manitowoc	4	105	3	$65				37,980	11,000	168,150
Marinette								18,956	7,000	80,855
Milwaukee								258,450	32,000	365,569
Oconto	2	450				805	222	20,170	7,895	87,221
Ozaukee								21,760	12,000	78,560
Racine								12,100		78,480
Sheboygan	3	90						19,510	6,500	128,645
Total	40	7,945	3	65	205	5,255	1,409	617,623	173,395	1,687,424
Grand total	40	7,945	3	65	430	5,255	1,409	1,827,075	828,452	4,247,964

Statistics of the fisheries of Lake Michigan in 1922, by States and counties—Con.

YIELD, BY SPECIES

State and county	Buffalofish		Burbot		Carp, German		Catfish and bullheads	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Michigan:								
Allegan	60	$4	1,720	$50	1,000	$30	160	$16
Berrien	62	4	200	10	502	20		
Delta			1,400	28	2,245	63	3,260	195
Emmet			400	20				
Grand Traverse					750	28		
Mason			100	2				
Menominee			400	4	100	4		
Muskegon			720	36	100	2		
Ottawa			140	5	400	8	245	16
Total	122	8	5,080	155	5,097	155	3,665	227
Indiana:								
Lake	100	5	300	6	100	5		
Laporte	620	34	120	12	5,100	203		
Porter	50	3			150	12		
Total	770	42	420	18	5,350	220		
Wisconsin:								
Brown			1,141	16	481,388	10,591	129,269	5,869
Door					65,000	5,200		
Kenosha			2,000	100				
Kewaunee					116,544	5,827		
Manitowoc			600	30	2,518	140		
Marinette					3,500	95	2,500	250
Oconto					73,930	2,944	13,195	1,174
Ozaukee			5,000	200	200	10		
Sheboygan					500	40		
Total			8,741	346	743,580	24,847	144,964	7,293
Grand total	892	50	14,241	519	754,027	25,222	148,629	7,520

Statistics of the fisheries of Lake Michigan in 1922, by States and counties—Con.

YIELD, BY SPECIES—Continued

State and county	Ciscoes						Pike	
	Fresh		Salted		Smoked			
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Michigan:								
Allegan	9,060	$451						
Antrim	7,725	299						
Benzie	17,853	1,093						
Berrien	130,742	5,319						
Charlevoix	37,237	2,682						
Delta	95,189	3,013					17,003	$2,455
Emmet	1,563	129						
Grand Traverse	25,605	1,255					400	60
Leelanau	40,646	2,356					70	10
Mackinac	550	27					300	44
Manistee	6,449	257						
Mason	62,105	3,292						
Menominee	238,037	5,852	13,680	$399				
Muskegon	100,910	4,296					1,991	299
Oceana	6,000	420						
Ottawa	38,130	1,500					475	71
Schoolcraft	30,781	1,229					88	12
Van Buren	6,135	384						
Total	854,717	33,754	13,680	399			20,327	2,951
Indiana:								
Lake	58,000	2,500						
Laporte	176,800	10,884					25	3
Porter	61,800	3,090						
Total	296,600	16,474					25	3
Illinois:								
Cook	154,000	15,340						
Lake	98,000	4,230			29,165	$4,893		
Total	252,000	19,570			29,165	4,893		
Wisconsin:								
Brown	564,635	11,549					15,404	1,440
Door	753,998	22,611	974,280	26,158			1,236	119
Kenosha	23,200	1,028						
Kewaunee	87,363	2,479						
Manitowoc	481,274	23,389					174	28
Marinette	657,500	19,520	29,325	895			1,510	155
Milwaukee	274,649	16,321						
Oconto	807,700	18,786	272,820	8,481	250	25	7,712	725
Ozaukee	116,340	5,221			9,000	1,080		
Racine	500	40						
Sheboygan	264,537	11,719						
Total	4,031,696	132,663	1,276,425	35,534	9,250	1,105	26,036	2,467
Grand total	5,435,013	202,461	1,290,105	35,933	38,415	5,998	46,388	5,421

State and county	Pike perch (wall-eyed) or yellow pike		Sheepshead or drum		Steelhead trout		Sturgeon		Sturgeon caviar	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Michigan:										
Allegan	2,700	$405								
Berrien	308	46					2,089	$1,046	25	$75
Delta	53,846	7,933					1,001	402	8	12
Mackinac	250	25					2,387	1,020	467	142
Manistee	520	93					325	162	170	85
Mason	6,584	987								
Menominee	915	125					81	23		
Muskegon	3,015	509	60	$2			650	325		
Ottawa	2,435	365	500	25			300	125		
Schoolcraft	469	75					210	74		
Total	71,042	10,563	560	27			7,043	3,177	670	314
Indiana:										
Lake					8,000	$1,600	500	250		
Laporte	150	37			115	23	820	121		
Porter					3,050	610	840	33		
Total	150	37			11,165	2,233	2,160	404		
Wisconsin:										
Brown	43,704	7,461	3,912	80						
Door	550	128								
Kewaunee	140	32								
Marinette	860	129								
Oconto	16,502	2,835								
Total	61,756	10,585	3,912	80						
Grand total	132,948	21,185	4,472	107	11,165	2,233	9,203	3,581	670	314

Statistics of the fisheries of Lake Michigan in 1922, by States and counties—Con.

YIELD, BY SPECIES—*Continued*

State and county	Suckers				Trout, lake			
	Fresh		Salted		Fresh		Salted	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Michigan:								
Allegan	6,500	$264			750	$112		
Antrim					3,340	410		
Benzie	18,784	802			290,255	39,018		
Berrien	4,070	270			168,486	24,885		
Charlevoix					1,125,847	130,540		
Delta	448,601	19,264			203,160	26,851		
Emmet	130	5			99,050	12,469		
Grand Traverse	38,506	3,080			42,102	4,971		
Leelanau	11,384	907			336,670	38,720		
Mackinac	15,343	900			112,283	14,564		
Manistee	21,155	1,144			135,725	20,304		
Mason	17,060	1,023			147,454	18,158		
Menominee	10,638	635			48,290	4,900		
Muskegon	2,685	126			27,516	4,531		
Oceana					14,800	1,856		
Ottawa	4,070	104			140,650	19,526		
Schoolcraft	10,366	329			461,341	63,164		
Van Buren	600	30			96,706	13,397		
Total	609,892	28,982			3,454,425	438,385		
Indiana:								
Lake	100	5			3,000	310		
Laporte	750	54			265,270	37,145		
Porter	125	6			3,300	330		
Total	975	65			271,570	37,785		
Illinois:								
Cook					35,300	4,210		
Lake					167,775	25,894		
Total					203,075	30,104		
Wisconsin:								
Brown	286,380	15,505			2,000	249		
Door	26,853	1,650	5,760	$147	1,289,407	156,383	120	$5
Kenosha					122,860	19,596		
Kewaunee	13,940	1,216			515,200	77,280		
Manitowoc	54,527	2,765			546,277	76,973		
Marinette	214,800	16,439			128,200	13,320		
Milwaukee	50	3			620,140	93,495		
Oconto	294,065	21,723			12,950	1,475		
Ozaukee	1,850	111			396,555	57,751		
Racine					400,703	55,687		
Sheboygan	10,566	513			772,223	113,318		
Total	903,040	59,925	5,760	147	4,806,515	665,527	120	5
Grand total	1,513,907	88,972	5,760	147	8,735,585	1,171,801	120	5

Statistics of the fisheries of Lake Michigan in 1922, by States and counties—Con.

YIELD, BY SPECIES—Continued

State and county	White bass		Whitefish, common		Whitefish, Menominee			
					Fresh		Salted	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Michigan:								
Allegan			8,815	$1,763				
Antrim			5,425	795	30	$4		
Benzie			76,469	12,211				
Berrien			39,610	7,777				
Charlevoix			242,295	36,388	10,053	663		
Delta			113,947	21,570	17,037	1,081		
Emmet			20,562	3,260	800	56		
Grand Traverse			52,564	7,824	1,424	142		
Leelanau			84,076	14,983	1,658	150		
Mackinac			276,327	49,781	39,043	3,018		
Manistee			8,881	1,466	50	5		
Mason			20,803	3,795	300	24		
Menominee			62,992	9,434	225	20		
Muskegon			53,998	9,811	100	8		
Oceana			2,600	470				
Ottawa			28,955	5,744	200	16		
Schoolcraft			95,167	17,930	4,805	480		
Van Buren			47,195	9,233				
Total			1,240,681	214,235	75,725	5,667		
Indiana:								
Lake			1,100	178				
Laporte			16,000	2,690				
Porter			3,700	592				
Total			20,800	3,460				
Wisconsin:								
Brown	1,005	$38	313	75				
Door			170,846	28,651	9,038	430	14,480	$677
Kewaunee					20,000	1,600		
Manitowoc			11,753	1,509	1,400	210		
Marinette			90,667	13,601				
Oconto			2,300	384	800	40		
Ozaukee			5,055	1,110	200	30		
Sheboygan			4,635	910				
Total	1,005	38	285,568	46,240	31,438	2,310	14,480	677
Grand total	1,005	38	1,547,049	263,935	107,163	7,977	14,480	677

Statistics of the fisheries of Lake Michigan in 1922, by State and counties—Con.

YIELD, BY SPECIES—Continued

State and county	Yellow perch		Crawfish		Oil		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Michigan:								
Allegan	1,610	$96					32,375	$3,191
Antrim							16,520	1,508
Benzie	1,250	100					404,611	53,224
Berrien	7,288	438					353,382	39,890
Charlevoix	33,255	1,995					1,448,687	172,168
Delta	161,744	9,768					1,118,441	92,635
Emmet	1,990	254					124,495	16,193
Grand Traverse	2,450	178					163,801	17,538
Leelanau	5,178	362					479,682	57,497
Mackinac	1,590	96					448,540	69,626
Manistee	1,370	92					174,645	23,608
Mason	100	6					254,506	27,287
Menominee	17,525	598					392,883	21,094
Muskegon	7,380	483					199,125	20,428
Oceana							23,400	2,746
Ottawa	3,450	220					219,950	27,815
Schoolcraft	25	1					603,252	83,294
Van Buren	3,745	307					154,381	23,351
Total	249,950	14,994					6,612,676	753,993
Indiana:								
Lake	2,500	200					73,700	5,059
Laporte	8,800	1,181					474,570	52,387
Porter	2,200	110					75,215	4,786
Total	13,500	1,491					623,485	62,232
Illinois:								
Cook	26,300	3,642					215,600	23,192
Lake	3,100	310					298,040	35,327
Total	29,400	3,952					513,640	58,519
Wisconsin:								
Brown	299,358	17,764	68,764	$2,446			1,897,273	73,083
Door	250,250	22,584					3,561,817	264,743
Kenosha	1,250	225					149,310	20,949
Kewaunee	21,934	2,296					775,130	90,730
Manitowoc	11,294	1,122					1,109,817	106,166
Marinette	53,850	3,532					1,182,712	67,936
Milwaukee	27,590	2,345					922,429	112,164
Oconto	279,700	14,632	14,000	441			1,795,924	73,665
Ozaukee	260	16					534,460	65,529
Racine	3,270	450					404,473	56,177
Sheboygan	3,162	345			2,625	$105	1,058,248	126,950
Total	951,918	65,311	82,764	2,887	2,625	105	13,391,503	1,058,092
Grand total	1,244,768	85,748	82,764	2,887	2,625	105	21,141,394	1,932,836

FISHERIES BY APPARATUS

Of the total yield of Lake Michigan in 1922, the vessel fishery produced 13,294,749 pounds, valued at $1,395,396, and the shore and boat fisheries produced 7,846,645 pounds, valued at $537,440. Gill nets and lines were employed, the former catching 11,152,890 pounds of fish, mainly ciscoes, lake trout, whitefish, yellow perch, and pike perch, and the latter catching 2,141,859 pounds of lake trout and 260 pounds of pike. In the shore and boat fisheries the pound nets were most important, yielding 3,771,600 pounds, followed by gill nets with a yield of 2,397,435 pounds.

The following tables show in detail the products of the fisheries of Lake Michigan by gear:

Yield of vessel fisheries of Lake Michigan in 1922, by States, counties, apparatus, and species

Apparatus and species	Michigan							
	Allegan		Benzie		Berrien		Charlevoix	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Gill nets:								
Burbot	120	$2						
Ciscoes, fresh	1,480	148	17,853	$1,093	3,000	$210	33,262	$2,304
Suckers	100	8	16,484	664	1,100	98		
Trout, lake	125	22	265,914	35,527	92,664	13,945	950,589	109,533
Whitefish—								
Common	695	139	74,289	11,819	16,906	3,238	223,005	33,621
Menominee, fresh							8,953	558
Yellow perch	150	9	650	52			11,655	699
Total	2,670	328	375,190	49,155	113,670	17,491	1,227,464	146,715
Lines: Trout, lake			8,256	1,239	63,900	9,148	110,900	13,367
Grand total	2,670	328	383,446	50,394	177,570	26,639	1,338,364	160,082

Apparatus and species	Michigan—Continued							
	Delta		Grand Traverse		Leelanau		Mackinac	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Gill nets:								
Ciscoes, fresh	54,806	$1,809	10,995	$609	33,491	$2,037	150	$15
Pike	150	22					200	29
Pike perch (wall-eyed)	210	31					250	25
Suckers	56,840	2,728			100	4	7,000	408
Trout, lake	136,112	18,282	3,686	452	302,644	34,696	84,733	11,259
Whitefish—								
Common	37,600	6,614	200	31	70,716	12,470	41,350	6,442
Menominee, fresh	5,647	512					19,709	1,679
Yellow perch	76,230	4,584					1,265	76
Total	367,595	34,582	14,881	1,092	406,951	49,207	154,657	19,933
Lines: Trout, lake	62,450	7,920	4,468	536	7,000	790		
Grand total	430,045	42,502	19,349	1,628	413,951	49,997	154,657	19,933

Apparatus and species	Michigan—Continued							
	Manistee		Mason		Menominee		Muskegon	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Gill nets:								
Ciscoes, fresh			45,105	$2,782	105,200	$3,150	73,634	$3,191
Pike perch (wall-eyed)	300	$60			565	85	1,000	200
Sturgeon	325	162						
Sturgeon caviar	170	85						
Suckers	9,038	417			2,875	100		
Trout, lake	114,375	17,111	137,564	17,010	41,265	4,126	20,885	3,406
Whitefish, common	7,420	1,174	20,703	3,780	62,530	9,379	6,000	1,080
Yellow perch	810	60			15,725	493	2,000	160
Total	132,438	19,069	203,372	23,572	228,160	17,333	103,519	8,037
Lines: Trout, lake	21,000	3,150	9,490	1,088			2,600	520
Grand total	153,438	22,219	212,862	24,660	228,160	17,333	106,119	8,557

Yield of vessel fisheries of Lake Michigan in 1922, by States, counties, apparatus, and species—Continued

Apparatus and species	Michigan—Continued									
	Oceana		Ottawa		Schoolcraft		Van Buren		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Gill nets:										
Burbot									120	$2
Ciscoes, fresh	6,000	$420	10,170	$632	30,756	$1,228	6,135	$384	432,037	20,012
Pike									350	51
Pike perch (wall-eyed)									2,325	401
Sturgeon									325	162
Sturgeon caviar									170	85
Suckers					1,967	71	600	30	96,104	4,528
Trout, lake	14,700	1,844	41,785	5,501	379,387	51,828	35,076	5,401	2,621,504	329,943
Whitefish—										
Common	1,000	150	3,395	632	30,748	5,046	47,195	9,233	643,752	104,848
Menominee, fresh					1,500	150			35,809	2,899
Yellow perch							2,045	137	110,530	6,270
Total	21,700	2,414	55,350	6,765	444,358	58,323	91,051	15,185	3,943,026	469,201
Lines: Trout, lake			95,100	13,564	38,608	5,268	61,630	7,996	485,402	64,586
Grand total	21,700	2,414	150,450	20,329	482,966	63,591	152,681	23,181	4,428,428	533,787

Apparatus and species	Illinois						Indiana	
	Cook		Lake		Total		Laporte	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Gill nets:								
Ciscoes—	105,000	$10,500	95,000	$4,050	200,000	$14,550	150,000	$9,000
Fresh			28,165	4,733	28,165	4,733		
Smoked	25,000	2,980	167,275	25,814	192,275	28,794	215,200	30,128
Trout, lake								
Whitefish, common							10,000	1,400
Yellow perch	16,000	2,340	100	10	16,100	2,350	1,000	100
Total	146,000	15,820	290,540	34,607	436,540	50,427	376,200	40,628
Lines: Trout, lake							50,000	7,000
Grand total	146,000	15,820	290,540	34,607	436,540	50,427	426,200	47,628

Apparatus and species	Wisconsin							
	Brown		Door		Kenosha		Kewaunee	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Gill nets:								
Burbot					2,000	$100		
Ciscoes, fresh	394,755	$7,490	582,580	$17,128	23,200	1,028	10,000	$200
Pike	156	14	720	72				
Pike perch (wall-eyed)	5,968	1,158	150	23				
Suckers	12,260	823	5,406	129			1,000	80
Trout, lake	2,000	249	810,703	95,550	48,600	6,804	212,000	31,800
Whitefish—								
Common	163	30	102,080	15,834				
Menominee, fresh			1,945	38			20,000	1,600
Menominee, salted			5,640	235				
Yellow perch	73,542	4,782	27,039	1,465	250	25	19,000	2,030
Total	488,844	14,546	1,536,263	130,474	74,050	7,957	262,000	35,710
Lines:								
Pike			260	21				
Trout, lake			381,653	46,545	74,260	12,792	302,200	45,330
Total			381,913	46,566	74,260	12,792	302,200	45,330
Grand total	488,844	14,546	1,918,176	177,040	148,310	20,749	564,200	81,040

Yield of vessel fisheries of Lake Michigan in 1922, by States, counties, apparatus, and species—Continued

Apparatus and species	Wisconsin—Continued									
	Manitowoc		Marinette		Milwaukee		Oconto		Ozaukee	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Gill nets:										
Burbot	600	$30							5,000	$200
Carp, German							1,200	$60		
Ciscoes—										
Fresh	407,494	20,762	441,000	$13,130	274,320	$16,307	453,500	9,120	106,340	4,921
Salted			24,265	741			146,100	4,784		
Smoked							250	25		
Pike			60	10						
Pike perch (wall-eyed)							7,372	1,229		
Suckers	250	13	13,250	576			44,065	2,753		
Trout, lake	405,327	55,913	115,900	12,090	540,140	81,295	12,500	1,430	197,335	28,926
Whitefish—										
Common	50	13	81,367	12,205			2,100	348		
Menominee, fresh	600	90								
Yellow perch	4,500	450	15,500	475	27,000	2,310	123,200	6,222		
Total	818,821	77,271	691,342	39,227	841,460	99,912	790,287	25,971	308,675	34,047
Lines: Trout, lake					80,000	12,200			195,220	28,105
Grand total	818,821	77,271	691,342	39,227	921,460	112,112	790,287	25,971	503,895	62,152

Apparatus and species	Wisconsin—Continued						Grand total	
	Racine		Sheboygan		Total			
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Gill nets:								
Burbot					7,600	$330	7,720	$332
Carp, German					1,200	60	1,200	60
Ciscoes—								
Fresh			122,830	$8,831	2,816,019	98,917	3,598,056	142,479
Salted					170,365	5,525	170,365	5,525
Smoked					250	25	28,415	4,758
Pike					936	96	1,286	147
Pike perch (wall-eyed)					13,490	2,410	15,815	2,811
Sturgeon							325	162
Sturgeon caviar							170	85
Suckers					76,231	4,374	172,335	8,902
Trout, lake	114,642	$15,198	345,285	51,649	2,804,432	380,904	5,833,411	769,769
Whitefish—								
Common					185,760	28,430	839,512	134,678
Menominee, fresh					22,545	1,728	58,354	4,627
Menominee, salted					5,640	235	5,640	235
Yellow perch					290,031	17,759	417,661	26,479
Oil			2,625	105	2,625	105	2,625	105
Total	114,642	15,198	470,740	60,585	6,397,124	540,898	11,152,890	1,101,154
Lines:								
Pike					260	21	260	21
Trout, lake	286,061	40,489	286,803	37,174	1,606,197	222,635	2,141,599	294,221
Total	286,061	40,489	286,803	37,174	1,606,457	222,656	2,141,859	294,242
Grand total	400,703	55,687	757,543	97,759	8,003,581	763,554	13,294,749	1,395,396

Yield of the shore fisheries of Lake Michigan in 1922, by States, counties, apparatus, and species

Apparatus and species	Michigan							
	Allegan		Antrim		Benzie		Berrien	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets and trap nets:								
Buffalofish	60	$4					62	$4
Carp, German							502	20
Catfish and bullheads	160	16						
Ciscoes, fresh			4,100	$164			121,692	4,867
Pike perch (wall-eyed) or yellow pike	1,400	210					308	46
Sturgeon							454	226
Sturgeon caviar							25	75
Suckers, fresh	1,350	54					640	32
Trout, lake			800	105				
Whitefish, common	320	64	3,665	531			3,810	760
Yellow perch	190	11					1,570	94
Total	3,480	359	8,565	800			129,063	6,124
Gill nets:								
Burbot	1,600	48					200	10
Carp, German	1,000	30						
Ciscoes, fresh	7,580	303	3,625	135			6,050	242
Pike perch (wall-eyed) or yellow pike	1,300	195						
Sturgeon							1,635	820
Suckers	5,050	202			2,300	$138	2,330	140
Trout, lake	625	90	2,540	305	16,085	2,252	11,922	1,792
Whitefish, common	7,800	1,560	1,760	264	2,180	392	18,894	3,779
Whitefish, Menominee			30	4				
Yellow perch	1,270	76			600	48	5,718	344
Total	26,225	2,504	7,955	708	21,165	2,830	46,749	7,127
Grand total	29,705	2,863	16,520	1,508	21,165	2,830	175,812	13,251

Yield of the shore fisheries of Lake Michigan in 1922, by States, counties, apparatus and species—Continued

Apparatus and species	Michigan—Continued							
	Charlevoix		Delta		Emmet		Grand Traverse	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets and trap nets:								
Carp, German			235	$5			750	$28
Catfish and bullheads			971	41				
Ciscoes, fresh			11,103	324				
Pike			9,323	1,305			400	60
Pike perch (wall-eyed) or yellow pike			15,143	2,127				
Sturgeon			890	347				
Sturgeon caviar			8	12				
Suckers, fresh			175,911	7,283			37,606	3,008
Trout, lake	37,541	$4,505	288	32	34,000	$4,080	29,989	3,517
Whitefish, common	13,590	1,912	30,797	5,866	18,000	2,700	51,464	7,637
Whitefish, Menominee, fresh			2,230	111			1,424	142
Yellow perch			24,080	1,499			2,000	135
Total	51,131	6,417	270,988	18,952	52,000	6,780	136,993	15,061
Gill nets:								
Burbot					400	20		
Carp, German			60	2				
Catfish and bullheads			1,589	112				
Ciscoes, fresh	3,975	278	22,555	678	1,563	129	1,250	112
Pike			2,760	413				
Pike perch (wall-eyed) or yellow pike			1,168	176				
Suckers			97,050	4,704	130	5	900	72
Trout, lake	26,817	3,135	4,210	605	65,050	8,380	2,090	242
Whitefish, common	5,700	855	44,500	8,880	2,562	560	900	156
Whitefish, Menominee	1,100	105	8,960	448	800	56		
Yellow perch	21,600	1,296	51,850	3,111	1,990	254	450	43
Total	59,192	5,669	234,702	19,120	72,495	9,413	5,590	625
Fyke nets:								
Burbot			1,400	28				
Carp, German			1,950	56				
Catfish and bullheads			700	42				
Ciscoes			6,725	202				
Pike			4,770	715				
Pike perch (wall-eyed) or yellow pike			37,325	5,599				
Sturgeon			111	55				
Suckers			118,800	4,549				
Trout, lake			100	12				
Whitefish, common			1,050	210				
Whitefish, Menominee			200	10				
Yellow perch			9,575	574				
Total			182,706	12,052				
Lines: Trout							1,869	224
Grand total	110,323	12,086	688,396	50,133	124,495	16,193	144,452	15,910

Yield of the shore fisheries of Lake Michigan in 1922, by States, counties, apparatus, and species—Continued

Apparatus and species	Michigan—Continued							
	Leelanau		Mackinac		Manistee		Mason	
Pound nets and trap nets:	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Burbot							100	$2
Ciscoes, fresh	100	$3			6,299	$252	17,000	510
Pike	70	10	100	$15				
Pike perch (wall-eyed) or yellow pike							6,084	912
Sturgeon			1,787	705				
Sturgeon caviar			395	106				
Suckers, fresh	11,284	903	1,800	108	9,057	543	16,060	963
Trout, lake	5,677	681	23,786	2,853			400	60
Whitefish, common	10,940	2,078	233,202	42,985	1,461	292	100	15
Whitefish, Menominee, fresh	208	20	2,381	208	50	5	300	24
Yellow perch	1,152	91	300	18	330	19	100	6
Total	29,431	3,786	263,751	46,998	17,197	1,111	40,144	2,492
Gill nets:								
Ciscoes, fresh	7,055	316	400	12	150	5		
Pike perch (wall-eyed) or yellow pike					220	33	500	75
Sturgeon			600	315				
Sturgeon caviar			72	36				
Suckers			6,543	393	3,060	184	1,000	60
Trout, lake	17,775	2,133	3,764	452	350	43		
Whitefish, common	2,420	435	1,775	354				
Whitefish, Menominee	1,450	130	16,953	1,131				
Yellow perch	4,026	271	25	2	230	13		
Total	32,726	3,285	30,132	2,695	4,010	278	1,500	135
Lines: Trout	3,574	429						
Grand total	65,731	7,500	293,883	49,693	21,207	1,389	41,644	2,627

Apparatus and species	Michigan—Continued							
	Menominee		Muskegon		Oceana		Ottawa	
Pound nets and trap nets:	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Burbot	400	$4	720	$36			140	$5
Carp, German	100	4	100	2			400	8
Catfish and bullheads							245	16
Ciscoes, fresh	111,137	2,146					960	38
Ciscoes, salted	13,680	399						
Pike			1,391	209			475	71
Pike perch (wall-eyed) or yellow pike	350	40	690	103			2,435	365
Sheepshead or drum							500	25
Sturgeon	81	23					300	125
Suckers, fresh	650	14	1,155	46			2,770	139
Trout, lake	3,925	459	500	75			3,465	416
Whitefish, common	462	55	21,174	4,234			22,610	4,522
Whitefish, Menominee, fresh	25	2						
Yellow perch	800	34	1,300	78			1,800	108
Total	131,610	3,180	27,030	4,783			36,100	5,838
Gill nets:								
Ciscoes, fresh	21,700	556	27,276	1,105			27,000	830
Pike			600	90				
Pike perch (wall-eyed) or yellow pike			1,325	206				
Sheepshead or drum			60	2				
Sturgeon			650	325				
Suckers	7,013	517	1,530	80			1,300	55
Trout, lake	3,100	315	3,531	530	100	$12	300	45
Whitefish, common			26,824	4,497	1,600	320	2,950	590
Whitefish, Menominee	200	18	100	8			200	16
Yellow perch	900	65	4,080	245			1,650	112
Total	32,913	1,471	65,976	7,088	1,700	332	33,400	1,648
Fyke nets:								
Suckers	100	4						
Yellow perch	100	6						
Total	200	10						
Grand total	164,723	4,661	93,006	11,871	1,700	332	69,500	7,486

Yield of the shore fisheries of Lake Michigan in 1922, by States, counties, apparatus, and species—Continued

Apparatus and species	Michigan—Continued					
	Schoolcraft		Van Buren		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets and trap nets:						
Buffalofish					122	$8
Burbot					1,360	47
Carp, German					2,087	67
Catfish and bullheads					1,376	73
Ciscoes, fresh					285,751	8,838
Ciscoes, salted					13,680	399
Pike	88	$12			11,847	1,682
Pike perch (wall-eyed) or yellow pike	469	75			26,879	3,878
Sheepshead or drum					500	25
Sturgeon	210	74			3,722	1,500
Sturgeon caviar					428	193
Suckers, fresh	7,813	225			266,096	13,318
Trout, lake	43,346	6,068			183,717	22,851
Whitefish, common	62,951	12,590			474,546	86,241
Whitefish, Menominee, fresh					6,618	512
Yellow perch					33,631	2,003
Total	114,877	19,044			1,312,360	141,725
Gill nets:						
Burbot					2,200	78
Carp, German					1,060	32
Catfish and bullheads					1,589	112
Ciscoes, fresh	25	1			130,204	4,702
Pike					3,360	503
Pike perch (wall-eyed) or yellow pike					4,513	685
Sheepshead or drum					60	2
Sturgeon					2,885	1,460
Sturgeon caviar					72	36
Suckers	586	33			128,792	6,583
Trout, lake					158,259	20,340
Whitefish, common	1,468	294			121,333	22,936
Whitefish, Menominee	3,305	330			33,098	2,246
Yellow perch	25	1	1,700	$170	96,114	6,051
Total	5,409	659	1,700	170	683,539	65,766
Fyke nets:						
Burbot					1,400	28
Carp, German					1,950	56
Catfish and bullheads					700	42
Ciscoes					6,725	202
Pike					4,770	715
Pike perch (wall-eyed) or yellow pike					37,325	5,599
Sturgeon					111	55
Suckers					118,900	4,553
Trout, lake					100	12
Whitefish, common					1,050	210
Whitefish, Menominee					200	10
Yellow perch					9,675	580
Total					182,906	12,062
Lines: Trout					5,443	653
Grand total	120,286	19,703	1,700	170	2,184,248	220,206

Yield of the shore fisheries of Lake Michigan in 1922, by States, counties, apparatus, and species—Continued

Apparatus and species	Indiana							
	Lake		Laporte		Porter		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets and trap nets:								
Buffalofish	100	$5	620	$34	50	$3	770	$42
Burbot	300	6	120	12			420	18
Carp, German	100	5	5,100	203	150	12	5,350	220
Ciscoes, fresh	40,000	1,600	22,000	1,500	59,000	2,950	121,000	6,050
Pike			25	3			25	3
Pike perch (wall-eyed) or yellow pike			150	37			150	37
Steelhead	500	100	115	23	3,050	610	3,665	733
Sturgeon	500	250	620	61	840	33	1,960	344
Suckers, fresh	100	5	550	34	125	6	775	45
Trout, lake	2,500	250	70	17	3,300	330	5,870	597
Whitefish, common	1,000	160	6,000	1,290	3,700	592	10,700	2,042
Yellow perch	1,000	50	5,000	800	1,100	55	7,100	905
Total	46,100	2,431	40,370	4,014	71,315	4,591	157,785	11,036
Gill nets:								
Ciscoes, fresh	18,000	900	4,800	384	2,800	140	25,600	1,424
Steelhead	7,500	1,500					7,500	1,500
Sturgeon			200	60			200	60
Suckers			200	20			200	20
Trout, lake	500	60					500	60
Whitefish, common	100	18					100	18
Yellow perch	1,500	150	2,800	281	1,100	55	5,400	486
Total	27,600	2,628	8,000	745	3,900	195	39,500	3,568
Grand total	73,700	5,059	48,370	4,759	75,215	4,786	197,285	14,604

Apparatus and species	Illinois					
	Cook		Lake		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Gill nets:						
Ciscoes, fresh	49,000	$4,840	3,000	$180	52,000	$5,020
Ciscoes, smoked			1,000	160	1,000	160
Trout, lake	10,300	1,230	500	80	10,800	1,310
Yellow perch	10,300	1,302	3,000	300	13,300	1,602
Grand total	69,600	7,372	7,500	720	77,100	8,092

Yield of the shore fisheries of Lake Michigan in 1922, by States, counties, apparatus, and species—Continued

Apparatus and species	Wisconsin							
	Brown		Door		Kenosha		Kewaunee	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets and trap nets:								
Ciscoes, fresh	42,000	$840	118,800	$3,562				
Ciscoes, salted			974,280	26,158				
Pike			200	20				
Pike perch (wall-eyed) or yellow pike	2,200	330	100	15				
Suckers, fresh			4,247	147				
Suckers, salted			5,760	147				
Trout, lake			37,167	4,475				
Trout, lake, salted			120	5				
Whitefish, common			18,818	2,627				
Whitefish, Menominee, fresh			5,093	252				
Whitefish, Menominee, salted			8,840	442				
Yellow perch	14,000	980	3,728	305				
Total	58,200	2,150	1,177,153	38,155				
Gill nets:								
Carp, German			65,000	5,200			116,544	$5,827
Catfish and bullheads	5,000	500						
Ciscoes, fresh	127,280	3,202	52,618	1,921			77,363	2,279
Pike	740	87	56	6				
Pike perch (wall-eyed) or yellow pike	7,516	1,547	300	90			140	32
Suckers	90,676	7,003	17,200	1,374			12,949	1,136
Trout, lake			50,570	8,600			1,000	150
Whitefish, common	150	45	49,947	10,190				
Whitefish, Menominee			2,000	140				
Yellow perch	17,690	1,152	219,483	20,814			2,934	266
Total	249,052	13,536	457,174	48,335			210,930	9,690
Fyke nets:								
Burbot	1,141	16						
Carp, German	31,736	846						
Catfish and bullheads	119,669	5,099						
Ciscoes	600	17						
Pike	14,458	1,335						
Pike perch (wall-eyed) or yellow pike	23,000	3,523						
Sheepshead or drum	2,262	47						
Suckers	170,204	6,674						
White bass	1,005	38						
Yellow perch	194,126	10,850						
Total	558,201	28,445						
Seines (haul):								
Carp, German	449,652	9,745						
Catfish and bullheads	4,600	270						
Pike	50	4						
Pike perch (wall-eyed) or yellow pike	5,020	903						
Sheepshead or drum	1,650	33						
Suckers	13,240	1,005						
Total	474,212	11,960						
Lines:								
Trout			9,314	1,213				
Yellow perch					1,000	$200		
Total			9,314	1,213	1,000	200		
Crawfish pots: Crawfish	68,764	2,446						
Grand total	1,408,429	58,537	1,643,641	87,703	1,000	200	210,930	9,690

Yield of the shore fisheries of Lake Michigan in 1922, by States, counties, apparatus, and species—Continued

Apparatus and species	Wisconsin—Continued									
	Manitowoc		Marinette		Milwaukee		Oconto		Ozaukee	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets and trap nets:										
Carp, German	550	$34					100	$4	200	$10
Ciscoes, fresh	72,000	2,520	21,000	$600	329	$14	311,000	8,480	10,000	300
Ciscoes, salted			5,060	154			120,720	3,522		
Ciscoes, smoked									9,000	1,080
Pike							1,500	150		
Pike perch (wall-eyed) or yellow pike			500	75			1,200	190		
Suckers, fresh	16,000	470	450	18	50	3	11,200	812	1,850	111
Trout, lake	139,950	21,000	3,800	380			450	45	4,000	720
Whitefish, common	11,583	1,474	6,800	1,021			200	36	5,055	1,110
Whitefish, Menominee, fresh									200	30
Yellow perch	100	10	1,200	52	590	35	20,000	1,190	260	16
Total	240,183	25,508	38,810	2,300	969	52	466,370	14,429	30,565	3,377
Gill nets:										
Ciscoes, fresh	1,500	90	195,500	5,790			43,200	1,186		
Ciscoes, salted							6,000	175		
Pike							200	30		
Pike perch (wall-eyed) or yellow pike							150	22		
Suckers			196,200	15,696			171,500	13,760		
Trout, lake	1,000	60	8,500	850						
Whitefish, common	120	22	2,500	375						
Whitefish, Menominee	800	120					800	40		
Yellow perch	3,400	350	27,000	2,700			13,000	910		
Total	6,820	642	429,700	25,411			234,850	16,123		
Fyke nets:										
Carp, German	1,968	106	3,500	95			2,630	80		
Catfish and bullheads			2,500	250			11,195	1,054		
Ciscoes	280	17								
Pike	174	28	1,450	145			6,012	545		
Pike perch (wall-eyed) or yellow pike			360	54			5,780	1,094		
Suckers	36,777	2,207	4,000	149			37,300	1,998		
Yellow perch	2,794	287	10,150	305			123,500	6,310		
Total	41,993	2,645	22,860	998			186,417	11,081		
Seines (haul):										
Carp, German							70,000	2,800		
Catfish and bullheads							2,000	120		
Pike perch (wall-eyed) or yellow pike							2,000	300		
Suckers	1,500	75					30,000	2,400		
Yellow perch	500	25								
Total	2,000	100					104,000	5,620		
Crawfish pots: Crawfish							14,000	441		
Grand total	290,996	28,895	491,370	28,709	969	52	1,005,637	47,694	30,565	3,377

Yield of the shore fisheries of Lake Michigan in 1922, by States, counties, apparatus, and species—Continued

Apparatus and species	Wisconsin—Continued						Grand total	
	Racine		Sheboygan		Total			
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets and trap nets:								
Buffalofish							892	$50
Burbot							1,780	65
Carp, German					850	$48	8,287	335
Catfish and bullheads							1,376	73
Ciscoes, fresh			141,707	$2,888	716,836	19,204	1,123,587	34,092
Ciscoes, salted					1,100,060	29,834	1,113,740	30,233
Ciscoes, smoked					9,000	1,080	9,000	1,080
Pike					1,700	170	13,572	1,855
Pike perch (wall-eyed) or yellow pike					4,000	610	31,029	4,525
Sheepshead or drum							500	25
Steelhead							3,665	733
Sturgeon							5,682	1,844
Sturgeon caviar							428	193
Suckers, fresh			1,566	63	35,363	1,624	302,234	14,987
Suckers, salted					5,760	147	5,760	147
Trout, lake			140,135	24,495	325,502	51,115	515,089	74,563
Trout, lake, salted					120	5	120	5
Whitefish, common			4,635	910	47,091	7,178	532,337	95,461
Whitefish, Menominee, fresh					5,293	282	11,911	794
Whitefish, Menominee, salted					8,840	442	8,840	442
Yellow perch			1,162	105	41,040	2,693	81,771	5,691
Total			289,205	28,461	2,301,455	114,432	3,771,600	267,193
Gill nets:								
Burbot							2,200	78
Carp, German					181,544	11,027	182,604	11,059
Catfish and bullheads					5,000	500	6,589	612
Ciscoes, fresh	500	$40			497,961	14,508	705,765	25,654
Ciscoes, salted					6,000	175	6,000	175
Ciscoes, smoked							1,000	160
Pike					996	123	4,356	626
Pike perch (wall-eyed) or yellow pike					8,106	1,691	12,619	2,376
Sheepshead or drum							60	2
Steelhead							7,500	1,500
Sturgeon							3,085	1,520
Sturgeon caviar							72	36
Suckers			3,000	150	491,525	39,119	620,517	45,722
Trout, lake					61,070	9,660	230,629	31,370
Whitefish, common					52,717	10,632	174,150	33,586
Whitefish, Menominee					3,600	300	36,698	2,546
Yellow perch	3,270	450	2,000	240	288,777	26,882	403,591	35,021
Total	3,770	490	5,000	390	1,597,296	114,617	2,397,435	192,043
Fyke nets:								
Burbot					1,141	16	2,541	44
Carp, German					39,834	1,127	41,784	1,183
Catfish and bullheads					133,364	6,403	134,064	6,445
Ciscoes					880	34	7,605	236
Pike					22,094	2,053	26,864	2,768
Pike perch (wall-eyed) or yellow pike					29,140	4,671	66,465	10,270
Sheepshead or drum					2,262	47	2,262	47
Sturgeon							111	55
Suckers					249,181	11,028	368,081	15,581
Trout, lake							100	12
White bass					1,005	38	1,005	38
Whitefish, common							1,050	210
Whitefish, Menominee							200	10
Yellow perch					330,570	17,752	340,245	18,332
Total					809,471	43,169	992,377	55,231
Seines (haul):								
Carp, German			500	40	520,152	12,585	520,152	12,585
Catfish and bullheads					6,600	390	6,600	390
Pike					50	4	50	4
Pike perch (wall-eyed) or yellow pike					7,020	1,203	7,020	1,203
Sheepshead or drum					1,650	33	1,650	33
Suckers			6,000	300	50,740	3,780	50,740	3,780
Yellow perch					500	25	500	25
Total			6,500	340	586,712	18,020	586,712	18,020
Lines:								
Trout					9,314	1,213	14,757	1,866
Yellow perch					1,000	200	1,000	200
Total					10,314	1,413	15,757	2,066
Crawfish pots: Crawfish					82,764	2,887	82,764	2,887
Grand total	3,770	490	300,705	29,191	5,388,012	294,538	7,846,645	537,440

MUSSEL FISHERIES OF RIVERS TRIBUTARY TO LAKE MICHIGAN

In 1922 the mussel fisheries of rivers tributary to Lake Michigan were found to be of sufficient importance to be canvassed in connection with the Great Lakes canvass. Though not formerly canvassed with the Great Lakes, earlier statistics on certain of the rivers are available as the result of a special mussel canvass for the year 1913. In order to avoid confusion in comparisons, the statistics of the mussel fishery have been omitted from the foregoing treatment of the fisheries of Lake Michigan and are shown in the following table:

Persons engaged, investment, and products in the mussel fisheries of rivers tributary to Lake Michigan in 1922, by apparatus, States, and counties

Items	St. Joseph River					
	Michigan					
	Berrien		St. Joseph		Total	
	Number	*Value*	*Number*	*Value*	*Number*	*Value*
PERSONS ENGAGED						
Fishermen	44		56		100	
Shoresmen	26		12		38	
Total	70		68		138	
INVESTMENT						
Rowboats	22	$230	56	$340	78	$570
Power boats	23	3,450	20	3,000	43	6,450
Crowfoot bars (pairs)	44	660	7	105	51	765
Picks			54	54	54	54
Shore and accessory property		12,726		2,450		15,176
Total		17,066		5,949		23,015
PRODUCTS						
By crowfoot bars:	*Pounds*		*Pounds*		*Pounds*	
Mussel shells	536,000	12,255	90,000	3,270	626,000	15,525
Pearls		1,310		460		1,770
Slugs		1,070		50		1,120
By picks:						
Mussel shells			740,000	25,600	740,000	25,600
Pearls				3,200		3,200
Slugs				560		560
Total, all apparatus:						
Mussel shells	536,000	12,255	830,000	28,870	1,366,000	41,126
Pearls		1,310		3,660		4,970
Slugs		1,070		610		1,680

NOTE.—The mussel fisheries on the above rivers have not previously been shown with Great Lakes statistics, but those of some of them were shown in an independent mussel canvass for the year 1913.

Persons engaged, investment, and products in the mussel fisheries of rivers tributary to Lake Michigan in 1922, by apparatus, States, and counties—Continued

Items	St. Joseph River—Continued							
	Indiana						Total	
	Elkhart		St. Joseph		Total			
PERSONS ENGAGED	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Fishermen	8		6		14		114	
Shoresmen							38	
Total	8		6		14		152	
INVESTMENT								
Rowboats	3	$35	2	$30	5	$65	83	$635
Power boats	5	750	4	600	9	1,350	52	7,800
Crowfoot bars (pairs)	8	120	6	90	14	210	65	975
Picks							54	54
Shore and accessory property		500		450		950		16,126
Total		1,405		1,170		2,575		25,590
PRODUCTS								
By crowfoot bars:	*Pounds*		*Pounds*		*Pounds*		*Pounds*	
Mussel shells	108,000	3,330	117,000	3,465	225,000	6,795	851,000	22,320
Pearls		190		180		370		2,140
Slugs		350		400		750		1,870
By picks:								
Mussel shells							740,000	25,600
Pearls								3,200
Slugs								560
Total, all apparatus:								
Mussel shells	108,000	3,330	117,000	3,465	225,000	6,795	1,591,000	47,920
Pearls		190		180		370		5,340
Slugs		350		400		750		2,430

Items	Grand River						Kalamazoo River: Michigan, Allegan	
	Michigan				Total			
	Ionia		Kent					
PERSONS ENGAGED	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Fishermen	150		150		300		4	
Shoresmen			13		13			
Total	150		163		313		4	
INVESTMENT								
Rowboats	129	$1,290	129	$1,290	258	$2,580	2	$20
Power boats	21	3,318	21	3,318	42	6,636	2	300
Crowfoot bars (pairs)	120	1,800	120	1,800	240	3,600	4	60
Picks	75	75	75	75	150	150		
Shore and accessory property		15,375		27,775		43,150		1,150
Total		21,858		34,258		56,116		1,530
PRODUCTS								
By crowfoot bars:	*Pounds*		*Pounds*		*Pounds*		*Pounds*	
Mussel shells	1,200,000	49,800	1,200,000	49,800	2,400,000	99,600	80,000	3,600
Pearls		600		600		1,200		25
Slugs		900		900		1,800		75
By picks:								
Mussel shells	300,000	12,450	300,000	12,450	600,000	24,900		
Pearls		375		75		450		
Slugs				300		300		
Total, all apparatus:								
Mussel shells	1,500,000	62,250	1,500,000	62,250	3,000,000	124,500	80,000	3,600
Pearls		975		675		1,650		25
Slugs		900		1,200		2,100		75

NOTE.—The mussel fisheries on the above rivers have not previously been shown with Great Lakes statistics, but those of some of them were shown in an independent mussel canvass for the year 1913.

Persons engaged, investment, and products in the mussel fisheries of rivers tributary to Lake Michigan in 1922, by apparatus, States, and counties—Continued

Items	Maple River: Michigan, Ionia		Muskegon River: Michigan, Newaygo		Pigeon River					
					Michigan, St. Joseph		Indiana, La Grange		Total	
PERSONS ENGAGED	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Fishermen	4		7		2		3		5	
INVESTMENT										
Rowboats	4	$40	5	$50	2	$10	3	$30	5	$40
Power boats			2	300						
Forks	4	12								
Picks	4	4	7	7	2	2			2	2
Shore and accessory property		400		700		100		60		160
Total		456		1,057		112		90		202
PRODUCTS	*Pounds*		*Pounds*		*Pounds*		*Pounds*		*Pounds*	
By forks:										
Mussel shells	35,000	1,200								
Pearls		100								
Slugs		200								
By picks:										
Mussel shells	35,000	1,200	150,000	6,500	20,000	140			20,000	140
Pearls		100		75		60				60
Slugs		200		300		40				40
By hand:										
Mussel shells							10,000	300	10,000	300
Slugs								12		12
Total, all apparatus:										
Mussel shells	70,000	2,400	150,000	6,500	20,000	140	10,000	300	30,000	440
Pearls		200		75		60				60
Slugs		400		300		40		12		52

Items	Thornapple River: Michigan, Kent		Wolf River: Wisconsin, Waupaca		Grand total	
PERSONS ENGAGED	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Fishermen	3		2		439	
Shoresmen					51	
Total	3		2		490	
INVESTMENT						
Rowboats	3	$30	2	$20	362	$3,415
Power boats			1	175	99	15,211
Crowfoot bars (pairs)			2	30	311	4,665
Forks			2	6	6	18
Picks	3	3			220	220
Shore and accessory property		75		197		61,958
Total		108		428		85,487
PRODUCTS	*Pounds*		*Pounds*		*Pounds*	
By crowfoot bars:						
Mussel shells			20,000	336	3,351,000	125,856
Pearls				20		3,385
Slugs				12		3,757
By forks:						
Mussel shells			5,805	72	40,805	1,272
Pearls				6		106
Slugs						200
By picks:						
Mussel shells	40,000	1,800			1,585,000	60,140
Pearls		20				3,905
Slugs		80				1,480
By hand:						
Mussel shells					10,000	300
Slugs						12
Total, all apparatus:						
Mussel shells	40,000	1,800	25,805	408	4,986,805	187,568
Pearls		20		26		7,396
Slugs		80		12		5,449

NOTE.—The mussel fisheries on the above rivers have not previously been shown with Great Lakes statistics, but those of some of them were shown in an independent mussel canvass for the year 1913.

WHOLESALE FISHERY TRADE

In 1922 the wholesale fishery trade of Lake Michigan was carried on by 59 establishments, which employed 615 persons; paid $1,023,224 in wages; had $1,547,805 invested in property; and used $827,952 of cash capital to carry on the business. Compared with 1917 there was a material decrease in the number of establishments and number of persons employed and an increase in all phases of the investment. The detailed statistics are shown in the following table:

Wholesale fishery trade of Lake Michigan

Cities and towns	State	Number of firms	Persons engaged	Wages paid	Shore and accessory property	Cash capital
Chicago [1]	Illinois	22	416	$837,104	$990,397	$519,000
Milwaukee and Kenosha	Wisconsin	4	19	25,200	241,900	33,000
Sheboygan, Cedar Grove, and Port Washington.	do	5	21	11,900	17,140	18,000
Two Rivers, Manitowoc, and Sturgeon Bay.	do	5	14	9,397	38,250	17,000
Green Bay and Big Suamico	do	7	69	74,077	133,832	90,000
Marinette and Oconto	do	5	25	7,250	20,476	14,895
Menominee, Escanaba, and Fairport	Michigan	4	20	25,196	41,410	72,300
Charlevoix and Ludington	do	4	15	20,400	38,300	24,500
St. Joseph and Grand Haven	do	3	16	12,700	26,100	39,257
Total		59	615	1,023,224	1,547,805	827,952

[1] Includes two firms at Michigan City, Ind.

FISHERIES OF LAKE HURON

Lake Huron ranks third in importance among the Great Lakes. Reference to previous statistics indicates that her fisheries have suffered a lesser diminution than those of the other lakes, with the possible exception of Lake Erie.

In 1922 there were 1,001 persons engaged in the fisheries of Lake Huron, 131 of them on vessels fishing, 705 in the shore and boat fisheries, and 165 employed as shoresmen and on transporting vessels. The total investment in the fisheries amounted to $1,648,767, of which $280,540 was invested in vessels and boats, $534,339 in gear, and $833,888 in shore and accessory property and cash capital. There were 29 fishing vessels over 5 tons net, 18 of them operated by steam and 11 by gasoline. Their fishing gear consisted of 4,043 gill nets, valued at $78,885, and lines valued at $7,275. There were 472 sail, power, and row boats engaged in the shore fishery. These operated 1,474 pound nets, 2,960 gill nets, 425 fyke nets, 75 haul seines, and a small number of lines.

The products of Lake Huron in 1922 aggregated 13,942,115 pounds, valued at $945,259. The more important species were ciscoes, 5,496,463 pounds, valued at $153,613; lake trout, 2,108,249 pounds, valued at $215,501; common whitefish, 1,300,621 pounds, valued at $199,503; pike perch, 1,260,374 pounds, valued at $171,102; suckers, 1,889,129 pounds, valued at $104,204; and yellow perch, 633,188 pounds, valued at $47,138.

FISHERIES BY COUNTIES

The number of persons engaged, investment, and quantity and value of products of the fisheries of Lake Huron in 1922 are shown by counties in the following tables:

Statistics of the fisheries of Lake Huron in 1922, by counties

PERSONS ENGAGED

Counties	On vessels fishing	On vessels transporting	In shore or boat fisheries	Shoresmen	Total
Alcona			15		15
Alpena	60		39	23	122
Arenac			39		39
Bay			149	57	206
Cheboygan	17	9	50	4	80
Chippewa	6		26	3	35
Huron	17		232	29	278
Iosco	14		36	17	67
Mackinac			46	8	54
Presque Isle	13		13	8	34
St. Clair	4		21	7	32
Sanilac			25		25
Tuscola			14		14
Total	131	9	705	156	1,001

INVESTMENT

Items	Alcona		Alpena		Arenac		Bay		Cheboygan	
Vessels fishing:	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Steam			10	$55,000						
Tonnage			294							
Outfit				15,350						
Gasoline									7	$5,900
Tonnage									57	
Outfit										835
Vessels transporting:										
Gasoline[1]			2	2,000					12	24,950
Tonnage			15						103	
Outfit				200						1,865
Sail and row boats	4	$145	13	475	16	$1,625	36	$2,755	21	880
Power boats	5	1,450	14	8,950	14	3,050	44	16,275	19	6,950
Apparatus, vessel fisheries:										
Gill nets			2,123	53,405					324	4,340
Lines				4,800						50
Apparatus, shore fisheries:										
Pound nets and trap nets	8	1,500	178	52,740	38	5,200	114	29,480	409	36,600
Gill nets	130	1,295	71	1,345			61	610	406	6,816
Fyke nets					33	1,600	94	5,340	32	950
Seines (haul)					14	4,000	25	7,460		
Shore and accessory property		625		67,525		3,900		107,050		88,324
Cash capital				15,000				71,000		20,000
Total		5,015		270,790		20,275		239,960		198,460

Items	Chippewa		Huron		Iosco		Mackinac		Presque Isle	
Vessels fishing:	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Steam	2	$2,000	3	$21,500	2	$3,000				
Tonnage	20		77		45					
Outfit		110		4,730		4,000				
Gasoline					1	500			3	$3,000
Tonnage					7				25	
Outfit						250				1,300
Sail and row boats	11	415	59	2,605	12	790	34	$1,105	2	45
Power boats	13	5,150	76	45,475	15	10,450	15	3,775	5	4,200
Apparatus, vessel fisheries:										
Gill nets	130	1,300	200	3,000	436	6,540			680	8,800
Lines				1,975						450
Apparatus, shore fisheries:										
Pound nets and trap nets	45	6,620	311	175,050	84	25,825	198	18,700	30	1,500
Gill nets	404	4,040	519	6,068	459	6,885	228	1,345	283	3,295
Fyke nets			254	17,300	2	100				
Seines (haul)			31	5,590						
Lines		10		495				90		
Shore and accessory property		11,240		250,814		46,775		13,740		7,900
Cash capital		5,000		33,000		23,000		7,500		
Total		35,885		567,692		128,115		46,255		30,490

[1] Includes 1 steamer in Cheboygan County.

Statistics of the fisheries of Lake Huron in 1922, by counties—Continued

INVESTMENT—Continued

Items	St. Clair		Sanilac		Tuscola		Total	
	Number	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Vessels fishing:								
Steam	1	$3,000					18	$84,500
Tonnage	7						443	
Outfit		1,000						25,190
Gasoline							11	9,400
Tonnage							89	
Outfit								2,385
Vessels transporting:								
Gasoline [1]							14	26,950
Tonnage							118	
Outfit								2,065
Sail and row boats	7	300	6	$295	3	$300	224	11,825
Power boats	14	5,700	9	4,300	5	1,600	248	118,225
Apparatus, vessel fisheries:								
Gill nets	150	1,500					4,043	78,885
Lines								7,275
Apparatus, shore fisheries:								
Pound nets and trap nets	19	1,775	29	10,250	11	1,150	1,474	366,390
Gill nets	192	1,920	180	2,250	27	270	2,960	36,139
Fyke nets	10	1,000					425	26,290
Seines (haul)					5	1,250	75	18,290
Lines		475						1,070
Shore and accessory property		18,700		23,445		4,350		644,388
Cash capital		15,000						189,500
Total		50,370		40,540		8,920		1,648,767

YIELD, BY SPECIES

Species	Alcona		Alpena		Arenac		Bay	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Burbot	3,000	$60					30	$1
Carp, German	40	1	1,915	$127	89,465	$2,850	218,162	7,254
Catfish and bullheads					7,996	276	19,737	1,150
Ciscoes, fresh	207,762	5,462	597,821	29,197	39,858	708	359,422	5,431
Pike	300	15	175	18	3,591	231	9,709	897
Pike perch (wall-eyed, or yellow pike)	7,440	953	23,153	5,358	46,887	6,546	218,218	27,265
Sheepshead or drum					150	5	2,326	67
Sturgeon	60	17	255	114				
Suckers	15,576	563	87,429	4,212	142,230	4,106	747,209	23,387
Trout, lake	17,618	1,756	671,681	75,183			402	60
Whitefish:								
Common	14,944	1,937	376,503	67,525	13,302	1,763	7,296	1,209
Menominee, fresh	200	10	9,142	476				
Caviar			889	889				
Yellow perch	2,020	197	14,962	1,652	68,223	4,636	212,920	16,437
Total	268,960	10,971	1,783,925	184,751	411,771	21,121	1,795,431	83,158

Species	Cheboygan		Chippewa		Huron		Iosco	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Carp, German	126	$5	710	$42	700,867	$29,371	965	$81
Catfish and bullheads	16,529	1,146	200	12	18,671	1,814	20	1
Ciscoes:								
Fresh	58	2	5,128	233	408,217	13,242	581,766	6,258
Salted					2,641,500	60,790		
Pike	827	69	17,627	1,091	1,371	128	3,394	173
Pike perch (wall-eyed, or yellow pike)	8,660	1,623	9,606	1,899	605,281	76,105	256,157	39,267
Sheepshead or drum					14,744	539	115	5
Sturgeon			38	13	250	25	171	76
Sturgeon caviar							3	6
Suckers	299,623	48,730	93,005	4,024	244,466	6,447	115,095	5,438
Trout, lake	80,460	7,164	121,323	12,170	332,254	41,698	691,650	56,085
Whitefish:								
Common	138,762	19,260	20,479	3,117	202,862	31,328	268,182	30,027
Menominee, fresh	3,600	186	705	41			11,257	489
Caviar					400	120		
Yellow perch	8,897	836	16,921	1,072	177,219	13,089	29,190	1,811
Total	557,542	79,021	285,742	23,714	5,348,102	274,696	1,957,965	139,667

[1] Includes 1 steamer in Cheboygan County.

Statistics of the fisheries of Lake Huron in 1922, by counties—Continued

YIELD, BY SPECIES—Continued

Species	Mackinac		Presque Isle		St. Clair	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Burbot			45	$1		
Carp, German					301	$7
Catfish and bullheads					506	34
Ciscoes:						
Fresh	1,745	$52	251,758	17,504	5,902	191
Salted	840	23				
Pike	2,022	303	310	46		
Pike perch (wall-eyed, or yellow pike)	1,331	200	25	3	12,656	970
Sheepshead or drum					1,213	33
Sturgeon	376	177			466	173
Sturgeon caviar					16	20
Suckers	94,102	5,646	5,000	150	19,117	544
Trout, lake	45,924	5,670	61,948	6,219	60,630	6,198
Whitefish:						
Common	103,562	20,712	17,751	2,928	103,524	14,268
Menominee, fresh	4,516	452	609	54		
Menominee, salted	960	60				
Yellow perch	23,222	1,394	690	66	46,535	3,081
Total	278,600	34,689	338,136	26,971	250,866	25,519

Species	Sanilac		Tuscola		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Buffalofish	63	$3			63	$3
Burbot					3,075	62
Carp, German	847	23	51,718	$1,545	1,065,116	41,256
Catfish and bullheads	294	26	873	59	64,826	4,518
Ciscoes:						
Fresh	308,001	11,714	7,965	182	2,775,403	90,176
Salted	78,720	2,624			2,721,060	63,437
Pike	12	1	135	13	39,473	2,985
Pike perch (wall-eyed, or yellow pike)	53,736	8,385	17,224	2,528	1,260,374	171,102
Sheepshead or drum	27,275	722	937	29	46,760	1,400
Sturgeon	758	333			2,374	928
Sturgeon caviar	107	243			126	260
Suckers	7,126	231	19,142	726	1,889,129	104,204
Trout, lake	24,359	3,298			2,108,249	215,501
Whitefish:						
Common	33,386	5,428	8	1	1,300,621	199,503
Menominee, fresh					30,029	1,708
Menominee, salted					960	60
Caviar					1,289	1,009
Yellow perch	26,818	2,433	5,571	434	633,188	47,138
Total	561,502	35,464	103,573	5,517	13,942,115	945,259

FISHERIES BY APPARATUS

The vessel fisheries of Lake Huron in 1922 produced 2,617,201 pounds, valued at $250,588, and the shore and boat fisheries, 11,324,914 pounds, valued at $694,671. In the vessel fisheries most of the catch was made by gill nets and consisted chiefly of lake trout, ciscoes, and whitefish; the catch by lines consisted entirely of lake trout. In the shore fisheries the pound net was the chief form of apparatus, taking 8,724,330 pounds of fish, principally ciscoes, suckers, pike perch, and whitefish. The remainder of the catch was distributed among gill nets, seines, fyke nets, and lines, the first two named being the most important.

The following tables present in detail the products of the vessel and shore fisheries of Lake Huron by gear in 1922:

Yield of vessel fisheries of Lake Huron in 1922, by counties and apparatus

Apparatus and species	Alpena		Cheboygan		Chippewa		Huron	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Gill nets:								
Ciscoes	473,916	$23,112						
Pike perch (wall-eyed or yellow pike)			4,487	$736				
Suckers			2,000	100				
Trout, lake	437,095	49,171	23,244	2,103	19,560	$2,174	60,000	$8,500
Whitefish—								
Common	162,030	26,920	25,377	3,740	1,075	131	14,015	1,962
Menominee	3,440	179						
Yellow perch			1,728	116				
Total	1,076,481	99,382	56,836	6,795	20,635	2,305	74,015	10,462
Lines: Trout, lake	229,611	25,488	2,400	240			241,044	29,406
Grand total	1,306,092	124,870	59,236	7,035	20,635	2,305	315,059	39,868

Apparatus and species	Iosco		Presque Isle		St. Clair		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Gill nets:								
Ciscoes			173,098	$12,040	150	$4	647,164	$35,156
Pike perch (wall-eyed or yellow pike)	8,075	$734			643	67	13,205	1,537
Suckers	7,050	141					9,050	241
Trout, lake	518,175	39,888	30,833	3,103	27,341	2,494	1,116,248	107,433
Whitefish—								
Common	61,693	5,532	10,447	1,635	54,956	8,601	329,593	48,521
Menominee							3,440	179
Yellow perch					3,318	231	5,046	347
Total	594,993	46,295	214,378	16,778	86,408	11,397	2,123,746	193,414
Lines: Trout, lake			20,400	2,040			493,455	57,174
Grand total	594,993	46,295	234,778	18,818	86,408	11,397	2,617,201	250,588

Yield of the shore fisheries of Lake Huron in 1922, by counties and apparatus

Apparatus and species	Alcona		Alpena		Arenac		Bay	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets and trap nets:								
Burbot	3,000	$60					30	$1
Carp, German	40	1	1,915	$127	15,425	$469	76,810	2,373
Catfish and bullheads					1,274	52	7,607	430
Ciscoes, fresh	207,762	5,462	114,633	5,760	38,093	690	340,231	5,142
Pike	300	15	125	13	621	60	2,996	290
Pike perch (wall-eyed) or yellow pike	7,091	901	22,778	5,328	12,412	1,713	158,177	19,223
Sheepshead or drum					150	5	2,296	66
Sturgeon	60	17	255	114				
Suckers	14,815	536	87,229	4,205	43,368	1,231	560,173	17,282
Trout, lake			1,466	174			402	60
Whitefish—								
Common	9,231	1,082	212,535	40,332	13,362	1,763	7,161	1,189
Menominee	200	10						
Whitefish caviar			889	889				
Yellow perch	2,020	197	13,901	1,546	34,911	2,398	123,701	9,931
Total	244,519	8,281	455,726	58,488	159,616	8,381	1,279,584	55,987
Gill nets:								
Carp, German							400	12
Ciscoes, fresh			9,272	325				
Pike			50	5			128	13
Pike perch (wall-eyed) or yellow pike	349	52	375	30				
Suckers	701	27	200	7			3,908	117
Trout, lake	17,618	1,756	3,509	850				
Whitefish—								
Common	5,713	855	1,938	273				
Menominee, fresh			5,702	297				
Yellow perch			1,061	106			9,620	818
Total	24,441	2,690	22,107	1,393			14,056	960
Fyke nets:								
Carp, German					6,000	240	2,097	88
Catfish and bullheads					2,300	60	590	44
Ciscoes							100	2
Pike					600	48	676	63
Pike perch (wall-eyed) or yellow pike					633	113		
Suckers					7,757	164	47,413	2,222
Yellow perch					9,020	541	25,708	1,641
Total					26,310	1,166	76,584	4,000
Seines:								
Carp, German					68,040	2,141	138,855	4,781
Catfish and bullheads					4,422	164	11,540	676
Ciscoes					1,765	18	19,091	287
Pike					2,370	123	5,909	531
Pike perch (wall-eyed) or yellow pike					33,842	4,720	60,041	8,042
Sheepshead or drum							30	1
Suckers					91,114	2,711	135,715	3,766
Whitefish							135	20
Yellow perch					24,292	1,607	53,891	4,047
Total					225,845	11,574	425,207	22,151
Grand total	268,960	10,971	477,833	59,881	411,771	21,121	1,795,431	83,158

Yield of the shore fisheries of Lake Huron in 1922, by counties and apparatus—Con.

Apparatus and species	Cheboygan		Chippewa		Huron		Iosco	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets and trap nets:								
Carp, German	126	$5	710	$42	68,327	$2,944	965	$31
Catfish and bullheads	16,529	1,146	200	12	13,407	1,335	20	1
Ciscoes—								
Fresh			1,978	103	405,306	13,106	581,296	6,241
Salted					2,641,500	60,790		
Pike	763	64	17,127	1,056	35	3	426	25
Pike perch (wall-eyed) or yellow pike	2,812	675	9,606	1,899	556,990	67,540	245,827	38,076
Sheepshead or drum					14,088	514	115	5
Sturgeon			38	13	250	25	171	76
Sturgeon caviar							3	6
Suckers	272,585	47,639	90,347	3,917	175,098	3,501	107,341	5,263
Trout, lake	14,355	1,291	18,246	1,663	7,704	855	21,206	1,653
Whitefish—								
Common	98,860	13,838	17,635	2,721	175,752	26,998	171,342	20,462
Menominee	2,900	146	170	8			2,691	117
Whitefish caviar					400	120		
Yellow perch	3,568	420	16,768	1,060	131,307	9,344	29,029	1,800
Total	412,498	65,224	172,825	12,494	4,190,164	187,075	1,160,432	73,756
Gill nets:								
Carp, German					32	1		
Ciscoes, fresh	58	2	3,150	130	1,338	105	470	17
Pike					82	11	2,968	148
Pike perch (wall-eyed) or yellow pike	1,100	173			33,606	6,302	2,255	457
Suckers			2,658	107	2,443	88	616	31
Trout, lake	40,461	3,530	83,517	8,333	17,604	2,135	152,269	14,544
Whitefish—								
Common	14,525	1,682	1,769	265	11,060	2,062	35,147	4,033
Menominee, fresh	700	40	535	33			8,566	372
Yellow perch	2,100	202	153	12	20,299	1,590		
Total	58,944	5,629	91,782	8,880	86,464	12,294	202,291	19,602
Fyke nets:								
Carp, German					9,300	392		
Catfish and bullheads					5,264	479		
Ciscoes					1,573	31		
Pike	64	5			1,254	114		
Pike perch (wall-eyed) or yellow pike	261	39			14,685	2,263		
Suckers	25,038	991			46,842	2,201	88	3
Trout, lake					500	60		
Whitefish					2,035	306		
Yellow perch	1,501	98			25,363	2,130	161	11
Total	26,864	1,133			106,816	7,976	249	14
Seines:								
Carp, German					623,208	26,034		
Sheepshead or drum					656	25		
Suckers					20,083	657		
Total					643,947	26,716		
Lines:								
Pike			500	35				
Trout, lake					5,402	742		
Yellow perch					250	25		
Total			500	35	5,652	767		
Grand total	498,306	71,986	265,107	21,409	5,033,043	234,828	1,362,972	93,372

Yield of the shore fisheries of Lake Huron in 1922, by counties and apparatus—Con.

Apparatus and species	Mackinac		Presque Isle		St. Clair	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets and trap nets:						
Carp, German					132	$3
Catfish and bullheads					460	31
Ciscoes, fresh	1,745	$52			3,237	70
Pike	2,022	303	300	$45		
Pike perch (wall-eyed) or yellow pike	1,331	200			460	60
Sheepshead or drum					1,087	30
Sturgeon	376	177			196	68
Sturgeon caviar					16	20
Suckers	94,102	5,646	5,000	150	18,158	527
Trout, lake	25,077	3,133	1,150	120	980	98
Whitefish—						
Common	98,279	19,655	805	149	442	66
Menominee	300	30				
Yellow perch	17,956	1,078	600	60	2,765	144
Total	241,188	30,274	7,855	524	27,933	1,117
Gill nets:						
Burbot			45	1		
Ciscoes—						
Fresh			78,660	5,464	1,840	99
Salted	840	23				
Pike			10	1		
Pike perch (wall-eyed) or yellow pike			25	3	8,904	613
Trout, lake	18,480	2,253	9,565	958	19,717	2,178
Whitefish—						
Common	5,283	1,057	6,499	1,144	48,079	5,595
Menominee, fresh	4,216	422	609	54		
Menominee, salted	960	60				
Yellow perch	5,260	316	90	6	38,879	2,578
Total	35,045	4,131	95,503	7,629	117,419	11,063
Fyke nets:						
Carp, German					169	4
Catfish and bullheads					46	3
Ciscoes					675	18
Pike perch (wall-eyed) or yellow pike					2,649	230
Sheepshead or drum					126	3
Sturgeon					270	105
Suckers					959	17
Whitefish					47	6
Yellow perch					423	28
Total					5,364	414
Lines:						
Trout, lake	2,367	284			12,592	1,428
Yellow perch					1,150	100
Total	2,367	284			13,742	1,528
Grand total	278,600	34,689	103,358	8,153	164,458	14,122

Yield of the shore fisheries of Lake Huron in 1922, by counties and apparatus—Con.

Apparatus and species	Sanilac		Tuscola		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets and trap nets:						
Buffalofish	63	$3			63	$3
Burbot					3,030	61
Carp, German	847	23	37,659	$1,000	202,956	7,018
Catfish and bullheads	294	26	873	59	40,664	3,092
Ciscoes:—						
Fresh	204,541	8,103			1,898,822	44,729
Salted					2,641,500	60,790
Pike	12	1	110	10	24,837	1,885
Pike perch (wall-eyed) or yellow pike	31,475	4,955	10,333	1,450	1,059,292	142,020
Sheepshead or drum	17,828	470			35,564	1,090
Sturgeon	758	333			2,104	823
Sturgeon caviar	107	243			126	269
Suckers	7,126	231	11,179	407	1,486,521	90,535
Trout, lake	15,568	2,071			106,154	11,118
Whitefish:—						
Common	27,777	4,684			833,181	132,939
Menominee					6,261	311
Whitefish caviar					1,289	1,009
Yellow perch	2,300	200	3,140	188	381,966	28,366
Total	308,696	21,343	63,294	3,114	8,724,330	526,058
Gill nets:						
Burbot					45	1
Carp, German					432	13
Ciscoes:—						
Fresh	103,460	3,611			198,248	9,753
Salted	78,720	2,624			79,560	2,647
Pike					3,238	178
Pike perch (wall-eyed) or yellow pike	22,261	3,430	1,891	378	70,766	11,438
Sheepshead or drum	9,447	252			9,447	252
Suckers			963	39	11,549	416
Trout, lake	660	82			363,400	36,117
Whitefish:—						
Common	5,609	744	8	1	135,630	17,711
Menominee, fresh					20,328	1,218
Menominee, salted					960	60
Yellow perch	24,518	2,233	1,344	114	103,330	7,975
Total	244,675	12,976	4,206	532	996,933	87,779
Fyke nets:						
Carp, German					17,566	724
Catfish and bullheads					8,200	586
Ciscoes					2,348	51
Pike					2,594	230
Pike perch (wall-eyed) or yellow pike					18,228	2,645
Sheepshead or drum					126	3
Sturgeon					270	105
Suckers					128,097	5,598
Trout, lake					500	60
Whitefish					2,082	312
Yellow perch					62,176	4,449
Total					242,187	14,763
Seines:						
Carp, German			14,059	545	844,162	33,501
Catfish and bullheads					15,962	840
Ciscoes			7,965	182	28,821	487
Pike			25	3	8,304	657
Pike perch (wall-eyed) or yellow pike			5,000	700	98,883	13,462
Sheepshead or drum			937	29	1,623	55
Suckers			7,000	280	253,912	7,414
Whitefish					135	20
Yellow perch			1,087	132	79,270	5,876
Total			36,073	1,871	1,331,072	62,312
Lines:						
Pike					500	35
Trout, lake	8,131	1,145			28,492	3,599
Yellow perch					1,400	125
Total	8,131	1,145			30,392	3,759
Grand total	561,502	35,464	103,573	5,517	11,324,914	694,671

WHOLESALE FISHERY TRADE

In 1922 there were 20 establishments engaged in the wholesale fishery trade of Lake Huron. These employed 115 persons, paid out $107,118 in wages, had $357,688 invested in property, and used $189,500 cash capital to carry on their business. Compared with 1917 this is a decrease in the number of firms and the number of persons engaged and an increase in the investment. The following table shows the detailed statistics of this business.

Wholesale fishery trade of Lake Huron in 1922

Cities and towns	State	Number of firms	Persons engaged	Wages paid	Shore and accessory property	Cash capital
Bay City	Michigan	5	57	$58,765	$78,525	$71,000
Alpena, Oscoda, and East Tawas	do	3	19	15,000	23,675	38,000
Cheboygan, St. Ignace, and Detour	do	4	12	10,832	22,574	32,500
Bayport, Sebewaing, and Caseville	do	5	16	13,300	208,054	27,000
Port Huron and Port Austin	do	3	11	9,221	24,860	21,000
Total		20	115	107,118	357,688	189,500

FISHERIES OF LAKE ST. CLAIR AND ST. CLAIR RIVER

The fisheries of Lake St. Clair and St. Clair River in 1922 show increases as compared to 1917, although not approaching their former importance. There were 90 persons, 82 power and row boats, and $17,857 in investment utilized in the fisheries, which in 1922 produced 310,012 pounds of fish, valued at $17,365. Carp and pike perch were the most important species.

The following table shows, by counties, the number of persons engaged, investment, and quantity and value of the products of these fisheries in 1922:

Persons engaged, investment, and products (by apparatus) in the fisheries of Lake St. Clair and St. Clair River in 1922, by counties

Items	Macomb		St. Clair		Total	
PERSONS ENGAGED	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Fishermen	13		77		90	
INVESTMENT						
Rowboats	4	$170	48	$2,600	52	$2,770
Power boats	7	2,100	23	4,800	30	6,900
Seines (haul)	1	2,000	2	700	3	2,700
Hand lines		6		81		87
Shore and accessory property		1,500		3,900		5,400
Total		5,776		12,081		17,857
PRODUCTS	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Seines: Carp	200,000	$8,000	60,000	$2,400	260,000	$10,400
Hand lines:						
Black bass			2,000	200	2,000	200
Catfish	1,005	148			1,005	148
Pike	40	4	4,000	400	4,040	404
Pike perch (wall-eyed or yellow pike)	185	30	38,435	5,711	38,620	5,741
Sheepshead or drum	16	1			16	1
Sturgeon	166	42	65	19	231	61
Yellow perch	100	10	4,000	400	4,100	410
Total	1,512	235	48,500	6,730	50,012	6,965
Grand total	201,512	8,235	108,500	9,130	310,012	17,365

FISHERIES OF LAKE ERIE

In 1922 Lake Erie ranked first among the Great Lakes except in the number of persons engaged, in which respect Lake Michigan ranked first. Lake Erie is one of the lakes whose production has been fairly well maintained throughout the period covered by the available statistics. Certain of the important species show material decreases, principal among these being sturgeon, lake trout, and whitefish. It is evident that the total production has been maintained through the greater catch of formerly unimportant species.

In 1922 the fisheries of Lake Erie gave employment to 2,504 persons. Of these, 582 were on fishing vessels, 1,226 in the shore and boat fisheries, and 696 employed as shoresmen and on transporting vessels. The total investment in the fisheries and related industries amounted to $5,161,482, of which $950,359 was invested in vessels and boats, $917,466 in gear, and $3,293,657 in shore property and cash capital. There were 106 fishing vessels over 5 tons net, 69 of them operated by steam and 37 by gasoline, altogether carrying 36,555 gill nets valued at $260,999. In the shore fisheries there were 380 power boats and 555 rowboats operating 5,849 gill nets, valued at $36,995; 3,931 pound nets and trap nets, valued at $554,510; 752 fyke nets, valued at $35,190; 213 haul seines, valued at $29,685, and lines to the value of $87.

The products aggregated 55,079,128 pounds, valued at $2,944,204. Of this quantity, Ohio is credited with the greatest amount (37,342,813 pounds), followed, in order, by Pennsylvania, New York, and Michigan. The principal species were pike perch, all species, 22,357,996 pounds, valued at $1,285,399; ciscoes, 16,158,239 pounds, valued at $804,601; carp, 5,899,181 pounds, valued at $242,937; yellow perch, 2,969,332 pounds, valued at $177,492; and whitefish, 922,209 pounds, valued at $173,402.

FISHERIES BY STATES AND COUNTIES

The following tables show, by States and counties, the extent of the fisheries of Lake Erie in 1922:

Statistics of the fisheries of Lake Erie in 1922, by States and counties

PERSONS ENGAGED

State and county	On vessels fishing	On vessels transporting	In shore or boat fisheries	Shoresmen	Total
New York:					
Chatauqua	84		57	27	168
Erie	12		38	73	123
Total	96		95	100	291
Pennsylvania: Erie	249	2	33	195	479
Ohio:					
Ashtabula	46		57	25	128
Cuyahoga	55	2	45	69	171
Erie	112	10	269	140	531
Lake	18		71	12	101
Lorain	6		21	5	32
Lucas		1	119	21	141
Ottawa		11	337	25	373
Sandusky			26		26
Total	237	24	945	297	1,503
Michigan:					
Monroe			124	2	126
Wayne			29	76	[1] 105
Total			153	78	231
Grand total	582	26	1,226	670	2,504

[1] Includes persons engaged in the wholesale fish trade of Detroit.

Statistics of the fisheries of Lake Erie in 1922, by States and counties—Continued

INVESTMENT

State and county	Vessels fishing							
	Steam				Gasoline			
	Number	*Tonnage*	*Value*	*Outfit*	*Number*	*Tonnage*	*Value*	*Outfit*
New York								
Chautauqua	8	193	$57,500	$11,600	8	68	$21,500	$5,575
Erie	1	15	7,500	1,400	1	20	3,000	1,000
Total	9	208	65,000	13,000	9	88	24,500	6,575
Pennsylvania: Erie	34	850	229,000	57,874	10	120	28,000	7,607
Ohio:								
Ashtabula	6	100	41,500	4,775	2	15	3,000	650
Cuyahoga	7	167	40,100	14,042	3	20	4,400	1,250
Erie	11	224	49,500	10,415	10	211	48,000	10,115
Lake	1	9	3,000	900	3	19	6,000	4,200
Lorain	1	34	10,000	1,500				
Total	26	543	144,100	31,632	18	265	61,400	16,215
Grand total	69	1,601	438,100	102,506	37	473	113,900	30,397

State and county	Vessels transporting								Rowboats	
	Steam				Gasoline					
	Number	*Tonnage*	*Value*	*Outfit*	*Number*	*Tonnage*	*Value*	*Outfit*	*Number*	*Value*
New York:										
Chautauqua									15	$470
Erie									16	550
Total									31	1,020
Pennsylvania: Erie	2	66	$12,000	$4,148					15	520
Ohio:										
Ashtabula									15	360
Cuyahoga	1	24	1,500	250					19	580
Erie					6	53	$27,500	$2,898	97	3,055
Lake									21	630
Lorain									2	75
Lucas					6	40	8,250	1,435	76	2,420
Ottawa	2	28	8,000	800	5	54	9,000	1,250	207	7,775
Sandusky									10	405
Total	3	52	9,500	1,050	17	147	44,750	5,583	447	15,300
Michigan:										
Monroe									46	1,925
Wayne									16	2,120
Total									62	4,045
Grand total	5	118	21,500	5,198	17	147	44,750	5,583	555	20,885

Statistics of the fisheries of Lake Erie in 1922, by States and counties—Continued

INVESTMENT—Continued

State and county	Power boats		Apparatus, vessel fisheries: Gill nets		Apparatus of capture, shore fisheries: Gill nets		Apparatus of capture, shore fisheries: Pound nets and trap nets	
	Number	*Value*	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
New York:								
Chautauqua	11	$9,350	4,583	$55,795	2,245	$20,500		
Erie	13	3,050	234	3,520	250	3,000	22	$1,460
Total	24	12,400	4,819	59,315	2,495	23,500	22	1,460
Pennsylvania: Erie	12	8,800	16,212	113,108	370	1,450	65	19,950
Ohio:								
Ashtabula	12	8,500	4,848	36,924	76	765	232	37,685
Cuyahoga	16	9,300	3,540	15,080			269	39,500
Erie	118	46,180	7,068	30,672	1,000	4,000	1,607	251,000
Lake	24	13,600	768	4,700	624	2,300	380	42,750
Lorain	5	3,150	300	1,200			47	10,200
Lucas	37	11,800			25	125	395	37,675
Ottawa	96	38,710			1,231	4,743	864	110,350
Sandusky	4	750						
Total	312	131,990	16,524	88,576	2,956	11,933	3,794	529,160
Michigan:								
Monroe	27	11,650			28	112	50	3,940
Wayne	5	2,700						
Total	32	14,350			28	112	50	3,940
Grand total	380	167,540	36,555	260,999	5,849	36,995	3,931	554,510

State and county	Apparatus of capture, shore fisheries—Continued: Fyke nets		Seines (haul)		Lines	Shore and accessory property	Cash capital	Total investment
	Number	*Value*	*Number*	*Value*	*Value*	*Value*	*Value*	*Value*
New York:								
Chautauqua			12	$1,285	46	$77,875	$30,000	$201,496
Erie					41	244,639	376,157	645,317
Total			12	1,285	87	322,514	406,157	936,813
Pennsylvania: Erie						439,609	287,000	1,209,156
Ohio:								
Ashtabula			2	55		60,000	35,000	229,214
Cuyahoga						194,970	70,800	391,772
Erie	88	$3,840	16	2,010		421,832	180,200	1,091,217
Lake			3	75		45,729	10,000	133,884
Lorain						17,146	3,000	46,271
Lucas	278	17,140	15	1,525		222,200	28,000	330,570
Ottawa	66	5,640	107	17,645		152,600	65,000	421,413
Sandusky			8	1,100		500		2,755
Total	432	26,620	151	22,310		1,114,977	392,000	2,647,096
Michigan:								
Monroe	254	6,760	33	3,790		30,050	1,000	59,227
Wayne	66	1,810	17	2,300		237,160	63,100	[1] 309,190
Total	320	8,570	50	6,090		267,210	64,100	368,417
Grand total	752	35,190	213	29,685	87	2,144,400	1,149,257	5,161,482

[1] Includes investment in the wholesale fish trade of Detroit.

Statistics of the fisheries of Lake Erie in 1922, by States and counties—Continued

YIELD, BY SPECIES

State and county	Burbot		Carp, German		Catfish and bullheads		Ciscoes	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
New York:								
Chautauqua	350	$7	57,985	$2,924	1,190	$74	2,905,105	$141,771
Erie			1,075	30	20	2	210,949	10,562
Total	350	7	59,060	2,954	1,210	76	3,116,054	152,333
Pennsylvania: Erie	6,438	65	41,472	1,379	1,531	149	6,963,128	347,499
Ohio:								
Ashtabula	38,278	1,015	4,371	214	4,292	328	694,450	36,982
Cuyahoga	55,925	803	47,021	1,732	20,670	1,544	1,460,630	73,286
Erie	116,047	2,756	760,671	30,267	707,466	52,234	2,524,096	123,797
Lake	118,967	1,190	13,478	539	553	45	1,192,329	59,619
Lorain	3,060	63	13,250	478	4,800	374	207,342	11,071
Lucas			457,058	18,293	96,796	6,820		
Ottawa	14,939	190	2,117,839	84,971	438,523	29,789		
Sandusky			220,235	8,810	5,735	375		
Total	347,216	6,017	3,633,923	145,304	1,278,835	91,509	6,078,847	304,755
Michigan:								
Monroe			1,622,913	55,691	54,693	5,031		
Wayne			541,813	37,609	1,250	118	210	14
Total			2,164,726	93,300	55,943	5,149	210	14
Grand total	354,004	6,089	5,899,181	242,937	1,337,519	96,883	16,158,239	804,601

State and county	Goldeye or mooneye		Muskellunge		Pike		Pike perch: Blue pike	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
New York:								
Chatauqua							532,691	$17,251
Erie							31 838	1,624
Total							564 529	18,875
Pennsylvania: Erie							3,208,861	149,438
Ohio:								
Ashtabula			85	$9	2,362	$237	2,248,928	112,403
Cuyahoga					54,425	2,721	2,497,363	140,625
Erie	6,818	$73			16	1	1,577,379	76,480
Lake							4,111,574	206,470
Lorain							292,151	14,610
Lucas	1,285	13						
Ottawa	1,443	15			960	9	41,410	2,069
Total	9,546	101	85	9	57,763	2,968	10,768,805	552,657
Michigan:								
Monroe	3,892	39			4,732	530		
Wayne					2,600	380		
Total	3,892	39			7,332	910		
Grand total	13,438	140	85	9	65,095	3,878	14,542,195	720,970

Statistics of the fisheries of Lake Erie in 1922, by States and counties—Continued

YIELD, BY SPECIES—Continued

State and county	Pike perch—Continued				Sheepshead or drum		Sturgeon	
	Sauger		Wall-eyed or yellow pike					
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
New York:								
Chautauqua	94,277	$4,711	5,367	$1,180	25	$1	6,127	$1,759
Erie			5,540	1,139			7,772	1,937
Total	94,277	4,711	10,907	2,319	25	1	13,899	3,696
Pennsylvania: Erie	139,480	6,973	25,962	4,348	58,509	1,449	1,341	503
Ohio:								
Ashtabula	325	10	2,030	605	8,784	268		
Cuyahoga	400,698	16,115	56,562	8,494	95,019	2,111		
Erie	4,350,275	217,595	837,990	122,676	1,319,151	32,100		
Lake	94,917	4,746	11,080	1,660	44,633	1,116		
Lorain	137,508	5,952	28,035	4,214	14,717	366		
Lucas	149,929	7,496	333,490	50,022	192,931	4,857		
Ottawa	634,969	31,739	475,715	71,256	603,374	14,173	235	94
Sandusky			65	9	12,815	256		
Total	5,768,621	283,653	1,744,967	258,936	2,291,424	55,237	235	94
Michigan:								
Monroe			30,827	3,337	12,385	265		
Wayne			760	152				
Total			31,587	3,489	12,385	265		
Grand total	6,002,378	295,337	1,813,423	269,092	2,362,343	56,952	15,475	4,293

State and county	Sturgeon caviar		Suckers		Trout, lake		White bass	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
New York:								
Chautauqua	14	$36	42,481	$3,018	1,079	$96	1,598	$113
Erie			27,254	1,167	202	20		
Total	14	36	69,735	4,185	1,281	116	1,598	113
Pennsylvania: Erie	105	200	45,664	1,488	585	49	14,257	566
Ohio:								
Ashtabula			48,161	1,925	31	3	16,346	966
Cuyahoga			83,408	1,975			37,286	1,719
Erie			533,978	16,091			381,479	15,257
Lake			43,926	1,318			7,719	308
Lorain			16,885	307			52,440	2,507
Lucas			303,921	9,173			243,324	9,732
Ottawa	8	20	307,771	9,222			263,439	10,555
Sandusky			600	24			2,740	85
Total	8	20	1,338,650	40,035	31	3	1,004,773	41,129
Michigan:								
Monroe			135,392	3,449			1,981	198
Wayne			8,730	429				
Total			144,122	3,878			1,981	198
Grand total	127	256	1,598,171	49,586	1,897	168	1,022,609	42,006

State and county	Whitefish		Yellow perch		Turtles		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
New York:								
Chautauqua	199,411	$39,090	41,758	$2,820			3,889,458	$214,851
Erie	5,297	1,075	5,005	427			294,952	17,983
Total	204,708	40,165	46,763	3,247			4,184,410	232,834
Pennsylvania: Erie	375,972	75,093	160,354	8,398			11,043,659	597,597
Ohio:								
Ashtabula	33,726	6,100	123,394	11,078			3,225,563	172,143
Cuyahoga	4,702	846	262,882	14,480			5,076,591	266,441
Erie	146,391	23,862	1,576,058	94,261			14,837,815	807,450
Lake	23,058	4,579	307,360	15,401			5,969,594	296,091
Lorain	12,963	2,462	74,773	4,349			857,924	46,753
Lucas	14,335	2,294	71,716	5,562			1,864,785	114,262
Ottawa	103,290	17,470	263,028	15,779	85	$7	5,267,028	287,358
Sandusky					1,323	106	243,513	9,665
Total	338,465	57,613	2,679,211	160,910	1,408	113	37,342,813	2,001,063
Michigan:								
Monroe	3,064	531	81,724	4,719			1,951,603	73,790
Wayne			1,280	218			556,643	38,920
Total	3,064	531	83,004	4,937			2,508,246	112,710
Grand total	922,209	173,402	2,969,332	177,492	1,408	113	55,079,128	2,944,204

FISHERIES BY APPARATUS

The catch of the vessel fisheries amounted to 24,297,307 pounds, valued at $1,280,146, and of the shore and boat fisheries to 30,781,821 pounds, valued at $1,664,058. The entire catch of the vessel fisheries was taken by gill nets, and consisted principally of ciscoes, pike perch, and yellow perch. In the shore fisheries the catch by pound nets was most important, amounting to 22,118,403 pounds, followed in order by haul seines with 5,618,210 pounds, gill nets with 1,636,282 pounds, fyke nets with 1,349,905 pounds, and other apparatus with 68,021 pounds.

The following tables give the products of the vessel and the shore fisheries of Lake Erie by States, counties, and species in 1922:

Yield of the gill-net vessel fisheries of Lake Erie in 1922, by States, counties, and species

Species	New York						Pennsylvania	
	Chautauqua		Erie		Total		Erie	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Burbot							1,877	$19
Carp							37	1
Catfish							20	2
Ciscoes	2,427,019	$119,862	203,099	$10,154	2,630,118	$130,016	6,823,907	340,580
Pike perch:								
Blue pike	356,569	13,190	21,788	871	378,357	14,061	3,032,784	141,412
Sauger	94,277	4,711			94,277	4,711	139,480	6,973
Wall-eyed	867	130			867	130	1,022	156
Sheepshead or drum	25	1			25	1	5,295	117
Suckers	1,254	28	1,054	32	2,308	60	8,264	257
Trout, lake	1,066	95	202	20	1,268	115	585	49
White bass	378	15			378	15	4,143	165
Whitefish	123,816	24,571	2,560	512	126,376	25,083	328,256	65,559
Yellow perch	27,510	1,650			27,510	1,650	148,388	7,763
Total	3,032,781	164,253	228,703	11,589	3,261,484	175,842	10,494,058	563,053

Species	Ohio							
	Ashtabula		Cuyahoga		Erie		Lake	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Burbot	12,225	$235	17,063	$213	210	$3		
Carp			27	1	4,466	156		
Catfish	40	4			700	56		
Ciscoes	617,329	31,584	1,452,434	72,796	2,485,268	121,477	807,856	$40,396
Pike perch:								
Blue pike	632,738	31,636	1,126,158	55,245	839,245	42,753	50,816	3,431
Sauger			1,746	88	1,097,646	54,977	32,505	1,625
Wall-eyed	30	5	110	17	10,768	1,595	610	90
Sheepshead or drum	705	17	2,380	50	3,682	148		
Suckers	690	25	1,307	66	6,926	280		
Trout, lake	31	3						
White bass	435	17	225	9	1,193	47		
Whitefish	32,272	5,809	49	9	12,711	2,250	6,437	1,255
Yellow perch	29,687	1,708	109,342	6,168	729,358	43,460	3,255	195
Total	1,326,182	71,043	2,710,841	134,662	5,192,173	267,201	901,479	46,992

Yield of the gill-net vessel fisheries of Lake Erie in 1922, by States, counties, and species—Continued

Species	Ohio—Continued				Grand total	
	Lorain		Total			
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Burbot			29,498	$451	31,375	$470
Carp			4,493	157	4,530	158
Catfish			740	59	760	61
Ciscoes	199,730	$10,463	5,562,617	276,716	15,016,642	747,312
Pike perch:						
Blue pike	148,540	7,427	2,797,497	140,492	6,208,638	295,965
Sauger	30,350	1,517	1,162,247	58,207	1,396,004	69,891
Wall-eyed			11,518	1,707	13,407	1,993
Sheepshead or drum			6,767	215	12,087	333
Suckers			8,923	371	19,495	688
Trout, lake			31	3	1,884	167
White bass	90	3	1,943	76	6,464	256
Whitefish			51,469	9,323	506,101	99,965
Yellow perch	32,380	1,943	904,022	53,474	1,079,920	62,887
Total	411,090	21,353	10,541,765	541,251	24,297,307	1,280,146

Yield of the shore fisheries of Lake Erie in 1922, by States, counties, apparatus, and species

Apparatus and species	New York					
	Chautauqua		Erie		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets and trap nets:						
Burbot	350	$7			350	$7
Carp			1,075	$30	1,075	30
Catfish and bullheads	50	5	20	2	70	7
Ciscoe			700	49	700	49
Pike perch—						
Blue pike	1,500	150	4,170	358	5,670	508
Wall-eyed or yellow pike	4,500	1,050	4,940	1,019	9,440	2,069
Sturgeon	665	416			665	416
Sturgeon caviar	14	36			14	36
Suckers	5,000	200	7,900	354	12,900	554
White bass	600	48			600	48
Yellow perch	600	48	2,580	205	3,180	253
Total	13,279	1,960	21,385	2,017	34,664	3,977
Gill nets:						
Ciscoes	473,415	21,042	7,150	359	480,565	21,401
Pike perch—						
Blue pike	174,622	3,911	5,880	395	180,502	4,306
Wall-eyed or yellow pike			600	120	600	120
Suckers	6,818	236	18,300	781	25,118	1,017
Trout, lake	13	1			13	1
White bass	620	50			620	50
Whitefish	75,595	14,519	2,737	563	78,332	15,082
Yellow perch	3,821	285	2,425	222	6,246	507
Total	734,904	40,044	37,092	2,440	771,996	42,484
Seines:						
Carp	57,985	2,924			57,985	2,924
Catfish and bullheads	1,140	69			1,140	69
Ciscoes	4,671	867			4,671	867
Suckers	29,409	2,554			29,409	2,554
Yellow perch	9,827	837			9,827	837
Total	103,032	7,251			103,032	7,251
Set lines: Sturgeon	5,462	1,343	7,772	1,937	13,234	3,280
Grand total	856,677	50,598	66,249	6,394	922,926	56,992

Yield of the shore fisheries of Lake Erie in 1922, by States, counties, apparatus, and species—Continued

Apparatus and species	Pennsylvania: Erie		Ohio			
			Ashtabula		Cuyahoga	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets and trap nets:						
Burbot	4, 171	$42	25, 523	$764	38, 312	$578
Carp	21, 994	594	2, 153	108	39, 443	1, 429
Catfish and bullheads	604	55	1, 717	137	19, 936	1, 479
Ciscoe	88, 713	4, 394	32, 443	2, 271	1, 014	60
Muskellunge			85	9		
Pike			2, 287	229	54, 425	2, 721
Pike perch—						
Blue pike	157, 709	7, 357	1, 586, 847	79, 293	1, 368, 571	85, 248
Sauger			100	3	398, 909	16, 006
Wall-eyed or yellow pike	23, 491	3, 975	2, 000	600	56, 431	8, 474
Sheepshead or drum	53, 035	1, 324	6, 705	203	92, 000	2, 032
Sturgeon	1, 341	503				
Sturgeon caviar	105	200				
Suckers	36, 729	1, 209	46, 296	1, 851	81, 679	1, 896
White bass	9, 368	371	14, 938	896	36, 990	1, 707
Whitefish	45, 665	9, 124	1, 079	216	4, 653	837
Yellow perch	5, 321	302	92, 024	9, 202	153, 055	8, 282
Total	448, 246	29, 450	1, 814, 197	95, 782	2, 345, 418	130, 749
Gill nets:						
Burbot	390	4	440	13		
Carp	19, 441	784	428	21		
Catfish and bullheads	907	92				
Ciscoes	50, 508	2, 525	44, 678	3, 127		
Pike			75	8		
Pike perch—						
Blue pike	18, 368	669	28, 993	1, 455		
Sauger			225	7		
Wall-eyed or yellow pike	1, 449	217				
Sheepshead or drum	179	8	490	15		
Suckers	671	22	825	33		
White bass	746	30	788	44		
Whitefish	2, 051	410	110	22		
Yellow perch	6, 645	333	1, 633	163		
Total	101, 355	5, 094	78, 685	4, 908		
Seines:						
Carp			1, 680	80		
Catfish and bullheads			195	19		
Pike perch, blue pike			325	18		
Sheepshead or drum			50	2		
Suckers			325	15		
White bass			175	8		
Whitefish			265	53		
Total			3, 015	195		
Minor apparatus:						
Burbot			90	3	550	12
Carp			110	5	7, 551	302
Catfish and bullheads			2, 340	168	734	65
Ciscoes					7, 182	430
Pike perch—						
Blue pike			25	1	2, 634	132
Sauger					43	21
Wall-eyed or yellow pike					21	3
Sheepshead or drum			834	31	639	19
Suckers			25	1	422	13
White bass			10	1	71	3
Yellow perch			50	5	485	30
Total			3, 484	215	20, 332	1, 030
Grand total	549, 601	34, 544	1, 899, 381	101, 100	2, 365, 750	131, 779

Yield of the shore fisheries of Lake Erie in 1922, by States, counties, apparatus, and species—Continued

Apparatus and species	Ohio—Continued					
	Erie		Lake		Lorain	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets and trap nets:						
Burbot	115,738	$2,751	118,967	$1,190	2,930	$60
Carp	152,285	6,068	8,960	358	12,092	428
Catfish and bullheads	510,977	39,280	500	40	2,398	205
Ciscoe	38,183	2,289	125,680	6,284	7,612	608
Goldeye or mooneye	3,150	36				
Pike perch—						
Blue pike	737,848	33,713	4,057,538	202,877	143,318	7,166
Sauger	3,212,173	160,590	12,412	621	107,123	4,433
Wall-eyed or yellow pike	822,972	120,445	10,470	1,570	28,035	4,214
Sheepshead or drum	1,187,844	28,695	44,553	1,114	13,660	331
Suckers	508,682	15,260	43,806	1,314	16,835	305
White bass	317,748	12,710	7,444	298	52,340	2,503
Whitefish	120,721	19,385	8,191	1,638	12,963	2,462
Yellow perch	838,903	50,334	304,000	15,200	42,353	2,402
Total	8,567,224	491,565	4,742,521	232,504	441,659	25,117
Fyke nets:						
Burbot	50	1				
Carp	14,472	578				
Catfish and bullheads	49,803	3,238				
Goldeye or mooneye	193	2				
Pike perch—						
Sauger	11,167	558				
Wall-eyed or yellow pike	2,570	385				
Sheepshead or drum	52,666	1,316				
Suckers	15,730	472				
White bass	43,921	1,756				
Yellow perch	1,209	72				
Total	191,781	8,378				
Gill nets:						
Burbot	49	1				
Carp	209,072	8,251				
Catfish and bullheads	8,865	699				
Ciscoes	645	31	258,793	12,939		
Pike perch—						
Blue pike	286	14	2,035	102		
Sauger	22,076	1,100	50,000	2,500		
Wall-eyed or yellow pike	403	59				
Sheepshead or drum	20,279	574				
Suckers	1,433	43				
White bass	175	7				
Whitefish	12,959	2,227	8,430	1,686		
Yellow perch	6,538	392				
Total	282,780	13,398	319,258	17,227		
Seines:						
Carp	379,552	15,181	4,518	181		
Catfish and bullheads	131,912	8,549	53	5		
Goldeye or mooneye	3,475	35				
Pike	16	1				
Pike perch—						
Blue pike			1,185	60		
Sauger	7,213	361				
Wall-eyed or yellow pike	1,277	192				
Sheepshead or drum	54,680	1,367	80	2		
Suckers	1,207	36	120	4		
White bass	18,442	737	275	10		
Yellow perch	50	3	105	6		
Total	597,824	26,462	6,336	268		
Minor apparatus:						
Burbot					130	3
Carp	824	33			1,158	50
Catfish and bullheads	5,209	413			2,402	169
Pike perch—						
Blue pike					293	17
Sauger					35	2
Sheepshead or drum					1,057	35
Suckers					50	2
White bass					10	1
Yellow perch					40	4
Total	6,033	446			5,175	283
Grand total	9,645,642	540,249	5,068,115	249,999	446,834	25,400

Yield of the shore fisheries of Lake Erie in 1922, by States, counties, apparatus, and species—Continued

Apparatus and species	Ohio—Continued							
	Lucas		Ottawa		Sandusky		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets and trap nets:								
Burbot			14,887	$189			316,357	$5,532
Carp	126,734	$5,068	73,208	3,178			414,875	16,637
Catfish and bullheads	44,568	2,902	188,058	11,391			768,154	55,434
Cisco							204,932	11,512
Goldeye or mooneye	1,200	12	1,443	15			5,793	63
Muskellunge							85	9
Pike			960	9			57,672	2,959
Pike perch—								
Blue pike			41,410	2,069			7,935,532	410,366
Sauger	114,117	5,706	606,440	30,323			4,451,274	217,691
Wall-eyed or yellow pike	241,659	36,248	465,412	69,811			1,626,979	241,362
Sheepshead or drum	132,125	3,325	427,710	10,150			1,904,597	45,850
Sturgeon			235	94			235	94
Sturgeon caviar			8	20			8	20
Suckers	201,992	6,059	299,488	8,984			1,198,778	35,669
White bass	156,344	6,253	136,409	5,452			722,213	29,819
Whitefish	14,335	2,294	71,981	12,301			233,923	39,133
Yellow perch	44,626	3,395	256,235	15,372			1,731,196	104,187
Turtles			85	7			85	7
Total	1,077,700	71,262	2,583,969	169,365			21,572,688	1,216,344
Fyke nets:								
Burbot							50	1
Carp	56,860	2,276	38,650	1,556			109,982	4,410
Catfish and bullheads	31,709	2,027	90,931	6,823			172,443	12,088
Goldeye or mooneye	85	1					278	3
Pike perch—								
Sauger	34,548	1,727	5,570	278			51,285	2,563
Wall-eyed or yellow pike	88,635	13,295	3,460	419			94,665	14,099
Sheepshead or drum	55,986	1,399	28,740	574			137,392	3,289
Suckers	97,868	2,936	3,060	91			116,658	3,499
White bass	82,900	3,316	55,563	2,222			182,384	7,294
Yellow perch	26,419	2,113	430	25			28,058	2,210
Total	475,010	29,090	226,404	11,988			893,195	49,456
Gill nets:								
Burbot			52	1			541	15
Carp	320	13	24,168	966			233,988	9,251
Catfish and bullheads	996	77	181	14			10,042	790
Ciscoes							304,116	16,097
Pike							75	8
Pike perch—								
Blue pike							31,314	1,571
Sauger	264	13	10,905	546			83,470	4,166
Wall-eyed or yellow pike	85	13	840	127			1,334	199
Sheepshead or drum	625	16	1,179	56			22,573	661
Suckers	212	63	833	26			3,303	165
White bass			516	43			1,479	94
Whitefish			31,309	5,169			52,808	9,104
Yellow perch	140	11	4,577	274			12,888	840
Total	2,642	206	74,566	7,222			757,931	42,961
Seines:								
Carp	272,174	10,887	1,981,813	79,271	220,235	$8,810	2,859,972	114,410
Catfish and bullheads	4,438	322	156,568	11,339	5,735	375	298,901	20,609
Goldeye or mooneye							3,475	35
Pike							16	1
Pike perch—								
Blue pike							1,510	78
Sauger	1,000	50	12,054	592			20,207	1,003
Wall-eyed or yellow pike	3,040	456	5,987	897	65	9	10,369	1,554
Sheepshead or drum	3,394	85	145,745	3,393	12,815	256	216,764	5,105
Suckers	3,849	115	4,390	121	600	24	10,491	315
White bass	4,080	163	70,951	2,838	2,740	85	96,663	3,841
Whitefish							265	53
Yellow perch	500	40	1,776	107			2,431	156
Turtles					1,323	106	1,323	106
Total	292,475	12,118	2,379,284	98,558	243,513	9,665	3,522,447	147,266

Yield of the shore fisheries of Lake Erie in 1922, by States, counties, apparatus, and species—Continued

Apparatus and species	Ohio—Continued							
	Lucas		Ottawa		Sandusky		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Minor apparatus:								
Burbot							770	$18
Carp	970	$49					10,613	439
Catfish and bullheads	15,085	1,492	2,785	$222			28,555	2,529
Ciscoe							7,182	430
Pike perch—								
Blue pike							2,952	150
Sauger							78	23
Wall-eyed or yellow pike	71	10	10	2			102	15
Sheepshead or drum	801	32					3,331	117
Suckers							497	16
White bass							91	5
Yellow perch	31	3	10	1			616	43
Total	16,958	1,586	2,805	225			54,787	3,785
Grand total	1,864,785	114,262	5,267,028	287,358	243,513	$9,665	26,801,048	1,459,812

Apparatus and species	Michigan						Grand total	
	Monroe		Wayne		Total			
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets and trap nets:								
Burbot							320,878	$5,581
Carp	5,831	$173			5,831	$173	443,775	17,434
Catfish and bullheads	1,935	136			1,935	136	770,763	55,632
Ciscoe							294,345	15,955
Goldeye or mooneye	3,892	39			3,892	39	9,685	102
Muskellunge							85	9
Pike	40	4			40	4	57,712	2,963
Pike perch—								
Blue pike							8,098,911	418,231
Sauger							4,451,274	217,691
Wall-eyed or yellow pike	7,637	940			7,637	940	1,667,547	248,346
Sheepshead or drum	3,642	26			3,642	26	1,961,274	47,200
Sturgeon							2,241	1,013
Sturgeon caviar							127	256
Suckers	18,236	614			18,236	614	1,266,643	38,046
White bass	198	20			198	20	732,379	30,258
Whitefish	3,064	531			3,064	531	282,652	48,788
Yellow perch	18,330	1,400			18,330	1,400	1,758,027	106,142
Turtles							85	7
Total	62,805	3,883			62,805	3,883	22,118,403	1,253,654
Fyke nets:								
Burbot							50	1
Carp	50,761	2,006	123,323	$8,750	174,084	10,756	284,006	15,166
Catfish and bullheads	46,708	4,470	290	22	46,998	4,492	219,441	16,580
Goldeye or mooneye							278	3
Pike	2,842	320	2,600	380	5,442	700	5,442	700
Pike perch—								
Sauger							51,285	2,563
Wall-eyed or yellow pike	22,890	2,367	260	52	23,150	2,419	117,815	16,518
Sheepshead or drum	8,743	239			8,743	239	146,135	3,628
Suckers	115,756	2,721	8,580	422	124,336	3,143	240,994	6,642
White bass	1,783	178			1,783	178	184,167	7,472
Yellow perch	62,194	3,229	980	172	63,174	3,401	91,232	5,611
Total	311,677	15,530	136,033	9,798	447,710	25,328	1,340,905	74,784

Yield of the shore fisheries of Lake Erie in 1922, by States, counties, apparatus, and species—Continued

Apparatus and species	Michigan						Grand total	
	Monroe		Wayne		Total			
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Gill nets:								
Burbot							931	$19
Carp	3,000	$240			3,000	$240	256,429	10,275
Catfish and bullheads							10,949	882
Ciscoes							835,189	40,023
Pike	1,000	120			1,000	120	1,075	128
Pike perch—								
Blue pike							230,184	6,546
Sauger							83,470	4,166
Wall-eyed or yellow pike							3,383	536
Sheepshead or drum							22,752	669
Suckers							29,092	1,204
Trout, lake							13	1
White bass							2,845	174
Whitefish							133,191	24,596
Yellow perch	1,000	70			1,000	70	26,779	1,750
Total	5,000	430			5,000	430	1,636,282	90,969
Seines:								
Carp	1,563,321	53,272	418,490	$28,859	1,981,811	82,131	4,899,768	199,465
Catfish and bullheads	6,050	425	960	96	7,010	521	307,051	21,199
Ciscoes			210	14	210	14	4,881	881
Goldeye or mooneye							3,475	35
Pike	850	86			850	86	866	87
Pike perch—								
Blue pike							1,510	78
Sauger							20,267	1,003
Wall-eyed or yellow pike	300	30	500	100	800	130	11,169	1,684
Sheepshead or drum							216,764	5,105
Suckers	1,400	114	150	7	1,550	121	41,450	2,990
White bass							96,663	3,841
Whitefish							265	53
Yellow perch	200	20	300	46	500	66	12,758	1,059
Turtles							1,323	106
Total	1,572,121	53,947	420,610	29,122	1,992,731	83,069	5,618,210	237,586
Set lines: Sturgeon							13,234	3,280
Minor apparatus:								
Burbot							770	18
Carp							10,613	439
Catfish and bullheads							28,555	2,529
Ciscoes							7,182	430
Pike perch—								
Blue pike							2,952	150
Sauger							78	23
Wall-eyed or yellow pike							102	15
Sheepshead or drum							3,331	117
Suckers							497	16
White bass							91	5
Yellow perch							616	43
Total							54,787	3,785
Grand total	1,951,603	73,790	556,643	38,920	2,508,246	112,710	30,781,821	1,664,058

24309—25†——14

MUSSEL FISHERIES OF RIVERS TRIBUTARY TO LAKE ERIE

The statistics of the mussel fisheries of rivers tributary to Lake Erie, not previously canvassed in connection with the Great Lakes, have been omitted from the foregoing treatment of the statistics of Lake Erie and are shown in the following table:

Persons engaged, investment, and products (by apparatus) in the mussel fisheries of rivers tributary to Lake Erie, in 1922, by States and counties

River, State, and county	Fishermen	Rowboats		Apparatus: Forks		Apparatus: Picks		Shore and accessory property
	Number	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*	*Value*
Auglaize River: Ohio: Defiance	2	2	$20					$40
Maumee River:								
Ohio—								
Defiance	22	22	220					440
Henry	28	28	280					560
Paulding	20	20	200					400
Wood	3	3	30					60
Total	73	73	730					1,460
Indiana: Allen	6	6	60					120
Total, Maumee River	79	79	790					1,580
Sandusky River: Ohio: Seneca	8	8	80					160
Tiffin River: Ohio: Defiance	2	2	20					40
St. Marys River: Indiana: DeKalb	3	3	30					60
St. Joseph of the Maumee River:								
Indiana—								
Allen	5	5	50					100
DeKalb	10	10	100					200
Total	15	15	150					300
Huron River: Michigan: Wayne	5	5	35	3	$9	5	$5	150
Raisin River: Michigan: Monroe	10	10	50	10	30			1,500
Grand total	124	124	1,175	13	39	5	5	3,830

River, State, and county	Products: By forks: Mussel shells		Pearls	Slugs	By picks: Mussel shells		Pearls	Slugs
	Pounds	*Value*	*Value*	*Value*	*Pounds*	*Value*	*Value*	*Value*
Huron River: Michigan: Wayne	14,000	$595	$75	$100	9,170	$390	$98	$20
Raisin River:								
Michigan—								
Lenawee	40,000	1,100	100	20				
Monroe	36,000	1,080	58	50				
Total	76,000	2,180	158	70				
Grand total	90,000	2,775	233	170	9,170	390	98	20

Persons engaged, investment, and products (by apparatus) in the mussel fisheries of rivers tributary to Lake Erie, in 1922, by States and counties—Continued

River, State, and county	Products—Continued							
	By hand				Total			
	Mussel shells		Pearls	Slugs	Mussel shells		Pearls	Slugs
	Pounds	*Value*	*Value*	*Value*	*Pounds*	*Value*	*Value*	*Value*
Auglaize River:								
Ohio: Defiance	14,000	$210		$12	14,000	$210		$12
Maumee River:								
Ohio—								
Defiance	354,000	8,250	$150	392	354,000	8,250	$150	392
Henry	246,000	6,150	85	300	246,000	6,150	85	300
Paulding	270,000	6,750	150	272	270,000	6,750	150	272
Wood	28,000	700	5	35	28,000	700	5	35
Total	898,000	21,850	385	999	898,000	21,850	385	999
Indiana: Allen	80,000	2,000	40	80	80,000	2,000	40	80
Total, Maumee River	978,000	23,850	425	1,079	978,000	23,850	425	1,079
Sandusky River:								
Ohio: Seneca	42,000	1,050	50	55	42,000	1,050	50	55
Tiffin River:								
Ohio: Defiance	20,000	300		20	20,000	300		20
St. Marys River:								
Indiana: DeKalb	46,000	805	10	48	46,000	805	10	48
St. Joseph of the Maumee River:								
Indiana—								
Allen	20,000	400		20	20,000	400		20
DeKalb	40,000	800		40	40,000	800		40
Total	60,000	1,200		60	60,000	1,200		60
Huron River:								
Michigan: Wayne					23,170	985	173	120
Raisin River:								
Michigan—								
Lenawee					40,000	1,100	100	20
Monroe					36,000	1,080	58	50
Total					76,000	2,180	158	70
Grand total	1,160,000	27,415	485	1,274	1,259,170	30,580	816	1,464

WHOLESALE FISHERY TRADE

There were 69 establishments engaged in the wholesale fishery trade of Lake Erie in 1922. These employed 670 persons, to whom $775,716 were paid in wages, representing a total investment of $1,911,689. Cash capital to the amount of $1,149,257 was used. Compared with 1917, this shows a slight decrease in number of establishments and persons employed, although the investment has increased in all phases.

The following table shows the statistics of the wholesale fishery trade of Lake Erie in 1922:

Wholesale fishery trade of Lake Erie in 1922

Cities	State	Number of firms	Persons engaged	Wages paid	Shore and accessory property	Cash capital
Buffalo	New York	8	73	$141,568	$244,439	$376,157
Dunkirk and Westfield	do	3	27	30,750	74,100	30,000
Erie	Pennsylvania	9	195	150,149	437,959	287,000
Cleveland	Ohio	10	69	93,756	190,770	70,800
Toledo	do	4	21	13,456	207,000	28,000
Port Clinton	do	3	25	24,000	76,500	65,000
Sandusky	do	5	93	131,820	269,556	138,500
Ashtabula and Grand River	do	4	37	65,915	75,629	45,000
Vermilion and Lorain	do	4	29	23,506	40,577	28,000
Huron	do	3	23	31,810	59,199	16,700
Detroit [1]	Michigan	16	78	68,986	235,960	64,100
Total		69	670	775,716	1,911,689	1,149,257

[1] Includes one firm at Monroe, Mich.

FISHERIES OF LAKE ONTARIO

The fisheries of Lake Ontario in 1922 gave employment to 366 persons, of whom 352 were in the shore or boat fisheries and 14 were employed as shoresmen.

The investment amounted to $173,287, which included 192 rowboats, valued at $6,341; 100 power boats, valued at $31,920; fishing apparatus used on boats, valued at $62,511; shore and accessory property, valued at $47,515; and cash capital amounting to $25,000. The fishing apparatus included 419 trap nets, valued at $33,589; 2,319 gill nets, valued at $24,215; 204 fyke nets, valued at $3,362; and seines, lines, etc., to the value of $1,345.

The products of the fisheries amounted to 929,186 pounds, valued at $109,094, all of which were taken in the shore or boat fisheries, as no vessels were engaged in the fisheries of this lake in 1922. The principal species taken included ciscoes, 187,484 pounds, valued at $15,191; German carp, 138,711 pounds, valued at $10,927; bullheads, 107,481 pounds, valued at $8,209; pike perch, 141,210 pounds, valued at $28,490; suckers, 77,925 pounds, valued at $4,664; common whitefish, 54,951 pounds, valued at $9,603; and lake trout, 46,698 pounds, valued at $5,826.

Compared with 1917, the latest previous year for which statistics are available, there was an increase of 77 in the number of persons employed, of $40,634 in the investment, and of 13,570 pounds in the quantity and $24,981 in the value of the products.

FISHERIES BY COUNTIES

The following table shows, by counties, the number of persons employed, investment, and quantity and value of products of the fisheries in 1922:

Persons engaged, investment, and products (by species) in the fisheries of Lake Ontario in 1922, by counties

Item	Cayuga		Jefferson		Monroe		Niagara	
PERSONS ENGAGED	*No*	*Value*	*No.*	*Value*	*No.*	*Value*	*No.*	*Value*
In shore or boat fisheries	44		135		41		16	
Shoresmen			14					
Total	44		149		41		16	
INVESTMENT								
Rowboats	37	$1,050	62	$2,375	15	$380	4	$130
Power boats	4	1,400	54	18,720	5	1,075	12	2,425
Trap nets	46	3,830	289	22,344	1	75	5	2,000
Gill nets	30	395	998	6,888	86	866	66	3,054
Fyke nets			199	3,310	1	15		
Seines (haul)			10	465	2	45	2	155
Lines		8		215		40		70
Scap nets			3	11	17	51		
Spears			10	50				
Eel pots					3	10		
Shore and accessory property		280		35,610				500
Cash capital				25,000				
Total		6,963		114,988		2,557		8,334
PRODUCTS	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Bowfin			530	$29	20	$2		
Bullheads	1,904	$43	89,465	7,038	1,070	60		
Burbot					6,815	655	496	$130
Carp, German	635	69	28,168	1,644	1,619	130	92,708	7,408
Ciscoes:								
Fresh	34,545	3,228	32,105	1,910	4,972	473	12,450	837
Salted			3,000	450				
Eels	856	89	43,832	3,463	297	43	160	16
Pike	124	13	19,258	2,284	46	5		
Pike perch:								
Blue pike	856	106	6,903	614	1,704	241	22,553	1,742
Wall-eyed or yellow pike	421	56	105,103	25,160	21	6		
Rock bass			5,496	260	78	8		
Shiner			6,600	4,950				
Sturgeon	576	187	13,322	3,717	1,094	181	8,730	2,217
Sturgeon caviar			62	222			125	345
Suckers	1,312	115	55,484	3,332	4,666	334	7,816	313
Sunfish	400	32	12,287	540	400	28		
Trout, lake			31,720	3,043	72	21	3,369	443
Whitefish			22,796	2,800	125	22	2,574	463
Yellow perch	1,430	146	25,708	2,035	1,237	163	310	55
Other fish							1,200	60
Total	43,050	4,084	501,839	63,491	24,236	2,372	152,491	14,029

Persons engaged, investment, and products (by species) in the fisheries of Lake Ontario, in 1922, by counties—Continued

Item	Orleans		Oswego		Wayne		Total	
PERSONS ENGAGED	*No.*	*Value*	*No.*	*Value*	*No.*	*Value*	*No.*	*Value*
In shore or boat fisheries	7		26		83		352	
Shoresmen							14	
Total	7		26		83		366	
INVESTMENT								
Rowboats	4	$170	7	$880	63	$1,356	192	$6,341
Power boats	2	650	14	5,425	9	2,225	100	31,920
Trap nets					78	5,340	419	33,580
Gill nets	13	550	792	8,442	334	4,020	2,319	24,215
Fyke nets			2	30	2	7	204	3,362
Seines (haul)					1	150	15	815
Lines		10		65				408
Scap nets							20	62
Spears							10	50
Eel pots							3	10
Shore and accessory property				10,750		375		47,515
Cash capital								25,000
Total		1,380		25,592		13,473		173,287
PRODUCTS	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Bowfin					1,008	$55	1,558	$86
Bullheads			236	$23	14,806	1,045	107,481	8,209
Burbot	3,810	$465			4,520	337	15,641	1,587
Carp, German			50	4	15,531	1,072	138,711	10,927
Ciscoes:								
Fresh	612	36	58,783	4,660	41,017	3,597	184,484	14,741
Salted							3,000	450
Eels			90	9	404	48	45,639	3,668
Pike					20	2	19,448	2,304
Pike perch:								
Blue pike	550	125	880	123	1,454	149	34,900	3,100
Wall-eyed or yellow pike			500	125	265	43	106,310	25,390
Rock bass					400	40	5,974	308
Shiner							6,600	4,950
Sturgeon	1,052	324	6,994	1,623	2,428	712	34,196	8,961
Sturgeon, caviar			150	450	8	26	345	1,043
Suckers	2,470	247	4,500	233	1,677	90	77,925	4,664
Sunfish			600	36			13,687	636
Trout, lake	417	100	10,822	2,148	298	71	46,698	5,826
Whitefish	2,365	663	25,767	5,350	1,324	305	54,951	9,603
Yellow perch			400	40	1,353	142	30,438	2,581
Other fish							1,200	60
Total	11,276	1,960	109,772	14,824	86,513	8,334	929,186	109,094

FISHERIES BY APPARATUS

The catch, as previously noted, was all taken in the shore or boat fisheries. Trap nets took 494,871 pounds of fish, valued at $57,168; gill nets, 263,337 pounds, valued at $33,232; fyke nets, 82,966 pounds, valued at $6,107; seines, 37,351 pounds, valued at $7,441; lines, 30,381 pounds, valued at $3,798; scap nets, 2,026 pounds, valued at $170; spears, 18,000 pounds, valued at $1,140; and eel pots, 254 pounds, valued at $38. The principal species taken with trap nets were bullheads, German carp, ciscoes, pike perch, and suckers; with gill nets, ciscoes, pike perch, sturgeon, lake trout, and whitefish; with fyke nets, bullheads, eels, pike, and suckers; with seines, German carp; and with lines, sturgeon, lake trout, and yellow perch. Scap nets took small quantities of bowfin, bullheads, German carp, eels, and suckers; and spears took German carp, eels, and suckers. Eel pots took a small catch of eels.

The following table gives the products of the fisheries of Lake Ontario by counties, apparatus, and species in 1922:

Yield of the fisheries of Lake Ontario in 1922, by counties, apparatus, and species

Apparatus and species	Cayuga		Jefferson		Monroe		Niagara	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Trap nets:								
Bullheads	1,904	$43	39,724	$3,423	400	$20		
Carp, German	635	69	18,346	1,059			92,000	$7,360
Ciscoes—								
Fresh	31,206	2,918	9,573	556			6,310	378
Salted			2,800	420				
Eels	788	82	26,535	2,102				
Pike	18	3	10,290	1,209				
Pike perch—								
Blue pike	356	36	4,695	417			3,541	212
Wall-eyed or yellow pike	110	11	104,145	24,994				
Rock-bass			5,215	243				
Sturgeon			3,394	856				
Sturgeon caviar			42	137				
Suckers	252	54	37,648	2,282	200	20	3,600	108
Sunfish	400	32	8,276	380				
Trout, lake			5,248	555				
Whitefish			12,134	1,569				
Yellow perch	920	97	13,244	1,109	150	18		
Total	36,589	3,345	301,309	41,311	750	58	105,451	8,058
Gill nets:								
Bullheads					112	9		
Burbot					6,467	622	496	130
Ciscoes—								
Fresh	3,339	310	22,532	1,354	4,952	471	4,525	362
Salted			200	30				
Pike	106	10	1,788	219	46	5		
Pike perch—								
Blue pike	500	70	1,941	169	1,696	240	16,300	1,416
Wall-eyed or yellow pike	311	45	120	19	21	6		
Rock bass					78	8		
Sturgeon	576	187	8,872	2,584	542	104	5,560	1,449
Sturgeon cavier			20	85				
Suckers	1,060	61	343	16	3,779	253	1,910	100
Trout, lake			12,972	1,408	72	21	3,369	443
Whitefish			10,662	1,231	110	20	2,574	463
Yellow perch	510	49	1,644	142	1,077	144	310	55
Other fish							1,200	60
Total	6,402	732	61,094	7,257	18,952	1,903	36,244	4,478
Fyke nets:								
Bowfin			530	29				
Bullheads			48,814	3,544				
Burbot					300	30		
Carp, German			2,547	188				
Ciscoes					20	2		
Eels			6,222	483				
Pike			4,709	596				
Pike perch—								
Blue pike			267	28	8	1		
Wall-eyed or yellow pike			368	68				
Rock bass			281	17				
Suckers			12,447	805	15	1		
Sunfish			3,411	142				
Whitefish					15	2		
Yellow perch			2,470	116	10	1		
Total			82,066	6,016	368	37		
Seines:								
Bullheads			927	71	100	8		
Carp, German			2,275	147	1,000	80	708	48
Ciscoes							1,615	97
Eels			75	8			160	16
Pike			2,471	260				
Pike perch—								
Blue pike							2,712	114
Wall-eyed or yellow pike			470	79				
Shiner			6,600	4,950				
Suckers			1,582	89	250	20	2,306	105
Sunfish			600	18	400	28		
Yellow perch			350	28				
Total			15,350	5,650	1,750	136	7,501	880

Yield of the fisheries of Lake Ontario in 1922, by counties, apparatus, and species—Continued

Apparatus and species	Cayuga		Jefferson		Monroe		Niagara	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Lines:								
Burbot					48	$3		
Eels	68	$7	1,000	$70				
Sturgeon			1,056	277	552	77	3,170	$768
Sturgeon caviar							125	345
Trout, lake			13,500	1,080				
Yellow perch			8,000	640				
Total	68	7	23,556	2,067	600	80	3,295	1,113
Scap nets:								
Bowfin					20	2		
Bullheads					458	23		
Carp, German					619	50		
Eels					43	5		
Suckers			464	50	422	40		
Total			464	50	1,562	120		
Spears:								
Carp, German			5,000	250				
Eels			10,000	800				
Suckers			3,000	90				
Total			18,000	1,140				
Eel pots: Eels					254	38		
Grand total	43,059	4,084	501,839	63,491	24,236	2,372	152,491	14,029

Apparatus and species	Orleans		Oswego		Wayne		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Trap nets:								
Bowfin					993	$54	993	$54
Bullheads					14,736	1,038	56,764	4,524
Carp, German					2,731	394	113,712	8,882
Ciscoes—								
Fresh					30,684	2,721	77,773	6,573
Salted							2,800	420
Eels					379	45	27,702	2,229
Pike							10,308	1,212
Pike perch—								
Blue pike					125	16	8,717	681
Wall-eyed or yellow pike							104,255	25,005
Rock bass					400	40	5,615	283
Sturgeon					112	36	3,506	892
Sturgeon caviar							42	137
Suckers					512	37	42,212	2,501
Sunfish							8,676	412
Trout, lake							5,248	555
Whitefish							12,134	1,569
Yellow perch					100	15	14,414	1,239
Total					50,772	4,390	494,871	57,168
Gill nets:								
Bullheads							112	9
Burbot	3,810	$405			4,520	337	15,293	1,554
Ciscoes—								
Fresh	612	36	58,783	$4,660	10,303	873	105,046	8,066
Salted							200	30
Pike					20	2	1,960	236
Pike perch—								
Blue pike	550	125	880	123	1,329	133	23,196	2,276
Wall-eyed or yellow pike			500	125	265	43	1,217	238
Rock bass							78	8
Sturgeon	740	231	4,544	1,190	2,316	676	23,150	6,421
Sturgeon caviar			150	450	8	26	178	561
Suckers	2,470	247	4,500	233	1,090	47	15,161	957
Sunfish			600	36			600	36
Trout, lake	417	100	10,822	2,148	298	71	27,950	4,191
Whitefish	2,365	663	25,767	5,350	1,324	305	42,802	8,032
Yellow perch			400	40	1,253	127	5,194	557
Other fish							1,200	60
Total	10,964	1,867	106,946	14,355	22,735	2,640	263,337	33,232

Yield of the fisheries of Lake Ontario in 1922, by counties, apparatus, and species—Continued

Apparatus and species	Orleans		Oswego		Wayne		Total	
	Pounds	*Value*	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fyke nets:								
Bowfin					15	$1	545	$30
Bullheads			136	$18	70	7	49,020	3,569
Burbot							300	30
Carp, German			50	4	50	3	2,647	195
Ciscoes					30	3	50	5
Eels			90	9	25	3	6,337	495
Pike							4,709	596
Pike perch—								
Blue pike							275	29
Wall-eyed or yellow pike							368	68
Rock bass							281	17
Suckers					66	6	12,528	812
Sunfish							3,411	142
White fish							15	2
Yellow perch							2,480	117
Total			276	31	256	23	82,966	6,107
Seines:								
Bullheads							1,027	79
Carp, German					12,750	1,275	16,733	1,550
Ciscoes							1,615	97
Eels							235	24
Pike							2,471	260
Pike perch—								
Blue pike							2,712	114
Wall-eyed or yellow pike							470	79
Shiner							6,600	4,950
Suckers							4,138	214
Sunfish							1,000	46
Yellow perch							350	28
Total					12,750	1,275	37,351	7,441
Lines:								
Bullheads			100	5			100	5
Burbot							48	3
Eels							1,068	77
Sturgeon	312	$93	2,450	433			7,640	1,648
Sturgeon caviar							125	345
Trout, lake							13,500	1,080
Yellow perch							8,000	640
Total	312	93	2,550	438			30,381	3,798
Scap nets:								
Bowfin							20	2
Bullheads							458	23
Carp, German							619	50
Eels							43	5
Suckers							886	90
Total							2,026	170
Spears:								
Carp, German							5,000	250
Eels							10,000	800
Suckers							3,000	90
Total							18,000	1,140
Eel pots: Eels							254	38
Grand total	11,276	1,960	109,772	14,824	86,513	8,334	929,186	109,094

FISHERIES OF THE ST. LAWRENCE RIVER

The fisheries of the St. Lawrence River in 1922 gave employment to 47 persons. The investment amounted to $6,894, including 30 rowboats, valued at $903; 11 power boats, valued at $3,825; fishing apparatus valued at $2,141; and shore property valued at $25. The fishing apparatus included 5 seines, valued at $403; 2 weirs, valued at $150; and lines to the value of $1,588. The products of the fisheries amounted to 58,192 pounds, with a value of $19,641. The catch taken with seines amounted to 14,250 pounds, valued at $8,538; with lines, 37,442 pounds, valued at $10,128; and with weirs 6,500 pounds, valued at $975. The products included sturgeon, 34,502 pounds, valued at $8,169; sturgeon caviar, 590 pounds, valued $1,753; eels, 8,850 pounds, valued at $1,181; shiner, 6,850 pounds, valued at $5,138; and suckers, 7,400 pounds, valued at $3,400.

The following table gives, by counties, the persons, investment, and the quantity and value of the products of the fisheries of the St. Lawrence River in 1922:

Persons engaged, investment, and products (by apparatus) in the fisheries of the St. Lawrence River in 1922, by counties

Items	Jefferson		St. Lawrence		Total	
PERSONS ENGAGED	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
Fishermen	17		30		47	
INVESTMENT						
Rowboats	3	$175	27	$728	30	$903
Power boats	8	2,925	3	900	11	3,825
Seines (haul)	5	403			5	403
Lines (set)		120		1,468		1,588
Weirs			2	150	2	150
Shore and accessory property				25		25
Total		3,623		3,271		6,894
PRODUCTS	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Seines:						
Shiner	6,850	$5,138			6,850	5,138
Suckers	7,400	3,400			7,400	3,400
Total	14,250	8,538			14,250	8,538
Lines:						
Eels			2,350	$206	2,350	206
Sturgeon	7,858	1,756	26,644	6,413	34,502	8,169
Sturgeon caviar	53	173	537	1,580	590	1,753
Total	7,911	1,929	29,531	8,199	37,442	10,128
Weirs: Eels			6,500	975	6,500	975
Grand total	22,161	10,467	36,031	9,174	58,192	19,641

FISHERIES OF THE NIAGARA RIVER

The fisheries of the Niagara River in 1922 were conducted in Niagara County, N. Y., and gave employment to 27 persons. The investment amounted to $2,099, including 10 power boats, valued at $254; 5 seines, valued at $261; 9 fishing machines, valued at $1,175; lines valued at $49; and shore and accessory property valued at $360. The products of the fisheries amounted to 38,421 pounds, with a value of $3,066. The catch taken with seines was 9,111 pounds, valued at $580; with fishing machines, 27,914 pounds, valued at $2,308; and with lines, 1,396 pounds, valued at $178. The species taken included bullheads, 2,838 pounds, valued at $139; German carp, 2,406 pounds, valued at $132; ciscoes, 9,835 pounds, valued at $804; eels, 834 pounds, valued at $82; pike perch, 12,640 pounds, valued at $1,147; suckers, 6,791 pounds, valued at $468; and yellow perch, 3,077 pounds, valued at $294.

The following table gives the number of persons employed, investment, and the quantity and value of the products of the fisheries of Niagara River in 1922:

Persons engaged, investment, and products (by apparatus) in the fisheries of the Niagara River in 1922

Items	Niagara County		Items	Niagara County	
PERSONS ENGAGED	*Number*	*Value*	PRODUCTS—continued		
Fisherman	27	....	Seines—Continued.	*Pounds*	*Value*
			Suckers	2,205	$118
INVESTMENT			Total	9,111	580
Rowboats	10	$254			
Seines (haul)	5	261	Fishing machines:		
Fishing machines	9	1,175	Bullheads	1,358	64
Lines (set)	6	49	Carp, German	803	45
Shore and accessory property	....	360	Ciscoes	9,535	789
			Eels	761	73
Total	....	2,099	Pike perch (blue pike)	9,190	871
			Suckers	3,190	172
PRODUCTS			Yellow perch	3,077	294
Seines:	*Pounds*	*Value*			
Bullheads	1,480	$75	Total	27,914	2,308
Carp, German	1,603	87			
Ciscoes	300	15	Lines: Suckers	1,396	178
Eels	73	9			
Pike perch (blue pike)	3,450	276	Grand total	38,421	3,066

FISHERIES CONSIDERED BY STATES

The fisheries of the Great Lakes are prosecuted in the following States: New York, Pennsylvania, Ohio, Indiana, Michigan, Illinois, Wisconsin and Minnesota. Michigan borders on Lakes Superior, Michigan, Huron, St. Clair, and Erie; Wisconsin on Lakes Superior and Michigan; and New York on Lakes Erie and Ontario. It is therefore of importance to consider these statistics by States as well as by lakes.

In 1922 there were 8,039 persons engaged in the fisheries of the Great Lakes, of whom 731 are credited to New York, 479 to Pennsylvania, 1,588 to Ohio, 96 to Indiana, 3,046 to Michigan, 476 to Illinois, 1,346 to Wisconsin, and 277 to Minnesota.

The investment, amounting to $12,046,458, was divided among the States as follows: New York, $1,119,093; Pennsylvania, $1,209,156; Ohio, $2,649,646; Indiana, $67,375; Michigan $3,251,305; Illinois, $1,580,252; Wisconsin, $1,879,684; and Minnesota, $289,947.

The products, aggregating 108,732,443 pounds, valued at $6,689,611, were distributed among the States as follows: New York, 5,210,209 pounds, valued at $364,635; Pennsylvania, 11,043,659 pounds, valued at $567,597; Ohio, 38,316,813 pounds, valued at $2,025,994; Indiana, 1,044,485 pounds, valued at $74,702; Michigan, 30,415,369 pounds, valued at $2,217,310; Illinois, 513,640 pounds, valued at $58,519; Wisconsin, 15,601,039 pounds, valued at $1,164,788; and Minnesota, 6,587,229 pounds, valued at $186,066. Separate statistics, by lakes, are given for States whose fisheries are conducted in more than one lake.

The following table gives, by States, the number of persons engaged, apparatus and capital employed, and products of the fisheries of the Great Lakes in 1922:

Persons engaged, investment, and products in the fisheries of the Great Lakes in 1922, by States

Items	New York [1]		Pennsylvania		Ohio [2]	
PERSONS ENGAGED	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
On vessels fishing	96		249		237	
On vessels transporting			2		24	
In shore or boat fisheries	521		33		1,030	
Shoresmen	114		195		297	
Total	731		479		1,588	
INVESTMENT						
Vessels fishing:						
Steam	9	$65,000	34	$229,000	26	$144,100
Tonnage	208		850		543	
Outfit		13,000		57,874		31,632
Gasoline	9	24,500	10	28,000	18	61,400
Tonnage	88		120		265	
Outfit		6,575		7,607		16,215
Vessels transporting:						
Steam			2	12,000	3	9,500
Tonnage			66		52	
Outfit				4,148		1,050
Gasoline					17	44,750
Tonnage					147	
Outfit						5,583
Sail and row boats	263	8,518	15	520	532	16,150
Power boats	135	48,145	12	8,800	312	131,990
Apparatus, vessel fisheries:						
Gill nets	4,819	59,315	15,212	113,108	16,524	88,576
Apparatus, shore fisheries:						
Pound nets and trap nets	441	35,049	65	19,950	3,794	529,160
Gill nets	4,814	47,715	370	1,450	2,956	11,933
Fyke nets	204	3,362			432	26,620
Seines (haul)	37	2,764			151	22,310
Lines		2,132				
Fishing machines	9	1,175				
Other apparatus		272				
Shore and accessory property		370,414		439,699		1,116,677
Cash capital		431,157		287,000		392,000
Total		1,119,003		1,209,156		2,649,646
PRODUCTS	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Bowfin	1,558	$86				
Burbot	15,991	1,594	6,438	$65	347,216	$6,017
Carp, German	200,177	14,013	41,472	1,879	3,633,923	145,304
Catfish and bullheads	111,529	8,424	1,531	149	1,278,835	91,509
Ciscoes:						
Fresh	3,310,373	167,878	6,963,128	347,499	6,078,847	304,755
Salted	3,000	450				
Eels	55,323	4,931				
Goldeye and mooneye					9,546	101
Muskellunge					85	9
Pike	19,448	2,304			57,763	2,968
Pike perch:						
Blue pike	612,069	23,122	3,208,861	149,438	10,768,805	552,657
Saugers	94,277	4,711	139,480	6,973	5,768,621	283,653
Wall-eyed or yellow pike	117,217	27,709	25,962	4,348	1,744,967	258,936
Rock bass	5,974	308				
Sheepshead or drum	25	1	58,509	1,449	2,291,424	55,237
Shiner	13,450	10,088				
Sturgeon	82,597	20,826	1,341	503	235	94
Sturgeon caviar	949	2,832	105	200	8	20
Suckers, fresh	161,851	12,717	45,664	1,488	1,338,650	40,035
Sunfishes	13,687	636				
Trout, lake, fresh	47,979	5,942	585	49	31	3
White bass	1,598	113	14,257	566	1,004,773	41,129
Whitefish, common, fresh	259,659	40,768	375,972	75,093	338,465	57,613
Yellow perch	80,278	6,122	160,354	8,398	2,679,211	160,910
Other fish	1,200	60				
Turtles					1,408	113
Mussel shells					974,000	23,410
Pearls						435
Slugs						1,086
Total	5,210,209	304,635	11,043,659	597,597	38,316,813	2,025,994

[1] Includes St. Lawrence and Niagara Rivers.
[2] Includes mussel fisheries of the Auglaize, Maumee, Sandusky, and Tiffin Rivers.

Persons engaged, investment, and products in the fisheries of the Great Lakes in 1922, by States—Continued

Items	Indiana [3]		Michigan [4]		Illinois	
PERSONS ENGAGED	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
On vessels fishing	22		582		38	
On vessels transporting			57			
In shore or boat fisheries	63		2,000		12	
Shoresmen	11		407		426	
Total	96		3,046		476	
INVESTMENT						
Vessels fishing:						
Steam	4	$14,000	63	$202,750	2	$12,000
Tonnage	92		1,199		43	
Outfit		3,700		62,820		925
Gasoline	1	500	123	113,900	8	20,000
Tonnage	8		1,005		83	
Outfit		20		29,896		5,545
Vessels transporting:						
Steam			1	1,000		
Tonnage			8			
Outfit				65		
Gasoline			39	44,600		
Tonnage			294			
Outfit				4,540		
Sail and row boats	39	550	1,021	31,985	5	135
Power boats	17	5,250	623	214,071	4	2,800
Apparatus, vessel fisheries:						
Gill nets	1,206	22,120	20,788	248,522	1,710	15,218
Lines		800		23,280		
Apparatus, shore fisheries:						
Pound nets and trap nets	13	7,600	2,284	491,495		
Gill nets	149	725	9,836	95,107	190	642
Fyke nets			818	39,775		
Seines (haul)			135	27,500		
Lines				6,317		
Other apparatus		210		4,701		
Shore and accessory property		10,900		1,214,324		1,004,987
Cash capital		1,000		394,657		518,000
Total		67,375		3,251,305		1,580,252
PRODUCTS	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Black bass			2,000	$200		
Buffalofish	772	$42	185	11		
Burbot	420	18	8,984	233		
Carp, German	5,350	220	3,494,939	145,111		
Catfish and bullheads			125,439	10,042		
Ciscoes:						
Fresh	296,600	16,474	3,962,743	134,183	252,000	$19,570
Salted			2,734,740	63,836		
Smoked					29,165	4,893
Goldeye and mooneye			3,892	39		
Pike	25	3	81,344	8,579		
Pike perch: Wall-eyed or yellow pike	150	37	1,412,934	192,237		
Sheepshead or drum			59,721	1,693		
Sturgeon	2,160	404	9,991	4,289		
Sturgeon caviar			796	583		
Suckers, fresh	975	65	2,842,094	145,389		
Trout, lake, fresh	271,570	37,785	6,918,905	782,661	203,075	30,104
Trout, steelhead	11,165	2,233				
White bass			1,981	198		
Whitefish, common:						
Fresh	20,800	3,460	2,834,020	454,834		
Caviar			1,289	1,009		
Whitefish, Menominee:						
Fresh			106,214	7,394		
Salted			960	60		
Yellow perch	13,500	1,491	987,028	68,703	29,400	3,952
Mussel shells	421,000	11,100	4,825,170	183,230		
Pearls		420		7,931		
Slugs		950		4,865		
Total	1,044,485	74,702	30,415,309	2,217,310	513,640	58,519

NOTE.—The mussel fisheries in the rivers tributary to the Great Lakes have been prosecuted only a few years and have never previously been shown with statistics of the Great Lakes.

[3] Includes mussel fisheries of the Maumee, St. Marys, St. Joseph of the Maumee, St. Joseph, and Pigeon Rivers.

[4] Includes mussel fisheries of the St. Joseph, Grand, Kalamazoo, Maple, Muskegon, Pigeon, and Thornapple Rivers.

Persons engaged, investment, and products in the fisheries of the Great Lakes in 1922, by States—Continued

Items	Wisconsin [5]		Minnesota		Total	
PERSONS ENGAGED	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
On vessels, fishing	549		4		1,777	
On vessels, transporting	70		7		160	
In shore or boat fisheries	457		241		4,357	
Shoresmen	270		25		1,745	
Total	1,346		277		8,039	
INVESTMENT						
Vessels, fishing:						
Steam	42	$216,000			180	$882,850
Tonnage	933				3,868	
Outfit		35,572				205,523
Gasoline	153	228,650	2	$4,000	324	480,950
Tonnage	1,478		21		3,068	
Outfit		31,800		500		98,158
Vessels, transporting:						
Steam					6	22,500
Tonnage					126	
Outfit						5,263
Gasoline	37	38,950	3	11,000	96	139,300
Tonnage	354		25		820	
Outfit		4,170		2,400		16,693
Sail and row boats	221	7,415	217	6,510	2,313	71,783
Power boats	150	39,085	95	26,800	1,348	476,941
Apparatus, vessel fisheries:						
Gill nets	17,659	174,503	120	1,400	78,038	722,762
Lines		9,550				33,630
Apparatus, shore fisheries:						
Pound nets and trap nets	230	88,725	4	800	6,831	1,172,779
Gill nets	7,860	43,531	3,493	41,605	29,668	242,708
Fyke nets	1,151	23,940			2,605	93,697
Seines (haul)	40	7,945			363	60,519
Lines		220		1,120		9,789
Crawfish pots	5,255	1,409			5,255	1,409
Fishing machines					9	1,175
Other apparatus		101				5,284
Shore and accessory property		699,695		169,812		5,026,508
Cash capital		228,423		24,000		2,276,237
Total		1,879,684		289,047		12,046,458
PRODUCTS	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Black bass					2,000	$200
Bowfin					1,558	86
Buffalofish					955	53
Burbot	8,741	$346			387,790	8,273
Carp, German	743,580	24,847			8,119,441	330,874
Catfish and bullheads	144,964	7,293			1,662,298	117,417
Ciscoes:						
Fresh	5,202,800	150,705	3,654,737	$70,978	29,721,228	1,212,042
Frozen	110,400	2,302	825,751	16,679	936,151	18,981
Salted	1,279,425	35,631	1,289,200	39,742	5,306,365	139,659
Smoked	9,250	1,105	7,500	375	45,915	6,373
Eels					55,323	4,931
Goldeye and mooneye					13,438	140
Muskellunge					85	9
Pike	31,493	3,100	572	101	190,645	17,055
Pike perch:						
Blue pike					14,589,735	725,217
Saugers					6,002,378	295,337
Wall-eyed or yellow pike	73,743	12,511			3,374,973	495,778
Rock bass					5,974	308
Sheepshead or drum	3,912	80			2,413,591	58,460
Shiner					13,450	10,088
Sturgeon					96,324	26,116
Sturgeon caviar					1,858	3,635
Suckers:						
Fresh	986,444	63,201	1,975	120	5,377,653	263,015
Salted	17,560	560			17,560	560
Sunfishes					13,687	636
Trout, lake:						
Fresh	5,519,223	737,437	738,551	52,000	13,699,919	1,645,981
Salted	9,020	501	17,100	1,156	26,120	1,657
Trout, steelhead					11,105	2,233
White bass	7,905	245			1,030,514	42,251

[5] Includes mussel fisheries of the Wolf River.

Persons engaged, investment, and products in the fisheries of the Great Lakes in 1922, by States—Continued

Items	Wisconsin		Minnesota		Total	
PRODUCTS—continued						
Whitefish, common:	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Fresh	341,389	$53,058	34,925	$4,105	4,205,230	$697,931
Salted			50	35	50	35
Caviar					1,289	1,009
Whitefish, Menominee:						
Fresh	33,037	2,399	8,768	370	148,019	10,163
Salted	14,480	677	8,100	405	23,540	1,142
Yellow perch	952,479	65,352			4,902,250	314,928
Other fish					1,200	60
Crawfish	82,764	2,887			82,764	2,887
Turtles					1,408	113
Mussel shells	25,805	408			6,245,975	218,148
Pearls		26				8,812
Slugs		12				6,913
Oil	2,625	105			2,625	105
Total	15,601,039	1,104,788	6,587,229	186,066	108,732,443	6,689,611

NOTE.—The mussel fisheries in the rivers tributary to the Great Lakes have been prosecuted only a few years and have never previously been shown with statistics of the Great Lakes.

MICHIGAN

The fisheries of Michigan were prosecuted in Lakes Superior, Michigan, Huron, St. Clair and tributaries, and Erie, but were most extensive in Lake Huron and Lake Michigan. They are given in detail in the following table:

Persons engaged, investment, and products of the fisheries of Michigan in 1922, by lakes

Items	Lake Erie [1]		Lake St. Clair [2]		Lake Huron	
PERSONS ENGAGED	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
On vessels fishing					131	
On vessels transporting					9	
In shore or boat fisheries	168		90		705	
Shoresmen	78				156	
Total	246		90		1,001	
INVESTMENT						
Vessels fishing:						
Steam					18	$84,500
Tonnage					443	
Outfit						25,190
Gasoline					11	9,400
Tonnage					89	
Outfit						2,385
Vessels transporting:						
Steam					1	1,000
Tonnage					8	
Outfit						65
Gasoline					13	25,950
Tonnage					110	
Outfit						2,000
Sail and rowboats	77	$4,130	52	$2,770	224	11,825
Power boats	32	14,350	30	6,900	248	118,225
Apparatus, vessel fisheries:						
Gill nets					4,043	78,885
Lines						7,275
Apparatus, shore fisheries:						
Pound nets and trap nets	50	3,940			1,474	366,390
Gill nets	28	112			2,960	36,139
Fyke nets	320	8,570			425	26,290
Seines (haul)	50	6,090	3	2,700	75	18,290
Lines				87		1,070
Other apparatus		44				
Shore and accessory property		268,860		5,400		644,388
Cash capital		64,100				189,500
Total		370,196		17,857		1,648,767

[1] Includes the mussel fisheries of the Huron and Raisin Rivers.
[2] Includes St. Clair River.

Persons engaged, investment, and products of the fisheries of Michigan in 1922, by lakes—Continued

Items	Lake Erie		Lake St. Clair		Lake Huron	
PRODUCTS	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Black bass			2,000	$200		
Buffalofish					63	$3
Burbot					3,075	62
Carp, German	2,164,726	$93,300	260,000	10,400	1,065,116	41,256
Catfish and bullheads	55,943	5,149	1,005	148	64,826	4,518
Ciscoes:						
Fresh	210	14			2,775,403	90,176
Salted					2,721,060	63,437
Goldeye and mooneye	3,892	39				
Pike	7,332	910	4,040	404	39,473	2,985
Pike perch: Wall-eyed or yellow pike	31,587	3,489	38,620	5,741	1,260,374	171,102
Sheepshead or drum	12,385	265	16	1	46,760	1,400
Sturgeon			231	61	2,374	928
Sturgeon caviar					126	269
Suckers	144,122	3,878			1,889,129	104,204
Trout, lake					2,108,249	215,501
White bass	1,981	198				
Whitefish:						
Common	3,064	531			1,300,621	199,503
Caviar					1,289	1,009
Menominee—						
Fresh					30,029	1,708
Salted					960	60
Yellow perch	83,004	4,937	4,100	410	633,188	47,138
Mussel shells	99,170	3,165				
Pearls		331				
Slugs		190				
Total	2,607,416	116,396	310,012	17,365	13,942,115	945,259

Items	Lake Michigan [3]		Lake Superior		Total	
PERSONS ENGAGED	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
On vessels fishing	417		34		582	
On vessels transporting	45		3		57	
In shore or boat fisheries	749		288		2,000	
Shoresmen	158		15		407	
Total	1,369		340		3,046	
INVESTMENT						
Vessels fishing:						
Steam	40	$104,100	5	$14,150	63	$202,750
Tonnage	656		100		1,199	
Outfit		28,660		8,970		62,820
Gasoline	109	102,000	3	2,500	123	113,900
Tonnage	892		24		1,005	
Outfit		24,811		2,700		29,896
Vessels transporting:						
Steam					1	1,000
Tonnage					8	
Outfit						65
Gasoline	25	17,160	1	1,500	39	44,600
Tonnage	174		10		294	
Outfit		2,240		300		4,540
Sail and row boats	590	11,015	78	2,245	1,021	31,985
Power boats	195	38,211	[4] 118	36,385	623	214,071
Apparatus, vessel fisheries:						
Gill nets	15,590	149,512	1,155	20,125	20,788	248,522
Lines		13,175		2,830		23,280
Apparatus, shore fisheries:						
Pound nets and trap nets	489	84,690	271	36,475	2,284	491,495
Gill nets	3,599	21,668	3,249	37,188	9,836	95,107
Fyke nets	65	4,715	8	200	818	39,775
Seines (haul)			7	420	135	27,500
Lines		225		4,935		6,317
Other apparatus		4,657				4,701
Shore and accessory property		255,806		39,870		1,214,324
Cash capital		136,057		5,000		394,657
Total		998,692		215,793		3,251,305

[3] Includes the mussel fisheries of the St. Joseph, Grand, Kalamazoo, Maple, Muskegon, Pigeon, and Thornapple Rivers.

[4] Includes one small steamer valued at $500.

NOTE:—The mussel fisheries in the rivers tributary to the Great Lakes have been prosecuted only a few years and have never previously been shown in the statistics of the fisheries of Great Lakes.

Persons engaged, investment, and products of the fisheries of Michigan in 1922, by lakes—Continued

Items	Lake Michigan		Lake Superior		Total	
PRODUCTS	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Black bass					2,000	$200
Buffalo fish	122	$8			185	11
Burbot	5,080	155	829	$16	8,984	233
Carp, German	5,097	155			3,494,939	145,111
Catfish and bullheads	3,665	227			125,439	10,042
Ciscoes:						
Fresh	854,717	33,754	332,413	10,239	3,962,743	134,183
Salted	13,680	399			2,734,740	63,836
Goldeye and mooneye					3,892	39
Pike	20,327	2,951	10,172	1,329	81,344	8,579
Pike perch: Wall-eyed or yellow pike	71,042	10,563	11,311	1,342	1,412,934	192,237
Sheepshead or drum	560	27			59,721	1,693
Sturgeon	7,043	3,177	343	123	9,991	4,289
Sturgeon caviar	670	314			796	583
Suckers	609,892	28,982	198,951	8,325	2,842,094	145,389
Trout, lake	3,454,425	438,385	1,356,231	128,775	6,918,905	782,601
White bass					1,981	198
Whitefish:						
Common	1,240,681	214,235	289,654	40,565	2,834,020	454,834
Caviar					1,289	1,009
Menominee—						
Fresh	75,725	5,667	460	19	106,214	7,394
Salted					960	60
Yellow perch	249,950	14,994	16,786	1,224	987,028	68,703
Mussel shells	4,726,000	180,065			4,825,170	183,230
Pearls		7,600				7,931
Slugs		4,675				4,865
Total	11,338,670	946,333	2,217,150	191,957	30,415,369	2,217,310

WISCONSIN

The fisheries of Wisconsin, which were prosecuted in Lake Superior and Lake Michigan, are shown in detail in the following table:

Persons engaged, investment, and products of the fisheries of Wisconsin in 1922, by lakes

Items	Lake Michigan		Lake Superior		Total	
PERSONS ENGAGED	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
On vessels fishing	534		15		549	
On vessels transporting	70				70	
In shore or boat fisheries	346		111		457	
Shoresmen	240		30		270	
Total	1,190		156		1,346	
INVESTMENT						
Vessels fishing:						
Steam	41	$211,000	1	$5,000	42	$216,000
Tonnage	918		15		933	
Outfit		31,997		3,575		35,572
Gasoline	151	226,350	2	2,300	153	228,650
Tonnage	1,459		19		1,478	
Outfit		29,970		1,830		31,800
Vessels transporting:						
Gasoline	37	38,950			37	38,950
Tonnage	354				354	
Outfit		4,170				4,170
Rowboats	197	6,695	24	720	221	7,415
Power boats	96	23,960	54	15,125	150	39,085
Apparatus, vessel fisheries:						
Gill nets	17,424	170,803	235	3,700	17,659	174,503
Lines		9,550				9,550

Persons engaged, investment, and products of the fisheries of Wisconsin in 1922, by lakes—Continued

Items	Lake Michigan [1]		Lake Superior		Total	
INVESTMENT—continued						
Apparatus, shore fisheries:	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Pound nets and trap nets	202	$82, 525	28	$6, 200	230	$88, 725
Gill nets	6, 515	28, 067	1, 345	15, 464	7, 860	43, 531
Fyke nets	1, 131	22, 940	20	1, 000	1, 151	23, 940
Trammel nets	3	65			3	65
Seines (haul)	40	7, 945			40	7, 945
Lines		205		15		220
Crowfoot bars	2	30			2	30
Forks	2	6			2	6
Crawfish pots	5, 255	1, 409			5, 255	1, 409
Shore and accessory property		617, 820		81, 875		699, 695
Cash capital		173, 395		55, 028		228, 423
Total		1, 687, 852		191, 832		1, 879, 684
PRODUCTS						
Burbot	8, 741	346			8, 741	346
Carp, German	743, 580	24, 847			743, 580	24, 847
Catfish and bullheads	144, 964	7, 293			144, 964	7, 293
Ciscoes:						
Fresh	4, 031, 696	132, 663	1, 171, 104	18, 042	5, 202, 800	150, 705
Frozen			110, 400	2, 302	110, 400	2, 302
Salted	1, 276, 425	35,534	3, 000	97	1, 279, 425	35, 631
Smoked	9, 250	1, 105			9, 250	1, 105
Pike	26, 036	2, 467	5, 457	633	31, 493	3, 100
Pike perch: Wall-eyed, or yellow pike	61, 756	10, 585	11, 987	1, 926	73, 743	12, 511
Sheepshead, or drum	3, 912	80			3, 912	80
Suckers:						
Fresh	903, 040	59, 925	83, 404	3, 276	986, 444	63, 201
Salted	5, 760	147	11, 800	413	17, 560	560
Trout:						
Fresh	4, 806, 515	665, 527	712, 708	71, 910	5, 519, 223	737, 437
Salted	120	5	8, 900	496	9, 020	501
White bass	1, 005	38	6, 900	207	7, 905	245
Whitefish:						
Common	285, 568	46, 240	55, 821	6, 818	341, 389	53, 058
Menominee—						
Fresh	31, 438	2, 310	1, 599	89	33, 037	2, 399
Salted	14, 480	677			14, 480	677
Yellow perch	951, 918	65, 311	561	41	952, 479	65, 352
Crawfish	82, 764	2, 887			82, 764	2, 887
Mussel shells	25, 805	408			25, 805	408
Pearls		26				26
Slugs		12				12
Oil	2, 625	105			2, 625	105
Total	13, 417, 398	1, 058, 538	2, 183, 641	106, 250	15, 601, 039	1, 164, 788

[1] Includes mussel fishery of the Wolf River in Wisconsin, which has never previously been shown.

NEW YORK

The fisheries of New York in the Great Lakes were prosecuted in Lake Ontario and the St. Lawrence and Niagara Rivers and in two counties (Erie and Chautauqua) on Lake Erie. The number of persons engaged, investment, and products of these fisheries are given in detail in the following table:

Persons engaged, investment, and products of the fisheries of New York in 1922, by lakes

Items	Lake Ontario [1]		Lake Erie		Total	
PERSONS ENGAGED	*Number*	*Value*	*Number*	*Value*	*Number*	*Value*
On vessels fishing			96		96	
In shore or boat fisheries	426		95		521	
Shoresmen	14		100		114	
Total	440		291		731	
INVESTMENT						
Vessels fishing:						
Steam			9	$65,000	9	$65,000
Tonnage			208		208	
Outfit				13,000		13,000
Gasoline			9	24,500	9	24,500
Tonnage			88		88	
Outfit				6,575		6,575
Rowboats	232	$7,498	31	1,020	263	8,518
Power boats	111	35,745	24	12,400	135	48,145
Apparatus, vessel fisheries:						
Gill nets			4,819	59,315	4,819	59,315
Apparatus, shore fisheries:						
Trap nets and weirs	421	33,739	22	1,460	443	35,199
Gill nets	2,319	24,215	2,495	23,500	4,814	47,715
Fyke nets	204	3,362			204	3,362
Seines (haul)	25	1,479	12	1,285	37	2,764
Lines		2,045		87		2,132
Scap nets	20	62			20	62
Fishing machines	9	1,175			9	1,175
Other apparatus	13	60			13	60
Shore and accessory property		47,900		322,514		370,414
Cash capital		25,000		406,157		431,157
Total		182,280		936,813		1,119,093
PRODUCTS	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Bowfin	1,558	$86			1,558	$86
Burbot	15,641	1,587	350	$7	15,991	1,594
Carp, German	141,117	11,059	59,060	2,954	200,177	14,013
Catfish and bullheads	110,319	8,348	1,210	76	111,529	8,424
Ciscoes:						
Fresh	194,319	15,545	3,116,054	152,333	3,310,373	167,878
Salted	3,000	450			3,000	450
Eels	55,323	4,931			55,323	4,931
Pike	19,448	2,304			19,448	2,304
Pike perch:						
Blue pike	47,540	4,247	564,529	18,875	612,069	23,122
Sauger			94,277	4,711	94,277	4,711
Wall-eyed or yellow pike	106,310	25,390	10,907	2,319	117,217	27,709
Rock bass	5,974	308			5,974	308
Sheepshead or drum			25	1	25	1
Shiner	13,450	10,088			13,450	10,088
Sturgeon	68,698	17,130	13,899	3,696	82,597	20,826
Sturgeon caviar	935	2,796	14	36	949	2,832
Suckers	92,116	8,532	69,735	4,185	161,851	12,717
Sunfish	13,687	636			13,687	636
Trout, lake	46,698	5,826	1,281	116	47,979	5,942
White bass			1,598	113	1,598	113
Whitefish	54,951	9,603	204,708	40,165	259,659	49,768
Yellow perch	33,515	2,875	46,763	3,247	80,278	6,122
Other fish	1,200	60			1,200	60
Total	1,025,799	131,801	4,184,410	232,834	5,210,209	364,635

[1] Includes St. Lawrence and Niagara Rivers.

FISHERIES OF LAKE OF THE WOODS, RAINY LAKE, AND LAKES KABETOGAMA, NAMAKAN, AND SAND POINT

The number of persons engaged in the fisheries of Lake of the Woods, Rainy Lake, and Lakes Kabetogama, Namakan, and Sand Point, in 1922, was 123, of whom 2 were on transporting vessels, 99 in the shore or boat fisheries, and 22 were shoresmen.

The investment amounted to $139,955, and included 1 transporting vessel, valued at $1,700, and outfit valued at $150; 95 row and gasoline boats valued at $29,680; fishing apparatus valued at $29,225; shore and accessory property valued at $51,150; and cash capital amounting to $28,050. The fishing apparatus included 94 pound nets and trap nets, valued at $22,375; 461 gill nets, valued at $4,525; and 80 fyke nets, valued at $2,325.

The products of the fisheries amounted to 1,677,999 pounds, valued at $110,022, which were divided among the different forms of fishing apparatus as follows: Pound nets and trap nets, 677,877 pounds, valued at $46,627; gill nets, 819,979 pounds, valued at $54,986; and fyke nets, 180,143 pounds, valued at $8,409. The principal species taken were pike perch, 831,558 pounds, valued at $71,761; pike, 305,888 pounds, valued at $15,474; ciscoes, 151,983 pounds, valued at $3,272; whitefish, 141,544 pounds, valued at $8,368; catfish and bullheads, 97,409 pounds, valued at $5,509; suckers, 96,703 pounds, valued at $1,500; yellow perch, 13,204 pounds, valued at $991; burbot, 11,750 pounds, valued at $204; German carp, 9,896 pounds, valued at $270; and sturgeon, 5,059 pounds, valued at $1,974.

The following table shows the extent of the fisheries of Lake of the Woods, Rainy Lake, and Lakes Kabetogama, Namakan, and Sand Point, Minn., in 1922:

Fisheries of Lake of the Woods, Rainy Lake, and Lakes Kabetogama, Namakan, and Sand Point, Minn., 1922

Items	Lake of the Woods		Rainy Lake, and Lakes Kabetogama, Namakan, and Sand Point		Total	
	Number	*Value*	*Number*	*Value*	*Number*	*Value*
PERSONS ENGAGED						
On vessels transporting			2		2	
In shore or boat fisheries	70		29		99	
Shoresmen	18		4		22	
Total	88		35		123	
INVESTMENT						
Transporting vessels:						
Gasoline			1	$1,700	1	$1,700
Tonnage			11		11	
Outfit				150		150
Rowboats	18	$745	6	360	24	1,105
Gasoline boats	45	21,925	26	6,650	71	28,575
Pound nets and trap nets	78	18,375	16	4,000	94	22,375
Gill nets	291	2,825	170	1,700	461	4,525
Fyke nets	80	2,325			80	2,325
Shore and accessory property		45,050		6,100		51,150
Cash capital		21,500		6,550		28,050
Total		112,745		27,210		139,955

Fisheries of Lake of the Woods, Rainy Lake, and Lakes Kabetogama, Namakan, and Sand Point, Minn., 1922—Continued

Items	Lake of the Woods		Rainy Lake, and Lakes Kabetogama, Namakan, and Sand Point		Total	
PRODUCTS						
Pound nets and trap nets:	*Pounds*	*Value*	*Pounds*	*Value*	*Pounds*	*Value*
Bullheads	6,300	$369			6,300	$369
Burbot	11,500	200			11,500	200
Carp, German	4,777	128			4,777	128
Ciscoes	75,339	1,368			75,339	1,368
Crappie	60	5			60	5
Goldeye and mooneye	1,639	29			1,639	29
Muskellunge	251	26			251	26
Pike	107,655	6,122			107,655	6,122
Pike perch (sauger)	41	7			41	7
Pike perch (wall-eyed or yellow pike)	333,623	30,821			333,623	30,821
Rock bass	1,150	80			1,150	80
Sturgeon	5,059	1,974			5,059	1,974
Suckers	51,087	800			51,087	800
Whitefish	75,906	4,395			75,906	4,395
Yellow perch	3,490	303			3,490	303
Total	677,877	46,627			677,877	46,627
Gill nets:						
Burbot	250	4			250	4
Cisco	22,079	221	54,565	$1,683	76,644	1,904
Crappie	378	37			378	37
Goldeye and mooneye	2,807	53			2,807	53
Pike	112,004	4,243	31,735	3,020	143,739	7,263
Pike perch (wall-eyed or yellow pike)	396,845	32,866	92,230	7,583	489,075	40,449
Rock bass			2,286	170	2,286	170
Suckers	28,865	446			28,865	446
Trout, lake	920	24			920	24
Whitefish—						
Common	12,789	944	51,814	3,020	64,603	3,964
Menominee	1,035	9			1,035	9
Yellow perch	1,622	85	7,755	578	9,377	663
Total	579,594	38,932	240,385	16,054	819,979	54,986
Fyke nets:						
Buffalofish	400	12			400	12
Bullheads	91,109	5,140			91,109	5,140
Carp, German	5,119	142			5,119	142
Crappie	2,926	251			2,926	251
Pike	54,494	2,089			54,494	2,089
Pike perch (wall-eyed or yellow pike)	8,819	484			8,819	484
Rock bass	188	12			188	12
Suckers	16,751	254			16,751	254
Yellow perch	337	25			337	25
Total	180,143	8,409			180,143	8,409
Grand total	1,437,614	93,968	240,385	16,054	1,677,999	110,022

NOTE.—There were, in 1922, three wholesale firms engaged in business on the above lakes. These firms used buildings, with accessories, valued at $41,150 and cash capital amounting to $26,500. There were 3 proprietors, or managers, 4 clerks, and 15 other employees engaged, the total wages paid amounting to $35,614.

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PROPAGATION AND DISTRIBUTION OF FOOD FISHES, FISCAL YEAR 1924[1]

By Glen C. Leach, *Assistant in Charge, Division of Fish Culture*

CONTENTS

[1] Appendix V to Report of the U. S. Commissioner of Fisheries for 1924. B. F. Doc. No. 978

Part 2.—DISTRIBUTION OF FISH AND FISH EGGS

INTRODUCTION

During the fiscal year 1924 the fish-cultural activities of the bureau were not varied in any essential particular from those of recent years. No extension of the fields of operation was possible owing to lack of funds. However, the output of fish and fish eggs was the largest in many years, notwithstanding the fact that the funds available for the work were no greater than in 1917. There is no question but that at the present time the fish-cultural stations of the bureau are operating on a very high standard of efficiency, and the results are being accomplished in the face of increased expenditures for all materials and labor entering into the work.

FRESH-WATER FISHES

The demands for fish for stocking interior waters were greatly increased in 1924, probably because the interest in fish culture is becoming greater and because of the constantly increasing number of fishponds constructed. Some of the States have recently established additional hatcheries, opened up new fields of operation, and strengthened their game-warden service.

With respect to the fishes of interior waters no material changes occurred in the bureau's methods of procedure. No extensions in hatching facilities were made during the year, since the financial situation prohibits the enlargement of the pond areas. Moreover, the holding of a larger stock of brood fish would have involved increased expenditures for food, and funds to cover its purchase were out of the question.

The bureau has always depended upon the overflowed lands along the Mississippi River to furnish approximately 70 per cent of the black bass, crappie, and other so-called warm-water fishes needed for stocking ponds and streams in various parts of the country, the facilities for the production of such species at the permanently established pond-culture stations being too limited to meet the requirements.

In view of the uncertain conditions involved in the rescue work, it is realized that dependence upon the Mississippi River collections for fish of this character can not be continued indefinitely. During some seasons the floods do not attain their usual volume. In such years they cover only a comparatively small area, and there is a consequent shortage in the supply of fish. This naturally necessitates delay in the filling of many applications, and they have to be carried on file for attention the following year. The difficulties encountered will probably compel the bureau to take steps in the near future for the establishment of bass stations on a widely extended scale. For this purpose it may be possible to obtain control of certain areas that are not suitable for agriculture and devote from 100 to 1,000 acres of such lands to the cultivation of bass and kindred species. It is believed that ponds of this size could be established in several sections of the country, and that through such means it would be possible to meet the demands for warm-water pondfishes for some years to come. Trout are being produced in sufficient numbers to meet all present demands.

Fish-cultural work in the Great Lakes regions was limited to the collection and incubation of eggs of the whitefish, lake trout, and pike perch, and the distribution of the resulting fry on suitable spawning areas. As usual the eggs were taken by placing men on the fishing boats to remove the eggs before the fish were sent to market.

MARINE AND ANADROMOUS FISHES

While there has been no expansion of the fields covering this branch of the bureau's work, fluctuations occur from year to year, depending upon weather conditions. The usual number of salmon stations was operated on the Pacific coast. It has been the policy to enlarge the rearing facilities at such stations as much as possible, so as to permit of a yearly increase in the number of fingerling salmon distributed. Some minor improvements were effected in hatching equipment in the interest of greater efficiency.

The eggs of the salmon were obtained by the usual method of placing racks across the streams to intercept the run. Eggs of the cod and other marine species were secured by placing spawn takers on the boats, except in the case of the Woods Hole station, which is equipped with a cod pool where spawning fish are held and permitted to deposit their eggs under more or less natural conditions. On receipt of a report during the spring of 1924 that large numbers of cod with ripe eggs were being taken off the fishing banks, the bureau at once placed spawn takers on the boats operating in this region to take and fertilize the eggs and immediately plant them on the natural spawning grounds. All eggs thus taken represent actual saving, since otherwise they would be lost in the process employed in preparing the fish for market. It would doubtless be expedient for some of the States to undertake similar operations for the salvage of eggs of the shad, herring, and other commercial fishes. The work could be conducted at points where it is impossible to transfer the eggs to hatcheries for incubation, or where fishing operations are prosecuted on too small a scale to warrant the establishment of hatcheries.

COOPERATIVE OPERATIONS WITH STATES, OTHER FEDERAL AGENCIES, AND FOREIGN GOVERNMENTS

It has been the bureau's policy to cooperate with the States in fish-cultural activities wherever it could be advantageously managed, and such work has been of material benefit both to the States and to the bureau. It is largely through cooperation that the bureau was able to increase its output in 1924 over that of recent years, notwithstanding the curb placed upon its efforts by the limited funds available. Exchanges of eggs with State fishery authorities were made on an extended scale, and in so far as was practicable distributions of fish were planned with the view of avoiding duplication of effort in making deliveries. In many instances applicants apply to their State authorities and also to the bureau for fish. They are frequently inconsistent in such demands, requesting a certain species from the State and another wholly imcompatible species from the bureau, both of them being intended for the same waters. In several instances the bureau has aided State authorities by detailing men of experience to assist in the establishment of fish-cultural stations or to give advice in regard to pending fish-cultural problems.

Cooperative work along similar lines has been taken up with the Forest Service, the Reclamation Service, and the National Park Service. All of these agencies have been of great assistance to the bureau in the transportation of fish and eggs to waters within the jurisdiction of the Government. At this time practically all of the national preserves are well protected and fishing is closely regulated.

It is the general opinion that the stocking of waters located within the national reservations is of considerable benefit to surrounding communities. These waters serve as nurseries to the fish planted therein, and after attaining the adult stage the fish usually seek the lower waters of the streams or such portions as contain a more abundant food supply. In this way the stocking of waters outside the reservations is brought about.

Very satisfactory exchanges were effected with the Canadian Government during the year. The bureau's Craig Brook (Me.) station was stocked with Atlantic salmon eggs furnished from Canadian hatcheries, and the bureau furnished in return eggs of other especially desired species.

FISH CONSERVATION

The bureau finds a growing sentiment in favor of fish protection. This is evidenced through the recent changes in the fishery laws of many States, the more favorable legislation enacted being made possible largely through the influence and united efforts of interested organizations and individuals.

It is realized that if the streams are depleted there will be no means of obtaining fish or fish eggs for propagation, and for a long time the bureau has been urging the protection of fish during the spawning season, a reduction in the bag limit, and an increase in the size limit.

If the supply of fish in public streams is to be maintained it is very essential that special consideration be given to these three important points.

There has been considerable agitation in regard to the establishment of dams in rivers. Where such obstructions prevent the passage of the anadromous species to their natural spawning grounds they may constitute a serious menace to the future of certain fisheries. Under some conditions dams are a distinct benefit, since they form large reservoirs that furnish more protection and longer nursery areas to fish than do the natural streams, and thus serve as a source for the development of a large amount of natural food for fish.

Every year the bureau is receiving an increased amount of cooperation from fish and game clubs in the protection of waters in which they are directly interested. Such organizations not only receive the fish and carefully plant them in suitable places, but they are instrumental in the enforcement of the bag and size limit and in the protection of local waters against illegal fishing.

A more favorable sentiment is developing along the upper Mississippi River with regard to the salvage of food fishes from landlocked pools, and several organizations have furnished within recent years an appreciable amount of assistance in the work. This is especially true in Louisiana, where the fish are removed from more or less inaccessible waters and placed in streams and lakes where they will be of future benefit to the public.

Part 1.—FISH PRODUCTION: PROPAGATION AND RESCUE WORK

TABULAR SUMMARIES OF OPERATIONS

SPECIES OF FISHES HANDLED

During the fiscal year 1924 the fish-cultural work of the bureau, including artificial propagation and rescue work, involved the handling of 53 species of fishes, as follows:

LIST OF SPECIES HANDLED

THE CATFISHES (SILURIDÆ):
- Blue catfish (*Ictalurus furcatus*).
- Channel catfish (*Ictalurus punctatus*).
- Horned pout, bullhead (*Ameiurus nebulosus*).
- Mississippi catfish (*Ameiurus lacustris*).
- Yellow catfish (*Ameiurus natalis*).
- Black bullhead (*Ameiurus melas*).
- Mud catfish (*Leptops olivaris*).

THE SUCKERS (CATOSTOMIDÆ):
- Mongrel buffalo fish (*Ictiobus urus*).
- Common buffalo fish (*Ictiobus cyprinella*).
- Small-mouth buffalo fish (*Ictiobus bubalus*).

THE CARPS (CYPRINIDÆ): German carp (*Cyprinus carpio*).

THE SHADS AND HERRINGS (CLUPEIDÆ):
- Shad (*Alosa sapidissima*).
- Glut herring (*Pomolobus æstivalis*)

THE SALMONS, TROUTS, WHITEFISHES, ETC. (SALMONIDÆ):
- Common whitefishes, (*Coregonus albus* and *C. clupeaformis*).
- Cisco (*Argyrosomus artedi*).
- Chinook salmon, king salmon, quinnat salmon (*Oncorhynchus tschawytscha*).
- Chum salmon, dog salmon, (*Oncorhynchus keta*).
- Humpback salmon, pink salmon (*Oncorhynchus gorbuscha*).
- Silver salmon, coho salmon (*Oncorhynchus kisutch*).
- Sockeye salmon, blueback salmon, redfish (*Oncorhynchus nerka*).
- Steelhead salmon (*Salmo gairdneri*).
- Atlantic salmon (*Salmo salar*).
- Landlocked salmon (*Salmo sebago*).
- Rainbow trout (*Salmo shasta*).
- Black-spotted trout, redthroat trout (*Salmo lewisi*).
- Loch Leven trout (*Salmo levenensis*).
- Lake trout, Mackinaw trout (*Cristivomer namaycush*).
- Brook trout (*Salvelinus fontinalis*).

THE GRAYLINGS (THYMALLIDÆ): Montana grayling (*Thymallus montanus*).

THE SMELTS (OSMERIDÆ): Smelt (*Osmerus mordax*).

THE PIKES (ESOCIDÆ):
- Little pickerel (*Esox vermiculatus*).
- Common pickerel (*Esox lucius*).

THE SUNFISHES, BLACK BASSES, AND CRAPPIES (*Centrarchidæ*):
- Crappies (*Pomoxis annularis* and *P. sparoides*).
- Large-mouth black bass (*Micropterus salmoides*).
- Small-mouth black bass (*Micropterus dolomieu*).
- Rock bass (*Ambloplites rupestris*).
- Warmouth bass, goggle-eye (*Chænobryttus gulosus*).
- Green sunfish (*Apomotis cyanellus*).
- Red-breasted bream (*Lepomis auritus*).
- Bluegill sunfish (*Lepomis pallidus*).
- Long-eared sunfish (*Lepomis megalotis*).
- Common sunfish (*Eupomotis gibbosus*).

THE PERCHES (PERCIDÆ):
- Pike perch (*Stizostedion vitreum*).
- Sauger (*Stizostedion canadense*).
- Yellow perch, ringed perch (*Perca flavescens*).

THE SEA BASSES (SERRANIDÆ): White bass (*Roccus chrysops*).

THE DRUMS (SCIÆNIDÆ): Fresh-water drum, lake sheepshead (*Aplodinotus grunniens*).

THE CODS (GADIDÆ):
- Cod (*Gadus callarias*).
- Haddock (*Melanogrammus æglefinus*).
- Pollock (*Pollachius virens*).

THE FLOUNDERS (PLEURONECTIDÆ): Winter flounder, American flatfish (*Pseudopleuronectes americanus*).

OUTPUT

The combined work of the fish-cultural and the rescue stations of the bureau during the fiscal year 1924 resulted in a gross output of 5,361,947,981 eggs, fry, and fingerling fish. Losses in transportation amounted to 137,327, leaving a net total of 5,361,810,654 fish and eggs actually distributed, an increase of 1,046,951,625 over the net output of the preceding year. About 90 per cent of the output consisted of such commercial species as the salmons, whitefishes, cisco, pike perch, yellow perch, shad, herring, cod, haddock, pollock, and flounder. With the exception of a few shipments furnished to State fish commissions, the entire output of the commercial species was returned to the waters from which the egg collections were made.

Summary, by species, of the output of fish and fish eggs during the fiscal year ended June 30, 1924

Species	Eggs	Fry	Fingerlings	Total
Catfish			30,245,755	30,245,755
Buffalofish	281,728,500		23,706,323	305,434,823
Carp	13,500,000	28,875,000	36,693,618	79,068,618
Shad		15,033,000		15,033,000
Glut herring		95,000,000		95,000,000
Whitefish	73,560,000	299,220,000		372,780,000
Cisco	10,000,000	128,360,000		138,360,000
Chinook salmon	12,785,100	1,801,000	41,526,405	56,112,505
Chum salmon		23,512,320	765,600	24,277,920
Silver salmon		11,419,990	11,430,150	22,850,140
Sockeye salmon	3,320,000	8,819,840	30,168,545	42,308,385
Humpback salmon		1,260,000	11,580	1,271,580
Steelhead salmon	2,180,000	383,685	4,927,290	7,490,975
Atlantic salmon		494,000	7,000	501,000
Landlocked salmon	90,500	752,350	155,360	998,210
Rainbow trout	1,360,611	1,261,000	3,075,513	5,697,124
Black-spotted trout	13,332,000	6,314,900	2,710,000	22,356,900
Loch Leven trout	2,178,000		2,095,800	4,273,800
Lake trout	1,839,646	34,286,710	313,296	36,439,652
Brook trout	17,857	3,052,089	9,569,385	12,639,331
Smelt	8,000,000	9,300,000		17,300,000
Pike and pickerel		7,392,000	784,027	8,176,027
Crappie			22,575,531	22,575,531
Large-mouth black bass		710,950	1,675,724	2,386,674
Small-mouth black bass		596,300	69,500	665,800
Rock bass			100,800	100,800
Warmouth bass			4,519	4,519
Sunfish			27,552,589	27,552,589
Pike perch	97,005,000	71,250,000		168,255,000
Yellow perch		212,009,400	630,452	212,639,852
White bass			714,447	714,447
Fresh-water drum			230,566	230,566
Cod	481,355,000	392,423,000		873,778,000
Haddock	235,330,000	2,590,000		237,920,000
Pollock		263,440,000		263,440,000
Winter flounder		2,244,290,000		2,244,290,000
Miscellaneous fishes			8,641,131	8,641,131
Total	1,237,582,214	3,863,847,534	260,380,906	5,361,810,654

Assignments of fish eggs to State and Territorial fish commissions, fiscal year 1924

State and species	Number
California:	
Black-spotted trout	100,000
Lake trout	75,000
Colorado: Steelhead salmon	75,000
Connecticut:	
Lake trout	50,000
Pike perch	5,180,000
Hawaii: Steelhead salmon	25,000
Idaho: Chinook salmon	140,000
Illinois:	
Brook trout	2,500
Chinook salmon	10,000
Loch Leven trout	20,000
Rainbow trout	55,000
Whitefish	6,560,000
Iowa:	
Brook trout	9,000
Rainbow trout	152,220
Pike perch	13,825,000
Maine: Lake trout	75,000
Maryland: Rainbow trout	36,666
Massachusetts: Lake trout	3,000
Michigan:	
Cisco	10,000,000
Whitefish	3,000,000
Minnesota: Lake trout	250,000
Missouri: Rainbow trout	11,000
Montana:	
Black-spotted trout	3,872,000
Chinook salmon	200,000
Loch Leven trout	1,500,000
Nebraska: Rainbow trout	148,000
Nevada: Steelhead salmon	25,000
New Hampshire: Lake trout	75,000
New Mexico: Steelhead salmon	25,000
New York:	
Black-spotted trout	10,000
Lake trout	320,000
Rainbow trout	10,000
Steelhead salmon	100,000
North Dakota: Steelhead salmon	50,000
Oregon:	
Black-spotted trout	1,000,000
Chinook salmon	10,886,000
Rainbow trout	323,010
Sockeye salmon	3,120,000
Pennsylvania:	
Landlocked salmon	20,000
Loch Leven trout	108,000
Pike perch	78,000,000
Whitefish	16,680,000
South Dakota: Loch Leven trout	250,000
Utah:	
Lake trout	250,000
Landlocked salmon	20,000
Steelhead salmon	100,000
Vermont:	
Lake trout	201,646
Landlocked salmon	20,000
Steelhead salmon	75,000
Wisconsin: Lake trout	450,000
Wyoming:	
Black-spotted trout	723,000
Loch Leven trout	100,000
Total	158,406,042

Shipments of fish eggs to foreign countries, fiscal year 1924

Country and species	Number	Country and species	Number
Canada: Black-spotted trout	250,000	Netherlands: Chinook salmon	200,000
Chile: Sockeye salmon	200,000	Poland: Rainbow trout	50,000
Czechoslovakia: Steelhead salmon	50,000		
France:		Total	850,000
Black-spotted trout	50,000		
Rainbow trout	50,000		

EGG COLLECTIONS

The records show a large increase in egg collections over those of the preceding year. This excess was made possible by the unusual degree of success attained in the work with the commercial fishes, the collections of the marine species alone exceeding those in 1923 by over 800,000,000. An important factor in this connection was the work conducted in connection with the fisheries on Georges Bank, these operations yielding nearly 197,000,000 eggs in addition to those obtained for the hatcheries. In its prosecution spawn takers detailed by the bureau accompany the vessels to those distant fisheries to take and fertilize eggs of the cod and haddock, which would otherwise be discarded, and plant them on the natural spawning areas.

Other notable increases in the yearly collections were in those of the pike perch, yellow perch, and black-spotted trout in the Yellowstone National Park, and of Loch Leven trout in the Meadow Creek field.

Comparison of egg collections, fiscal years 1924 and 1923

Species	1924	1923	Species	1924	1923
Buffalofish	376,778,500	179,173,600	Black-spotted trout	39,859,500	16,655,820
Carp	55,325,000	160,500,000	Loch Leven trout	7,920,050	98,130
Shad	16,452,000	17,877,000	Lake trout	78,016,233	77,775,890
Glut herring	222,740,000	313,422,620	Brook trout	18,488,304	19,100,040
Whitefish	481,018,000	537,546,000	Smelt	18,000,000	42,000,000
Cisco	200,790,000	76,800,000	Pike perch	333,875,000	230,040,000
Pilotfish		255,000	Sauger	8,400,000	
Chinook salmon	55,474,800	30,889,000	Yellow perch	224,780,000	151,010,000
Chum salmon	25,344,700	26,513,500	Striped bass		22,084,000
Humpback salmon	1,573,000	1,099,200	Cod	1,002,814,000	1,279,709,000
Silver salmon	22,722,400	15,159,800	Haddock	239,610,000	109,220,000
Sockeye salmon	46,688,000	97,886,000	Pollock	401,824,000	420,536,000
Steelhead salmon	6,031,164	7,946,300	Winter flounder	2,404,887,000	1,391,411,000
Landlocked salmon	1,298,600	852,350			
Rainbow trout	11,433,217	11,488,410	Total	6,302,143,468	5,237,057,660

FISH-RESCUE WORK

That part of the 1924 output of fish obtained through the rescue of stranded fishes in the Mississippi Valley region was increased over that of 1923 by upward of 10,500,000. The following table gives a résumé of operations:

Number and disposition of fish rescued, fiscal year 1924

Station and species	Delivered to applicants	Restored to original waters	Total
Homer, Minn.:			
Black bass	89,635	65,310	154,945
Buffalo fish		242,795	242,795
Carp	125	3,755,770	3,755,895
Catfish	68,245	2,370,230	2,438,475
Crappie	58,865	8,464,010	8,522,875
Drum		67,020	67,020
Pike and pickerel		230,000	230,000
Sunfish	164,330	9,093,320	9,257,650
White bass		18,915	18,915
Yellow perch	12,691	324,889	337,580
Miscellaneous		206,835	206,835
Total	393,891	24,839,094	25,232,985
Bellevue, Iowa:			
Black bass	29,405	7,750	37,155
Buffalo fish		13,885,150	13,885,150
Carp	600	16,500,000	16,500,600
Catfish	32,600	3,750,000	3,782,600
Crappie	445	311,790	312,235
Drum		21	21
Pike and pickerel		402	402
Sunfish	27,385	551,715	579,100
White bass		437	437
Yellow perch	2,755	921	3,676
Miscellaneous		5,076,390	5,076,390
Total	93,190	40,084,576	40,177,766
La Crosse, Wis.:			
Black bass	96,070	52,435	148,505
Buffalo fish		7,926,514	7,926,514
Carp	200	12,270,570	12,270,770
Catfish	95,900	14,488,220	14,584,120
Crappie	16,875	7,922,180	7,939,055
Drum		161,370	161,370
Pike and pickerel		375,025	375,025
Sunfish	129,057	10,642,854	10,771,911
Warmouth bass	15		15
White bass		2,174	2,174
Yellow perch	5,191	231,510	236,701
Miscellaneous		2,617,506	2,617,506
Total	343,308	56,690,358	57,033,666
Marquette, Iowa:			
Black bass	74,360	20,745	95,105
Buffalo fish		1,284,800	1,284,800
Carp		3,864,050	3,864,050
Catfish	22,260	8,341,800	8,364,060
Crappie		5,090,600	5,090,500
Drum		2,000	2,000
Pike and pickerel		177,750	177,760
Sunfish	270	4,198,025	4,198,295
White bass		691,600	691,000
Yellow perch	1,895	49,330	51,225
Total	98,785	23,720,600	23,819,385
Rock Island, Ill.:			
Black bass		2,015	2,015
Buffalo fish		125,570	125,570
Carp		161,010	161,010
Catfish		356,850	356,850
Crappie		380,800	380,800
Drum		155	155
Sunfish		693,600	693,600
White bass		155	155
Miscellaneous		502,400	502,400
Total		2,222,555	2,222,555

Number and disposition of fish rescued, fiscal year 1924—Continued

Station and species	Delivered to applicants	Restored to original waters	Total
Atchafalaya, La.:			
Black bass	950	1,650	2,600
Buffalo fish		72,900	72,900
Catfish	600	232,400	233,000
Crappie		30,800	30,800
Pike and pickerel		850	850
Sunfish	1,880	54,100	55,980
White bass		950	950
Yellow perch		1,100	1,100
Miscellaneous		238,000	238,000
Total	3,430	632,750	636,180
Friar Point, Miss.:			
Black bass	33,170	2,435	35,605
Catfish	7,650	36,020	43,670
Crappie	11,890	15,250	27,140
Rock bass	5,700	8,450	14,150
Sunfish	67,950	613,800	681,750
Total	126,360	675,955	802,315
Fairport, Iowa:			
Black bass	289	18,599	18,888
Buffalo fish	12,064	78,265	90,329
Carp		70,684	70,684
Catfish	111	193,046	193,157
Crappie		100,434	100,434
Sunfish	23,593	87,257	110,850
Warmouth bass	538		538
White bass		108	108
Total	36,595	548,393	584,988
Total of all stations:			
Black bass	323,879	170,939	494,818
Buffalo fish	12,064	23,615,994	23,628,058
Carp	925	36,022,084	36,023,009
Catfish	227,366	29,768,566	29,995,932
Crappie	88,075	22,315,764	22,403,839
Drum		230,566	230,566
Rock bass	5,700	8,450	14,150
Pike and pickerel		784,027	784,027
Sunfish	414,465	25,934,671	26,349,136
Warmouth bass	553		553
White bass		714,339	714,339
Yellow perch	22,532	607,750	630,282
Miscellaneous		8,641,131	8,641,131
Grand total	1,095,559	149,414,281	150,509,840

STATIONS AND SUBSTATIONS AND OUTPUT OF EACH

During the fiscal year 1924 propagation work was conducted at 35 main stations and 40 substations. In the following table each main station is listed in its alphabetical order, together with the substations attached thereto. The numbers of fish and eggs furnished for distribution are also shown, including those propagated and those rescued from overflowed lands.

Stations and substations operated and output of each, fiscal year 1924

[Asterisk (*) denotes transfer of eggs. See table, p. 376]

Stations and substations	Species	Eggs	Fry	Fingerlings, yearlings, and adults	Total
Baird, Calif	Chinook salmon			1,242,300	1,242,300
Battle Creek, Calif	do			2,523,700	2,523,700
Mill Creek, Calif	do	(*)	1,050,000	720,000	1,770,000
Baker Lake, Wash	do		38,000		38,000
	Silver salmon	(*)	1,850,000		1,850,000
	Sockeye salmon	(*)	7,517,000	638,000	8,155,000
Birdsview, Wash	Chinook salmon			1,137,105	1,137,105
	Silver salmon	(*)	5,653,000	87,000	5,740,000
	Sockeye salmon	200,000			200,000
	Steelhead salmon	*70,000		555,000	625,000
Duckabush, Wash	Chum salmon		14,540,000		14,540,000
	Humpback salmon		890,100		890,100
	Silver salmon			2,622,000	2,622,000
	Steelhead salmon			209,110	209,110
Quilcene, Wash	Chum salmon		8,972,320		8,972,320
	Silver salmon		1,100,000	1,138,000	2,238,000
	Steelhead salmon			658,450	658,450
Sultan, Wash	Chinook salmon		259,000	278,000	537,000
	Humpback salmon		27,900		27,900
	Silver salmon		1,822,000	45,000	1,867,000
	Sockeye salmon		2,840		2,840
	Steelhead salmon			216,000	216,000
Berkshire trout hatchery, Mass.	Brook trout			107,340	107,340
	Rainbow trout			3,270	3,270
Boothbay Harbor, Me	*Winter flounder*		1,548,771,000		1,548,771,000
Bozeman, Mont	Black-spotted trout		145,000	651,500	796,500
	Brook trout			792,145	792,145
	Lake trout			61,000	61,000
	Loch Leven trout	*2,078,000		421,000	2,499,000
	Rainbow trout	*40,000		194,000	234,000
	Steelhead salmon			26,000	26,000
Glacier Park, Mont	Black-spotted trout	329,000		665,000	994,000
	Rainbow trout			150,000	150,000
Meadow Creek, Mont.	Black-spotted trout		5,400		5,400
	Rainbow trout	*397,215	1,172,122		1,569,337
Cape Vincent, N. Y.	Brook trout		922,000		922,000
	Cisco	*10,000,000	128,360,000		138,360,000
	Lake trout	*13,000	725,000		738,000
	Rainbow trout		89,000		89,000
	Whitefish		72,670,000		72,670,000
	Yellow perch			100	100
Swanton, Vt	Pike perch	*83,180,000	29,800,000		112,980,000
	Yellow perch		10,300,000		10,300,000
Central Station, Washington, D. C.	Chinook salmon		6,000		6,000
	Brook trout			136,600	136,600
	Rainbow trout			23,200	23,200
Bryans Point, Md	Shad		7,963,000		7,963,000
	Yellow perch		193,769,400	150	193,769,550
Lakeland, Md	Large-mouth black bass.			58,585	58,585
	Catfish			2,945	2,945
	Crappie			34,235	34,235
	Sunfish			33,785	33,785
Clackamas, Oreg	Brook trout			542,000	542,000
	Chinook salmon	*4,010,000		7,918,700	11,928,700
	Chum salmon			7,600	7,650
	Silver salmon			8,850	8,800
	Steelhead salmon	25,000		55,600	80,600
Applegate, Oreg.	Silver salmon			5,341,800	5,341,800
	Steelhead salmon	*2,085,000		1,721,800	3,806,800
Big White Salmon, Wash.	Brook trout		477,930		477,930
	Chinook salmon			8,487,600	8,487,600
	Rainbow trout			203,000	203,000
	Silver salmon		994,990		994,990
	Steelhead salmon		298,685		298,685
Little White Salmon, Wash.	Chinook salmon	*2,246,000		11,394,000	13,640,000
	Chum salmon			758,000	758,000
Pahsimeroi, Idaho	Chinook salmon		448,000		448,000
Rogue River, Oreg	Black-spotted trout			18,000	18,000
	Chinook salmon			3,647,000	3,647,000
	Silver salmon			2,074,500	2,074,500
	Sockeye salmon			23,700	23,700
	Steelhead salmon			373,500	373,500
Sandy River, Oreg	Chinook salmon			901,000	601,000
	Silver salmon			113,000	113,000
	Steelhead salmon			721,000	721,000

Stations and substations operated and output of each, fiscal year 1924—Continued

Stations and substations	Species	Eggs	Fry	Fingerlings, yearlings, and adults	Total
Clackamas, Oreg.—Con.					
Snake River, Oreg.	Chinook salmon	5,180,000		3,577,000	8,757,000
	Rainbow trout			200,000	200,000
Upper Clackamas, Oreg.	Chinook salmon	*1,349,100			1,349,100
Cold Springs, Ga.	Large-mouth black bass.		37,750	103,750	141,500
	Catfish			5,300	5,300
	Crappie			950	950
	Sunfish			95,600	95,600
Craig Brook, Me.	Atlantic salmon		494,000	7,000	501,000
	Brook trout	(*)	238,000	722,700	960,700
	Humpback salmon		342,000	11,580	353,580
	Landlocked salmon	*90,500	70,000	111,600	272,100
Green Lake, Me.	Brook trout		48,000		48,000
	Landlocked salmon	(*)	607,350		607,350
	Smelt	8,000,000	9,300,000		17,300,000
Duluth, Minn.	Brook trout			136,000	136,000
	Lake trout	825,000	11,830,000	152,000	12,807,000
	Pike perch		1,450,000		1,450,000
	Steelhead salmon			41,000	41,000
	Whitefish		13,000,000		13,000,000
Erwin, Tenn.	Large-mouth black bass.		7,000	25,000	32,000
	Brook trout			247,000	247,000
	Loch Leven trout			36,500	36,500
	Rainbow trout			364,400	364,400
	Rock bass			16,900	16,900
	Steelhead trout			10,600	10,600
	Sunfish			20,760	20,760
Edenton, N. C.	Large-mouth black bass.		1,500	21,845	23,345
	Catfish			200	200
	Glut herring		95,000,000		95,000,000
	Shad		7,070,000		7,070,000
	Sunfish			2,600	2,600
	Yellow perch		2,450,000		2,450,000
Fairport, Iowa	Large-mouth black bass.			37,487	37,487
	Buffalo fish			168,594	168,594
	Carp			141,368	141,368
	Catfish			386,295	386,295
	Crappie			200,868	200,868
	Sunfish			201,225	201,225
	Warmouth bass			559	559
	White bass			216	216
Gloucester, Mass.	Cod	481,355,000	388,760,000		870,115,000
	Haddock	235,330,000	2,590,000		237,920,000
	Pollock		261,790,000		261,790,000
	Winter flounder		91,460,000		91,460,000
Homer, Minn.	Large-mouth black bass.			154,945	154,945
	Buffalo fish			242,795	242,795
	Carp			3,755,895	3,755,895
	Catfish			2,438,475	2,438,475
	Crappie			8,522,875	8,522,875
	Fresh-water drum			67,020	67,020
	Pike and pickerel			230,000	230,000
	Sunfish			9,257,650	9,257,650
	White bass			18,915	18,915
	Yellow perch			337,580	337,580
	Miscellaneous			206,835	206,835
Atchafalaya, La.	Large-mouth black bass.			2,600	2,600
	Buffalo fish	182,462,500		72,900	182,535,400
	Catfish			233,000	233,000
	Crappie			30,800	30,800
	Pike and pickerel			850	850
	Sunfish			55,980	55,980
	White bass			950	950
	Yellow perch			1,100	1,100
	Miscellaneous			238,000	238,000
Bellevue, Iowa	Large-mouth black bass.			37,155	37,155
	Buffalo fish	99,266,000		13,885,150	113,151,15
	Carp	13,500,000		16,500,600	30,000,600
	Cat fish			3,782,600	3,782,600
	Crappie			312,235	312,230
	Fresh-water drum			21	25
	Pike and pickerel			402	401
	Sunfish			579,100	579,10

Stations and substations operated and output of each, fiscal year 1924—Continued

Stations and substations	Species	Eggs	Fry	Fingerlings, yearlings, and adults	Total
Homer, Minn.—Contd.					
Bellevue, Iowa—Con.	White bass			437	437
	Yellow perch			3,676	3,676
	Miscellaneous			5,076,390	5,076,390
La Crosse, Wis.	Large-mouth black bass.			148,505	148,505
	Brook trout			482,100	482,100
	Buffalo fish			7,926,514	7,926,514
	Carp			12,270,770	12,270,770
	Catfish			14,584,120	14,584,120
	Crappie			7,939,055	7,939,055
	Fresh-water drum			161,370	161,370
	Loch Leven trout			75,000	75,000
	Pike and pickerel			375,025	375,025
	Rainbow trout			179,200	179,200
	Sunfish			10,771,911	10,771,911
	Warmouth bass			15	15
	White bass			2,174	2,174
	Yellow perch			236,701	236,701
	Miscellaneous			2,617,506	2,617,506
Marquette, Iowa	Large-mouth black bass.			95,105	95,105
	Buffalo fish			1,284,800	1,284,800
	Carp			3,864,050	3,864,050
	Catfish			8,364,060	8,364,060
	Crappie			5,090,500	5,090,500
	Fresh-water drum			2,000	2,000
	Pike and pickerel			177,750	177,750
	Sunfish			4,198,300	4,198,300
	White bass			691,600	691,600
	Yellow perch			51,225	51,225
Rock Island, Ill.	Large-mouth black bass.			2,015	2,015
	Buffalo fish			125,570	125,570
	Carp			161,010	161,010
	Catfish			356,850	356,850
	Crappie			380,800	380,800
	Fresh-water drum			155	155
	Sunfish			693,600	693,600
	White bass			155	155
	Miscellaneous			502,400	502,400
Yellowstone, Wyo.	Black-spotted trout	*13,003,000	6,193,500		19,196,500
Leadville, Colo.	do			912,000	912,000
	Brook trout	(*)		3,452,500	3,452,500
	Lake trout			84,000	84,000
	Loch Leven trout			185,000	185,000
	Rainbow trout			12,400	12,400
	Steelhead salmon			45,250	45,250
Louisville, Ky.	Large-mouth black bass.			250	250
	Rock bass			2,000	2,000
	Small-mouth black bass.		522,000	8,285	530,285
	Sunfish			25,050	25,050
Mammoth Spring, Ark.	Large-mouth black bass.			64,300	64,300
	Rock bass			19,100	19,100
	Small-mouth black bass.			48,100	48,100
	Sunfish			12,825	12,825
Manchester, Iowa	Large-mouth black bass.			3,500	3,500
	Brook trout	2,500		591,010	593,510
	Crappie			370	370
	Rainbow trout	*153,000		181,816	334,816
	Rock bass			6,000	6,000
	Small-mouth black bass.			6,400	6,400
	Steelhead salmon			130	130
Nashua, N. H.	Brook trout			340,650	340,650
	Lake trout			32,496	32,496
	Landlocked salmon			43,760	43,760
	Pike perch		4,000,000		4,000,000
	Rainbow trout			71,220	71,220
	Small-mouth black bass.		3,800		3,800

Stations and substations operated and output of each, fiscal year 1924—Continued

Stations and substations	Species	Eggs	Fry	Fingerlings, yearlings, and adults	Total
Neosho, Mo	Large-mouth black bass			19,538	19,538
	Brook trout			915	915
	Catfish			1,200	1,200
	Crappie			1,756	1,756
	Rainbow trout	a 222,000		228,243	450,243
	Rock bass			5,800	5,800
	Small-mouth black bass			315	315
	Sunfish			79,003	79,003
	Yellow perch		1,575,000		1,575,000
Bourbon, Mo	Rainbow trout	a 86,886		59,500	146,386
Langdon, Kans	Large-mouth black bass			33,725	33,725
	Catfish			8,480	8,480
	Crappie			16,471	16,471
	Rock bass			2,425	2,425
	Sunfish			71,325	71,325
Northville, Mich	Brook trout		525,700	22,880	548,580
	Rainbow trout	28,000		102,855	130,855
	Small-mouth black bass		56,500	6,400	62,900
	Sunfish			1,000	1,000
Alpena, Mich	Lake trout		4,052,000		4,052,000
	Whitefish	3,000,000	30,150,000		33,150,000
Charlevoix, Mich	Lake trout	a 860,000	17,500,000		18,360,000
	Whitefish		35,000,000		35,000,000
Orangeburg, S. C.	Large-mouth black bass		37,700	229,980	267,680
	Crappie			30	30
	Sunfish			3,595	3,595
	Warmouth bass			3,525	3,525
Put in Bay, Ohio	Carp		28,875,000		28,875,000
	Pike perch	13,825,000	36,000,000		49,825,000
	Sauger		7,392,000		7,392,000
	White fish	a 70,560,000	148,400,000		218,960,000
	Yellow perch		3,915,000		3,915,000
Quinault, Wash	Sockeye salmon	a 3,120,000	1,000,000	3,890,000	8,010,000
	Steelhead salmon		70,000	260,000	330,000
St. Johnsbury, Vt	Brook trout	5,000	531,000		536,000
	Lake trout		89,000		89,000
	Landlocked salmon		15,000		15,000
	Steelhead salmon		15,000		15,000
Holden, Vt	Brook trout		242,370		242,370
	Lake trout	141,646	90,710		232,356
York Pond, N. H	Brook trout	10,357	77,089	51,336	138,782
	Lake trout			300	300
San Marcos, Tex	Large-mouth black bass			479,310	479,310
	Catfish			2,500	2,500
	Crappie			4,426	4,426
	Rock bass			325	325
	Sunfish			9,995	9,995
	Warmouth bass			420	420
Kerr Co. bass hatchery, Tex.	Large-mouth black bass.			1,040	1,040
Medina Lake, Tex	do			1,038	1,038
New Braunfels, Tex	do			5,105	5,105
Saratoga, Wyo	Black-spotted trout			460,000	460,000
	Brook trout			581,000	581,000
	Loch Leven trout	100,000		214,000	314,000
	Rainbow trout	a 323,010		56,000	379,010
Spearfish, S. Dak	Large-mouth black bass.			600	600
	Brook trout			360,100	360,100
	Catfish			900	900
	Loch Leven trout			1,034,500	1,034,500
	Rainbow trout			15,000	15,000
	Steelhead salmon			50,600	50,000
	Sunfish			300	800
Springville, Utah	Black-spotted trout			25,000	25,000
	Brook trout	(a)		196,650	196,650
	Rainbow trout			332,075	332,075
Tupelo, Miss	Large-mouth black bass.		461,500	53,230	514,730
	Crappie			1,200	1,200

Stations and substations operated and output of each, fiscal year 1924—Continued

Stations and substations	Species	Eggs	Fry	Fingerlings, yearlings, and adults	Total
Tupelo, Miss—Con.	Sunfish			111,675	111,675
Friar Point, Miss	Large-mouth black bass.			38,040	38,040
	Catfish			79,690	79,690
	Crappie			42,390	42,390
	Rock bass			22,600	22,600
	Sunfish			1,295,550	1.295,550
White Sulphur Springs, W. Va.	Large-mouth black bass.			47,375	47,375
	Brook trout			735,800	735,800
	Loch Leven trout			129,800	129,800
	Rainbow trout	*100,500		597,884	698,384
	Rock bass			3,800	3,800
	Small-mouth black bass.		14,000		14,000
	Sunfish			2,420	2,420
Woods Hole, Mass	Cod		3,663,000		3,663,000
	Pollock		1,650,000		1,650,000
	Winter flounder		604,059,000		604,059,000
Wytheville, Va	Large-mouth black bass.		167,500	16,360	183,860
	Brook trout			90,550	90,550
	Catfish			1,200	1,200
	Rainbow trout	*10,000		110,400	120,400
	Rock bass			22,000	22,000
	Sunfish			31,500	31,500
Yes Bay, Alaska	Sockeye salmon		300,000	25,616,845	25,916,845
Gross output		1,237,582,214	3,863,888,656	260,477,111	5,361,947,981
Loss in transit			41,122	96,205	137,327
Net output		1,237,582,214	3,863,847,534	260,380,906	5,361,810,654

TRANSFERS OF EGGS BETWEEN STATIONS

Every year considerable numbers of eggs are transferred between various stations of the bureau. In each case such transfers are made in the interest of economy and convenience in the distribution of the product.

Transfers of eggs between stations, fiscal year 1924

Species	Number of eggs	From—	To—
Black-spotted trout	1,500,000	Yellowstone Park, Wyo	Bozeman, Mont.
	1,000,000	do	Glacier Park, Mont.
	1,000,000	do	Leadville, Colo.
	500,000	do	Saratoga, Wyo.
	50,000	do	Springville, Utah.
Brook trout	50,000	Craig Brook, Me	Green Lake, Me.
	300,000	Leadville, Colo	Bozeman, Mont.
	400,000	do	La Crosse, Wis.
	500,000	do	Manchester, Iowa.
	500,000	Springville, Utah	Bozeman, Mont.
	400,000	do	Clackamas, Oreg.
	375,000	do	Spearfish, S. Dak.
	200,000	do	La Crosse, Wis.
Chinook salmon	800,000	Mill Creek, Calif	Battle Creek, Calif.
	360,000	do	Baird, Calif.
	10,000	Clackamas, Oreg	Central station, Washington, D. C.
	126,000	Little White Salmon, Wash.	Salmon, Idaho.
	350,000	Upper Clackamas, Oreg	Clackamas, Oreg.
Chum salmon	1,455,000	Brinnon, Wash	Quilcene, Wash.
	9,410,000	do	Duckabush, Wash.
Cisco	800,000	Cape Vincent, N. Y	Central station, Washington, D.
Lake trout	25,000	do	Nashua, N. H.
	20,000	do	Craig Brook, Me.

Transfers of eggs between stations, fiscal year 1924—Continued

Species	Number of eggs	From—	To—
Lake trout—Con.	6,750,000	Charlevoix, Mich	Duluth, Minn.
	60,000	do	Bozeman, Mont.
	144,000	do	Leadville, Colo.
	50,000	do	Pittsford, Vt.
Landlocked salmon	25,000	Craig Brook, Me	Nashua, N. H.
	25,000	do	St. Johnsbury, Vt.
	212,000	Green Lake, Me	Craig Brook, Me.
Loch Leven trout	102,000	Bozeman, Mont	Erwin, Tenn.
	100,000	do	La Crosse, Wis.
	400,000	do	Leadville, Colo.
	400,000	do	Saratoga, Wyo.
	1,005,400	do	Spearfish, S. Dak.
	200,000	do	White Sulphur Springs, W. Va.
Pike perch	4,000,000	Swanton, Vt	Nashua, N. H.
	8,000,000	do	Cape Vincent, N. Y
Rainbow trout	60,000	Bozeman, Mont	Neosho, Mo.
	25,000	Meadow Creek, Calif	White Sulphur Spring, W. Va.
	82,000	Manchester, Iowa	La Crosse, Wis.
	50,000	Neosho, Mo	Do.
	78,000	do	Nashua, N. H.
	25,000	do	Mammoth Spring, Ark.
	52,000	Bourbon, Mo.	La Crosse, Wis.
	53,235	Saratoga, Wyo	San Marcos, Tex.
	75,000	White Sulphur Springs, W. Va.	La Crosse, Wis.
	100,000	do	Northville, Mich.
	25,000	do	Meadow Creek, Calif.
	50,000	Wytheville, Va	Craig Brook, Me.
Silver salmon	5,000,000	Baker Lake, Wash	Birdsview, Wash.
	1,000,000	Birdsview, Wash	Duckabush, Wash.
	1,000,000	do	Quilcene, Wash.
Sockeye salmon	200,000	Baker Lake, Wash	Birdsview, Wash.
	25,000	Quinault, Wash	Medford, Oreg.
Steelhead salmon	25,000	Birdsview, Wash	Leadville, Colo.
	75,000	Applegate, Oreg	Spearfish, S. Dak.
	50,000	do	Duluth, Minn.
	50,000	do	St. Johnsbury, Vt.
	150,000	do	Clackamas, Oreg.
	75,000	Sandy River, Oreg	Do.
Whitefish	43,400,000	Put in Bay, Ohio	Charlevoix, Mich.
	880,000	do	Central station, Washington, D. C.
	17,000,000	do	Cape Vincent, N. Y.

EGG COLLECTING AT AUXILIARY STATIONS

In many instances the eggs hatched at the main stations and also at the substations are derived from temporary collecting fields established for that especial purpose. These field stations are always located as near as possible to the points where egg collections are to be made. In such sections as the Great Lakes and the New England coast regions egg collections are frequently made by means of the bureau's boats.

FISH FOOD USED AT HATCHERIES

The following table shows the amounts and kinds of food used at fish-cultural stations of the bureau during 1924, with the cost per pound of each material used.

Pounds and cost per pound of fish food used during the fiscal year 1924

PACIFIC SALMON STATIONS

Station	Salted salmon		Canned salmon		Salted salmon eggs	
	Pounds	*Cost*	*Pounds*	*Cost*	*Pounds*	*Cost*
Baird and substations, Calif	10,200	$0.02				
Baker Lake and substations, Wash	1,550	.021	8,237	$0.004		
Clackamas and substations, Oreg	33,000	.011				
Quinault, Wash			4,464	.035		
Yes Bay, Alaska	1,800	.0125	650	.005	800	$0.005
Total	46,550		13,351		800	

Station	Beef liver		Beef spleen		Sheep liver	
	Pounds	*Cost*	*Pounds*	*Cost*	*Pounds*	*Cost*
Baird and substations, Calif	660	$0.09				
Baker Lake and substations, Wash	2,406	.077	3,369	$0.05		
Clackamas and substations, Oreg			9,789	0.45		
Quinault, Wash					1,388	$0.06
Yes Bay, Alaska	252	.10				
Total	3,318		13,158		1,388	

ROCKY MOUNTAIN TROUT STATIONS

Station	Beef hearts		Beef liver		Sheep liver		Hog liver		Cereal	
	Pounds	*Cost*	*Pounds*	*Cost*	*Pounds*	*Cost*	*Pounds*	*Cost*	*Pounds*	*Cost*
Bozeman and substations, Mont			6,249	$0.063			10,786	$0.055	489	$0.019
Leadville, Colo	2,886	$0.038	10	.18						
Saratoga, Wyo	2,916	.045	3,280	.055						
Spearfish, S. Dak	1,500	.055	27	.075	4,730	$0.055			449	.01
Springville, Utah	15,096	.045	8,854	.0425	181	.05			5,500	.023
Total	22,398		18,420		4,911		10,786		6,438	

NEW ENGLAND TROUT AND SALMON STATIONS

Station	Beef hearts		Beef liver		Sheep liver		Hog liver		Fish trimmings	
	Pounds	*Cost*	*Pounds*	*Cost*	*Pounds*	*Cost*	*Pounds*	*Cost*	*Pounds*	*Cost*
Berkshire trout hatchery, Mass			969	$0.0866						
Craig Brook, Me	97	$0.0625	998	.09	242	$0.0625	1,201	$0.0475		
Nashua, N. H			1,309	.0625	4,771	.045				
St. Johnsbury, Vt			570½	.064						
York Pond, N. H			4,138½	.054					921	$0.0353
Total	97		7,985		5,013		1,201		921	

Station	Low-grade flour		Bran		Horse meat		Beef spleen		Cod-liver oil	
	Pounds	*Cost*	*Pounds*	*Cost*	*Pounds*	*Cost*	*Pounds*	*Cost*	*Gals.*	*Cost*
Berkshire trout hatchery, Mass							3,404	$0.05		
York Pond, N. H	600	$0.02325	400	$0.018¾	137	$0.0166			1	$1.60
Total	600		400		137		3,404		1	

Pounds and cost per pound of fish food used during the fiscal year 1924—Continued

COMBINATION TROUT AND POND FISH-CULTURAL STATIONS

Station	Beef hearts		Beef liver		Sheep liver		Hog hearts		Low-grade flour	
	Pounds	*Cost*	*Pounds*	*Cost*	*Pounds*	*Cost*	*Pounds*	*Cost*	*Pounds*	*Cost*
Erwin, Tenn	7,023	$0.055			8,187	$0.05			3,807	$0.026
Manchester, Iowa	3,960	.048			11,660	.046			900	.02
Neosho, Mo., and substations	2,727	.051			13,161	.04	5,033	$0.045	1,200	.0175
White Sulphur Springs, W. Va	10,737	.05	462	$0.051	12,869	.046				
Wytheville, Va	11,785	.055							15,578	.005
Total	36,232		462		45,877		5,033		21,485	

POND FISH-CULTURAL STATIONS

Station	Beef hearts		Beef liver		Mullet		Cereal		Fishotine	
	Pounds	*Cost*	*Pounds*	*Cost*	*Pounds*	*Cost*	*Pounds*	*Cost*	*Pounds*	*Cost*
Cold Springs, Ga					4,220	$0.10	382	$0.0205	483	$0.08
Edenton, N. C			21½	$0.20						
Louisville, Ky	482½	$0.10	22	.10						
Mammoth Spring, Ark	1,954	.061								
Orangeburg, S. C	1,944½	.10								
Tupelo, Miss	1,932	.09								
Total	6,313		43½		4,220		382		483	

HATCHERY FISH-CULTURAL NOTES

EFFECT OF CHANGED CONDITIONS ON FISH-CULTURAL WORK IN THE WASHINGTON FIELD

It is evident that there has been no decline in the runs of the various species of salmons in Puget Sound during the past few years. In fact, it is very probable that, with the exception of the sockeye, the runs have increased materially. However, conditions have so changed as a result of lumbering and other industrial activities that it can not be claimed that any of the stations in the Washington field are advantageously located at the present time for the propagation of the chinook or the humpback salmon.

At Baker Lake, where only the sockeye and the silver salmons are propagated, most excellent results are apparent from the fish-cultural operations. There is but little variation in the runs of either species from year to year, and it would appear that the Puget Sound sockeye run has thus far been maintained intact. It may therefore be concluded that the adverse conditions complained of do not exist to any great extent in the Baker Lake field. At every other point in the State the work has been very seriously handicapped as a result of deforestation, and if it is to be maintained at a high degree of efficiency hereafter certain changes in methods will be necessary, which will involve the expenditure of a larger amount of funds than has been available in the past.

At the Birdsview substation conditions are unsatisfactory. Grandy Creek, on which it is located, and the lake which it drains at one time provided excellent spawning areas for large numbers of salmon of various species. Because of deforestation this creek at the present time is almost a negligible factor during most of the year as regards suitable spawning areas for the fall-run salmons. It pursues a sinuous course for a mile or more from the station to its junction with the Skagit River. In this part of the creek, with its widened bed of loose gravelly bars, the first effects of low water stages are apparent. Thus, it frequently happens that the creek, flowing in a comparatively narrow channel through the station grounds, contains sufficient water of suitable depth to permit the ready ascent of spawning fish, while at some distance below the reservation the water spreads out into tiny rivulets on the uneven gravel formation, and the flow becomes so attenuated by seepage that the creek at its mouth appears quite dry.

A practical remedy for this condition would be to divert the flow of the creek from its natural tortuous course and carry it in a straight channel from the station grounds to the Skagit River, a distance of approximately 300 yards. If this were done much greater returns might reasonably be expected from fish-cultural operations.

At the other stations remedial measures are not so readily at hand, and the answer to the demand for a greater amount of fish-cultural work seems to lie in the opening up of new fields. It seems in many cases that the fish, debarred from their wonted spawning areas, have sought other localities not so seriously affected by the changed conditions or offering an acceptable substitute for the places originally selected for spawning. An investigation of a number of such areas, while the large runs of humpback and chum salmon were spawning in the fall of 1923, disclosed the fact that it would be possible to increase the volume of work 100 per cent through a comparatively small increased expenditure. This undertaking would involve the establishment of egg-collecting or eying stations at some of the many points advantageously located for such work and the incubation of the eggs and the rearing of the fry at hatcheries already in existence.

EXTENSION OF THE RUN OF SOCKEYE SALMON

Of passing interest in connection with the work of the Sultan (Wash.) substation was the appearance of three sockeye salmon in the traps on September 23, one of them being a female. While it is known that a few sockeyes (apparently stragglers from other runs) occasionally appear in the Skyhomish River at spawning time, this would seem to be the only recorded instance of their presence in Elwell Creek.

EFFECT OF TURBID WATER ON SALMON EGGS

There are frequent intervals of great turbidity in Grandy Creek, on which the Birdsview (Wash.) substation depends for its egg collections and water supply. Being impressed with the large percentage of infertile eggs handled during such periods, the station superintendent decided to conduct a series of experiments with the view of obtaining definite data on the subject. It was found that the rate of infertility on several lots of eggs washed and hardened in turbid creek water ran from 12 to 13 per cent, while the losses from this cause on eggs taken from the same fish at the same time, but washed and hardened in the creek water after precipitation had freed it from sediment, amounted to not over 7 per cent.

RESULTS ATTAINED IN THE STOCKING OF IDAHO WATERS

During June, 1924, the United States forest examiner, in company with the Idaho State fish commissioner, made an extensive survey of the conditions in a number of streams and lakes under Federal jurisdiction in the State of Idaho, and in connection with this inspection considerable numbers of brook trout, rainbow trout, and landlocked salmon were planted. Shiners were also introduced in practically all waters in which the game fishes were placed with the object of establishing a source of food supply for them.

Practically all of these waters were barren of game fish prior to 1920, when the first plants of the species mentioned above were made. In several of the lakes examined the investigation showed conclusively that the fish planted then and at subsequent periods had become firmly established. Especially was this the case in Alturas Lake, where small rainbow trout in considerable numbers were found, indicating that the introduced fish had spawned there. Abundant evidence of the recent spawning of rainbow trout was also found in Toxaway Lake. In upper Champion Lake, eastern brook trout, planted there for the first time in 1922, now weigh from 2 to 2¾ pounds. Rainbow trout planted in 1920 were found to weigh from 4 to 5 pounds. This lake contains an abundance of natural food, and the brook trout were very fat. In a number of other lakes the fish appeared to be well established, and indications that the results of former plantings had been unsuccessful were found in only a few instances.

GROWTH OF RAINBOW TROUT IN MONTANA WATERS

During the progress of rainbow-trout egg collections at the Meadow Creek (Mont.) substation an interesting feature was the capture of a female rainbow trout 12 pounds in weight. This fish was spawned on May 1 and yielded 43 ounces of eggs at 135 per ounce, or a total of 5,805. It is believed this may be the same large fish that was recorded as having been captured and spawned during the first week of May in the two years previous.

MORTALITY OF FISH IN LAKE ERIE

Visitors arriving at Put in Bay, Ohio, on the passenger steamer leaving Toledo on June 22, reported that they had seen thousands of dead pike perch and saugers floating on the surface of the water between the mouth of the Maumee River and Put in Bay, a stretch of 32 miles. On measuring, some of the dead fish were found to be from 9 to 12 inches in length. The cause of the mortality was generally believed to have been due to pollution carried in the water of Maumee River.

REPORT OF FISH FOOD USED AT THE WYTHEVILLE (VA.) STATION DURING JUNE, 1924

The appended table shows the amount of fish food required at one of the bureau's stations for a period of 30 days, the cost of feeding a specified number of fish of several species, and the cost for food per 1,000 fish of the species mentioned.

Species	Size of fish	Number of fish	Pounds fed per 1,000 fish		Cost per 1,000 fish	Total cost per month	Water temperatures	
			Beef hearts	Mush			Hatchery	Ponds
Rainbow trout	Fingerlings	11,000	3.09		$0.177	$1.947	54.39	
	Yearlings	2,330	5.57	29.98	.47	1.095		56.13
	Adults	3,480	58.04	508.9	5.881	20.465		55.68
Brook trout	Yearlings	1,870	5.57	29.98	.47	.878		56.13
Brown trout	do	2,970	5.57	29.98	.47	1.395		59.26
Large-mouth black bass	Adults	225	93.33		5.366	1.207		72.60
Small-mouth black bass	do	24	166.66		9.528	.229		65.83
Rock bass	do	208	19.23		1.105	.229		74.60

A comparison of this information with the results of feeding fish of the same species at other stations of the bureau shows a wide variation in the cost per 1,000. At certain stations having a mean water temperature 10° higher than that indicated above, the cost of feeding the same kind of food was much higher.

COMMERCIAL FISHES

Among the more important commercial fishes propagated by the bureau during the fiscal year 1924 were the salmons of the Pacific coast, the whitefish, cisco, lake trout, and pike perch of the Great Lakes, the carp in the Lake Erie region, such marine species as the cod, haddock, pollock, and flounder, the buffalo fish in the Mississippi Valley region, and such anadromous fishes of the Atlantic coast as the shad, glut herring, and Atlantic salmon.

PACIFIC SALMONS

The outcome of fish-cultural operations at the salmon stations on the Pacific coast shows a considerable decrease as compared with that in 1923. The shortage was caused in part by lack of funds to prosecute the work to its fullest extent in some fields, while in other sections it is attributable to unfavorable weather conditions during the spawning season.

AFOGNAK (ALASKA) STATION

[F. R. LUCAS, Superintendent]

In view of the exceptionally small number of sockeye salmon that ascended to the spawning grounds adjacent to the Afognak station in July, 1923, it was deemed advisable to defer active salmon propagation for the period of one year and devote all available funds to extensive repairs, of which the station was in great need. By reason of this decision the output of the year was limited to a small number of fingerling salmon carried over from the previous year's stock, and all sockeyes making their appearance during the summer were given unobstructed passage to the spawning grounds of their own selection in Letnik Lake. The run began on June 6 and extended to September 8, the total escapement for the season numbering 8,025 fish. While it is impossible to assign a definite cause for this material decline from the large runs of recent years, it was ascertained that many salmon were captured in the course of the spawning season near the mouth of the river at Little Afognak, and as the captured fish proved to be similar in size and character to those found in Letnik Bay it was concluded that at least part of the shortage in the run might reasonably be ascribed to that fact.

The annual runs of sockeye salmon to spawning grounds in the Afognak region within recent years have excited unusal interest because of the extraodinary conditions involved. In the early summer of 1912 all spawning fish in Letnik Lake were destroyed as a result of the violent eruption of the Katmi volcano. For several years thereafter only a few salmon entered the lake, though runs of considerable size were the rule prior to the eruption. However, there was a noticeable increase with each succeeding year up to 1919, when a very large run occurred, probably equal in numbers to the average run before 1912. In accordance with the four-year cycle theory another unusually large run was due to arrive in the summer of 1923 but, as stated above, it failed to materialize.

The more important items of repair work accomplished during the year included the laying of new foundation sills and flooring in the large hatchery building. A large amount of construction work was also done on the proposed wagon road, which is to take the place of the tram road leading from the station grounds to tidewater.

The first annual count of the salmon ascending the Karluk River, undertaken in May of the preceding fiscal year, was concluded on October 12, the tally showing the passage of 694,579 salmon upstream in the course of the season.

Dolly Varden trout entered Letnik Lake in the usual large numbers and, following the practice of recent years, persistent efforts were made to destroy them. Drag seines have been found to be the most effective equipment for this purpose, and they were operated to good advantage throughout the season.

During the week beginning October 7, 1923, the station was subjected to a violent wind and rain storm, which resulted in serious damage. The bulkhead protecting the station grounds fronting on Letnik Lake was destroyed throughout several hundred feet of its length and the grounds were badly eroded. The boathouse was entirely destroyed, the 100-foot wireless tower wrecked, and a number of large trees on and adjacent to the reservation were uprooted. The lake reached its highest recorded level during this period.

YES BAY (ALASKA) STATION

[JOHN W. GARDNER, Superintendent]

The results of the year's fish-cultural activities at this station were fairly successful. Operations for the capture of sockeye salmon for propagation work were undertaken on September 6 and diligently prosecuted during the next 15 days, in the course of which 25,550,000 eggs were taken. This figure does not represent all that might have been secured, as, in pursuance of a recently adopted policy, spawn-taking was discontinued when a sufficient number of eggs had been obtained to seed the somewhat limited spawning areas within reach of the station, and the remaining fish were allowed to ascend above the racks to spawn naturally.

Owing to some difficulty with the water supply while the eggs were in the tender stage of development, the losses were somewhat above normal, the total death rate during the incubation period amounting to slightly more than 15 per cent. Early in October the water in the hatchery became heavily charged with gas, its presence being made evident through the formation of masses of tiny bubbles on the baskets and upon the eggs. The constant bursting of the bubbles agitated the eggs, and whenever the slightest jar occurred they were released in sufficient numbers to lift the entire egg mass from the bottom of the baskets. During the night this movement among the eggs caused many of them to accumulate at the lower ends of the baskets, where they were in danger of smothering. The heavy loss occurring during this period appeared to result entirely from the unnatural movement of the eggs while in the tender state, as no injurious effects of the gas other than its mechanical action were discernible. The cause of this abnormal condition of the water supply was not definitely determined, but as it disappeared immediately after fall rains and cooler weather set in, it is supposed to have been a result of the warm dry summer. No prior occurrence of a similar character has ever been experienced at the station.

The artificial feeding of sockeye salmon in the slough pond in Lake McDonald resulted less successfully than last year. This was attributed to the warm dry summer. By the middle of July, when the water temperature in the slough had risen to 69° F., the fish showed evidence of loss of appetite and became restless. In view of the conditions the gates of the inclosure were removed shortly afterwards and the fish permitted to leave at will.

The result of a feeding experiment conducted by the Territorial Fish Commission of Alaska during the year is mentioned as being of interest in connection with salmon culture. Across the narrow neck of a small arm of the sea on Gravina Island, a short distance from Ketchikan, Alaska, a dam was constructed of sufficient height to retain a mean depth of about 4 feet of water at low tide. Extending above high water on the dam, a wire mesh inclosure of approximately 2,000 square feet was constructed, with the intention of retaining therein only such fish as it was desired to introduce. The only change of water in the pond thus formed was brought about by tide action, the inclosure being flooded for an hour or more during high-tide periods, and the entrance of fresh water was limited to the comparatively small amount of surface drainage after rains. Late in February some 50,000 humpback-salmon fry were placed in the pond. The superintendent of the Yes Bay station, who visited this point on two occasions during the spring of 1924, has made the following statement:

> On my arrival at this salt-water pond late in March the fish were just beginning to take food. When I again saw them, on May 17, I was surprised to note their rapid development. There was much variation in size, ranging from 1½ to 4 inches in length, but all of the fish appeared to be in most excellent condition. The artificial foods given were beef liver and immature salmon eggs, both in the fresh state. The total loss on the lot up to the time of my second visit was reported to be about 15 per cent.

BAKER LAKE (WASH.) STATION AND SUBSTATIONS

[JOSEPH KEMMERICH, Superintendent]

Fish-cultural operations were conducted at six points in the State of Washington, and at five of these the work was in progress throughout the year. As heretofore, the Brinnon substation was operated merely as an egg-collecting and eying auxiliary of the permanent hatcheries in the State. The work of the group was addressed to all species of the Pacific salmon, including the steelhead.

While adverse climatic conditions were encountered in certain fields during the spawning season, thereby curtailing the results that might otherwise have been expected, the returns in general were quite satisfactory. The aggregate egg collections for the year amounted to 50,545,000, while the losses of eggs and young fish up to the completion of the distribution period were merely nominal, and all stock handled was liberated in excellent condition. Included in the output are a number of fingerling fish carried over from the previous year's egg collections as well as the product resulting from 1,000,000 eggs of the chinook salmon received from the State hatchery at Kalama, Wash.

Baker Lake (Wash.) station.—This station, picturesquely located on the shore of Baker Lake at the foot of the perpetually snow-capped mountain of the same name, has in recent years built up an enviable record for efficiency in artificial propagation of salmon. From the early days of Pacific salmon culture the importance of the Baker Lake field has been recognized from the fact that it is the only spawning area of the sockeye salmon in the United States proper. This species has been propagated here for many years, and though in certain respects the returns were not altogether satisfactory during the early days of the work it has been developed in recent years to a point of efficiency which, so far as practical results are concerned, is not excelled by that of any similar establishment.

Between July 1 and August 13, 5,408 adult sockeye salmon were taken in the trap maintained at the outlet of Baker Lake for intercepting the run of spawning fish. With a very good run of sockeyes in Puget Sound, suitable water stages in the Skagit and Baker Rivers, and generally favorable climatic conditions a large take of brood fish was anticipated, and under the conditions no satisfactory explanation for the comparatively small number reaching the trap can be found. The fish captured were retained in the inclosure with the usual degree of success, and at spawning time (September 26 to December 5) the females, constituting 49 per cent of the catch, yielded 8,125,000 eggs. Of these 200,000 were shipped, when eyed, to the Government of Chile. Only nominal losses were sustained in the incubation of the remainder, and the resulting fry were carried to the feeding stage in stacked trays, which system is now in general use at most of the Pacific coast and Alaska stations of the bureau.

The run of silver salmon in the Baker Lake field was the largest recorded in the past 10 years. In the belief that these fish are among the more serious enemies of the highly prized sockeye salmon, it has been the bureau's policy to exclude them from the spawning areas of Baker Lake so far as possible. With this in view, all eggs of the species taken there have been transferred to the Birdsview substation to be incubated. Between September 21 and November 26, 6,000 adult silver salmon were taken in the trap used for the sockeye work. This number does not by any means represent the stock available, but owing to the limited capacity of the Birdsview hatchery and the necessity for making all transfers thereto by pack horses, the trap was closed on the last-mentioned date, and the remaining fish, numbering several thousand, were permitted to spawn naturally in Baker River, the trap and its leads effectually barring them from the lake. Of the fish captured 2,619 were females, and from them 7,350,000 eggs were obtained during the period from November 6 to December 15. After the eyespots had developed practically all of these eggs were forwarded to Birdsview, 12 trips with pack horses being necessary to make the transfer.

No important run of chinook salmon has occurred in the Baker River since the inauguration of the bureau's work in that region, but it has always been the policy to secure for propagation all available eggs of that species. Between September 21 and October 25 a small number of brood chinooks entered the trap, 8 of them being females. From this stock 40,000 eggs were taken, fertilized, and placed in process of incubation.

Birdsview (Wash.) substation.—The extensive lumbering operations prosecuted in the vicinity of the Birdsview substation are proving a serious detriment to the work in that region. The effects of the deforestation that has occurred are made evident by the extreme turbidity of the hatchery water supply after rains, even very light ones, and by alternating periods of drought and flood. Quite frequently the propagation work is materially hampered by one and sometimes by a combination of these destructive influences. During the past year they were unusually aggravated. The Grandy Creek tributary of the Skagit River, on which the substation is located, carried, during a portion of the winter, enough sediment to completely overwhelm the settling tank and filter in the space of two or three hours, and a thickness of 2 to 3 feet of the material was deposited in the rearing ponds within the course of two days.

Aside from the losses of stock and the extra work entailed through the presence of such conditions, another factor, and one having a more direct bearing on the success of the work, was the extended period of low water in the streams at the time brood fish of various species were running. For instance, while the number of brood humpback salmon ascending Skagit River was estimated to be larger than for the past 10 years, the water stage in Grandy Creek was so low as to leave an area of practically bare ground at the point of its junction with the Skagit. Of course, this made it impossible for the fish to enter the creek, though in the past it has been a favorite resort for spawning humpbacks, and no eggs of this species were available. The fish spawned naturally in the main channel of the river and in such of its tributaries as they could ascend.

Similar conditions obtained while the chinook and chum salmons were spawning, and the results were the same, no eggs of either being available. However, 1,000,000 eggs of the chinook salmon were received at Birdsview hatchery from the State hatchery at Kalama, Wash. These were successfully incubated and the resulting fingerlings distributed in suitable localities. Brood silver salmon, running as they do at a somewhat later date than the other species mentioned, met with somewhat improved conditions, and 3,100,000 eggs, taken November 24 and February 13, were obtained, the collection being considerably smaller than last year's. While the run of steelhead salmon was in progress during the spring the water stages were again normal, and about the average collection of eggs was secured. A peculiar feature of the run was that female steelheads outnumbered the males in the ratio of 6 to 1, and owing to this fact certain lots of eggs carried a low percentage of fertility. Spawn-taking operations extended from March 6 to May 16.

Brinnon (Wash.) substation.—Because of changed conditions along the Dusewallops River as a result of extensive lumbering activities and the erection of dams no fish-cultural work at Brinnon has been possible for a number of years aside from the collection and eying of eggs of the chum salmon. Such work is conducted in Walcott Slough, which also affords an excellent environment for the young salmon. The work at this point during the past year consisted in the collection and partial incubation of 10,980,000 eggs. These were all transferred to the Quilcene and Duckabush substations to be hatched, and the resulting fry were returned for liberation in the slough. The collection—made between November 23 and January 10—exceeded that of the previous year by upward of 3,000,000, the improved results probably being due to the discontinuance of commercial fishing in Hood Canal.

Duckabush (Wash.) substation.—In connection with its work of road construction, the highway department of the State of Washington found it expedient during the spring of 1923 to alter the course of the Duckabush River near its mouth, and a new channel was excavated to divert the entire flow of the river, thus rendering useless the site the bureau has occupied for many years for the capture of chum and humpback salmon. A trap was therefore constructed in the new channel, and on August 28 chum-salmon propagation was undertaken. Eggs to the number of 5,736,000 were secured from the early run fish in the trap, the last lot being taken on September 20, on which date the collections were terminated by the destruction of the trap through a slight rise in the river, the banks and bed of the new channel being too soft and unsettled to withstand even the comparatively light flood that occurred. Eggs from a second run of this species, which enters the Duckabush several months later than the first one, usually are taken at the permanent barrier maintained on the station grounds, but while this run was in progress the river was at such a low stage that the fish were unable to ascend it.

A disappointing feature connected with the work at the new channel of the river was the failure to secure eggs from a considerable number of humpback salmon, a run of which was coincident with that of the chum salmon. Between September 1 and September 20, 950,000 eggs of this species were secured, and had the trap remained intact a few days longer it is believed that a much larger yield might have been realized. The first silver-salmon eggs of the season were taken November 17, and from that date to February 2 small lots came in at irregular intervals. Owing to the abnormally low water stages prevailing to the end of the season, only a few fish were able to ascend as far as the trap. Practically all of the 704,000 eggs secured were taken from fish seined from the deeper holes and eddies in the river. Silver-salmon eggs from Birdsview and chum-salmon eggs from Brinnon were incubated with the local collections, and during the spring 92,000 steelhead-salmon eggs were collected and hatched.

Quilcene (Wash.) substation.—Between September 3 and October 11 6,365,000 eggs were taken from the early run of chum salmon appearing below the temporary racks installed in the Big Quilcene and Little Quilcene Rivers. A late run of this species occurred in December, and eggs were taken at intervals during most of that month, the total amounting to 1,605,000. The silver-salmon run extended from November 23 to February 12 and yielded 1,520,000 eggs. Eggs of the silver salmon from Birdsview and of chum salmon from Brinnon were incubated at Quilcene with the local collections. During the run of spawning steelheads in the spring there was a period of unusually low water, this being the only unfavorable climatic condition experienced at this point in the course of the year.

The only important improvement at this substation during the year was the laying of a 12-inch wood-stave pipe line to connect the supply tank and rearing ponds, this line taking the place of the old trestle flume, which was unsightly and of insufficient capacity to meet the requirements.

Sultan (Wash.) substation.—The fish-cultural work at this substation suffered more from adverse weather conditions than at any other point in the Washington field. In the fall, when most of the important fishes were spawning, the prevailing low-water stages interfered materially with the work, and serious floods in the course of the winter wrecked the traps, undermined the intake and head gate, and entirely cut off the hatchery water supply. Then followed another period of low water at the spawning time of the steelheads, greatly reducing the egg collections and causing serious inconvenience in the hatchery.

This substation is located on a tributary of the Skyhomish River, and large numbers of both chinook and humpback salmon were present in that stream. Because of the conditions encountered, however, only a comparatively few fish were able to ascend the tributary to their customary spawning areas. Owing to this fact the egg collections of each species were practically negligible, amounting to 610,000 and 30,000, respectively. In the case of the chinook salmon the spawning period extended from September 21 to November 3, while the humpback eggs were taken between September 24 and October 8. While the egg collection of silver salmon was smaller by 50 per cent than last year, it was larger than there was reason to expect in the face of prevailing conditions. Between November 3 and January 30, 2,180,000 eggs of this species were secured.

On February 12 Elwell Creek attained its highest recorded stage. The traps were wrecked and the intake dam and head gate undermined throughout their entire length. Because of the high level of the creek at this time, water continued to flow through the flume to the hatchery, but following a rather sudden lowering of the air temperature on the night of February 15 the water in the creek dropped a foot or more, cutting off the hatchery supply. This necessitated the immediate removal of all baskets of eggs undergoing incubation to a shallow bed in an eddy of the creek, which had been previously prepared for the purpose. The fry and fingerling fish on hand were of necessity liberated in eddies of the creek. By the 16th the flood waters had receded sufficiently to permit of temporary repairs to the water supply, and the stock of eggs was again returned to the hatchery. The collection of steelhead eggs, made between April 21 and May 19, amounted to 98,000, or about one-third the number obtained the previous year.

QUINAULT (WASH.) STATION

[PHILO B. HAWLEY, Superintendent]

The outstanding features of the work at this station were: (*a*) Conduct of the salmon census, (*b*) propagation of sockeye salmon, and (*c*) improvement to ponds and other station property.

Since the run of sockeye salmon in Quinault Lake extends from about April 1 to the end of the succeeding August, it is obvious that the annual report of any fiscal year can not give a complete census of the run of an entire season. The total of the daily counts to the end of the fiscal year 1923 amounted to 123,022, but to this must be added 51,580 fish, the total of the number passing through the weir between July 1 and August 15, 1923, making a grand total of 174,602 fish entering the lake during the full season of 1923. In the spring of 1924 the weir was installed well in advance of the run. The first fish were observed in the trap on March 19, and between that date and the end of the fiscal year the sum of the daily tallies aggregated 109,298.

According to reports received from the superintendent of the Indian Reservation at Tahola, the Indians on the Quinault had taken for commercial purposes or home consumption approximately 100,000 fish from the beginning of the run to June 15. In view of the criticism of the salmon census by many of the Indians, who claimed that the counting weir was responsible for the death of considerable numbers of the adult salmon entering the lake, a careful watch has been maintained during the past two years with special reference to this feature. In this connection frequent trips were made by canoe to points 10 miles or more below the weir in an effort to obtain all relevant facts. The times for making such trips were gauged in accordance with conditions on the river, periods of clear water being especially advantageous, in order that the river bottom might be observed readily. The largest number of dead fish seen on any one trip was 21, and in practically every instance the cause of death was clearly traceable to bites inflicted by seals, either before the fish left the sea or while they were enmeshed in gill nets in the lower reaches of the river. The number whose death could reasonably be attributed to injuries at the counting weir was so small as to be inconsequential.

The minor difficulties developing during the first season's work at the counting weir were soon overcome, and in view of its successful operation since that time it is perhaps not amiss to indulge in speculation as to the advantages that may be expected to accrue from its use as the controlling factor in regulating fishing in the Quinault River. There is probably no other point where the opportunity is so good for controlling and regulating the fisheries with the view of effecting an equitable distribution of the products. Because of their hold on certain favorable fishing locations on the river, either through inheritance or purchase, comparatively few Indians are receiving, under the present system, practically all the monetary returns derived from the fishery, and the amounts that may be earned by less favored though not less industrious individuals seem almost negligible by contrast. This has long been a bone of contention among the Indians on the river.

As a remedy for the present faulty system of managing the fishery it has been suggested that all fishing operations should be conducted at the weir. The following are some of the advantages that might reasonably be expected to accrue from such a procedure:

1. It would be possible to provide for an equal division of the proceeds of the fishing among the Indians now holding fishing rights on the river.
2. The Indians would be put to no expense for the purchase of nets or other appliances.
3. The waste resulting from the present gill-net fishery would be eliminated. Appreciable numbers of fish are annually enmeshed which subsequently escape from the nets, but they are so seriously abraded from their struggles that death ensues before spawning occurs.
4. A certain predetermined percentage of each seasons's run would be assured entrance to the lake and the adjacent spawning areas.
5. The largest fish could be permitted to pass into the lake as potential breeders, to the quite probable improvement of future generations of sockeye salmon. Under the present regulations governing the type of nets that may be used, it is in the main the larger fish that are captured and the smaller ones that escape.
6. The considerable numbers of immature male fish that accompany the annual runs could be marketed and the profits distributed among the Indians. Apparently such fish are of no value as breeders.

The propagation work during the year was limited to the collection of 13,000,000 sockeye-salmon eggs and the development of the product, this number having been previously determined upon as adequate to meet distribution requirements and produce the number of fry that could be properly reared with available facilities. The eggs were obtained without difficulty from the customary spawning areas, and after developing them to the eyed stage, two shipments were made, one consignment of 25,000 being forwarded to the bureau's station at Clackamas, Oreg., and one of 3,120,000 to the Oregon Fish Commission, at Enterprise, Oreg. The remainder were successfully incubated, and the resulting fry and fingerling fish were carried through to the distribution period in excellent condition, there being only one period of heavy loss. This was occasioned by a mishap on the night of April 16, when the head gate in the main water-supply flume was closed in some unknown manner, either through carelessness or possibly with malicious intent. Fortunately the trouble was discovered and remedied shortly after midnight, and a real disaster was narrowly averted. Under the conditions the hatchery was without water long enough to cause some mortality, the fry on trays suffering the heaviest loss.

There appeared to be a very good run of silver salmon and also of the chinook salmon in Quinault Lake, but no attempt was made to collect eggs of either of these species. Because of the entire absence of male fish the preparations made for the collection of steelhead-salmon eggs were without result, and considerable numbers of female fish in spawning condition had to be released from the retaining inclosure without stripping.

CLACKAMAS (OREG.) STATION AND SUBSTATIONS

[HUGH C. MITCHELL, Superintendent]

Fish-cultural work in the Oregon field involved the collection of over 62,000,000 salmon eggs and the successful development and distribution of the product, only normal losses being sustained in any field. A very large percentage of the eggs was of the chinook salmon, the most important commercial fish occurring in the waters of the State. Though eggs of the chum salmon were available in considerable numbers in many of the coastal streams in Oregon, no special effort was made to collect them, it being deemed preferable, for the present at least, to devote the small amount of available funds to the propagation of the more valuable chinook, especially as it is not improbable, in view of the small demand for the chum salmon, that the escapement is sufficient to insure the maintenance of the run of that species through natural reproduction.

A profitable fishing season was experienced on the Columbia River, the estimated value of the salmon taken commercially amounting to $10,000,000. The pack of canned salmon exceeded 480,000 cases, while a large tonnage of salmon in the fresh state was shipped to eastern points and to European countries. In view of the continued success of the commercial fishery of this region, and the rather remarkable returns from marked fish artificially reared at the hatcheries, it seems only just to assume that artificial propagation is proving an eminently important factor in maintaining this highly satisfactory state of the fisheries.

The bureau is again indebted to the State of Oregon for very liberal assistance furnished during the year, financially and otherwise. In the absence of this timely aid the work would have been very seriously curtailed, owing to the bureau's lack of adequate funds. Similar assistance was extended by the States of Washington and Idaho, and this opportunity is taken to express the bureau's appreciation of it.

CLACKAMAS (OREG.) STATION

Clackamas (Oreg.) station.—Spawn-taking operations on the Clackamas River were more successful than in any previous year, the collections of chinook-salmon eggs in the two fields occupied amounting to nearly 13,000,000. Of these over 11,000,000 were obtained at Clackamas and the remainder on the upper Clackamas River In addition to the work with this species, comparatively small numbers of eggs of the silver and chum salmons were taken at the traps, and eggs of the brook trout and steelhead salmon, acquired by transfer, were also handled. Despitethe fact that the young fish hatched from these eggs were held under more crowded conditions than the best fish-cultural practice warrants, the final results in fingerling fish distributed were very satisfactory. The shipments from Clackamas during the year included a consignment of 200,000 chinook-salmon eggs for the Netherlands Government.

A remarkable occurrence in connection with the fish-cultural work was noted. A lot of 1,500,000 chinook-salmon eggs failed to "water harden" in response to the usual process applied, remaining soft to the end of the incubation period. Notwithstanding this fact, they were successfully hatched and the fry and fingerling fish produced from them were equal in vigor to those more normally developed. So far as is known such an occurrence has never before been experienced.

Upper Clackamas (Oreg.) substation.—The flood of January 6, 1922, practically wrecked this substation, destroying its buildings and rendering the station site quite unfit for the prosecution of fish-cultural work. However, with the view of securing all available eggs of the valuable chinook salmon, a small building was constructed in advance of the spawning season of 1923 to serve as an eying plant, lumber for the purpose being salvaged from the wreckage. The usual success was met with in the collection of eggs, and after developing them to the eyed stage they were transferred to the Clackamas station and the substation was closed for the season.

Little White Salmon (Wash.) substation.—During the year some important changes were made in the station water supply at this point to insure protection against the storms and floods to which this section of the country is subject. The old flume line was abandoned and a new line blasted out of the cliff on the south shore, concrete abutments being constructed to protect its intake. A run of spawning chinook salmon appeared at the racks at the usual time, and egg collections were prosecuted without interruption from September 20 to October 9. The run appeared lighter than usual, and it is believed the intensive fishing conducted in the Columbia River had some effect on its size. Eggs to a total of 14,415,000 were taken, and also 414,000 of the chum salmon. Prior to their liberation the fingerling fish resulting from these collections consumed several tons of salted salmon in addition to 5½ tons of canned salmon and 2 tons of beef spleen.

Big White Salmon (Wash.) substation.—Brood chinook salmon in very fair numbers appeared on the usual spawning areas in the Big White Salmon River and Spring Creek, and from them 7,205,000 eggs were collected. A hole cut in the rack by beavers during a period of turbid water, when the damage was not discernible, permitted some of the fish to escape, thereby reducing the collections to some extent. In addition to salmon propagation, a considerable amount of work was done for the State of Washington in incubating eggs of the brook trout, rainbow trout, the so-called "silver trout," and the steelhead salmon. The young fish resulting from this stock were also held and cared for until the distributions could be made by State employees.

Rogue River (Oreg.) substation.—The output of this station was 6,136,700 fingerling fish, and approximately 1,000,000 eggs and fry were still on hand at the end of the year. The work was concerned with the chinook, silver, sockeye, steelhead, and landlocked salmons, and the black-spotted trout, consignments of eggs of the two last-named species being received from Maine and the Yellowstone National Park, respectively. About one-third of the chinook-salmon eggs collected were secured on the new spawning grounds in Big Butte Creek. The run of silver salmon was well above the average, and 2,235,300 eggs were obtained and incubated. For several seasons past eggs of the steelhead salmon have not been available in large numbers at this point. The collection during the year amounted to 506,600.

Applegate Creek (Oreg.) substation.—Early in the year retaining corrals of a combined area of 6,000 square feet were built along the north shore line below the barrier in Applegate Creek and were very successfully used during the succeeding runs of silver and steelhead salmon for holding immature fish pending the ripening of their eggs. Climatic conditions at this point were very unfavorable to fish culture. As there was almost a complete absence of rain, the water level in the creek throughout the entire year was never above the normal summer stage, and there were only a few days when it was high enough to give fish ready access to the traps. Notwithstanding this drawback the results of the season's fish-cultural work compare favorably with those of recent years. In the course of the fishing season, extending from November to May, 5,476,000 eggs of the silver salmon and 3,504,000 of the steelhead were secured. No ill effects from the low water level were noticeable while the eggs were undergoing incubation, though the liberation of the steelhead fingerlings carried over from the preceding year at an unusually early period was necessitated. The distributions from this substation included shipments of eyed eggs to Hawaii, Czechoslovakia, Poland, France, and to a number of State hatcheries.

Sandy River (Oreg.) substation.—Since the Portland Electric Power Co. has extended the walls of its canal to a point where the entire flow of the river may be diverted, there are times when fish-cultural operations at this point are quite impracticable. In fact, it is not uncommon to find the river bed dry for a distance of 8 miles or more, and it seems to be only a matter of time when this once beautiful stream will be quite devoid of its famous salmons and trouts. Fortunately, the run of steelhead salmon occurs in the early spring months, and owing to this fact the species may be able to maintain itself in the river for a much longer period than the species running at other seasons of the year.

The year's egg collections, obtained under most difficult conditions, amounted to 1,823,918 of the chinook, silver, and steelhead salmons. From this stock a good percentage of fish was realized for distribution.

Salmon (Idaho) substation.—As at other points in the field subordinate to the Clackamas station, a successful season's fish-cultural work was experienced at this substation. From local streams, including the Pahsimeroi River and Lemhi Creek, approximately 9,500,000 chinook-salmon eggs were taken, and as the rearing capacity of the Salmon hatchery was not large enough to accommodate all of them, the surplus eggs had to be transferred to points nearer the coast for incubation. However, it is not considered good fish-cultural practice to ship salmon eggs from the upper tributaries of the Columbia River to points nearer its mouth, and with the view of obviating this necessity in the future an effort is being made to increase the hatching and rearing facilities at Salmon so that all eggs taken in that region hereafter may be cared for locally.

By way of experiment 125,000 chinook-salmon eggs were sent from the Little White Salmon station to the Salmon hatchery. It is planned to mark some of the fish resulting from these eggs before releasing them for the purpose of ascertaining if the homing instinct of these so-called "fall run" fish will be strong enough to induce them to ascend the Columbia and Snake Rivers to a point hundreds of miles above the tributary selected as spawning grounds by their parents. In the course of the year a consignment of rainbow trout eggs was handled at the Salmon station for the Idaho fisheries authorities.

BAIRD (CALIF.) STATION AND SUBSTATIONS

[W. K. HANCOCK, Superintendent]

The results of the fish-cultural work at stations in the California field were again materially curtailed by adverse climatic conditions. In contrast to the severe floods, which occur so frequently in the fall months, the fiscal year 1924 is noteworthy because of an almost continuous drought, the period of dry weather having been the most protracted experienced in this region in many years. Not once during the year did any of the streams on which the bureau's work is conducted even approach the high-water stage, and the consequences are evident in the reduced egg collections. The prevailing low water in the lower stretches of the Sacramento River favored the operations of the commercial fishermen, and the comparatively small numbers of chinook salmon escaping the nets were forced to spawn on riffles in the main river rather than on their usual spawning grounds in its tributaries.

Baird (Calif.) station.—Notwithstanding the unfavorable outlook for eggs, racks were installed in the McCloud River in April to intercept the spring run of chinook salmon, the existing low-water stages being favorable to such work. Taking all influencing factors into consideration, including the irrigation dam in the Sacramento River, a gratifying number of salmon reached the racks, and from them 1,000,000 eggs of the spring-run chinook salmon were obtained, the collections extending from September 9 to October 13. Because of the drought no water from the gravity source of supply was available for hatching operations at any time during the year, and to obviate the expense of pumping water troughs were set up near the mess house and the supply drawn from the small spring pipe line ordinarily used for domestic purposes. In this manner the eggs were successfully held to the close of the incubation period. From that time until the distributions were made, the hatchery was supplied with water by pumping.

Battle Creek (Calif.) substation.—Early in the year the matter of collecting eggs of the spring-run chinook salmon in Battle Creek was again arranged for. As was mentioned in a previous report, the site selected for this work is just below the dam of the Coleman Light & Power Co., about 4 miles above the Battle Creek hatchery. Though the work was undertaken on an experimental basis and conducted under most trying circumstances, 446,000 eggs of good quality were secured and sufficient experience was gained to demonstrate conclusively that under more normal climatic conditions profitable collections of eggs can be made at this point. The eggs taken were obtained between September 8 and 28.

The customary fishing operations in the vicinity of the Battle Creek hatchery were taken up in October, and from October 25 to December 4 the total collection of eggs for the season amounted to 1,620,000.

Mill Creek (Calif.) substation.—As an illustration of the severity of the drought prevailing at this substation, it may be stated that on

September 10, when the racks were installed in Mill Creek, they were placed on the dry bed of the stream with as little difficulty as would be experienced in placing them on any level stretch of land. Fishing and spawn-taking operations were in progress at this point from October 27 to December 5, inclusive, and 3,012,000 chinook eggs of good quality were the result, the collection being surprisingly large in view of the conditions encountered.

GREAT LAKES FISHES

The geographical range of the bureau's operations coming under this head extends from the Rainy Lake region, in Minnesota, to Lake Champlain, in Vermont, and the species to which especial attention is paid are the whitefish, lake trout, cisco, pike perch, and carp. Eggs of the yellow perch are also handled.

The total output of the group during the fiscal year 1924 was approximately 761,000,000 eggs and fry, as compared with 671,000,000 in round numbers in 1923. The increase is principally accounted for by the larger number of cisco eggs obtained in the Lake Ontario field and the pike-perch eggs secured at the Swanton (Vt.) substation. The aggregate collections of lake-trout eggs also slightly exceeded those of the previous year.

DULUTH (MINN.) STATION

[S. P. WIRES, Superintendent]

During the early fall arrangements were made by the force of the Duluth station for the collection of lake-trout eggs at all points on Lake Superior where there was a likelihood of securing them on a profitable basis. The spawning season opened September 25 at Washington Harbor and at other points on Isle Royale, Mich., and the last eggs were obtained on November 25, though the bulk of the collections had ceased by November 13. The aggregate results were 14,793,500 eggs of average quality, to which were added, on November 24, 7,000,000 green eggs taken in the Charlevoix (Mich.) field. As only about 45 per cent of the last-named lot were good, the losses sustained on the stock as a whole would appear to be abnormally heavy. On reaching the eyed stage a total of 825,000 were shipped to various State fish hatcheries; the remainder were incubated, producing 11,982,000 fry and fingerling fish for distribution, most of which were returned to the spawning grounds in Lake Superior from which the eggs were derived.

While the lake-trout work was in progress 3,840,000 white-fish eggs were secured, being collected at intervals by commercial fishermen operating in the vicinity of Isle Royale. Additional eggs of this species to the number of 21,660,000 were turned over to the Duluth station by the State Game and Fish Department of Minnesota. All of this stock was somewhat below the average in quality, owing to unfavorable weather conditions during the spawning season. From it 13,000,000 fry were hatched and planted on whitefish spawning grounds in Minnesota, Michigan, and Wisconsin waters.

Through cooperative work with the Minnesota fisheries authorities approximately 18,000,000 pike-perch eggs were obtained, the collections being made in the Rat Root River, near Ericsburg, Minn. The eggs were apparently of good quality when received, but subsequent losses so reduced the stock that only 1,450,000 fry were realized for distribution.

This station also distributed the product of 346,000 brook-trout eggs purchased from commercial fish-culturists in Pennsylvania and Colorado and 41,000 fingerling steelhead salmon hatched from a consignment of 50,000 eggs transferred to the Duluth hatchery by the Oregon State Game Commission.

In the course of the year an attractive cottage was constructed for the use of the station foreman. Most of the finish work on the second floor of this building was done at odd times by the station employees.

NORTHVILLE (MICH.) STATION AND SUBSTATIONS

[W. W. THAYER, Superintendent

The year's fish-cultural work at the Northville station consisted in the propagation of small-mouth black bass and the hatching and rearing of brook and rainbow trout fry and fingerlings from eggs furnished the hatchery from outside sources. During the early winter of 1924, 619,260 brook-trout eggs were acquired, 350,000 being purchased from private fish-culturists in the East while the remainder were donated to the bureau by the Pennsylvania Fish Commission, being taken from the stock in the Pleasant Mount hatchery operated by the State. Fry and fingerlings to the number of 548,580 were produced from these eggs and distributed, the losses during the time they were held amounting to slightly less than 11½ per cent of the original number.

From a total of 211,695 rainbow-trout eggs, part of which were furnished from the White Sulphur Springs (W. Va.) station and part from the Paris hatchery operated by the Michigan Fish Commission, one consignment of 28,000 was reshipped to an applicant, 102,855 fingerling fish were produced and distributed, and a considerable number of fingerlings remained on hand at the end of the year.

The unseasonably late spring hampered the work with the pondfishes and greatly curtailed the output. The brood stock of 199 small-mouth black bass was distributed in the breeding ponds on May 6. The fish began nesting on the 12th, and by May 22 the ponds contained 47 nests of bass fry. It is believed, however, that all of these earlier hatched fish perished as a result of the prevailing low water temperatures, which up to that date had not exceeded 58° and for a large portion of the time were considerably lower. Mild weather set in near the end of May, and air and water temperatures from that period to the close of the season were favorable. The fish continued to spawn up to and including June 17, and from the 31 nests of eggs realized there was an output of 56,500 advanced fry. The brood fish at this station are somewhat below the average size. With the view of producing a greater output a special effort will be made in advance of the next spawning season to secure brood fish of larger size from Lake Huron.

Charlevoix (Mich.) substation.—During the period from October 22 to November 26, 54,012,000 lake-trout eggs were obtained from commercial fisheries in Lake Michigan, Lake Huron, and the Straits of Mackinaw for stocking the Charlevoix hatchery. Their quality was no better than in past years, and the usual heavy losses were sustained in the course of the incubation period. There being no limitation as to the number of nets operated, the fishermen in some instances set more nets than they were able to lift at proper intervals, with the result that part of the fish in them were either dead or the quality of their eggs impaired. With the view of obviating faulty methods in taking and handling the eggs, steps were taken in the course of the season to instruct the crews of the various fishing boats as to the proper procedure in stripping fish, fertilizing the eggs, and caring for them pending their delivery to agents of the bureau. However, the spawn taker selected for this duty arrived on the fishing grounds too late to be of much service during the current season, but the work was started, and it is planned to pursue it on a systematic basis from the beginning of the next spawning period.

Of the eggs collected 6,750,000 were shipped in the green state to the Duluth (Minn.) hatchery, and eyed eggs to the number of 904,000 were furnished to applicants and other stations of the bureau. The remainder were incubated, producing 17,500,000 fry for return to the native spawning grounds.

Whitefish eggs to the number of 19,840,000 were collected between November 15 and November 29, and 53,400,000 were transferred to the hatchery from the Put in Bay (Ohio) field. From this stock 35,000,000 fry were hatched and planted.

Alpena (Mich.) substation.—Owing to the improved quality of the hatchery water following the completion of the city filtration plant, whitefish and lake trout propagation was conducted under much more favorable conditions than have prevailed at this substation for several years. Active fish-cultural work began on October 29 with the receipt of the first lot of lake-trout eggs, and from then until the close of the spawning period, on December 11, 7,824,000 of this species were secured. Collections of whitefish eggs were made between November 8 and November 28, the total for the season amounting to 48,880,000. The entire stock of both species was obtained from fisheries in the vicinity of Alpena, and, as compared with the yield from these grounds a few years ago, the collections may be regarded as successful. The improved results are largely attributable to a better cooperative spirit on the part of the commercial fishermen. The State game warden also rendered material assistance in the work. After reaching the eyed stage, 3,000,000 of the whitefish eggs were turned over to the Michigan Conservation Commission. The remainder were incubated in the Alpena hatchery, and all of the resulting fry were released on the spawning grounds from which the eggs were derived.

PUT IN BAY (OHIO) STATION

[David Davies, Superintendent]

With the approach of the whitefish spawning season in early November men were stationed at the various fishing centers in Lake Erie, and the usual arrangements for obtaining eggs for the hatchery were effected with the commercial fishermen. Between November 12 and December 6, eggs to the number of 313,200,000 were received, of which 250,320,000 came from the Port Clinton and North Bass fields. The remainder were derived from the fisheries at Middle Bass, Catawba Island, Put in Bay, and Toledo. No nets were operated in the formerly prolific field around Monroe Piers, Mich., owing to the poor results attained there in recent years. The cause of the failure here has not been definitely ascertained. Some of the fishermen have attributed it to the discharge of pollution into the lake from the Maumee, Raisin, and Detroit rivers, while others claim that so many gill nets were set across this portion of the lake that the passage of the fish to their spawning grounds in its western end was effectually cut off.

Shipments of green whitefish eggs to the number of 78,760,000 were made to other hatcheries, 9,680,000 of inferior quality were planted on the reefs near the hatchery immediately after being fertilized, and 5,760,000 eyed eggs were forwarded to the Lincoln Park Zoo at Chicago, Ill. From the remainder, 148,000,000 fry were realized, the proportion of hatch being slightly more than 67 per cent of the retained eggs. All of these were released in the lake at points ranging from 2 to 12 miles distant from the hatchery.

On April 3, nearly three weeks after the legal opening of the pike-perch fishing season, the spawning grounds in the western end of Lake Erie were still covered with ice, which interfered with the setting of nets. In some instances the fishermen placed their nets where open water was found, with the result that many of them were destroyed by ice fields with the shifting of the winds.

Despite the unfavorable prospects, spawn takers were stationed at the various collecting centers at the usual time, though no eggs were available until April 19. Between that date and May 3 a total of 117,425,000 eggs were received, nearly all of them being taken at the Toledo and Port Clinton fisheries, these fields yielding 72,625,000 and 36,575,000 eggs, respectively. Green eggs to the number of 13,825,000 were forwarded to the Iowa State hatchery, and from the remainder 36,000,000 fry were hatched and liberated.

Although the fishermen had been requested in advance of the pike-perch spawning season to save all available eggs of the sauger and yellow perch, only 8,400,000 of the former and 4,350,000 of the latter were secured. It is believed the collections of these species would have been much more satisfactory had weather conditions not interfered. In each instance the eggs were of good quality, yielding a good percentage of strong vigorous fry. The sauger eggs were eyed in 7 days, and incubation was completed at the expiration of 10 days additional in a mean water temperature of 51°.

As with the other spring-spawning species, the results of carp propagation in the Port Clinton and Sandusky Bay fields were quite disappointing. The commercial fishermen captured only about one-half the number of fish taken the previous year, and egg collections were correspondingly reduced, the total take amounting to 41,825,000, or about one-fourth that obtained in June, 1923. It would appear that the unfavorable natural conditions had the effect of reducing the run of fish to their customary spawning grounds. Egg collections of this species were made between June 5 and June 30.

CAPE VINCENT (N. Y.) STATION AND SUBSTATION

[J. P. SNYDER, Superintendent]

The active fish-cultural work of the year at the Cape Vincent station began in early October with the collection of lake-trout eggs, the fields occupied being Pigeon and Simcoe Islands on the Canadian side of Lake Ontario, and Stony Island in New York waters. The collections extended from October 16 to November 9 and resulted in 1,098,000 eggs, or about 200,000 less than were secured in these fields the preceding year. The decrease was attributed to a smaller catch of fish and to unfavorable weather during the spawning season.

Whitefish egg collections were seriously curtailed by the refusal of the deputy minister of fish and game of Ontario to permit the bureau's men to secure eggs in the important fields formerly occupied in the Bay of Quinte and along the lake shore near South Bay. It appears that this action was not taken in a spirit of antagonism, but was prompted by a desire to secure all possible eggs for filling the hatchery recently constructed by the Canadian Government at Glenora, Ontario. The bureau's men were allowed to make egg collections of all species at Simcoe Island and at Brighton and Bowmansville, Ontario, and the whitefish eggs secured at these points, together with those obtained at the usual points of collection on the American side of the lake, aggregated 95,258,000. The station also received 17,000,000 from Lake Erie, but they were of very poor quality. The eggs obtained in Chaumont Bay and in the vicinity of Cape Vincent exceeded the collection of any previous year in these fields. As a rule, they were of excellent quality.

In addition to the fields heretofore occupied in the search for eggs of the cisco, the operations were extended to Big Sandy Pond, N. Y., and to the Simcoe Island and Wellers Bay fields on the Canadian side. Plans were also effected to send men into the Bay of Quinte, but before any definite action had been taken it was learned that the run of fish in that field was too small to justify the expense involved. The spawning season covered the period from November 17 to December 5, during which time 200,790,000 eggs were secured. Most of the fry resulting from these eggs were planted on the cisco spawning grounds in Lake Ontario and adjoining bays, the number thus disposed of amounting to 128,360,000.

Somewhat heavy losses were incurred as a result of the efforts made to remove a growth, of vegetable origin, which developed in considerable quantities on the whitefish and cisco eggs undergoing incubation. The additional handling and frequent washings to which the eggs were subjected in this process not only impaired their quality, but some of them were washed away despite the precautions taken to prevent it. In an effort to check the growth, copper sulphate was used experimentally and with good results where the eggs were at an early stage of development. When used on those at an advanced stage, however, prematurely hatched fry in a weakened condition were the result.

Some losses also occurred as a result of minnows coming in through the pumps and lodging in the jar faucets, cutting off the flow of water. These were very troublesome at times, and to exclude them from the jars it became necessary to employ a different type of screen from that ordinarily used, with heavier and coarser wire cloth for the battery troughs. Even under this arrangement the screens had to be emptied and cleaned at frequent intervals, but the stream of minnows was not continuous for long periods, and sometimes for a week or more there would be no trouble from this source.

In the early winter of 1924, 749,000 brook-trout eggs were received by purchase from commercial hatcheries, and 436,000 were furnished the station by the Pennsylvania Fish Commission in payment for cisco eggs supplied to that State in past years. The Pennsylvania eggs were unusually large and highly colored, and the fry were correspondingly large and very vigorous. At the close of the fiscal year a considerable number of young brook trout were being held in troughs supplied with water from the city works in an effort to rear them to a larger size before planting. One hundred thousand rainbow-trout eggs were received from the State of Michigan in return for cisco eggs previously furnished that State, and 8,000,000 eyed pike-perch eggs were transferred to Cape Vincent station from the Swanton (Vt.) substation. The fry from all these eggs were used to supply applicants and to make plants in public waters.

It has been the practice in past years to distribute all brook and rainbow trout fry produced at this station in the fry stage. This procedure having been the cause of a great deal of dissatisfaction on the part of applicants receiving the fish, it was determined during the year to locate, if possible, a suitable site for a field rearing station, one where an abundant supply of water of good quality would be available for the work. With this in view, the station superintendent has inspected a number of sites, but thus far he has found none that is well adapted to the purpose.

SWANTON (VT.) SUBSTATION

[J. P. SNYDER, Superintendent]

Owing to lack of sufficient funds for its operation, this substation remained closed throughout the fiscal year 1923. It was opened early in April, 1924, and fitted up preparatory to undertaking pike-perch propagation on a cooperative basis with the States of Pennsylvania, Connecticut, and Vermont. Pennsylvania and Connecticut agreed to furnish most of the funds required, receiving in return therefor 50 per cent of the eggs collected; the bureau assumed a portion of the expense and provided the services of a competent fish-culturist to direct the operations, while the State of Vermont furnished the services of a man to assist in the hatchery.

The spring was unusally late, but as soon as ice conditions would permit seining operations were started, and two large traps and five small ones were set at suitable locations on the spawning grounds in the vicinity of the hatchery. Brood pike perch were taken before the total disappearance of the ice in the lake, and with them numbers of black and red fin suckers, mullet, catfish, and sheepshead; also, in smaller numbers, whitefish, ling, gar, black bass, sand pike, pickerel, bullhead, smelt, and sunfish. These fishes were sold by the fishermen, the State of Vermont having granted this privilege to compensate them for the brood fish turned over to the hatchery as a source of egg supply.

The existing shortage of male fish was overcome by the operation of seines in the Missisquoi River, 536 males and 120 additional females being secured from that source. Spawn taking extended from April 14 to May 5 and resulted in 185,850,000 eggs, the number being arrived at by measuring them when 24 hours old and estimating 150,000 to the quart. As the fish were spawned they were liberated in the lake. Many of the females, particularly the large ones, showed evidence of distress in the retaininig inclosures from the beginning. They seemed unable to maintain a balanced horizontal position under the water and showed an inclination to swim about with their tails above the surface of the water. However, the loss was not heavy until near the close of the season, when it became necessary to release many that had not spawned.

Seventy-eight million green eggs, the share of the Pennsylvania Department of Fisheries, were delivered at their hatchery in good condition and were reported later as having hatched with a loss of about 25 per cent. After reaching the eyed stage 5,180,000 were turned over to the Connecticut State hatchery and 12,000,000 were consigned to the bureau's stations at Cape Vincent, N. Y., and Nashua, N. H. The remaining eggs were hatched at Swanton, yielding 22,000,000 fry, of which 7,200,000 were turned over to the Vermont Department of Fish and Game, 7,800,000 were distributed to applicants, and 7,000,000 were returned to the spawning grounds from which the parent fish were derived.

Incidental to the pike-perch work 11,000,000 eggs of the yellow perch were taken, the collections extending from May 1 to May 12. Of the 10,300,000 fry produced from them 1,800,000 were supplied to applicants and 8,500,000 were furnished to the State of Vermont.

BRYANS POINT (MD.) SUBSTATION

[L. G. HARRON, Superintendent]

The work of collecting a brood stock of yellow perch for this substation was taken up on March 5 and continued to March 22. During this period 22,974 adult fish were secured and placed in the retaining pens. Spawning began on March 23 and continued to April 2, by which time a total of 203,970,000 eggs had been deposited. There was a loss of approximately 13 per cent on the brood fish while confined. The eggs yielded 193,769,000 fry of excellent quality.

RESCUE OPERATIONS

HOMER (MINN.) STATION AND SUBSTATIONS

[C. F. CULLER, in charge]

The more important work of this group of stations, which includes the Homer (Minn.) station as the administrative office and the substations at La Crosse, Wis., Marquette and Bellevue, Iowa, and Atchafalaya, La., consists of the so-called rescue operations, or the removal of valuable food and game fishes from the landlocked ponds and sloughs formed by the receding waters of the Mississippi River after the annual spring freshets and their liberation in the main channel of the river. During the fiscal year 1924 such work was actively pursued at suitable points between Prescott, Wis., and

Andalusia, Ill., and in the vicinity of Atchafalaya, La. The total number of fish removed from drying pools and sloughs was 150,509,840, and all of these were returned to their native waters with the exception of 1,095,559, or slightly more than one-half of 1 per cent of the aggregate, this comparatively small fraction of the total representing the fish that were diverted from the rescue work to meet the requirements of applicants in various parts of the country.

In connection with the rescue work the practice within recent years of infecting suitable host fishes with the glochidia of the commercially important fresh-water mussels was again taken up, and as a result of the work 1,335,595,000 larval mussels were released in a state of parasitism in waters favorable to their development and growth.

The Mississippi River did not attain as high a stage as usual during the spawning season of the native food and game fishes. As a consequence a smaller area of the adjacent lowlands than formerly was overflowed, and the receding waters naturally left a much smaller number of pools and ponds. Because of such conditions it was predicted early in the season that the results of the rescue work would fall short of the average numbers. As it progressed, however, it became apparent that, while the area of backwaters in which fish were stranded was considerably smaller than in some seasons, the fish population of such waters as were accessible was very dense. The effects of this density were made manifest in the serious mortality that occurred at many points and by the smaller average size of the young fish taken. Summarized tabular statements of the rescue and mussel infection operations appear on pages 370 and 404.

While commercial fishing for buffalofish and carp was in progress in the vicinity of Bellevue, Iowa, the bureau's spawn takers collected and fertilized upward of 99,000,000 buffalofish eggs and 13,500,000 eggs of the carp. These eggs, which otherwise would have been a total loss, were deposited immediately after being fertilized on the local spawning areas.

In view of the vast importance of the fishes involved in the bureau's rescue operations, the facility with which they may be prosecuted, the low cost of the work as compared with the results attained, and the unquestioned benefits accruing therefrom it seems particularly unfortunate that the small amount of money annually available for the purpose can not be augmented sufficiently to permit of an extension of the work, at least to the extent that the fields now occupied may be fully covered.

The season under discussion is an illustration of the desirability of more extended rescue work. Because of the rather unusual conditions, which have been explained elsewhere, millions of young fish were densely crowded into restricted waters, the areas of which were constantly and rapidly diminishing through evaporation and seepage. Under such conditions the mortality among these fishes must obviously be very great, and the only remedy lies in removing them from their unnatural environment and liberating them in the river.

Of added interest and value to this work are the recently adopted measures for mussel infection in connection therewith. By means of it enormous numbers of larval mussels are provided with suitable host fishes, without which they can not survive this stage of their existence. The work is most heartily indorsed by all interests concerned, including the Izaak Walton League of America, the pearl-button industry, which is directly dependent on the supply of fresh-water mussels for its raw material, and the commercial fishing interests generally.

La Crosse (Wis.) substation.—In addition to the rescue and mussel-infection work accomplished at the La Crosse (Wis.) substation, eggs of the rainbow trout from Neosho (Mo.), Manchester (Iowa), and White Sulphur Springs (W. Va.) stations, brook-trout eggs from a commercial breeder, Loch Leven trout eggs from the Bozeman (Mont.) station, and pike-perch eggs from the State of Minnesota were incubated and the resulting fry distributed to applicants in Wisconsin and Minnesota.

Atchafalaya (La.) substation.—The substation at Atchafalaya, La., was opened early in February and the necessary arrangements made for the collection of eggs of the buffalofish. The work of last season verifies beyond a doubt that a new location must be found if success is to be attained in the artificial propagation of this fish. Trouble of a similar nature has been encountered each succeeding year since the substation was established.

Through the course of the work in 1924 a careful check on all probable causes of the mortality was made, and there can no longer be a doubt that the trouble is attributable to pollution carried in the waters of the Ouachita River, which drains the southern Arkansas oil fields.

Several other possible sites were visited, two of which—Bayou Grosse Tete and Bayou Plaquemine—appear to offer the essential requirements for successful work. The station should be moved to one of these locations before the propagation of buffalofish is taken up next season.

Active egg collections began on March 6, and though climatic conditions were not at all favorable at any time during the spawning season 277,512,500 eggs had been secured by March 29, which date marks the close of the egg collections for the season. Repeated attempts to incubate the eggs at the hatchery proved futile. Fertilized eggs placed in the hatching jars in good condition showed a small white spot at the end of 24 hours, and in 48 hours all eggs were white and opaque. Because of this unfortunate situation it was necessary to plant the fertilized eggs on the spawning grounds immediately after they were impregnated.

MUSSEL INFECTION IN CONJUNCTION WITH THE RESCUE OF LAND-LOCKED FISHES

[H. L. CANFIELD, in charge]

Owing to the unusually small size of the fishes handled early in the rescue season, the mussel work was not undertaken until larger and more vigorous fishes were obtainable. As a consequence of this delay the results were considerably curtailed as compared with last year. The total number of mussel glochidia released on the gills of living fishes in the course of the season amounted to 1,335,595,700, indicating a falling off of upward of 713,000,000. The work is conducted at a minimum outlay of labor and time, the operation being performed just prior to the release of the fishes from the tubs into open waters. Its cost during the season of 1924 amounted to an average of $0.0011 per thousand, or less than half the average of the preceding year.

The bureau received a gratifying amount of cooperative assistance from clam fishermen and others engaged in the industry, and from reports furnished by the fishermen it is believed that the work is producing valuable results in maintaining the supply of mussels in certain areas. The following summary shows the fields in which mussel operations were prosecuted in 1924 and the number and species of mussels handled in each.

Summary of infection of fishes, fiscal year 1924

Stations	Species		
	Grass mucket (*L. luteola*)	River mucket (*L. ligamentina*)	Pocketbook (*L. ventricosa*) [1]
Alma, Wis.		63,700	
Minnieska, Minn.		11,364,300	
West Newton, Minn.		3,747,000	
Chimney Rock, Wis.		24,732,000	
Winona, Minn.		78,510,000	
Homer, Minn.	21,682,500	312,968,100	
Dakota, Minn.		6,236,000	
La Crosse, Wis.	92,390,000	107,689,500	
Genoa, Wis.	94,250,000	253,750,000	24,750,000
Ferryville, Wis.	154,000	3,179,000	
Lynxville, Wis.	17,120,000	246,167,500	
Marquette, Iowa	1,089,000	1,313,500	
Guttenberg, Iowa		4,841,000	
Bellevue, Iowa	7,032,900	22,190,700	
Buena Vista, Iowa		375,000	
Total	233,718,400	1,077,127,300	24,750,000

[1] This mussel is not first class in quality and fishes are infected with it only when first-class mussels are not available.

MARINE FISHES

Taken as a whole, the fish-cultural work of the marine stations may be regarded as successful, the total egg collections of the group being nearly 25 per cent greater than in the preceding year. This increase was made possible by the large collections of winter-flounder eggs obtained, all of the stations engaged in this branch of the work securing them in much larger numbers than last year. On the other hand, there was a shortage of nearly 267,000,000 cod eggs, as compared with last year, this being occasioned by the almost complete failure of the cod work at the Woods Hole (Mass.) station. The work with this species at the Gloucester (Mass.) station assumed larger proportions than ever before in its history.

BOOTHBAY HARBOR (ME.) STATION

[E. E. HAHN, Superintendent]

In the course of the fall and winter every effort was made to secure cod and haddock eggs for stocking the hatchery at this point but without success. No schools of spawning fish of either of these species could be located in waters along the Maine coast, and the alewives passing by on their way to spawning grounds in fresh waters were immature.

Unusual success was attained, however, in the work with the winter flounder, the egg collections and output of fry of that species being among the largest in the station's history. Seventy-eight fyke nets for the capture of a brood stock were set in Casco, Linekins, and Johns Bays, the same fields that have been resorted to in past years. While heavy ice was encountered in the early part of the season, and a few of the nets were damaged by it, the results in general were very gratifying. Large spawners in goodly numbers were transferred to the hatchery and cared for in the retaining tables until they had cast their spawn, the total for the season aggregating in excess of 6,000.

Spawning began on March 14, and the collections gradually increased to the point where 100,000,000 eggs were taken in a single day. They declined after that time, but there were many days when the daily receipts ran from 30,000,000, to 80,000,000. The last lot of eggs was taken on May 8. The total collections amounted to 1,627,025,000 eggs of much better than the average quality, and in the incubation and distribution of the product merely nominal losses were sustained.

The steamer *Gannet* and its crew rendered valuable assistance in connection with the work, transporting and operating the fyke nets, carrying the brood fish to the station, and liberating the fry on the spawning grounds.

GLOUCESTER (MASS.) STATION

[C. G. Corliss, Superintendent]

The active fish-cultural work of the year at the Gloucester station began on November 11, with the collection of pollock eggs from the commercial fisheries. The work was conducted under practically the same adverse conditions that prevailed in the past two years. Not only were fewer and smaller boats engaged in pollock fishing, but with one or two exceptions they were equipped with old, inefficient nets. The prevailing low market prices had much to do with the general lack of interest on the part of the fishermen. The earliest eggs came from Cape Ann, but the poor results attained in that region soon caused the fishermen to shift to territory in the vicinity of Plymouth, Mass., and most of the eggs obtained for the hatchery were secured here. The daily receipts from the Plymouth field were large until about the first week in December, when the transfer of many of the boats to the cod work caused them to drop off sharply. By the close of the season on January 31 eggs to the number of 399,680,000 had been secured. All of these were incubated in the hatchery, and the resulting fry were planted in the coastal waters of Massachusetts.

Collections of cod eggs extended over the entire fishing season for that species—from early November to the middle of May—and the results in eggs secured and fry developed were far in excess of any previous cod records at this station. During the first three months of the fishing season the egg collections were uniformly light, but as soon as the pollock work was closed and additional employees were available for cod-egg collections there was a large increase in the daily take. Eggs were secured on 109 days, and the total collection, between November 11 and May 13, amounted to 802,110,000. Of these only 516,680,000 were incubated, the remainder being planted on the fishing grounds immediately after being fertilized.

The propagation of haddock was somewhat curtailed as compared with other years, owing to a prevailing scarcity of fish throughout the season. The run appeared later than usual, and 237,770,000 eggs were taken between March 19 and May 14. As was the case in the cod work, the low water density in the hatchery at the time the eggs were secured necessitated the planting of large numbers on the spawning grounds as fertilized eggs.

In the latter part of February work with the winter flounder was taken up and prosecuted in connection with cod and haddock operations. Brood fish of this species to the number of 288 were captured in fyke nets set in Gloucester Harbor, and from them 102,740,000 eggs were obtained, the spawning season extending from March 19 to April 25. A noteworthy feature of this work was the unusually large size of the brood fish. One of them—the largest ever handled at the Gloucester station—measured 8¼ inches in width, weighed 5¼ pounds, and yielded 2,144,000 eggs.

WOODS HOLE (MASS.) STATION

[W. H. Thomas, Superintendent]

The efforts made to propagate cod at this station were almost a complete failure. Owing to the unseasonably mild water temperatures, which prevailed throughout the fall and early winter in all coastal waters of the region, no schools of cod were in evidence either at the traps at Narragansett Pier, upon which the station is dependent for its brood stock, or in Cape Cod Bay, where eggs of this species were plentiful last year. No results whatever were obtainable from the fishing traps, which were in continuous operation up to the end of November. Late in October the steamer *Phalarope* and a force of spawn takers proceeded to the eastern entrance of Cape Cod Canal to establish headquarters for the collection of spawn, the indications at that time being that the capture of cod in this field would at least equal the catch of the previous winter. Men were also sent to the usual cod-fishing centers along the coasts of Connecticut and Rhode Island. In all fields visited it was found that water temperature conditions were abnormal to the extent of excluding the migration of spawning cod in any of the coastal waters within reach of the station. The total results of the season's efforts were 4,779,000 eggs from fields that had yielded nearly 670,000,000 last year. Incidental to the search for cod spawn a few pollock eggs were taken in Cape Cod Bay and incubated.

In advance of the spawning season quite extensive arrangements were made for the propagation of winter flounder, the prevailing mild weather indicating that brood fish in large numbers would be available. The fyke nets set at Waquoit, Mass., were successfully operated early in the season, but toward the last of February very nearly normal weather set in, and the formation of ice on the fishing grounds made it difficult to handle the nets. The work in this field was prosecuted from early in January to March 10, and a sufficient number of brood fish were secured to yield upward of 507,000,000 eggs. The search was also extended to fields formerly occupied in the vicinity of Wickford, R. I., and Block Island and Noank, Conn., and from all points occupied a total of 604,159,000 eggs of good quality were obtained.

During the spring spawning period a persistent effort was made to secure eggs of the mackerel, scup, and sea bass. No success was attained, however, owing to the difficulty of finding ripe fish of both sexes at the same time. On the single occasion when mackerel spawn might have been taken and fertilized some delay was experienced in starting the engine of the motor boat, and the traps had all been lifted prior to the arrival of the spawn takers. On this particular morning about 60 barrels of large mackerel were taken in the traps.

ANADROMOUS FISHES OF THE ATLANTIC COAST

The fish-cultural work of the three stations under this head was concerned with the Atlantic salmon, the shad, river herring, and the humpback salmon. The total output of these species in round numbers during the year was 110,887,000, a decrease of approximately 56,000,000 as compared with that of the preceding year. The reduction in this branch of the work was due principally to the unfavorable weather conditions encountered during the shad spawning season on the Potomac River and in the Albemarle Sound region.

Owing to the presence of polluted water on the spawning grounds of the striped bass in the Roanoke River near Weldon, N. C., the bureau's hatchery for the propagation of that species was not opened during the year.

SHAD

Bryans Point (Md.) substation.—The most important work of this station is that addressed to the propagation of shad, and for a long period of years such work was almost uniformly successful. Notwithstanding the aggressive commercial fishing to which it has been subjected, the run of shad in this river is noteworthy in not having suffered diminution to the extent that has occurred in all other streams resorted to by this species. The maintenance of the shad run in the Potomac, in contrast to the entire disappearance of the species in many streams and greatly reduced runs in all others, has frequently been cited as a proof of the efficacy of artificial propagation in regions where the environment is reasonably favorable.

The run of shad in the Potomac River during the fiscal year 1924 proved to be almost an entire failure, both from the viewpoint of the fisheries and fish culture. Undoubtedly this unfortunate state of affairs was brought about by truly remarkable conditions. The first unfavorable weather affecting the run of fish was on March 10, when a heavy snowstorm occurred, accompanied by a strong northeast gale and followed by a heavy rain. A second severe snowfall was experienced on April 1, and on May 11 the river was subjected to one of the heaviest freshets recorded. It thus transpired that throughout the natural spawning season a continuous series of unfavorable conditions prevailed—unseasonably low water temperatures from the late snowstorms, and flood stages accompanied by extreme turbidity of the water. The same conditions extended throughout the entire length of the river.

The first shad of the season, in spawning condition, were taken on April 23, and small daily collections of eggs were obtained from that time to May 11, on which date the flood effectually put an end to further fishing. Eggs to the number of 8,597,000 were taken during the short collecting season. Of this number some 94 per cent were hatched, producing 7,953,000 fry of good quality. All of these were distributed on the principal natural spawning areas in the river.

SHAD AND RIVER HERRING. EDENTON (N. C.) STATION

[WM. S. VINCENT, Superintendent]

The work of this station was concerned with two species of commercial importance—the shad and the river herring—and it was extended during the year on a small scale to include the yellow perch, a species for which there is a strong demand and which supports a commercial fishery of some importance.

As was the case on the Potomac River, the weather in Albemarle Sound during the spring spawning season was most unpropitious, and its effect was made evident in the small numbers of fish and eggs taken. With the discontinuance of the former practice of granting permits to a limited number of fishermen to use gill nets on the natural spawning grounds of the shad, the bureau's only source of supply was the Capehart Beach fishery, which resumed operations last spring after a lapse of several years' duration. Operations here were conducted on a much smaller scale and with a much shorter seine than in past years, the total capture of shad for the season approximating 12,000 fish. Ripe eggs were taken from April 17 to May 8, the season's collections aggregating 7,855,000. These were incubated with a loss of only 10 per cent, and the resulting fry were planted in suitable places on the natural spawning grounds.

As the run of herring occurs simultaneously with that of the shad, the fishing operations suffered proportionately from adverse climatic conditions. Between April 15 and May 11, 222,000,000 eggs were obtained from herring taken for commercial purposes, this figure showing a shortage of about 30 per cent in the collections as compared with last year. The eggs were not equal in quality to those of the shad, only 50 per cent of them producing fry.

Egg collections of the yellow perch were taken up in a tentative way during the spring. Some 300 adult fish were acquired by purchase from local fishermen and held in confinement until the spawn ripened, some of them being retained in a pond having a natural earth bottom, while others were placed in a wooden crate immersed in the water of a small concrete pond. In each case the fish were allowed to spawn naturally and all of the eggs proved to be of high quality. Artificial manipulation of the fish as a means of obtaining eggs was also successfully tried. For this purpose a station employee accompanied the fishermen lifting the pound nets used for the capture of fish for the market. Because of the very small number of fish containing ripe eggs this undertaking did not prove profitable, though the small number taken were readily fertilized and incubated with as little loss as on those deposited naturally. A total of 5,460,000 eggs was secured.

ATLANTIC AND HUMPBACK SALMONS. CRAIG BROOK (ME.) STATION

[J. D. DE ROCHER, Superintendent]

Because of the persistent refusal of the salmon fishermen of the Penobscot River to render reasonable assistance to the bureau in the prosecution of its Atlantic salmon work, no attempt was made to secure brood fish of that species during the fiscal year 1924. The work was therefore confined to the incubation of some 500,000 eggs received from the Canadian Government in exchange for an equal number of eggs of other species of the Salmonidæ. Upward of 95 per cent of these eggs produced fry, which were distributed in the Naraguagus, Dennys, Piscataquis, and Penobscot Rivers, all in the State of Maine.

Of interest in connection with the fish-cultural work at this point is the continued presence in the Dennys and Pembroke Rivers every second year of a run of spawning humpback salmon. During the month of September employees of the Craig Brook station secured approximately 600,000 eggs from these fish, and the resulting fry were returned to the streams from which the eggs were derived. The losses during incubation were rather heavy, amounting to nearly 35 per cent of the original stock.

FISHES OF MINOR INTERIOR WATERS

The more important fishes propagated at the bureau's stations for the stocking of interior waters are the rainbow, black-spotted, and brook trouts, landlocked salmon, the crappies, the black basses, catfish, rock bass, and sunfish. The extensive fishing being done in the public waters of the country at the present time is making it exceedingly difficult to supply the ever-increasing demands for the game fishes. This applies especially to the brook trout and to practically all of the pondfishes, but more particularly to the large-mouth and small-mouth black bass. In the case of the brook trout the output is necessarily limited owing to the fact that a large proportion of the eggs are purchased from commercial fish culturists and in many instances are greatly inferior to those derived from wild fish. In the production of the pondfishes the work is frequently handicapped by unfavorable weather, and it is necessarily limited by the small pond areas available for carrying on the work.

The cooperative relations that have been developed within the past few years between the bureau and fish and game organizations in practically all parts of the country have done much to improve conditions pertaining to fish life in public waters. Many of these organizations have been instrumental in having laws passed for the better protection of wild life in their respective States and have brought about an increased respect for such laws on the part of the general public.

ROCKY MOUNTAIN TROUT STATIONS

The activities of this group, comprising five main stations and a number of substations and field collecting auxiliaries, are confined to the States of South Dakota, Colorado, Wyoming, Utah, and Montana. They were engaged during the year in the cultivation of brook, rainbow, black-spotted, and Loch Leven trouts, and to a lesser degree in the propagation of the Montana grayling.

BOZEMAN (MONT.) STATION AND SUBSTATIONS

[W. T. THOMPSON, Superintendent]

The outcome of the year's fish-cultural work at Bozeman station and its auxiliaries was generally satisfactory. The newly opened field for the collection of Loch Leven spawn proved a prolific one, and through the exchange of surplus eggs of this species for those of the brook trout a very large season's work in the propagation of brook trout was made possible. An exchange of Loch Leven trout eggs for grayling eggs was made with the Montana Department of Fish and Game, the grayling being used to stock the waters of Glacier Park.

Bozeman (Mont.) station.—At the opening of the fiscal year the ponds at the Bozeman station contained 482,450 brook trout and 52 000 steelhead salmon fingerlings; also 211,000 rainbow-trout fry. Early in July a cloudburst in Bridger Creek flooded the ponds in which this stock was being held, causing a loss of approximately 120,000 brook trout and 36,500 rainbow trout. Before the distributions could be made the stock of brook trout was still further reduced by abnormally high water temperatures, the mortality from this cause exceeding 88,000.

As a result of the spawning of the station brood stock in the fall 58,000 brook-trout eggs and 38,000 rainbow-trout eggs were realized. Forty-two thousand rainbow-trout eggs were also collected from wild fish in the course of an investigation of the field at Mitchener Springs, Mont., and 500,550 eyed eggs of this species were transferred to the station from its Meadow Creek auxiliary early in June, 1924. Of this latter consignment 60,000 were reshipped to the Neosho (Mo.) station, 40,000 were planted in Sawtooth Lake in northern Wyoming, and the fry resulting from the remainder were on hand at the close of the fiscal year.

Shipments of eyed brook-trout eggs, in return for spawn of the Loch Leven trout, was received as follows: 485,000 from the Springville (Utah) station; 285,000 from the Leadville (Colo.) station; 608,000 from the Minnesota Game and Fish Department; 291,000 from the Canadian Fisheries Department.

Approximately 1,500,000 black-spotted-trout eggs were transferred to the Bozeman hatchery from the Yellowstone Park field in July, 1923. These suffered heavy losses during the incubation period, and many of the resulting fry succumbed owing to their inability to take food. Eyed eggs of this species to the number of 958,100 were received in June, 1924, and were successfully hatched. The station also received during the year 50,000 eyed lake-trout eggs from the Charlevoix (Mich.) substation and 650,000 Loch Leven trout eggs from the Madison Valley field. The output of the various species handled is shown in the general distribution statement on page 432.

Meadow Creek (Mont.) substation.—An outstanding feature of the work in this field was the remarkable success attained in the collection of Loch Leven trout eggs. An investigation of the field during the late summer having disclosed a very promising outlook, three traps were installed in Odell Creek late in September, and spawning trout in considerable numbers were captured almost immediately. Between October 11 and November 30, 7,700,000 excellent eggs were secured, the average number per fish being about 1,250. On reaching the eyed stage 6,288,000 were shipped to other hatcheries of the bureau and to various State fish commissions and associations, in many cases being exchanged for eyed brook-trout eggs.

The rainbow-trout spawning season opened April 4, about two weeks earlier than usual, and eggs were taken up to May 22, the total amounting to 2,737,970. The eggs were of excellent quality, and merely nominal losses were sustained during the incubation period. Very high water stages prevailed throughout the spawning season. At one time the water was over the tops of the racks, flooding the surrounding bottom land and releasing about 1,500 of the brood fish that were being held for the ripening of their eggs.

Incidental to the work with the rainbow trout, a few black-spotted trout were taken in the traps, and from them 6,000 eggs were collected, fertilized, and hatched. On June 3 a consignment of 3,000,000 green grayling eggs of fine quality was transferred to the Meadow Creek substation by the Montana Department of Fish and Game, with the view of planting the resulting fry in Odell and Meadow Creeks. This work was completed and the station closed for the season on June 25.

Glacier National Park (Mont.) substation.—There were on hand at the Glacier Park hatchery at the opening of the fiscal year 85,000 eggs and 70,000 fry of the rainbow trout. These were carried to the No. 1 fingerling stage and then distributed, the entire losses on eggs and fry being less than 3½ per cent of the original stock.

Of a lot of 1,000,000 eyed black-spotted trout eggs received in July, 1923, from the Yellowstone Park field 329,000 were planted in the eyed stage in some of the more inaccessible waters of Glacier Park. The remainder were incubated and liberated as fingerlings in August. All of the fry resulting from grayling eggs furnished by the State of Montana were also used for stocking the waters of this park. The Glacier Park Service rendered very efficient aid in connection with the distributions from this hatchery.

LEADVILLE (COLO.) STATION

[C. H. VAN ATTA, Superintendent]

In accordance with the usual practice this station operated several privately owned lakes and reservoirs, and with the exception of one lot of commercial eggs its entire stock of brook-trout spawn was obtained in this way. During October and November employees detailed from the Leadville station collected eggs of this species at Engelbrecht, Turquoise, Musgrove, Marma, Wurts, and Evergreen Lakes, securing in the aggregate 5,946,000, or 744,000 less than were obtained last season. At Engelbrecht Lakes, where fishing is allowed only to a limited extent, the yield was noticeably increased, and at Evergreen Lakes—situated on the station reservation—more eggs were taken than for several years past. At all other points there was a considerable decrease, especially at Turquoise Lake, where the collections were smaller by 800,000 than last year. The shortage at these lakes is attributed in some degree to excessive fishing but weather conditions also figured largely in the results at Turquoise, abnormally high water stages and the formation of ice on the lake early in the spawning season materially curtailing the output. The field collections of the species were augmented to the extent of 111,000 eggs purchased from a dealer in Colorado.

During the progress of the brook-trout spawning season 71,700 Loch Leven trout eggs were collected at Turquoise Lake, and 407,500 eyed eggs of this species were transferred from the Meadow Creek field in exchange for an equal number of brook-trout eggs. In the last half of May 20,300 eggs of the rainbow trout were secured in one of the Evergreen Lakes. The station also handled 991,000 black-spotted trout eggs transferred from the Yellowstone Park, 144,-400 lake-trout eggs from the Charlevoix (Mich.) hatchery, and 24,900 steelhead eggs from one of the bureau's substations in the State of Washington. The eyed eggs, fry, and fingerling fish produced and distributed from this stock of spawn are shown in the general distribution statement.

YELLOWSTONE NATIONAL PARK (WYO.) SUBSTATION

[C. F. CULLER, in charge]

Fish-cultural operations in this field were directed by the district supervisor, assisted by a force of trained men drawn from several of the permanently established stations. Of the 26,776,000 black-spotted trout eggs collected in July, 1923, approximately 50 per cent were incubated in the bureau's hatchery located near the Lake Hotel, and the resulting fry were liberated in park waters. The remaining 50 per cent were supplied to State and National hatcheries in the Rocky Mountain regions.

The most prolific egg-collecting fields are various streams located along the eastern shores of Yellowstone Lake, the principal ones being Pelican, Cub, Columbine, Clear, and Chipmunk Creeks.

On May 21, 1924, the operating crew landed at the lake hatchery and at once proceeded to install racks and traps in suitable streams on the west side, among them being Hatchery, Bridge, Arnica, and Thumb Creeks. Experience has shown that the fish start to run as soon as the ice disappears. After racking the west-side streams work was undertaken on the east side of the lake. A very satisfactory collection of eggs was made in Pelican Creek. These eggs were of better quality than those obtained there in recent years. The eggs secured in the Soda Butte field were transferred to the lake hatchery, and the resulting fry were planted in streams emptying into Yellowstone Lake. The fish in Soda Butte appear to be much larger than those in the lake, and it is purposed to introduce them into the lake in an effort to improve the stock.

Excellent cooperation in the work was extended by the superintendent of Yellowstone Park, while various employees of the National Park Service rendered valuable assistance in the transportation of fish and eggs to the more inaccessible waters of the reservation. It is the bureau's policy to plant both fish and eggs near the sources of many of the streams tributary to the lake at points not readily accessible to the public. The egg collections in this field during the fiscal year amounted to 39,253,500, while the eggs obtained during the season of 1924, from June 1 to July 30, aggregated 32,000,000.

The old launch *No. 8* having deteriorated to such an extent that it was no longer serviceable, a new 32-foot launch, built at Sandusky, Ohio, to meet the conditions on Lake Erie, was purchased. This boat is equipped with a 20-horsepower engine. It was delivered at the lake about June 1, 1924, and will aid greatly in making egg collections and in transporting fish to the more distant parts of the lake.

SARATOGA (WYO.) STATION

[O. N. BALDWIN, Superintendent]

At the beginning of the fiscal year this station was carrying 393,000 young brook trout from the hatch of the preceding year. These were distributed in the Nos. 2 and 2½ fingerling stages, some of them being supplied to applicants and the remainder planted in the national forests of the region, employees of the Forest Service cooperating in the work. In addition to the brook-trout eggs secured during the fall from the station brood stock, amounting to 376,000, eggs were collected between October 12 and November 15 from wild fish taken in Big Creek Lakes and transported by truck and pack horses to the station for incubation. Upward of 400,000 were thus obtained and hatched with a total loss of only 8 per cent. All of the fry resulting from this stock were distributed with the exception of 318,000, which were on hand at the close of the fiscal year.

The Big Creek Lakes property was formerly under the control of the Big Horn Cattle and Improvement Co., but suit to cancel its rights thereto was instituted three years ago by the Government. A decision having been rendered in favor of the Government, all fishing privileges were vested in the Forest Service, and as that service desires the development of the lakes from a fish-cultural standpoint, the bureau has undertaken to build up a field collecting station in that region by making annual plants of fish in the lakes.

During April and May operations connected with the collection of rainbow-trout eggs were in progress in the Sage Creek, Lost Creek, and Canon Creek fields. The season's total—aggregating 953,450—shows somewhat reduced results as compared with previous collections. All eggs obtained were of superior quality, however, owing to the more experienced help available for the work and also to the improved water conditions, the amount of sediment carried in the supply being unusually small. The falling off in numbers is attributed in part to the flooding of the creeks consequent to the rapid melting of the heavy snows of March and early April, permitting many of the brood fish to escape. The brood fish at the station furnished 26,000 additional eggs of this species. At the close of the year a fair proportion of the fry produced from the field collections were being reared, with the view of returning them to their native waters as fingerlings during the late summer months.

From the station brood stock of Loch Leven trout 18,000 eggs were obtained, and 403,000 eyed eggs of this species were transferred from the collections made in the Meadow Creek (Mont.) field. On account of the crowded condition of the Saratoga hatchery at the time of receipt, 100,000 of these eggs were turned over to the State hatchery at Laramie, Wyo., to be incubated for the Forest Service. Five hundred thousand eyed black-spotted-trout eggs received from the Yellowstone Park field were hatched with practically no loss, and the resulting fry and fingerlings were used to stock streams at a high altitude in various national forests.

The mountain streams in the vicinity of Pinedale, Wyo., were investigated during September with the view of finding a suitable site for the collection of black-spotted-trout eggs. A promising field was located, but as no funds were available for the purpose it was impossible to do anything toward its development during the year.

SPEARFISH (S. DAK.) STATION

[D. C. BOOTH, Superintendent]

Fish-cultural activities at this station were chiefly concerned in the propagation and distribution of the brook, Loch Leven, and rainbow trouts, and the steelhead salmon, the aggregate output of fish of these species for the year amounting in round numbers to 1,460,000. Aside from the work prosecuted at the main station and its Sand Creek auxiliary, located near Beulah, Wyo., the Spearfish station assisted in the black-spotted-trout operations in the Yellowstone Park by furnishing the services of two of its regular personnel during the egg-collecting and eying period in that field. Some work was also accomplished in the way of pond construction, and, to overcome a considerable wastage from the new concrete storage reservoir, a concrete bottom was laid over a large portion of its area.

Approximately 180,000 brook and Loch Leven trout eggs were collected during the fall from the station brood stock, and 110,500 additional wild eggs of these species were secured in the Sand Creek field. This stream constitutes the only available source of supply in the region for eggs from wild trout, and were it not for the fact that it is being heavily fished every year by tourists and automobile parties it could soon be built up to the point where it would form a valuable adjunct to the work of the Spearfish station. This stock was increased by the transfer of 375,000 brook-trout eggs from the Springville (Utah) station and 1,005,000 Loch Leven trout eggs from the Madison Valley (Mont.) field station.

Between January 29 and March 20 the brood rainbow trout carried in the station ponds yielded approximately 56,000 eggs, and later in the spring a consignment of about 55,000 steelhead eggs was forwarded to the station from a hatchery operated by the Oregon Fish Commission. Aside from the distributions made during the year, considerable numbers of young trout of the various species handled were reserved to supplement the station brood stock.

SPRINGVILLE (UTAH) STATION

[CLAUDIUS WALLICH, Superintendent]

In pursuance of an agreement entered into with the fisheries authorities of Utah, an employee of the bureau's Springville station was detailed during October to make collections of brook-trout eggs at Fish Lake in conjunction with employees of the State. This work extended from October 18 to November 25, and during its progress approximately 7,000,000 eggs of good quality were secured, of which 2,500,000 were allotted as the bureau's share. The spawning period could hardly be said to have closed when operations ceased, but the lateness of the season made it appear advisable to discontinue the work and transfer the collections to the home station before the roads were made impassable by snow. The great abundance of fingerling trout noted all along the shores of the lake in the course of spawn-taking furnishes good evidence that the supply of brook trout in this body of water is being well maintained.

From the eggs derived from this field, comprising the station's entire stock of this species, 1,475,000 were shipped in the eyed stage to various stations of the bureau and 520,000 fry were produced, the proceeds being equivalent to an 80 per cent hatch. The alevins were strong and continued to thrive until late in February, when the hatchery water appeared to be filled with finely divided vegetable matter, the water at the intake at this period being at a low level. In a short time the gills of many of the young fish became so congested that a heavy loss ensued. On being removed to another environment a considerable percentage of the affected fish recovered.

Quite extensive improvements were made during the year with the view of bettering the condition of the brood rainbow trout. Long parallel dikes were constructed down the center of two of the large earth ponds to confine all available water in an 18-foot channel, this arrangement providing a good current of water of a moderate temperature at all times. On the completion of the repairs the entire stock of 2,300 adult rainbow trout was transferred to the ponds, and a great improvement in their physical condition was soon noted. These fish spawned between December 15 and March 10, yielding 1,121,700 eggs, of which 878,180, or 78 per cent, were hatched. The loss of fry was light up to the time the stock was transferred to the concrete pond system, such action being necessitated through lack of space elsewhere. It was observed that the fry placed in the ponds having the first use of the water did very well, but the losses in the ponds fourth and fifth in line was extremely heavy. There was no lack of water, but a strong current was found to sweep the fish against the screens, where they soon succumbed. The experience indicates that the use of less water in the first place would have given better results. In this connection it is believed that a series of tanks installed along the south side of the concrete pond system, where water is abundant, would be a great aid to the station in carrying its needed stock of fingerling fish. The net result of the operations was the distribution of upward of 211,000 fingerlings Nos. 2 and 2½ and the retention of 60,000 fine fingerlings for the work of the succeeding year.

During April and May egg collections of the rainbow trout were undertaken in the Fish Lake field in cooperation with the State, and at the same time extensive plants of fish were made therein both from the Springville station and the State hatchery, the truck employed to bring out eggs for shipment returning each time with a load of fish for the lake. The spawning season extended from April 22 to May 24, the bureau receiving 905,000 as its share of the 5,407,000 secured. Quite extensive losses occurred in the egg and fry stages, and at the close of the year the proceeds of this work were 507,000 fry in the early feeding stage.

In the course of the year efforts were directed toward the establishment of additional field stations for the collection of rainbow-trout eggs in the Fish La e and Panguitch Lake fields. In this investigation the cooperation of the United States Forest Service was enlisted and favorable sites were found, the one at Fish Lake being within the forest reserve, while the one at Panguitch Lake is on private property. It is probable that egg collections in both these fields will be undertaken in the near future in conjunction with the State of Utah.

From 50,000 black-spotted-trout eggs received from the bureau's station in the Yellowstone Park during the summer of 1923, 25,000 fingerlings No. 2 were produced and distributed to applicants. In an attempt to fill additional demands for this species, egg collections in cooperation with the State were undertaken in the Strawberry Reservoir field early in June, 1924. As a result of this work the station acquired 600,000 eggs, but their number was so reduced by losses that only 165,000 survived to the eyed stage.

NEW ENGLAND TROUT AND SALMON STATIONS

Under this head are included the four stations located in the States of Massachusetts, Maine, Vermont, and New Hampshire, together with several substations. The fish-cultural work of these stations is addressed primarily to the propagation of trout. Owing to climatic and other adverse conditions the output of the group was considerably reduced as compared with that of the preceding year.

BERKSHIRE (MASS.) STATION

[G. R. Hoffses, Superintendent]

Though the fish-cultural work of this station was concerned with three species of fish, its output for the fiscal year consisted of brook trout and rainbow trout only. Between October 16 and December 19, 144,280 brook-trout eggs were collected from brood fish in the station ponds and 102,000 eyed eggs were acquired by purchase from a commercial hatchery in Massachusetts. The station eggs were taken from 245 brood fish, 99 of which were only 2 years old. The balance were of various ages, but the majority of them were past their prime. The 2-year-old fish produced an average of about 300 eggs per fish, while the average from the others amounted to less than 800. As might be anticipated, the eggs were not of high quality and the losses during incubation, and subsequently on fry and fingerling fish, were greater than could reasonably be expected from eggs resulting from more nearly normal parents. Notwithstanding these facts, however, a fair percentage of fingerlings Nos. 1½ and 2 was realized.

The commercial eggs were of exceptionally good quality when received, and they remained in good condition throughout the incubation period. The losses sustained in the fry and fingerling stages were also negligible. A number of young fish from this lot of eggs is being reserved to replenish the brood stock.

Twenty-five thousand rainbow-trout eggs, received in May from the Michigan State hatchery at Paris, Mich., were also of excellent quality, and from them a high percentage of fingerling fish was produced. One of the most gratifying features of the year's work was the entire absence of disease, which has so frequently become epidemic among the young trout at this station.

Fifty-four adult small-mouth black bass, received in May from the Cape Vincent (N. Y.) station, were at once distributed in ponds previously prepared for them. Three of these fish died almost immediately after being installed, apparently from injuries received during transportation. Within a few days there were indications of spawning, the fish working on two of the artificial nests provided and on a number of spots of their own selection. However, no eggs had been deposited at the close of the year, though the fish at the time appeared to be in excellent condition. It is impossible to account for this failure to spawn. Climatic conditions appeared to be favorable, and three dead fish proved on opening to be females with eggs well along toward maturity. It may be that the fish were not properly segregated as to sex when placed in the ponds.

CRAIG BROOK (ME.) STATION AND SUBSTATIONS

[J. D. DE ROCHER, Superintendent]

Aside from the work with the Atlantic and humpback salmons, a review of which may be found on page 407 under the heading "Anadromous fishes of Atlantic rivers," the operations at this group, including the main station at Craig Brook, near the town of East Orland, Me., and its substations at Grand Lake Stream and Green Lake, Me., involved the landlocked salmon, brook trout, rainbow trout, lake trout, and smelt. The work at all points met with a fair degree of success, and there was a noteworthy increase in the collection of eggs of the valuable landlocked salmon as compared with the preceding year.

During November a pound net set in Toddy Pond, near the station, was the means of capturing 74 adult landlocked salmon, from which 34,000 eggs were secured. The bureau has for several seasons past released limited numbers of landlocked salmon fry and fingerlings in this body of water, and the results of the tentative collections, undertaken for the first time during this year, give promise of considerable expansion in the future. In addition to the eggs collected, the State of Maine transferred from its collections at Caribou and Oquossoc, Me., approximately 250,000 eyed eggs and about the same number were transferred from the Grand Lake Stream substation. Of these 190,000 were reshipped to other stations of the bureau, State fish hatcheries, and other points to meet the distribution requirements. The remainder were incubated, the resulting fry entering into the general distribution from the station or remaining on hand at the close of the year.

Of this species 14,000 eggs were obtained from wild fish in Craig Pond, another body of water conveniently located and which the bureau is endeavoring to develop as a source of egg supply. About 1,268,000 eyed brook-trout eggs were acquired by purchase from commercial breeders, and 50,000 of this lot were reshipped to the substation at Grand Lake Stream. The others were successfully incubated, and the young fish resulting from them entered into the general distributions.

To meet distribution requirements consignments of eggs of the rainbow trout and lake trout were received by transfer—the former from the Wytheville (Va.) station and the latter from the Cape Vincent (N. Y.) station. The rainbow-trout eggs proved to be an inferior lot and suffered heavy mortality in the course of incubation.

Some repairs and alterations were made to the old pond system during the year, with the view of providing facilities for the production of larger numbers of fingerling fish.

Green Lake (Me.) substation.—For the past two years the fish-cultural work at this point has been confined to the propagation of landlocked salmon and smelt. Pound nets were placed in the lake at the mouth of the principal spawning stream early in November for the capture of a brood stock of landlocked salmon. The fish thus secured were of a considerably larger size than those similarly taken in previous years. The 280,000 eggs obtained from them produced 258,200 advanced fry for distribution. In pursuance of a recently adopted policy all of these fry were returned to Green Lake waters.

Between March 25 and April 18 smelt eggs numbering 18,000,000 were secured from adult fish taken in the traps installed in Great Brook. The season proved one of the most successful ever experienced at this point in smelt propagation, both as regards the number of eggs handled and their quality.

Every year there are two distinct runs of spawning smelt in streams tributary to Green Lake, the principal distinguishing feature between them being the size. The fish are locally known as large smelt and small smelt. Fish-cultural work in 1924 was concerned with the larger variety, the spawning season of which occurs in March and April, the actual time varying somewhat with climatic conditions. When the run of the smaller variety occurred several weeks later Great Brook was at flood stage and the water carried so much silt and drift that the efforts to collect eggs were fruitless.

Grand Lake Stream (Me.) substation.—The results of the landlocked salmon work at this point were more successful than for a number of years past. During the period extending from October 22 to November 20, 844,000 eggs were taken, this number representing the spawning of 444 female and 557 male fish, which were taken in traps set in Grand Lake Stream. These adult fish ran considerably larger than usual, their average weight being 4 pounds. The work at Dobsis Lake resulted in the taking of 140,000 eggs from the 96 female fish captured. Both lots of eggs of this species were of excellent quality and from them a good percentage of fry was produced. Fully 75 per cent of the eggs were developed at the Grand Lake Stream hatchery for replenishing local waters. The remainder, some 212,000, were shipped in the eyed stage to the Craig Brook station to meet the distribution requirements in that field.

A peculiarity of the landlocked salmon eggs taken at this substation is the invariably larger size of the eggs secured from Dobsis Lake as compared with those from Grand Lake or Grand Lake Stream, though there is no noticeable difference in the size or vigor of the resulting fry. Of interest also, as a basis of conjecture, is the unusually large number and size of the adult salmon taken in the bureau's traps at Grand Lake Stream during the fall of 1923.

The year's work at the Grand Lake Stream substation included the successful incubation of 50,000 eggs of the brook trout acquired by purchase and the distribution of the product in local waters.

ST. JOHNSBURY (VT.) STATION AND SUBSTATIONS

[A. H. DINSMORE, Superintendent]

The work in this field included that at the main station at St. Johnsbury and at its two substations, one at Holden, Vt., and the other at York Pond, N. H., located in the White Mountain National Forest. During the year the substation at Swanton, Vt., was transferred to the jurisdiction of the Cape Vincent (N. Y.) station, this action seeming appropriate since the work at Swanton is identical in character with the main line of endeavor at Cape Vincent. As in past years, the principal work at St. Johnsbury and Holden has been the incubation of trout eggs and the distribution of the fry. Only such improvement work as was essential to the property was undertaken, the object being to conserve all possible funds for the development of the important trout-rearing project at York Pond.

St. Johnsbury (Vt.) station.—Brook-trout eggs to the number of 883,000 collected in the Darling Pond field were successfully incubated, and the station received of this lot, in return for its work of collection and incubation, approximately 250,000 of the resulting fry for general distribution. The remainder were disposed of to private persons and to the State of Vermont in the interest of the pond owners. Of the brook-trout eggs purchased from commercial dealers some 245,000 were retained and the remainder—about 260,000—were transferred to Holden substation. Brook-trout eggs to the number of 120,000 were also incubated for the Caledonia Forest and Stream Club, and the product was distributed in the public waters of the region by the organization. Such work, which has been practiced for several seasons, has proved very profitable and it extends the service which the bureau is able to render at a minimum of expense. Other similar organizations are asking for this service, and the State commissioner of fish and game has agreed to duplicate all such purchases of eggs intended for the stocking of the public waters of the State. The season's work with the brook trout was highly satisfactory, the losses on both eggs and fry being quite trivial. Lake-trout eggs to the number of 92,000, from collections made at Lake Dunmore, Vt., were incubated at the station and distributed in local waters. The planting of lake-trout fry in certain ponds in northern Vermont has resulted in such marked improvement in the fishing as to fully warrant a continuance of such plants.

Twenty-five thousand landlocked-salmon eggs from the Green Lake (Me.) substation and 50,000 steelhead eggs from the Oregon field were also incubated. Most of the fry from these eggs were sent to the State hatchery at Roxbury, Vt., for rearing, and the remainder entered into the general distributions. A small number of eggs was obtained during April from 330 adult steelhead salmon held at the station. These eggs were of excellent quality and yielded a large percentage of fry. This item is of passing interest, since previous efforts to obtain eggs from steelheads held at this station have always resulted in failure.

Holden (Vt.) substation.—The cooperative work at Lake Dunmore resulted in a collection of 243,600 green lake-trout eggs. These were transferred to the substation on trays, and on attaining the eyed stage 50 per cent of the lot were delivered to the State of Vermont and the remainder were sent to the St. Johnsbury station. Some 50,000 eggs of this species were received from the Charlevoix (Mich.) field and all of the resulting fry were planted in Lake Dunmore. This substation also incubated approximately 260,000 commercial brook-trout eggs during the year for general distribution.

York Pond (N. H.) substation.—The development work which has been in progress at this substation for some time was vigorously pushed during the year. Among the more important items accomplished was the construction of spawning races below the diversion dam. Water is supplied to these races from the spring run along the base of Bear Mountain, to which supply is added the flow from two driven wells. There is also a sufficient amount of seepage water through the bottom of the races to care for a large number of fish even if the regular supply should be cut off by accident or for cleaning purposes. The diversion ditch from Cold Brook to York Pond was enlarged throughout its entire length and the embankment raised where necessary. Fearing a possible interruption of the flow through this ditch during the anchor ice period, fish were not carried in the large artificial pond formed by the diversion of Cold Brook. Some important improvements were made in the hatchery water supply, and a permanent water system for domestic use was installed at the main camp

Some difficulty was experienced in capturing the spawning trout in York Pond. They failed to enter the spawning races, and it became necessary to resort to seining to secure them. About 1,500 females were thus taken. These were small fish and yielded a total of 251,000 eggs in round numbers, an average of about 200 per fish.

Of interest in connection with the work were the results of natural spawning in one of the races. The spawning season—from October 1 to December 22—was unusually extended, and it was considered good practice not to strip all of the smallest fish. Some 600 females, averaging about 4 inches in length, were left in race No. 2 with a suitable number of males, and from time to time it was noted that they were spawning. Fry appeared in the race very early in the spring, and additional fry continued to come out of the gravel until late May. By this time many of the earlier ones had attained a length of 2 inches, indicating the presence of a good supply of natural food. At the close of the year it was estimated that the race contained upward of a thousand varying in size from fry to No. 3 fingerlings. It is known that many fry escaped from the race.

NASHUA (N. H.) STATION

[W. F. HUBBARD, Superintendent]

In the conduct of fish-cultural activities at this station there was no departure from the methods heretofore employed. With the opening of the year the hatchery and ponds were carrying considerable numbers of brook, lake, and rainbow trouts, also limited supplies of small-mouth black bass and landlocked salmon. All of this stock was disposed of during the summer and fall, the distributions extending into October.

The first eggs of the season were taken on November 5 from the brood brook and rainbow trout held in the station ponds. The spawning season of these fishes extended into the second week of January, and the entire collection amounted to 223,300 eggs, about equally divided as to species. During January consignments of brook-trout eggs aggregating 583,000 were received from commercial hatcheries. From the combined stock of eggs of this species 599,276 fry, or 80 per cent of the number in the hatchery, were produced.

On January 17 a consignment of 120,900 rainbow-trout eggs arrived from the Neosho (Mo.) station, and early in March 24,000 landlocked-salmon eggs were transferred from the Craig Brook (Me.) hatchery. The mortality on the former was heavy, the percentage of hatch being only 58, but the losses on the landlocked-salmon eggs were merely normal. The spring distributions were taken up on April 14 and continued to the close of the fiscal year. In the conduct of this work the more distant shipments were made in carload lots, and the station truck was utilized to make deliveries within a reasonable distance of Nashua.

A consignment of 4,000,000 eyed pike-perch eggs was received on May 15 from the Swanton (Vt.) substation. During the incubation of these eggs, and especially at night, when the fry came out faster than at any other time, an attendant was constantly employed in keeping the screens clear to prevent the overflow of the troughs.

An employee detailed to collect small-mouth bass fry in Lake Sunapee for the distribution work observed a considerable number of nests of eggs in the lake in early June, but a large proportion of them was destroyed. The cause of this can not be definitely stated, but the indications were that numbers of brood fish were being caught by anglers. Windy weather greatly interfered with the collections and resulted in the loss of many fry. The most difficult problem is to hold them successfully until they can be shipped. When held in the lake in wire cloth retainers, many die within 24 hours, and no better success has been attained by the use of hatching troughs for the purpose.

Fish-cultural work on an efficient basis is practically an impossibility at the Nashua station, owing to its dilapidated condition. Some of the buildings and most of the equipment, including the subsidiary hatchery, the supply flume leading to it, and the hatching-trough system, are in such an advanced stage of decay that it is considered hazardous for the station to acquire a valuable stock of eggs. In the course of last season's operations the flume had to be propped in several places to hold it in position.

Early in the year the station employees were occupied in completing the repairs undertaken last year on the rearing-pond system. The ponds are now so arranged that the water supply flows throughout the entire series, whereas only two could be supplied as originally constructed. These repairs were essentially of a temporary character, as it will be necessary, before any permanent construction is undertaken, to replace the old plank sides of the entire series of ponds with new material.

COMBINATION TROUT AND POND STATIONS

The stations in this group are located at Erwin, Tenn.; Manchester, Iowa; Neosho, Mo.; White Sulphur Springs, W. Va.; and Wytheville, Va. Various species of trout and such pondfishes as the black basses, crappies, and sunfishes are propagated at this group. As brood fish of the different species are always maintained and fish-cultural work in some of its phases is under way at all times, these stations are a source of attraction to the general public.

ERWIN (TENN.) STATION

[A. G. KEESECKER, Superintendent]

Fish-cultural work at this point was addressed to the rainbow trout, brook trout, Loch Leven trout, steelhead salmon, large-mouth black bass, small-mouth black bass, rock bass, and sunfish. The results achieved were generally satisfactory and compare favorably with similar work in past years.

Between October 25 and February 11 the female rainbow trout on hand—approximately 800—yielded 847,800 eggs. There was an unusually heavy loss on the green eggs, only 62½ per cent surviving to the eyed stage. Warm weather during the fall, with high water temperatures, was quite probably a contributing cause of this low percentage of fertility. After the eyed stage no further difficulty was experienced with either the eggs or the resulting fish.

The year's work with the brook trout included the successful incubation of 400,000 eyed eggs—acquired by purchase from commercial breeders in Pennsylvania—and the rearing of the product to the fingerling stage before distributing them. In connection with this branch of fish-cultural work the station handled 100,000 eggs of the Loch Leven trout transferred in the eyed stage from the Bozeman (Mont.) station.

The production of the pond fishes was curtailed to a considerable extent as a result of the flood that occurred during September, 1923, when practically all of the brood fish of both the small-mouth and large-mouth black bass were lost. Some of these were later recaptured and returned to the ponds, and the stock was further augmented by shipments from other points. Nevertheless, there was a shortage of breeders as compared with past years. A rather heavy mortality also occurred among the adult sunfish, the trouble developing after the introduction into the ponds of a lot of fish transferred from one of the Mississippi River stations and continuing after the fish had been segregated.

The repairs and improvements made during the year included a thorough overhauling of the building formerly used as the superintendent's residence. Work on this building consisted of an entirely new foundation of concrete, new sills and floor timbers, new roof, and new plastering. Toilet facilities were also added, and the building thus remodeled provides very comfortable quarters for the fish-culturist. New concrete outlets of modern pattern and new drains were installed in four of the ponds, while the area of two others was considerably increased by further excavating. The material removed in this work was used to level up the bottoms of certain ponds that were deeper than required. A number of galvanized-iron hatching troughs to replace worn-out troughs of wood were set up in the nursery and have proved highly satisfactory.

Of possible interest in connection with the feeding of fish is the use of whole-wheat mush. Being equipped with a small burr mill, the station purchased wheat during the year, ground it, and fed the product to the fish in the shape of mush made in the usual way.

MANCHESTER (IOWA) STATION

[F. E. HARE, Superintendent]

Very satisfactory progress was made in the work at this station during the year. The output of fish and fish eggs was increased over that of the previous year to the extent of 60 per cent, and much was accomplished in the way of permanent improvements to the station property. The results attained are particularly noteworthy in view of the fact that the station was operated under a reduced allotment of funds.

Among the more important items of improvements may be mentioned the erection of a dike of concrete construction along the bank of Dry Run. Although it is dry throughout the greater portion of the year, this run carries a large volume of water in periods of heavy rainfall, and the overflow from this source has in the past caused considerable damage to station property and heavy losses of stock. The new dike was designed to prevent a recurrence of such conditions. A cement foundation wall was also placed under the main hatching room to replace timberwork which had decayed.

The small brood stock of brook trout on hand yielded some 56,000 eyed eggs of fair quality. Unlike the rainbow trout, adult brook trout do not appear suited to the conditions at this station, and the brood fish of this species are quite generally affected with a gill disease which causes heavy mortality. To all appearances the fish were in prime condition last year, but with the approach of the spawning period the usual gill trouble developed. In view of the difficulty experienced it is proposed to discontinue the efforts toward brook-trout culture at Manchester and devote the space heretofore occupied by these fish to increasing the production of rainbow trout. This course seems particularly advisable, since the rainbow trout produce highly satisfactory results, and any surplus eggs of that species in stock may readily be exchanged for brook-trout eggs, many of the commercial trout breeders being ready to take advantage of every opportunity of that kind. Included in the station output were the fry and fingerlings produced from some 606,000 brook-trout eggs, 500,000 being transferred from the Leadville (Colo.) station, while the remainder were purchased from a commercial breeder in Colorado.

The results attained in the propagation of rainbow trout were very gratifying. The egg collections were larger by 200,000 than in the preceding year, and the brood stock has increased in numbers and also in quality. Of the 546,000 eggs obtained 235,000 were shipped in the eyed stage to fill the distribution requirements. From the remainder a sufficient number of fingerlings were produced to honor all applications listed. The output of the year also included limited numbers of such species as the small-mouth black bass, large-mouth black bass, and rock bass. An important factor in connection with the poor showing along this line was the exceptionally unfavorable climatic conditions encountered at the spawning time, particularly as regards the small-mouth bass. The spring was a cold one, with protracted frosts and unseasonably low water temperatures. As a result practically all the eggs of the first spawning were a total loss. In addition to the pondfish produced at the station, several thousand catfish, sunfish, and crappie were diverted to the station ponds from the Mississippi River rescue work during the fall, the object being to have such species available for early distribution the following spring.

NEOSHO (MO.) STATION AND SUBSTATIONS

[FRED. J. FOSTER, Superintendent]

The fish-cultural work in this field was addressed to the rainbow trout, brook trout, large-mouth black bass, small-mouth black bass, rock bass, bluegill sunfish, crappie, and yellow perch, and the aggregate output of fish and fish eggs for the year amounted to approximately 2,413,000.

The outcome of the year's work, which was marked by an increased production of fish and fish eggs at all points, tends to show the efficiency of improved methods in the handling of brood fish, care of ponds, and in combating the fish diseases which have been prevalent at the Neosho station for a long period.

Neosho (Mo.) station.—During a very protracted spawning season of the rainbow trout, extending from November 12 to January 23, slightly more than 1,000,000 eggs were obtained from the 1,280 2-year-old and 3-year-old female fish on hand. The usual low percentage of fertility was apparent among the eggs, although there was an improvement along this line amounting to 10 per cent over last season's egg collections, very nearly 64 per cent of the eggs taken producing fry.

There was an increased amount of disease among the fingerling trout, the most serious trouble being diagnosed as crystals in the kidneys, a condition which the superintendent believes to be due to an inherited predisposition. During May an epidemic of gyrodactylus was readily checked by dipping the affected fishes in a cider-vinegar solution. Later in the season ichthyophthirius also became mildly epidemic but was soon eliminated by increasing the flow of water and lowering its level, thereby increasing the current throughout the infected ponds. To gain some further knowledge of the cause of the disease diagnosed as crystals in the kidneys and a possible remedy therefor, it is purposed during the next few years to discard all brood fish after their first spawning. This policy will at least have the advantage of providing a larger number of adult fish for stocking local waters, and quite possibly it may result in gaining some information of practical value to fish culture.

The principal articles of diet for the fish during the year were fresh meats, largely beef heart, though considerable quantities of hog heart and sheep liver were also used. Clabbered milk in small quantities was employed occasionally to vary the diet and as a corrective measure in digestive disorders. The station superintendent expresses faith in the value of the milk in this connection.

No effort was made to obtain rainbow-trout eggs from the Roaring River field station during the year. After carefully noting the conditions at this point for four months prior to the spawning season it appeared certain that the field could not be advantageously worked. This decision was later substantiated by the low yield of fertile eggs obtained by the owner of the plant, the percentage being less than 10.

The distribution of brook trout was confined to a small number of fish that had been transferred earlier in the year from the Manchester (Iowa) station. From a small number of brood brook trout held in the station ponds during a portion of the year eggs of such inferior quality were obtained that the entire lot, together with the fish, was discarded as being of no value in practical fish culture.

Notwithstanding the fact that the floods occurring during the spawning season of 1923 interfered materially with the fish-cultural work, the number of fingerling bass and other pondfishes produced was over 100 per cent larger than in the previous year and was well above the general station average. One of the main difficulties encountered in the propagation of pondfishes at the Neosho station has been the innumerable parasites with which the brood fish soon become infested. In the late fall of 1923 practically all the brood fish were disposed of and the pond inclosures allowed to remain bare throughout the winter. At the present time all the ponds, with the exception of Nos. 20 and 22, carry new brood fish obtained from Langdon, Kans. As most of the young fish produced from the spawning of 1924 are being held for fall distribution, the exact results of the changes made are not definitely known, but it appears certain that more and better fingerlings will be available for the fall distribution.

Bourbon (Mo.) substation.—It is gratifying to note that the volume of the work at this substation was increased more than 100 per cent during the fiscal year 1924. Rainbow-trout eggs to the number of 588,000 were taken in the course of spawning operations in the fall, from which stock 213,930 eggs in the eyed stage were shipped and 150,000 fingerlings were reared, at a cost to the bureau's appropriation of only $207.49.

During the first four and one-half months of the fiscal year the station was in charge of employees of the Von Hoffman Press, the owners of the property, and with whom the fish-cultural work is being conducted on a cooperative basis. While under such management some difficulty was experienced in handling the fish. In October, after the occurrence of a loss of 8,000 large fingerling trout, the food in use was suspected, but an analysis revealed nothing injurious. The mortality occurred within a 15-hour period, all the fish previously having been in good condition, and those that recovered were apparently in normal health on the second day after the death rate. Later in the same month "popeye" developed among the adult fish held in Spring Lake. An analysis of the water disclosed a supersaturation of nitrogen, a deficiency of oxygen, and the presence of carbon dioxide. There seems little doubt that the condition of the water was responsible for the trouble, as it disappeared promptly after changing the fish to another environment. The abnormal gaseous condition of the water of Blue Spring seems to be present only during late summer and early fall.

Langdon (Kans.) substation.—At the end of the first full year of the bureau's lease of the Kansas property the results of the work may be viewed from different angles. From the number of applicants supplied and the size and condition of the fish produced for distribution the results may be considered highly satisfactory. It has also been the means of materially reducing the numbers of fish diverted from the Mississippi River field to the general distributions; and because of the superior condition of the fish reared in these ponds—as regards their ability to withstand transportation—such distributions have been more than satisfactory to all concerned, and it seems certain that it will eventuate in more and better fish in the waters stocked. Over 100,000 fingerling fish of the various pond species were produced at a cost—including lease of the property but exclusive of salaries of statutory employees—of about $32.68 per thousand. This compares favorably with the production cost per thousand at the regularly established stations. It should also be taken into consideration that there were several quite unavoidable factors militating against the highest production of fish and tending to increase the cost per thousand. The most serious of these was the flood in May, 1923, when a large number of newly hatched fry were lost, materially reducing the productivity of all the ponds. It seems certain that the cost per thousand fish can be materially lowered next year.

WHITE SULPHUR SPRINGS (W. VA.) STATION

[EDW. M. HAYNES, Superintendent]

The results of the trout propagation work at this station were generally successful, the year's output of fingerling trout being the largest in its history. Three species were handled—brook trout, the product of eggs purchased from commercial fish culturists, rainbow trout derived from eggs taken from brood fish produced in the station ponds, and Loch Leven trout resulting from eggs shipped from the Meadow Creek (Mont.) field station. It would appear from past experience that a brood stock of brook trout can not be successfully maintained at this station, while rainbow trout, on the other hand, have always been reared without difficulty in ponds of almost any description, and the fish appear to be uniformly healthy. In addition to the brook-trout eggs purchased by the bureau, 750,000 commercial eggs of this species, the property of the State of West Virginia, were incubated. The entire stock was developed with a loss of less than 4 per cent, and during the spring the fry belonging to the State were called for and distributed by State employees. The Loch Leven trout eggs were received in good condition and produced healthy, active fry. While the fingerlings are of somewhat slower growth than those of the rainbow or brook trout the losses appear to be lighter, and it is believed this species will prove well suited to many waters of West Virginia that are not now productive of either the rainbow or the brook trout and are too cold for bass.

Some of the eggs received from commercial hatcheries were packed by the bulk method and the remainder were shipped on trays. After years of experience with both methods the conclusion has been reached that tray shipments produce the best results. When shipped by the bulk method, there is apt to be considerable indentation and loss, especially if the eggs are somewhat overdeveloped.

This station has never attained any marked degree of success in propagating the small-mouth black bass, as their nesting is always interfered with by unseasonable weather during the spring. The past season was no exception, and in addition to unfavorable climatic conditions the work was handicapped by an inadequate brood stock.

During the year the small obsolete rearing ponds Nos. 7, 8, and 9 were converted into one large cement pond, and the remaining ponds of the series—4, 5, and 6—were filled in, graded, and sown to grass, greatly improving the appearance of the reservation. Minor improvements were made to a number of the other ponds, and an asbestos shingle roof of the diagonal type style was placed on the superintendent's cottage. It is believed these shingles will give better service than cedar shingles.

WYTHEVILLE (VA.) STATION

[C. B. GRATER, Superintendent]

During the year the water supply to the bass ponds was changed by placing the inlet about 50 feet from the outlet. After heavy rains the flow into these ponds is always roily, and with the inlet located as formerly, at the upper end of the system, the sediment is carried throughout its length and deposited over the entire pond area. Roily water during the nesting season of the bass is very injurious, as the majority of the eggs with which it comes in contact are usually smothered. Under the new arrangement the deposits are confined to a limited area around the outlet, and the outcome of the past season's work showed a marked increase over recent years in the production of pondfishes.

The soft mud deposited in several of the ponds had enabled the growth of water lilies to become firmly established, and the smaller plant forms, which serve as nurseries for the development of natural food for young fish, were in danger of being choked out. In advance of the spawning season the mud deposits were removed, and the result was a noticeable decline in the growth of lilies.

The rainbow-trout spawning season extended from October 15 to March 7, during which period 944,000 eggs were collected. In advance of the spawning period the brood trout were segregated into five lots, according to age, with the view of keeping an accurate record of the eggs from each lot, such information being desirable in the selection of eyed eggs for shipment.

Lot 1 comprised part of the fish over 5 years old; lot 2, 5 years; lot 3, the remainder of the fish over 5 years; lot 4, 3 years; lot 5, 2 years. Lot 1 yielded 498,600 green eggs, or 51 per cent of the total collection. With a few exceptions, however, they were of very poor quality, particularly in the early stages. The loss amounted to 38.5 per cent. Lot 2 produced 112,400 eggs, on which there was a loss of 38.8 per cent. Lot 3 produced 48,950 eggs, and the loss amounted to 35.5. From lot 4, 175,500 eggs were secured, on which a loss of 32.2 was sustained. Lot 5 yielded 20,150 eggs, and the loss was 45.9. As was expected, lot 5 produced the general average of good eggs that is usually obtained in collections from fish 2 years old, but the fry losses were heavier than had been anticipated.

The experiment undertaken last year of mixing a small amount of iodine with the food given to a lot of adult fish badly affected with thyroid tumor was continued to the close of the season, and there was a very noticeable reduction in the extent of the disease.

PONDFISH-CULTURAL STATIONS

The group comprises seven main stations and two substations. As a whole the results of the work were fairly satisfactory, though unfavorable weather during the spawning season and inability to obtain an adequate supply of suitable brood fishes served to curtail the output at some points. The following table gives the aggregate output of these stations by species during the fiscal years 1923 and 1924:

	1923	1924
Large-mouth black bass	1,478,204	1,526,355
Small-mouth black bass	422,200	578,385
Sunfish	260,888	202,525
Crappie	6,980	40,841
Catfish	13,505	10,745
Rock bass	19,610	21,425
Warmouth bass	8,900	3,945

COLD SPRINGS (GA.) STATION AND SUBSTATION

[CHAS. A. BULLOCK, Superintendent]

The work at this station was handicapped owing to the impossibility of securing an adequate stock of brood fish of the large-mouth black bass. The transfer of adult fish to this station from more northerly sections has not met with good results, and they appear to be very scarce in local waters. Another unfavorable factor was the unseasonably late spring and consequent low water temperatures. The first bass nests were observed on March 23, whereas in previous years spawning has commenced as early as March 8. It would appear that the late spring was conducive to the growth of such natural food as animal plankton, mostly daphnids, as these were produced in larger numbers than heretofore. Carnivorous insects and beetles were very scarce.

Past experience seems to demonstrate that crappie can not be successfully handled in the ponds at this station. The results obtained after a number of years' work along this line have been almost negative. A noteworthy fact in connection with these efforts is that the brood fish are always more or less emaciated when removed from the ponds in the fall.

Harris Ponds (Ga.) substation.—The output of sunfish from this field station has continued to increase from year to year. During the past season it reached a total of 95,600 fingerlings. Sixty adult catfish placed in three of the ponds produced only 5,300 fingerlings. This indicates a considerable falling off in output as compared with the average, and it can only be accounted for by the unusual water conditions.

EDENTON (N. C.) STATION

[WM. S. VINCENT, Superintendent]

For certain reasons not satisfactorily explained the propagation of the so-called pondfishes has never been attended with any high degree of success at the Edenton station. Fish-cultural work along this line during the fiscal year 1924 involved the large-mouth black bass, the bluegill sunfish (bream), the crappie, and the catfish. The work was moderately successful as compared with the results of past years. Some improvements were undertaken during the year with the view of increasing the extent of the work in this line of endeavor, among them being an increase in the water area of certain ponds, eradication of undesirable vegetation, and the introduction of new brood stock.

LOUISVILLE (KY.) STATION

[C. W. BURNHAM, Superintendent]

Owing to the impossibility of securing an adequate stock of brood large-mouth black bass the output of this station was curtailed as compared with the average of recent years. For the work of this station brood bass are obtained in the spring months, much better results being thus attained than by collecting the fish in the fall. Probably the explanation is that the fish are apt to be more evenly mated in the spring.

Five hundred adult small-mouth bass were distributed in four breeding ponds, each of which is three-quarters of an acre in area, and 522,000 fry and 8,285 fingerlings were produced. For the past two years it has been the practice at this station to handle the fry when first hatched, placing them in the ordinary shipping cans on removal from the ponds. This method has been more successful than past attempts to hold the fry in tanks or troughs. The usual iron frame retainers were placed around the schools of fry before they scattered from the nests.

MAMMOTH SPRING (ARK.) STATION

[DELL BROWN, Superintendent]

Though this station is primarily adapted to the culture of small-mouth black bass, great difficulty is experienced in securing from local waters sufficient adults to fill brood stock requirements, and most of the bass transferred here from northern waters refuse artificial food. The season's work with this species was greatly interfered with and the output curtailed by unseasonably cold inclement weather. The first spawning occurred in early April, and from the 81 nests of eggs deposited in the course of that month there was an output of approximately 48,000 No. 1 fingerling fish.

In view of the existing shortage in the number of brood large-mouth bass, the year's production of fingerling fish of that species was much larger than might have been expected. These fish spawned from April 4 to the end of June. The large-mouth bass at this station do not appear to take to the artificial nests as readily as do the small-mouth bass, but when they do occupy them the results in fry are much larger. Before the young fish leave the nests cheesecloth retainers are placed around the schools, and they are transferred to the ponds used earlier in the season for the rearing of small-mouth bass.

ORANGEBURG (S. C.) STATION

[G. W. N. BROWN, Superintendent]

Owing to the unusually severe weather prevailing in late February and early March the spawning of the large-mouth black bass began fully 15 days later than ever before at this station. The first eggs were discovered on March 5, and the fish continued to spawn at intervals until about the middle of June. A large majority of the first eggs deposited were killed by sudden temperature changes, and the subsequent loss of fry was very heavy, the unusually roily water making it difficult to locate the schools of young fish.

In addition to the work with the black bass, limited numbers of warmouth bass and bluegill sunfish (bream) were produced. Public sentiment appears to favor the introduction of the latter species in most of the waters of the State, and with the view of increasing the output it is quite probable that some of the ponds now devoted to bass culture will hereafter be stocked with sunfish.

SAN MARCOS (TEX.) STATION

[MARK RILEY, Superintendent]

Though the work at this station involved six species of fish, as is shown in the general distribution statement on page 434, most of the facilities were concentrated on the propagation of the large-mouth blackbass, for which there is a wide and steadily increasing demand in State of Texas. The total output was somewhat below that of the proceding year, though it was well above the average of recent years, and as regards the size and quality of the fish distributed the results were very satisfactory.

This station has recently been engaged in fish-cultural work in conjunction with certain municipalities in Texas. The ponds constructed by the citizens of New Braunfels are now in very good condition and are well stocked with bass. Four ponds constructed by the local public at Medina Lake were completed too late to be of much service in the production of bass during the fiscal year. However, one of them was stocked with crappie, and a few bass were produced in another. Two ponds, constructed by the citizens of Kerrvil e, were stocked with brood bass in advance of the spawning season, but high water during the spring washed out the end of one of them, permitting the fish to escape. All of these ponds are under the jurisdiction of the San Marcos station and are regularly inspected by a member of the station personnel.

A consignment of rainbow-trout eggs transferr d to Medina Lake from the Saratoga (Wyo.) station during the spring was incubated successfully, and the resulting fry were planted in the deeper waters of the lake where conditions appear favorable to the species. In December, 1922, approximately 7,000 rainbow trout 4 inches in length were planted in this lake. Several of these fish were caught during the past spring, the lar est of them measurin 17½ inches in length. The waters of Texas are not generally adapted to the rainbow trout, but on account of the depth in Medina Lake and the fact that it is partially fed by springs it is believed that certain parts of it may be successfully stocked with that species. In view of existing conditions it is probable that bass and trout will live in the lake in harmony.

TUPELO (MISS.) STATION

[C. R. WIANT, *Superintendent*]

In advance of the spawning season of the large-mouth black bass, which extended from April 9 to June 3, the 460 brood fish of this species were distributed among three ponds of an aggregate area of 4.16 acres. The fish ranged in weight from 1½ to 5 pounds, and the three ponds yielded for distribution 461,500 fry and 53,230 fingerling fish varying in size from No. 1 to No. 4. The distribution of this species was commenced on April 28 and continued to June 25. A very satisfactory season's work was accomplished with the sunfish, but the results of the operations with the crappie were rather poor, probably because of unsuitable pond conditions.

LAKELAND (MD.) PONDS SUBSTATION

[Supervised by Washington office of fish culture]

This pond system is approximately 75 acres in area, and its water supply is obtained from an adjoining creek. It is situated about 8 miles from the city of Washington on the Baltimore & Ohio Railroad, this road and the interurban electric line of the Washington Railway & Electric Co. passing through the land.

With the view of utilizing these ponds for fish-cultural work, the Bureau of Fisheries secured a 3-year lease of them in the early spring of 1923. The five ponds available for immediate use, covering an area of approximately 25 acres, were at once stocked with limited numbers of black bass, crappie, and a few catfish. As a result of this stocking the ponds yielded 29,085 large-mouth black bass ranging from 2 to 6 inches in length, 34,235 fingerling crappie, and about 2,000 fingerling catfish during October, 1923. An interesting feature of the work was that this entire stock of young crappie resulted from the spawning of 8 adult fish of that species.

During the spring of 1924 the ponds were stocked with large-mouth black bass obtained from the Potomac River, and also with brood crappie transferred from the Edenton (N. C.) station.

CENTRAL STATION AND AQUARIUM, WASHINGTON, D. C.

[L. G. HARRON, Superintendent]

The central station aquarium at Washington, D. C., was operated as heretofore. A total of 35 species of fish and marine animals comprised the year's exhibit, most of these being carried through the summer months. Trout of various species were acquired as soon as the water became cool enough to hold them successfully, and with the rising of the temperature in early spring they were distributed to applicants or liberated in suitable public waters of the region. During the winter attempts were made to incubate eggs of the chinook salmon, whitefish, and cisco in the exhibit hatchery, but the work in every instance resulted in failure, the eggs being killed by the chlorine with which the city water supply is charged by the health authorities.

In addition to its usual activities the central station was used during the year as a holding and distributing point for the output of the Lakeland (Md.) ponds. In connection with this work 88,399 fishes were handled, practically all of them being large-mouth black bass, crappie, and bluegill sunfish.

Part 2.—DISTRIBUTION OF FISH AND FISH EGGS

[E. C. FEARNOW, Superintendent of Fish Distribution]

During the fiscal year ended June 30, 1924, distribution of the bureau's output of fry and fingerling fish was made to approximately 10,000 individual applicants and 2,000 organizations. Ten per cent of the total output is diverted to inland waters for the purpose of maintaining a supply of fresh-water fishes in streams and lakes. The importance of this phase of the bureau's work is being recognized by a number of railroad companies, which grant free or reduced transportation for the bureau's cars when handling shipments of live fish for waters contiguous to their lines, and by organizations and individuals who cooperate with the bureau to the extent of meeting consignments at railroad stations and planting the fish in suitable waters at their own expense.

The species available for stocking interior waters are black-spotted, brook, and rainbow trouts, catfish, large-mouth black bass, small-mouth black bass, rock bass, crappie, and bream. The bureau usually is able to furnish reasonable allotments of trout, as the eggs of this species can be hatched artificially, but great difficulty is experienced in obtaining a sufficient number of large-mouth and small-mouth black bass to meet requirements, and at the present time the bureau is unable to make prompt deliveries of these species, especially of the small-mouth variety, which is propagated at only a few of its hatcheries.

During the fiscal year 1924 an unusually large number of applications were filled, but the output of fish, while larger than that of the previous year, was not sufficient to meet the increased demand.

Following are comparative figures showing the number of miles traveled by cars and messengers, number of applications honored, total output of fish, and the cost of distribution for the fiscal years 1923 and 1924:

Fiscal year	Total output of fish	Number of miles traveled		Number of applications honored	Cost of distribution	Cost of distribution per 1,000 fish
		Cars	Messengers			
1923	4,314,859,029	80,118	315,387	10,939	$58,751.71	$0.013
1924	5,361,810,654	76,221	342,677	12,000	58,783.01	.011

Summary, by species, of distribution of fish to all applicants, United States and Territories, fiscal year 1924

State and species	Number
Alabama:	
Catfish	6,115
Rainbow trout	400
Loch Leven trout	5,400
Crappie	3,010
Large-mouth black bass	108,016
Rock bass	1,600
Sunfish	66,500
Alaska: Sockeye salmon	25,916,815
Arizona:	
Catfish	1,900
Rainbow trout	4,000
Black-spotted trout	40,000
Brook trout	51,000
Crappie	300
Large-mouth black bass	2,100
Sunfish	1,000
Arkansas:	
Rainbow trout	81,000
Crappie	400
Large-mouth black bass	65,625
Small-mouth black bass	20,900
Rock bass	19,250
Sunfish	4,375
California:	
Catfish	100
Chinook salmon	5,536,000
Colorado:	
Catfish	9,710
Steelhead salmon	28,500
Rainbow trout	7,000
Black-spotted trout	771,800
Loch Leven trout	311,000
Lake trout	67,500
Brook trout	3,132,780
Large-mouth black bass	12,715
Sunfish	2,515
Yellow perch	1,450
Connecticut:	
Carp	600
Brook trout	27,000
Pike perch	630,000
Yellow perch	100
Delaware:	
Crappie	3,525
Large-mouth black bass	6,070
Sunfish	5,000
District of Columbia:	
Rainbow trout	5,050
Brook trout	4,500
Crappie	50
Sunfish	10
Georgia:	
Catfish	3,575
Steelhead salmon	5,000
Rainbow trout	29,000
Brook trout	42,000
Crappie	600
Large-mouth black bass	121,975
Rock bass	1,200
Warmouth bass	2,000
Sunfish	57,625
Idaho:	
Catfish	104
Chinook salmon	448,000
Rainbow trout	51,080
Black-spotted trout	25,000
Brook trout	8,840
Illinois:	
Catfish	101,700
Buffalo fish	43,600
Carp	20,100
Crappie	30,794
Large-mouth black bass	14,959
Sunfish	37,570
Yellow perch	1,511
White bass	108
Indiana:	
Catfish	10,100
Rainbow trout	4,500
Brook trout	69,000
Crappie	2,225
Large-mouth black bass	14,855
Small-mouth black bass	204,605
Rock bass	900
Sunfish	19,625
Pike perch	1,000,000
Yellow perch	3,950
Iowa:	
Catfish	121,774
Buffalo fish	46,720
Carp	50,584
Rainbow trout	14,496
Brook trout	4,900

Summary, by species, of distribution of fish to all applicants, United States and Territories, fiscal year 1924—Continued

State and species	Number
Iowa—Continued.	
Crappie	78,190
Large-mouth black bass	33,119
Small-mouth black bass	2,150
Warmouth bass	21
Sunfish	102,696
Kansas:	
Large-mouth black bass	2,525
Sunfish	8,445
Yellow perch	125
Kentucky:	
Catfish	6,200
Carp	50
Crappie	6,700
Large-mouth black bass	3,825
Small-mouth black bass	300,185
Rock bass	2,000
Sunfish	15,875
Yellow perch	480
Louisiana:	
Catfish	2,250
Buffalo fish	182,462,500
Crappie	400
Large-mouth black bass	5,625
Rock bass	150
Sunfish	5,230
Maine:	
Humpback salmon	353,580
Atlantic salmon	501,000
Landlocked salmon	862,290
Rainbow trout	9,120
Lake trout	9,296
Brook trout	1,078,150
Smelt	9,300,000
Crappie	110
Large-mouth black bass	1,700
Small-mouth black bass	1,000
Flounder	1,548,771,000
Maryland:	
Catfish	2,045
Carp	6
Shad	3,091,000
Chinook salmon	3,200
Rainbow trout	10,234
Loch Leven trout	6,800
Brook trout	58,000
Crappie	2,225
Large-mouth black bass	12,225
Sunfish	7,900
Yellow perch	105,692,400
Massachusetts:	
Catfish	6,300
Rainbow trout	9,270
Brook trout	78,890
Large-mouth black bass	4,585
Sunfish	4,700
Pike perch	776,000
Cod	392,423,000
Haddock	2,590,000
Pollock	263,440,000
Flounder	607,362,000
Yellow perch	255
Michigan:	
Whitefish	69,050,000
Steelhead salmon	11,000
Rainbow trout	102,855
Lake trout	27,513,500
Brook trout	535,580
Crappie	1,175
Large-mouth black bass	24,865
Small-mouth black bass	48,055
Sunfish	12,500
Pike perch	300,000
Yellow perch	400
Minnesota:	
Catfish	10,100
Whitefish	6,600,000
Steelhead salmon	30,000
Rainbow trout	45,400
Lake trout	3,206,340
Brook trout	130,860
Minnesota—Continued.	
Crappie	17,800
Large-mouth black bass	18,270
Sunfish	48,750
Pike perch	150,000
Yellow perch	100
Mississippi:	
Catfish	37,470
Crappie	20,135
Large-mouth black bass	413,485
Rock bass	11,075
Warmouth bass	538
Sunfish	750,525
Missouri:	
Catfish	2,000
Rainbow trout	208,347
Brook trout	12,915
Crappie	2,688
Large-mouth black bass	18,853
Small-mouth black bass	22,815
Rock bass	5,800
Sunfish	119,643
Yellow perch	1,576,245
Montana:	
Catfish	3,310
Steelhead salmon	26,000
Rainbow trout	1,443,422
Black-spotted trout	1,811,860
Loch Leven trout	421,000
Lake trout	61,000
Brook trout	698,855
Crappie	1,125
Large-mouth black bass	1,125
Sunfish	400
Nebraska:	
Catfish	300
Loch Leven trout	149,000
Brook trout	32,000
Crappie	280
Large-mouth black bass	1,125
Yellow perch	66
New Hampshire:	
Catfish	2,400
Steelhead salmon	5,000
Landlocked salmon	30,420
Rainbow trout	29,000
Lake trout	33,500
Brook trout	554,221
Crappie	400
Large-mouth black bass	729
Small-mouth black bass	900
Pike perch	1,750,000
New Jersey:	
Brook trout	2,400
Crappie	1,170
Large-mouth black bass	5,780
New Mexico:	
Catfish	1,200
Black-spotted trout	18,000
Brook trout	117,000
Crappie	1,800
Large-mouth black bass	2,275
Rock bass	325
Sunfish	2,400
New York:	
Catfish	5,400
Whitefish	72,670,000
Cisco	128,360,000
Steelhead salmon	5,000
Landlocked salmon	3,000
Rainbow trout	92,000
Lake trout	757,000
Brook trout	915,000
Crappie	6,000
Large-mouth black bass	6,785
Sunfish	1,000
Pike perch	11,360,000
Yellow perch	800,225
North Carolina:	
Catfish	200
Shad	7,070,000

Summary, by species, of distribution os fish to all applicants, United States and Territories, fiscal year 1924—Continued

State and species	Number
North Carolina—Continued.	
Glut herring	95,000,000
Steelhead salmon	5,000
Rainbow trout	243,900
Loch Leven trout	21,000
Brook trout	249,950
Crappie	180
Large-mouth black bass	103,670
Rock bass	7,500
Sunfish	24,230
Yellow perch	1,950,000
North Dakota:	
Catfish	2,450
Crappie	480
Large-mouth black bass	2,035
Sunfish	2,000
Yellow perch	800
Ohio:	
Catfish	5,800
Carp	28,875,000
Whitefish	148,400,000
Rainbow trout	2,900
Brook trout	41,200
Pike and pickerel	7,392,000
Crappie	528
Large-mouth black bass	19,875
Small-mouth black bass	49,590
Rock bass	1,500
Sunfish	13,660
Pike perch	35,000,000
Yellow perch	3,917,245
Oklahoma:	
Rainbow trout	10,300
Crappie	14,521
Large-mouth black bass	27,700
Rock bass	1,900
Sunfish	8,835
Oregon:	
Chinook salmon	15,740,500
Chum salmon	7,600
Silver salmon	7,538,150
Sockeye salmon	23,700
Steelhead salmon	2,286,500
Rainbow trout	208,600
Black-spotted trout	18,000
Brook trout	360,000
Pennsylvania:	
Catfish	15,350
Rainbow trout	255,200
Loch Leven trout	39,600
Brook trout	379,000
Crappie	10,850
Large-mouth black bass	19,485
Sunfish	37,425
Pike perch	340,000
Yellow perch	2,050
Rhode Island:	
Brook trout	5,000
Pike perch	560,000
Flounder	88,157,000
South Carolina:	
Rainbow trout	23,800
Brook trout	15,600
Large-mouth black bass	186,786
Warmouth bass	1,525
Sunfish	2,350
South Dakota:	
Catfish	900
Steelhead salmon	41,600
Rainbow trout	14,000
Loch Leven trout	695,500
Brook trout	315,600
Crappie	900
Large-mouth black bass	1,000
Sunfish	880
Tennessee:	
Catfish	7,900
Rainbow trout	66,000
Loch Leven trout	10,100
Brook trout	27,900
Large-mouth black bass	28,350
Tennessee—Continued.	
Small-mouth black bass	600
Rock bass	13,350
Sunfish	9,525
Texas:	
Catfish	3,300
Crappie	4,452
Large-mouth black bass	491,357
Rock bass	325
Warmouth bass	420
Sunfish	9,949
Utah:	
Rainbow trout	332,575
Black-spotted trout	25,000
Brook trout	224,900
Vermont:	
Steelhead salmon	5,000
Landlocked salmon	12,000
Rainbow trout	4,000
Lake trout	136,010
Brook trout	528,190
Large-mouth black bass	450
Small-mouth black bass	1,900
Pike perch	11,184,000
Yellow perch	1,000,000
Virginia:	
Catfish	3,250
Shad	4,869,000
Rainbow trout	99,400
Loch Leven trout	4,000
Brook trout	78,750
Crappie	14,220
Large-mouth black bass	208,360
Small-mouth black bass	14,000
Rock bass	20,800
Sunfish	38,830
Yellow perch	88,577,040
Washington:	
Chinook salmon	21,593,705
Chum salmon	24,270,320
Humpback salmon	918,000
Silver salmon	14,317,000
Sockeye salmon	13,047,840
Steelhead salmon	2,004,560
Rainbow trout	4,000
Brook trout	200,000
West Virginia:	
Catfish	2,250
Carp	75
Rainbow trout	59,084
Loch Leven trout	5,000
Brook trout	45,250
Crappie	1,425
Large-mouth black bass	36,390
Rock bass	4,675
Sunfish	11,850
Yellow perch	300
Wisconsin:	
Catfish	47,836
Carp	119
Whitefish	2,500,000
Rainbow trout	289,600
Loch Leven trout	75,000
Lake trout	516,500
Brook trout	954,400
Crappie	11,286
Large-mouth black bass	100,790
Warmouth bass	15
Sunfish	88,060
Pike perch	1,000,000
Yellow perch	4,770
Wyoming:	
Catfish	11,100
Rainbow trout	72,000
Black-spotted trout	6,015,240
Loch Leven trout	274,000
Brook trout	672,620
Large-mouth black bass	4,400
Sunfish	1,040
Yellow perch	500

Assignments of fish to State fish commissions, fiscal year 1924

[Asterisk (*) denotes fry; all others fingerlings]

State and species	Number
Illinois:	
Brook trout	1,060
Rainbow trout	20
Steelhead salmon	130
Iowa:	
Brook trout	10,250
Rainbow trout	12,900
Maryland:	
Black bass	1,740
Chinook salmon	* 6,000
Crappie	2,500
Yellow perch	110
Minnesota:	
Catfish	3,000
Crappie	5,000
Sunfish	7,950
Yellow perch	245
Nebraska:	
Brook trout	800
Lock Leven trout	4,000
Steelhead salmon	6,000
New Hampshire:	
Brook trout	43,200
Rainbow trout	6,000
New Mexico: Black bass	200
North Dakota:	
Black bass	1,950
Catfish	6,000
Crappie	2,000
Sunfish	8,450
Yellow perch	900
South Dakota: Brook trout	1,500
Utah: Brook trout	22,000
Vermont: Yellow perch	* 8,500,000
Washington:	
Brook trout	*477,930
Rainbow trout	195,000
Silver salmon	*994,990
Steelhead salmon	*298,685
West Virginia:	
Brook trout	367,000
Loch Leven trout	75,000
Rainbow trout	300,000
Wisconsin:	
Black bass	19,055
Catfish	33,800
Crappie	10,265
Sunfish	77,000
Yellow perch	835
Total	11,504,465

METHOD OF DISTRIBUTION

The bureau apportions its annual output of trouts, basses, sunfishes, crappies, and catfishes to applicants whose requests are on file at the beginning of the distribution periods, giving special consideration to requests that have been carried over from previous years.

The number of fish that can be furnished for a body of water depends on the output of the bureau's hatcheries, the size of the fish at the time of shipment, and the number of applications the bureau is required to fill. The customary allotment is from 1,000 to 5,000 fry, or from 100 to 300 3-inch fish. The bureau, with its limited facilities, does not undertake to furnish more than brood stocks of fish, with the understanding that they will be protected until they have had an opportunity to reproduce.

Blanks on which formal application for fish may be made can be obtained from the bureau upon request. Only one application is necessary in order to secure an allotment for a body of water, and in order to avoid duplications an applicant requesting blanks should give the name of the lake or stream which it is desired to stock. The application when executed should be returned to this office through a Member of Congress.

Applications are formally acknowledged when received, and the period of distribution is indicated on the acknowledgment. Should the bureau be unable to make shipment during the time specified, the applicant is notified accordingly. Requests for fish are forwarded by the bureau to its representatives in the field, who notify the applicants concerning the exact date of delivery and the number of vessels required to contain the consignment. Fish are delivered to railroad stations without expense to the applicant.

Trout are distributed during May and June in the Eastern and Middle Western States, and in the Rocky Mountain region from July to October. Warm-water fishes, including bass, crappie, and bream, are distributed from May to October. It is the bureau's policy to fill applications in the order of their receipt.

DISTRIBUTION OF FISHES OF INTERIOR WATERS

CAR NO. 3

[E. R. WIDMYER, Captain]

At the beginning of the fiscal year of 1924 the car's equipment was altered to accommodate 150 pails, its original capacity having been 108 ordinary 10-gallon cans.

The Fearnow pail is made of aluminum, it weighs less than 45 pounds when filled, and will safely carry as many fish as did the old type of can. The new pail increased the car's carrying capacity 40 per cent, and messenger shipments in baggage cars were increased even more, as a single trip contained as many as 100 pails. Under these conditions a considerable saving of funds was effected, as compared with records of past seasons, a maximum supply of fish having been transported at a minimum cost.

Distribution by car No. 3 was begun from the Mississippi River collecting stations on July 18, 1923. In addition to numerous messenger shipments to points in Wisconsin and Minnesota, the car made trips to Minnesota, Wisconsin, Michigan, Illinois, Indiana, and Pennsylvania, carrying from 138 to 160 pails of fish on each trip.

After the close of the distribution the car was moved to Milwaukee, Wis., and placed in the shops for general repairs, after which the car was returned to La Crosse, Wis., and the distribution of rainbow and brook trouts was taken up from the La Crosse station.

On May 1, 1924, the car left La Crosse for Ashland, Wis., with a load of trout for Minnesota and Wisconsin applicants. After completing this trip the car proceeded to Duluth, Minn., where it took up the distribution of the Great Lakes species, making six car trips, eight boat trips, and a number of messenger shipments. From May 3 to June 18 the car and its messengers handled 13,000,000 whitefish, 10,072,000 lake trout, 1,450,000 pike perch, 136,000 brook trout, and 29,000 steelhead trout from the Duluth (Minn.) station.

The car left Duluth on June 18 for St. Paul, Minn., with fish for applicants in western Minnesota, and after completing the trip was moved to La Crosse, where it was held in readiness to take up the distribution of rescued fishes.

During the fiscal year ended June 30, 1924, car No. 3 traveled 12,034 miles and delivered 25,257,785 fish.

CAR NO. 4

[T. S. KIBBE, Acting Captain]

After receiving a general inspection and the necessary repairs at Wilmington, Del., fisheries car No. 4 proceeded to Northville, Mich., arriving at that point on July 2, 1923. The car's crew took charge of the bass and trout distributions from the Northville (Mich.) hatchery, making messenger shipments to points in Michigan, Ohio, and

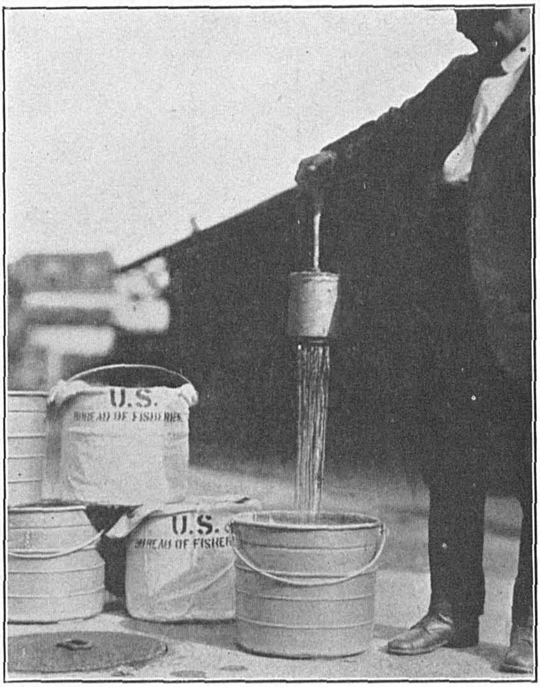

FIG. 1.—Aerating the water in which fish are carried

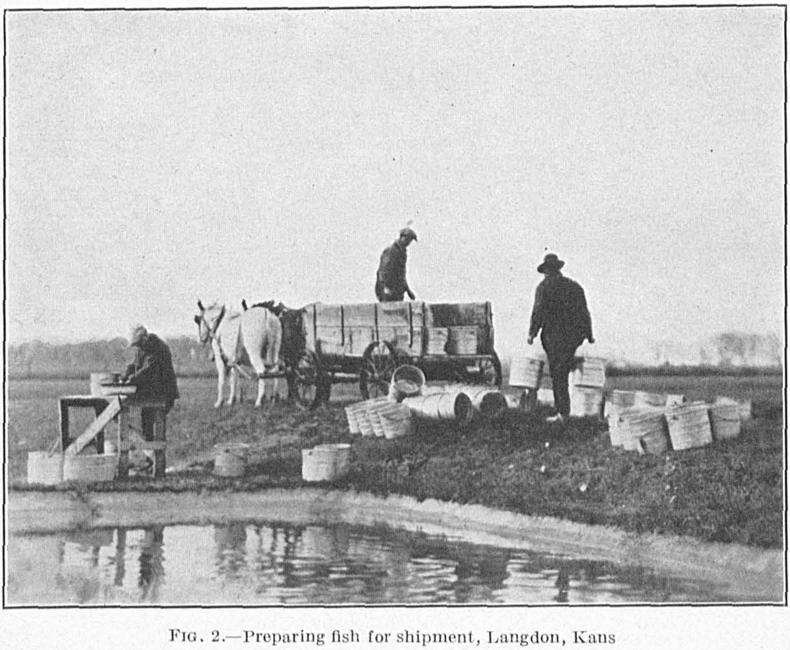

FIG. 2.—Preparing fish for shipment, Langdon, Kans

Indiana, and a carload shipment to Auburn, N. Y., from which point shipments of small-mouth black bass were made by detached messengers to points in Pennsylvania and New Jersey.

The distribution from the Northville (Mich.) station was completed on July 17, and the car then proceeded to La Crosse, Wis., to assist with the distribution of rescued fishes from the upper Mississippi River collecting stations and upon completion of this work returned to Washington, D. C., on September 27.

Early in October the car took up the distribution of bass and crappie from the Lakeland (Md.) ponds. One carload shipment, consisting of 214 pails of bass and crappie, was forwarded to Richmond, Va. The rest of the work was done by messenger shipments from Washington, the car being used to hold the fish until ready for departing trains. The total numbers of fish distributed were 21,260 (3 to 6 inch) large-mouth black bass and 23,425 (2 to 3 inch) crappie. On completion of the Lakeland distribution the crew was detailed to the Washington (D. C.) office of the bureau to assist with the office work.

On February 21, 1924, the car proceeded to the shops at Wilmington, Del., to undergo annual repairs. A train-line air system was installed, making it possible to use train-line air on the fish when in trains or at stations where compressed air is furnished.

On April 28 the car proceeded to White Sulphur Springs, W. Va., to assist in the distribution of trout. Carload shipments were made to Johnstown, Pa.; Richwood. W. Va.; and Philadelphia, Pa. From Philadelphia the car continued to Nashua, N. H., arriving at that point on May 19, where a carload of trout was received for points near Portland, Me. It then proceeded to Bucksport, Me., for the purpose of taking up the distribution from the Craig Brook (Me.) station.

From the Craig Brook station trips were made to Dennysville, Grindstone, Calais, Greenville, Houlton, and Farmington, Me. In the vicinity of these points the following fish were distributed: 494,000 advanced Atlantic-salmon fry, 100,100 1-inch landlocked salmon, and 679,200 1-inch brook trout.

On June 21 the car proceeded to Nashua, N. H., where it received a carload of trout for Wilkes-Barre, Pa., and thence proceeded directly to Washington, D. C., completing the distribution for the fiscal year 1924.

During the fiscal year 1924 car No. 4 traveled 12,099 miles and distributed 205,156 pondfishes, 993,006 trout, 100,100 landlocked salmon, and 494,000 Atlantic salmon.

In previous years it required six teams to load the car at Bucksport, Me., whereas with the Fearnow pails only three loads are necessary, the pails being double-decked. In heavily loaded baggage cars, where space is limited, the pails may be stacked in four or five tiers.

The filtros plugs now used on car No. 4 require very little attention, do not swell when the air is stopped on the fish, and are a decided improvement over the old wooden plugs.

The Bangor & Aroostook and the Maine Central Railroad Cos. made special concessions to fisheries car No. 4 by eliminating the minimum transportation charge and granting the bureau straight 5-fare charges for the movement of the car.

CAR NO. 7

[E. M. LAMON, Captain]

On July 20 the distribution of pondfishes was taken up from the upper Mississippi River stations. During July, August, September, and October, 1923, 214,000 fingerling pondfishes were distributed by the car and its messengers in Michigan, Wisconsin, Indiana, Illinois, Missouri, Arkansas, Tennessee, New York, New Hampshire, Massachusetts, Vermont, Maine, Pennsylvania, Maryland, and Kentucky, supplying 920 applicants.

On December 12 car No. 7 was placed in the Louisville & Nashville Railroad shops and the work of general repairs started. While in the shops the piping was so arranged that compressed air for the fish could be obtained from the train line when the car is moving in a train or parked in a depot where air is available, which eliminates the necessity for using the steam boilers in many instances, thereby effecting a considerable saving in coal. The steel fish compartment covers were eliminated and new wooden covers, hinged in back and center, were installed.

The car left the shops on March 3, and after being fitted up for distribution work proceeded to Fishery, Tenn., to take up the spring distribution from the Erwin (Tenn.) station. The car arrived at Fishery on March 11, and between that date and April 17 there were distributed by the car and its messengers 267,200 brook trout, 437,600 rainbow trout, and 16,600 Loch Leven trout, all fingerlings, to applicants in Tennessee, North Carolina, South Carolina, Georgia, and Alabama.

Car No. 7 arrived at Wytheville, Va., on April 20, where it obtained a shipment of trout for waters in western Pennsylvania, and upon completing the Pennsylvania trip it proceeded to Manchester, Iowa. During May and June 547,300 brook trout and 172,200 rainbow trout fingerlings from the Manchester station and 75,000 Loch Leven trout, 75,000 rainbow trout, and 36,000 brook trout from the La Crosse (Wis.) station were distributed to applicants in Minnesota and Wisconsin.

Car No. 7 traveled 17,642 miles, making 22 trips and supplying 1,850 applicants, and distributing a total of 1,920,900 fingerling fishes.

CAR NO. 8

[E. K. BURNHAM, Captain]

During the year car No. 8 was engaged in the distribution of fishes produced at La Crosse, Wis.; Leadville, Colo.; Langdon, Kans.; and Neosho, Mo., in the course of which it traveled a total of 12,905 miles and made deliveries to 556 individual applicants located in 10 different States. The following table shows the numbers of the various species delivered:

	Fingerlings	Yearlings		Fingerlings	Yearlings
Brook trout	1,161,000		Sunfish	45,610	6,490
Rainbow trout	11,000		Yellow perch	828	30
Black-spotted trout	302,000		Catfish	17,350	280
Steelhead salmon	16,000		Rock bass	2,425	
Lake trout	16,000				
Black bass	46,230	1,060	Total	1,642,914	7,860
Crappie	24,471				

The car has a carrying capacity of 134 10-gallon cans, or 220 of the modern fish pails. The crew made all minor repairs to the interior of the car, thereby considerably reducing the cost of maintenance and repairs.

The most notable improvement in operating equipment is the filtros plug, which is made of rock-like material and is used for liberating compressed air in cans containing live fish. Formerly wooden plugs were used for this purpose, but they proved impracticable because they swell and entirely shut off the air when the pressure is properly reduced. The filtros plug does not swell and close under reduced pressure and liberates the air freely when the pressure is increased.

CAR NO. 9

[A. H. KERTH, Captain]

Distribution work for the fiscal year began July 16, 1923, when the car was equipped with 24 of the new Fearnow pails (aluminum), which were received from car No. 8.

The first trip was taken out of La Crosse, Wis., and consisted of miscellaneous species of river fishes, which were distributed en route to Bozeman (Mont.) station to applicants at Harrison, Nebr.; Lusk, Keeline, and Casper, Wyo.; and Billings, Columbus, and Bozeman, Mont.

During August, 1923, while on a trip with trout, which was being made for the Montana State Fish Commission, it was necessary to use some cans that had been painted inside, and as a result a considerable loss of fish occurred.

Upon completion of the distribution from the Bozeman station the car came east and resumed the work of distributing the miscellaneous river fishes, after which it proceeded to Washington, D. C., and assisted in the distribution from the Lakeland (Md.) ponds.

At the close of the Lakeland distribution the car was placed in the shops at Wilmington, Del., for annual repairs and the crew detailed to fish-cultural and clerical duties.

During the month of March, 1924, an electrically driven air pump was installed on the car. The new pump was used in connection with distribution work with highly satisfactory results, and has not only effected a great saving in the amount of fuel consumed but has also added to the general convenience and safety of the crew by eliminating the necessity of carrying a heavy fire to generate steam for power.

During April, while the car was at Washington, D. C., a new type of brake beam was installed, giving more clearance for the generator belt. The old pulley on the axle was replaced with a wider one, which, it is thought, will prevent the loss of generator belts.

The spring distribution out of the White Sulphur Springs (W. Va.) station was taken up on April 16, 1924. In all, six trips were made from this station, which completed the distribution of fish by car No. 9 for the fiscal year 1924.

The car traveled 21,541 miles during the year, delivering 2,728,300 trout and 52,845 miscellaneous river fishes. At the close of the year it was equipped with the new type of transportation pails.

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NEW TRANSPORTATION PAILS

In July, 1923, three of the bureau's cars were completely equipped with the new type of transportation pail (described in Bureau of Fisheries Doc. 941, pp. 93–96), and one partially so, while small allotments of pails were sent to a number of the hatcheries that make extensive distributions. While tabulations have not been made showing the saving brought about at each station where the pails were used, the following table, based on the actual cost of distribution from the bureau's rescue stations and compiled from cost slips submitted by car captains and messengers, shows the cost of distribution from the bureau's Mississippi River collecting stations. This distribution covered practically all the Middle Western States and a few States east of the Allegheny Mountains.

Comparative table showing cost of distributing fishes rescued from the upper Mississippi River during the fiscal years 1923 and 1924[1]

Method	Total number of fish	Total cost	Cans delivered	Applications	Average cost per thousand	Mileage	
						Paid	Free
1923							
Station messengers[2]	68,595	$734.08	644	229	$10.70	11,864	----------
Car messengers[3]	270,047	2,555.77	2,557	1,174	9.723	33,683	1,026
Distribution cars[4]	590,442	13,287.45	4,527	1,795	22.50	37,763	----------
1924							
Station messengers[2]	95,425	720.73	779	176	7.553	12,354	----------
Car messengers[3]	342,058	2,255.00	2,987	1,371	6.593	32,489	----------
Distribution cars[4]	598,720	8,848.63	4,811	1,929	14.77	30,759	----------

[1] Includes distribution from La Crosse, Wis., Marquette and Bellevue, Iowa, and Homer, Minn. Size of fish ranges from 1 inch to 6 inches.

[2] Cost of making distribution direct from station without a car.

[3] Detached messenger shipments from cars. *Cost in addition to distribution by car.*

[4] Cost of transporting fish to destination or until delivered to car messenger.

From the foregoing it will be seen that in 1924 there were handled 117,119 more fish (849 more cans) than in 1923, and an actual saving of $4,752.96 was made. Based on 1923 costs per thousand fish, the expense of handling the 1924 collections would have been as follows: Station messengers, $1,021.25; car messengers, $3,325.83; cars, $13,471.20; or a total of $17,818.08. As the actual cost for 1923 was $11,824.36, on this basis the saving to the bureau would have been $5,993.72.

These savings, which have been brought about by furnishing the cars with transportation pails of the new type, have enabled the bureau to greatly extend its distribution work and at the same time keep within the limits of its appropriation.

At the Craig Brook (Me.), Manchester (Iowa), and White Sulphur Springs (W. Va.) stations the pails are hauled from the station to the car in double-deck loads.

O

IODINE CONTENT OF PRESERVED SEA FOODS[1]

By Arthur W. Wells
Assistant Technologist, United States Bureau of Fisheries

Contribution from the Fishery Products Laboratory, Washington, D. C.

INTRODUCTION

The amount of iodine necessary to prevent goiter is very small—according to some statements[2] only about 1 part in 3,000,000 parts of the body weight. It is important, however, that this amount be maintained, and various investigators have shown that, in localities where foods and drinking water do not contain sufficient iodine to supply the proper amount to the body, goiter and other diseases of the thyroid gland usually are prevalent.

In a previous paper[3] by Donald K. Tressler and this author it was shown that fish (especially marine fish and shellfish) contain larger amounts of iodine than do most other foods. It is believed that if people would use marine fish or shellfish in their diet two or three times each week the amount of iodine ingested would be increased considerably, with a consequent reduction in the number of persons suffering from goiter and other thyroid disorders. This applies especially to people living in the so-called goiterous belts. In this connection McClendon and Hathaway[4] believe that the probable cause of "the recession of goiter that has taken place in New York State during recent times is due to the greater transportation facilities for sea food into inland regions."

Many of these goiterous belts are so located, however, that it is difficult for the inhabitants to obtain marine fish in the fresh condition. Much of the marine fish which they consume has been preserved in some manner, such as canning, salting, or smoking. The question naturally arises as to whether these preserved products contain iodine in quantities comparable to those contained in fresh fish, and analyses, the results of which are reported in this paper, were made for the purpose of throwing light upon this question.

Since fish meal is used as a stock and poultry food, it has been suggested that its use, providing it were high in iodine, would be of

[1] Appendix VI to the Report of the United States Commissioner of Fisheries for 1924. B. F. Doc. No. 979.
[2] The American Public Health Association. Science News. Science, new series, Vol. LX, No. 1556, Oct. 24, 1924, p. x. New York.
[3] Iodine content of sea foods. Appendix I, Report of the U. S. Commissioner of Fisheries for 1924, 12 pp. B. F. Doc. No. 967. Washington.
[4] Inverse relation between iodin in food and drink and goiter, simple and exophthalmic. By J. F. McClendon and Joseph C. Hathaway. Journal, American Medical Association, vol. 82, No. 21, May 24, 1924, pp. 1668–1672. Chicago.

value in furnishing this element to animals. The importance of the meal for this purpose would depend largely upon whether or not the iodine contained in it were concentrated in the animal flesh used for human nutrition. A number of analyses of fish meals from different sources were made with the idea of getting some information as to their iodine content.

EXPERIMENTS

In this work the same process as that employed in the analyses of fresh fish was used, namely, a modification of Von Fellenberg's extraction method. A description of the procedure is to be found in the previous paper. The samples were taken (in the case of salt and smoked fish) by cutting all of the edible portion from one or two fish, chopping the material very finely, mixing well, and then weighing immediately a 50 or 75 gram sample. In the case of canned fish the sample was, as a rule, taken from but one can, although in some instances two or three cans were used. The contents were finely chopped, thoroughly mixed, and samples weighed as above. From this point the procedure described in the previous report was followed. For the fish meals a 25 or 30 gram sample was weighed, dried to constant weight and the regular method followed. Results of the analyses of the edible foods are given in Table 1, calculated on both a wet and a water-free basis. The analyses of fish meals are shown in Table 2. In order that a comparison may be made more easily, there is shown in Table 3, the iodine content of fresh fish, preserved sea foods, and other common foods.

TABLE 1.—*Iodine content of preserved sea foods*

Kind of preserved sea food	Wet substance		Water-free substance	
	Mg. I per kilogram	Parts per billion	Mg. I per kilogram	Parts per billion
Canned:				
Albacore	0.32	320	0.79	790
Clams, minced (New England)	.42	420	1.97	1,970
Codfish cakes	.34	340	1.15	1,150
Codfish, shredded	.31	310	1.52	1,520
Crab meat, Japanese	.74	740	3.15	3,150
Finnan haddie	.23	230	.82	820
Lobster	1.33	1,330	5.32	5,320
Mussels, sea—				
Meat	.97	970	2.86	2,860
Liquor in can	.42	420	6.72	6,720
Oysters—				
Meat	.80	800	4.01	4,010
Liquor in can	.35	350	9.60	9,600
Roe—				
Codfish	.42	420	1.51	1,510
Codfish, buck	.42	420	2.23	2,230
Herring	1.07	1,070	3.79	3,790
Shad	1.28	1,280	4.10	4,100
Salmon, chinook	.25	250	.78	780
Sardines—				
California	.43	430	1.05	1,050
Maine	.57	570	1.51	1,510
Shrimp	.38	380	1.14	1,140
Tuna, bluefin	.16	160	.39	390
Salted:				
Cod	.66	660	1.41	1,410
Haddock	.32	320	.68	680
Herring	.49	490	.89	890
Mackerel (common)	.40	400	.66	660
Mullet	.29	290	.56	560
Smoked: *Herring*	.53	530	1.00	1,000
Mild cured: Chinook salmon	.34	340	.72	720

TABLE 2.—*Iodine content of fish meal*

Kind of fish meal	As purchased		Dry basis	
	Mg. I per kilogram	Parts per billion	Mg. I per kilogram	Parts per billion
Menhaden	0.98	980	1.08	1,080
Salmon	1.28	1,280	1.31	1,310
Sardine	.89	890	.98	980
Shrimp	2.61	2,610	2.84	2,840

TABLE 3.—*Iodine content of sea foods*

Parts per billion (dry basis)	Fresh [1]	Preserved
Above 1,500	Lobster (11,590) Clams, hard (6,200) Oysters (6,000) Oyster juice (3,170) Shrimp (2,250) Rock (2,000) Bluefish (1,870)	Liquor from canned oysters (9,600). Liquor from canned mussels (6,720). Lobster, canned, (5,320). Roe, shad, canned (4,100). Oysters, canned (4,010). Roe, herring, canned (3,790). Crab meat, Japanese, canned (3,150). Mussels, sea (2,860). Buck roe, codfish (2,230). Clams, minced (New England) (1,970). Codfish, shredded (1,520). Sardines, Maine, canned (1,510). Roe, codfish, canned (1,510).
1,251—1,500	White perch (1,420) Mackerel, Spanish (1,410)	Cod, salt (1,410).
1,001—1,250	Tautog (1,170) Spot (1,140) Haddock (1,050)	Codfish cakes, canned (1,150). Shrimp, canned (1,140). Sardines, California, canned (1,050).
751—1,000	Cod (1,000) Scup (950) Pollock (900) Squeteague (850) Halibut (830) Scallops (810)	Herring, smoked (1,000). Herring, salt (890). Finnan haddie, canned (820). Albacore, canned (790). Salmon, chinook, canned (780).
501—750	Winter flounder (730)	Salmon, chinook, mild cured (720). Haddock, salt (680). Mackerel, common, salt (660). Mullet, salt (560).
251—500	Alewives (500) Crabs, soft (490) Mackerel, common (330)	Tuna, bluefin, canned (390).
0—250	Most fresh-water fish and such agricultural products as butter, eggs, corn, milk, beefsteak, apple, and wheat.	

[1] The figures in this column are taken from the previous report on the subject.

DISCUSSION

The results obtained from the analyses in this and the previous paper indicate, in general, that fresh and preserved sea foods are much richer in iodine than are land products or fresh-water fishes. In view of the variations in composition among individuals of the same species, especially seasonal variation and differences in methods of preservation, these investigations will admit of only general conclusions and are indicative only in comparisons of individual analyses.

The analyses, however, are approximate, and when considered collectively show that preserved fish and fishery products do contain iodine in quantities comparable to those of fresh fish. They also indicate that fish roes are especially rich in iodine, and likewise that the liquors from canned shellfish contain large amounts. Fish meals are about equal to fresh fish (calculated on the dry basis) in respect to amount of iodine contained, as shown in Table 3.

GOLDFISH: THEIR CARE IN SMALL AQUARIA AND PONDS[1]

By E. C. Fearnow

Superintendent of Fish Distribution, U. S. Bureau of Fisheries

CONTENTS

INTRODUCTION

The goldfish is a member of the carp family, and while its brilliant colors have become fairly well established through selective breeding the scale varieties, which include the common goldfish (*Carassius auratus*), assume the colors of the carp at first and change, when they are from 3 to 6 months old, to gold, white, or black. Through selective breeding in China, Korea, and Japan, numerous fancy breeds of goldfish have been produced and are now on the market.

Although the Bureau of Fisheries neither propagates nor distributes ornamental fish, the need of a publication for use in answering the numerous inquiries concerning the care of goldfish has been apparent for some time. It is the aim of this article to set forth briefly such practical advice as appears necessary for the amateur aquarist.

Since the bureau is concerned in the propagation of the food and game fishes only, it has no literature on the methods of goldfish breeding, but excellent advice on this subject may be obtained by consulting the current publications on goldfish. Neither does the bureau serve as a medium for advertising goldfish or aquarium accessories. Publications devoted to aquarium fishes and related subjects contain advertisements of dealers in goldfish, aquatic plants, and, in fact, everything that is needed by the aquarist.

In the preparation of this publication the following authorities have been freely consulted: Wolf, Mulertt, Innes, Mellen, and Aquatic Life. (See bibliography.)

[1] Appendix VII to the Report of the U. S. Commissioner of Fisheries for 1924. B. F. Doc. 980. This paper is a revision and enlargement of B. F. Doc. 935, "Goldfish: Their care in small aquaria."

SUITABLE FORM OF AQUARIUM

Because of its narrow neck the so-called fish globe is not adapted to keeping goldfish in a comfortable and healthy state, its small amount of water surface not permitting the process of absorption of air on a scale sufficient for the well-being of the fish. Another objectionable feature of the globe lies in its reflection and refraction of light rays, which tends to make the fish nervous and uneasy. An aquarium with straight sides is the most suitable for goldfish. It should be of rectangular shape and of equal width at the top and bottom. The rectangular battery jar, which may be purchased in the 5-gallon size, will give good results. The depth of water should be about the same as the width of the aquarium, and the bottom should be covered with clean sand and gravel to the depth of 1½ inches. Ordinary washed sand and pebbles are best for this purpose, as the more desirable aquarial plants draw most of their nourishment from the water and require merely an anchorage. In order to insure an abundant air supply, plants of high oxygenating powers should be selected for the aquarium.

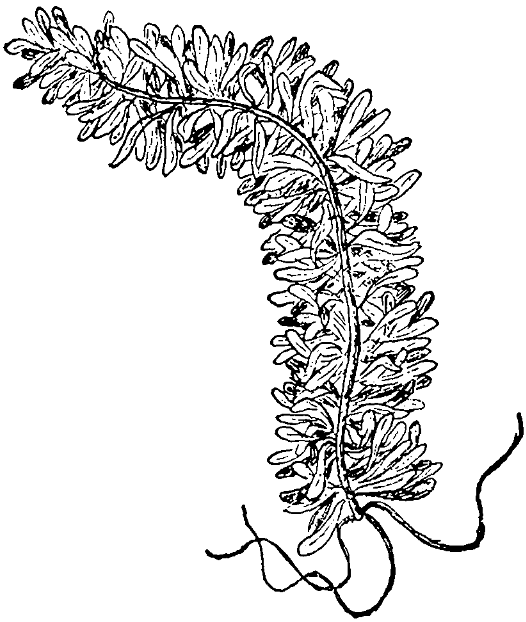

FIG. 1.—Anacharis (*Anacharis canadensis gigantea*). One-half natural size. A good oxygenator; grows rapidly; thrives with or without roots when set in pebbles or sand; may be purchased of dealers. This is considered the most satisfactory plant for the amateur aquarist

SUITABLE AQUARIAL PLANTS

Among the most suitable plants for an aquarium are anacharis and fanwort, also known as Elodea and Philotria. Anacharis, *Anacharis canadensis gigantea* (fig. 1) is a good oxygenator and at the same time provides forage for goldfish. Fanwort, *Cabomba caroliniana* (fig. 2), is a very hardy species and thrives well in small aquaria. It is evergreen, will grow from cuttings, especially the forked joints, and a branch planted in the sand at the bottom of an aquarium will produce roots. These plants are very common, and supplies can usually be purchased from goldfish dealers. Other desirable aquarial plants are willow moss, *Fontinalis antipyratica* (fig. 3), and arrowhead, *Sagittaria natans* (fig. 4). Very beautiful aquatic gardens may be made by a proper selection of plants. A frequently used and very hardy and beautiful plant is the hornwort, *Ceratophyllum demersum* (fig. 5), but it requires careful attention, as it is liable to decay and contaminate the water. Moreover, it is dormant in winter and has only decorative value at that period. Ludwigia, *Ludwigia glandulosa* (fig. 6), is highly prized for its fine appearance in the aquarium and is easily propagated from cuttings.

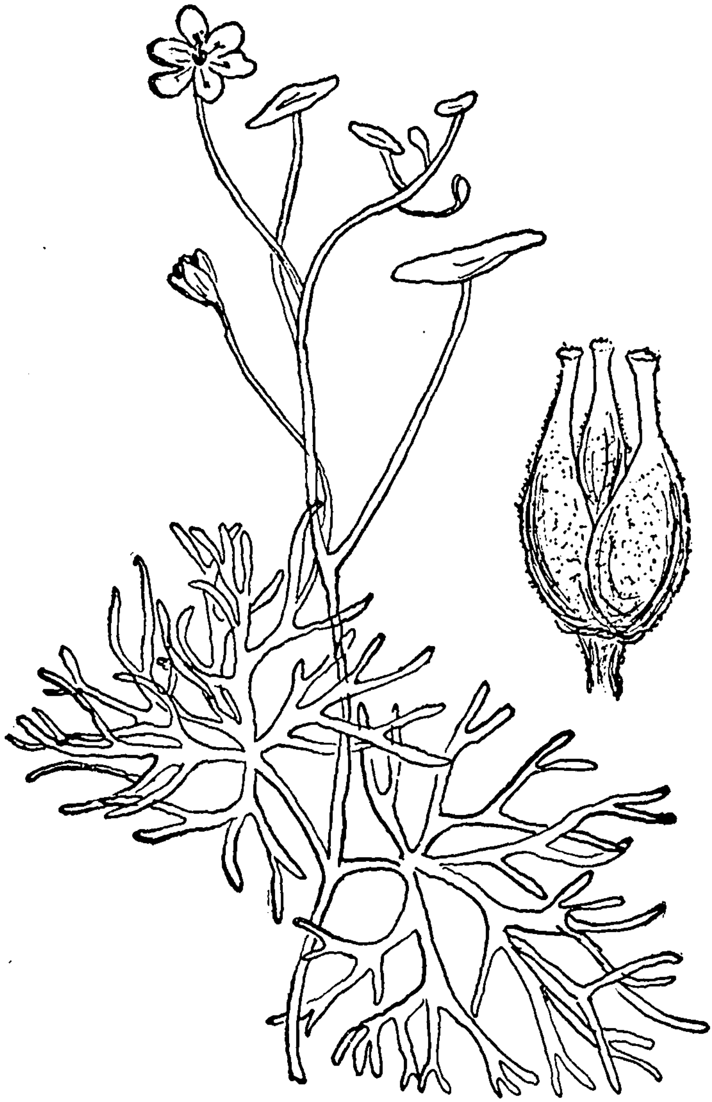

FIG. 2.—Fanwort (*Cabomba caroliniana*). Natural size. Found in ponds and slow streams, southern Illinois to North Carolina, south to Florida and Texas

BALANCED AQUARIUM

When the relations of plant life and animal life in an aquarium are properly proportioned, the aquarium is said to be self-sustaining or balanced, and under such a condition the water requires no change. Filling in to make up for what has evaporated is all that is necessary; or, if preferred, about half the water may be drawn off through a siphon and a similar amount of fresh, aerated water added. During very warm weather this will probably have to be done about once a month. If the water should become vitiated at any time, the aquarium must be thoroughly cleansed and the entire water supply renewed, the fish first having been removed to another vessel. When fish become restless and rise to the surface of the water to breathe, it indicates that the oxygen supply in the aquarium is insufficient. Relief may be given them by dipping up and pouring back some of the water.

FIG. 3.—Willow moss (*Fontinalis antipyratica*). Natural size. A fairly good oxygenator

A small aquarium can not sustain much life. Fishes, like human beings, can not thrive in crowded habitations, and thousands of goldfish have been lost by the overstocking of aquaria. The number that can be maintained in healthful condition in a 5-gallon vessel will depend upon its location and shape, the water temperature, character of the plant life, size of the fish, and the amount of light admitted.

It is better for beginners to start with a few of the hardier varieties of goldfish until the fundamental principles of aquarium keepings are understood. When common goldfish can be kept with no losses, it is time to branch out and undertake the keeping of the more interesting breeds.

A well-balanced aquarium of 5-gallon capacity is capable of maintaining 2 goldfish, each 2 inches long exclusive of tail, 1 frog tadpole, and 4 snails. One-fourth of the bottom area should be planted with aquatic vegetation, the ends or roots to be embedded from 1 to 1½ inches in the sand or gravel, and the plants evenly distributed over the entire surface to admit light and provide for the free movement of the fish. In choosing the snails, select species that do not feed on plants. The best ones are the Planorbis and Vivipara. Snails help to keep down the growth of algæ, while the tadpole acts as a scavenger, consuming all waste matter in the aquarium. When about to enter the frog stage the tadpole must be provided with a resting place on the surface of the water; otherwise it will drown. In a 5-gallon aquarium two handsome specimens of fringe-tail goldfish will make a fine appearance. Once or twice a week the inside surface of the front glass should be cleaned to prevent obstruction of the view by accumulations of algæ. For this purpose a flat sponge or piece of felt attached to the flattened end of a stick will be effective. Sediment may be removed by a glass dip tube or rubber siphon.

A 5-gallon aquarium is the minimum size recommended, but when it is possible a larger vessel should be used. A tank 24 inches long, 12 inches wide, and 15 inches high, with a capacity of 18 gallons, makes a suitable aquarium for a parlor or living room. A receptacle of that size should maintain 5 two-inch fish of different types and varieties, 2 tadpoles, and 10 snails. When larger aquaria are used, the number of fishes, scavengers, and plants may be increased proportionately. If the fish are larger, their number should be correspondingly reduced. A good rule in stocking an aquarium is to allow 1 gallon of water to each one-half inch of fish. Maintenance of goldfish under conditions less favorable than these is possible by making frequent changes of water.

FIG. 4.—Floating arrowhead (*Sagittaria natans*). One-half natural size. A very desirable plant for the aquarium. Flowers above water surface, but fruit ripens on or below the surface of the water

LIGHT

The aquarium should have a northeastern exposure in summer, but in winter it is advisable to so locate it that it will get the sunlight two or three hours a day. The light should enter an aquarium in about the same way it enters a stream—from the surface of the water. Too much light will overstimulate the growth of algæ, causing the water to turn green.

WATER

The best water supply for an aquarium is nearly always from a river, pond, or cistern, as water from such a source conforms more nearly to natural conditions. Excessively hard water, from whatever source, is undesirable. Mineral requirements should be satisfied preferably in the diet rather than by the addition of salts to the water. The demands of both fish and plants for inorganic matter are so small that a reasonable amount of natural crustacean food in the diet should be sufficient to maintain the balance.

TEMPERATURE

The temperature of the water in an indoor aquarium will range from 50 to 80° F. in winter and from 65 to 80° F. in summer. A temperature somewhat in excess of 85° should not prove harmful if the water is well aerated, but if the fish show signs of distress their condition may be improved by reducing the number in the aquarium. In all cases avoid sudden changes in water temperature.

PREVENTION OF ACID CONDITION

For the prevention of an acid condition in the aquarium, which is usually brought about by the decomposition of plants, a small piece of plaster of Paris in the aquarium is recommended. The plaster of Paris neutralizes the acid, and as it dissolves only under acid conditions there is no danger of getting the water too alkaline.

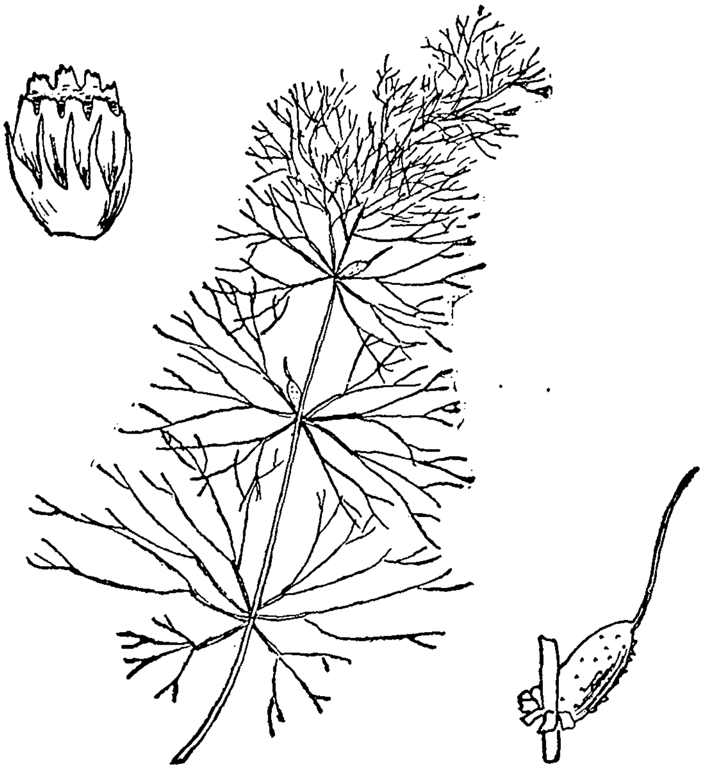

FIG. 5.—Hornwort (*Ceratophyllum demersum*). Natural size. Found in ponds and slow streams throughout North America, except extreme north. This plant is shallow-rooted, deriving most of its sustenance from the water

When the plaster of Paris dissolves quickly it is a sure sign of acid condition. Where snails are introduced, the calcium is necessary for their shell formation.

FOOD

Most aquarium fishes desire a variety of foods, and the aquarist should endeavor to imitate nature. Whatever foods are used it should always be borne in mind that a balance of vegetable, animal, and mineral content is required. The best prepared foods are those that are granular in form and usually of dark color. Such foods may be purchased at pet stores and contain a mixture of flour, fish roe, meat, etc. Dried bread crumbs are frequently recommended as food for goldfish, especially when whole-wheat bread is used.

Goldfish in an aquarium should be fed every day in summer and every other day in winter. Natural foods, such as small Crustacea (Entomostraca) and insects and their larvæ, are most desirable, but many useful substitutes for these foods are available. While such substances as fish roe, fish, ant eggs, rice and pea flours, etc., are recommended in complex formulæ, it should be remembered that the essential requirements—animal and cereal foods—can be simply supplied. For the former lean meat scraped fine, chopped earthworms, fresh or dried liver will serve admirably, while a satisfactory source of the latter is embodied in a flour paste or dough, ground oatmeal, or corn meal. If it is desired the mineral content may be supplemented by the addition of a little table salt or Epsom salts.

Prepared foods containing many of the ingredients mentioned are for sale in the market, and their use can be recommended to the amateur aquarist. The main thing to guard against is the giving of more than the fish will consume at one feeding, as any excess allowed to remain in the water will eventually pollute it and produce diseased conditions.

Daphnia, popularly known as "ditch fleas," are an excellent live food for goldfish. The same may be said with reference to the larvæ of the mosquito, which can be had in large quantities during the summer months and may be found in rain barrels or stagnant pools, the common name being "wrigglers."

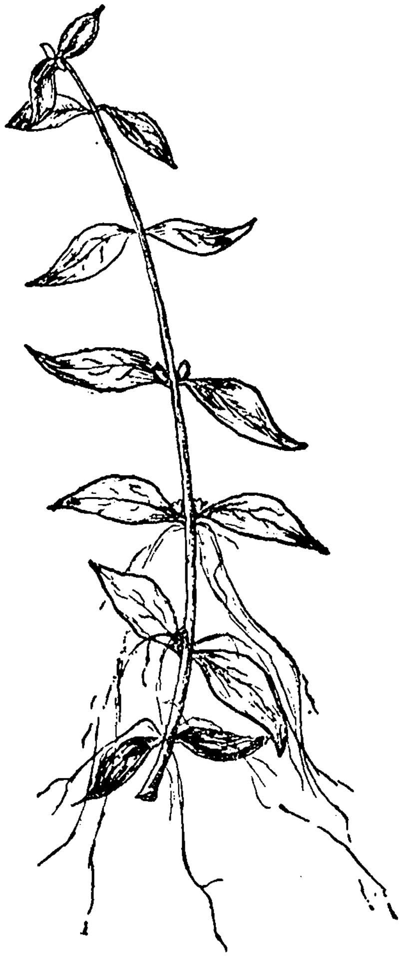

FIG. 6.—Ludwigia (*Ludwigia glandulosa*). Natural size. Prized for its beauty in the aquarium; grows from cuttings

DISEASES AND THEIR TREATMENT

Illness among goldfish becomes apparent in many ways, but as a usual thing the fins are bloodshot, the dorsal fin droops, and the affected fish is inclined to rest on the floor of the aquarium, with little or no desire for food. Where only one fish is diseased the cause may be attributed to overfeeding or constipation, but if a number are ill it is an indication that something is radically wrong, either with the food, the water, the oxygen supply, or the temperature conditions.

The excrement in health is dark, either a brownish green or black. If white or yellow, it indicates overfeeding. When a fish becomes diseased, it should be removed from the aquarium immediately.

Goldfish must be handled gently and as little as possible to avoid injury to their scales, fins, or tails. The dip net used for their transfer to and from the aquarium should be round and somewhat deep, rather than funnel-shaped. If it can be avoided, fish should never be grasped with the hands.

When the fish are in a weakened condition or have been bruised by excessive handling, diseases known as "white fungus" and "tail rot" will often develop on the body and fins. When a whitish coating or splitting of the fins is noted, the affected fish should be placed in another jar containing water just salty enough to be noticeable to the taste and kept there until cured, the salt water being changed daily. This treatment is good for run-down fish as well as for those that are diseased.

To overcome constipation, dissolve a tablespoonful of Epsom salts in a gallon of water and allow the fish to remain in the solution for a few hours if necessary. Then let them rest a day or two in a mild solution of Epsom salts with a little sea salt added. Constipation can be prevented by the use of live foods, such as Daphnia, at intervals.

Fish subject to a higher temperature than that which they were accustomed to are apt to develop fungus or other diseases. When fish are brought in from the open, the temperature should be lowered gradually and overcrowding should be avoided. At the first indication of fungus (white spots on the fins) the fish should be given a salt treatment, after which they should be kept apart from the healthy ones in well-aerated water.

Fungus is a parasitic plant, and species of it are always more or less abundant in the water. Healthy fish usually have the strength to resist them, but fish that have been injured by injudicious handling are liable to become affected. The fungus will be observed as black and white spots, or the fish may have most of its body covered with slime. A strong salt solution applied with a cotton swab will effect a cure in one or two treatments. There are preparations on the market that are sometimes used for painting spots made by fungus. These preparations or balsams are insoluble in water and act as a covering while the wound is healing. In their use the affected parts are cleaned and dried and the balsam freely applied with a small brush or a piece of cotton and permitted to dry for about three minutes, the head and gills of the fish being wrapped in a wet cloth while the operation is in process. If properly done, this will not endanger the life of the fish. The following methods of salt treatment are in common use:

TREATMENT WITH STRONG SALT SOLUTION

A solution containing 13 ounces of Turks Island salt per gallon of water is prepared. If this is not available, common salt may be substituted. The fish are dipped up in a deep net and lowered in the salt solution, where they should remain for two or three seconds. The fish are then transferred to another vessel containing well-aerated water of the same temperature as that from which they were taken. This treatment may be profitably repeated daily for two or three days.

TREATMENT WITH DILUTE SALT SOLUTION

In this case the fish are placed in a 3 per cent solution of common table salt, one-fourth pound to a gallon of water, and allowed to remain in the bath with aeration of the solution for 30 minutes. The fish may then be placed in another vessel containing well-aerated water. If the fish show signs of distress during the half hour—by turning on one side—they should be removed to fresh water. The treatment may be repeated on the following two or three days.

On cloudy days, even in well-conditioned aquaria, fishes will come to the surface of the water to breathe, but if they do this in clear weather it is a sign that something is wrong. The trouble may be from one of the following causes: Too few plants, too high temperature, infected gills, or decomposition of unconsumed food. The cause should be found and removed as quickly as possible.

Goldfish are subject to many diseases not described in this publication, among them being inflammation of the eyes, an affection of the swimming bladder, and the infestations of numerous parasites, both internal and external. The former are beyond treatment, but for many of the latter the salt treatment is efficacious.

ICHTHYOPHTHIRIUS

One of the most serious diseases, which is common in fish in their natural environment as well as fish in aquaria and ponds, is that caused by the parasitic protozoan, Ichthyophthirius.

The first symptoms of the presence of Ichthyophthirius are the queer actions of the fish and the appearance of small whitish-gray, sharply defined pimples sticking out over the surface of the body. When the fish are first infected they rub themselves continually against the bottom and sides of the tank in an attempt to brush off the young parasite. In a short time they will be seen to hang listlessly in the water, with drooping fins, or gasping at the surface, due to the impaired condition of the gills. All parts of the body, head, sides, fins, and especially the mouth and gills, may be heavily infected by these organisms.

As the parasite grows it becomes visible as a raised light-colored spot on the fish, and if these are numerous the adjacent ones may touch each other and unite to form a large spot, giving the skin a mottled appearance. As the disease spreads the raised spots often occur by the hundreds and thousands, covering the entire external surface of the fish. Fish that become heavily infected soon stop eating, and in the last stages of the disease they are covered with a heavy slime and red blotches or "scalded" areas. Fungus soon develops on the raw parts of the fins and body, and the fish live but a short time.

The most practical method of treating the disease consists in removing or destroying the large adult parasites after they have dropped off the fish. This may be accomplished by placing the fish in swiftly running water, which carries away the parasites before they have time to multiply and reinfect the fish. Long troughs or cylindrical tanks can be easily equipped for this purpose. The treatment may be made even more positive by scrubbing the trough or tank every day with a strong salt solution after removing the fish. In warm weather infected fish may be cured by this method in 7 to 10 days, and further epidemics can be prevented by quarantining newly brought in stock in this way. Successful treatment in any case depends upon combating the disease when the first symptoms are noticed and continuing it until all the parasites have had a chance to drop from the fish.

Nets and siphons used around infected fish should be sterilized each time they are used in a strong brine solution, lest the parasites be transferred to other tanks. Detailed information on this disease may be obtained by consulting Bureau of Fisheries Document No. 959.

It is not possible to enter into details concerning these diseases and their treatment. Further information on the subject may be obtained from the standard books on goldfish culture, a selective list of which is herewith appended. Many of these books may be consulted at the public libraries.

HOW TO DISTINGUISH SEX

In goldfish, as well as in other fishes, the male and female are so similar in external appearance that the sex can be determined only by an examination of the internal sexual organs. The following extract from Aquatic Life will be of interest to amateur aquarists:

> Quite the first question to be asked by one desiring to breed goldfish is how the sexes may be distinguished. It has been shown that a slight difference in contour exists in the region about the anus, but it is exceedingly hard to discern, and not a few experienced fanciers will refuse to guarantee the sex of a fish based on this feature alone.
>
> When in condition to breed, the distinguishing points are very evident. The male develops tubercles or "salt spots" on the gill plates and along the first ray of the pectoral fins. These marks may be absent from the fins and but few in number on the gill plates. The tubercles are usually considered an infallible distinction, but are not absolutely so. Once in a lifetime a fancier may find a female with tubercles.
>
> The female, except about the anus, exhibits no sexual difference until the development of the roes causes a distention of the body, which is more evident from a top view than from the side. Other than this it possesses no characters to distinguish it from the male. If both sexes are in the same tank, precocious males may "drive" barren females, and in that manner aid in identification, but a doubt may be cast on the certainty of it by the fact that males will sometimes drive other males.

REARING YOUNG GOLDFISH

As goldfish sometimes spawn in aquaria, the following advice is given for the benefit of those who may desire to protect the eggs and rear the resulting fry.

Goldfish begin breeding in their second year, and while they may continue to reproduce for six or seven years they yield the maximum number of eggs in their third and fourth years. When the male fish begins to follow the female about the aquarium it may be assumed that spawning will occur very soon. The fish may be allowed to remain in the aquarium and the eggs removed later, or they may be transferred to another tank which has been specially prepared with suitable aquatic plants to receive the eggs. In stocking the aquarium with aquatic plants care should be taken to see that they contain no snails or other enemies of fish eggs.

The female deposits her spawn on the leaves and roots of aquatic plants, the mucilaginous covering of the eggs causing them to adhere to the plants, where they are fertilized by the male fish. The plants preferable for the purpose are Myriophyllum and water hyacinth.

Goldfish eggs are about one-sixteenth of an inch in diameter and of a pale amber hue. From 10 to 20 eggs are deposited, and after short intervals the operation is repeated for several times. As the vegetation becomes covered sprigs of it containing the eggs should be removed and placed in suitable receptacles, which may consist of enameled pans or tubs. The vessels containing the eggs should be placed in a strong light and where they will receive sunlight for a short time each day. As development proceeds two black spots appear in each fertilized egg, usually within two or three days after incubation starts. These are the eyes of the embryo fish.

Young goldfish are very delicate and can not stand much water pressure. For this reason they remain near the surface of the water and are sometimes killed by even fine drops of water falling on them.

Attached to each little fish at its birth is a yolk sac, which provides it with nourishment for about three days. After the yolk sac is absorbed the young fish subsist on the infusorial organisms found in the water, these being too small to be seen with the unaided eye. Where ponds are accessible small quantities of green water derived therefrom should be introduced in the tanks, first taking the precaution to strain it through cheesecloth for the removal of any larger organisms.

To breed infusoria, a quantity of the muck or slime taken from the bottom of any small pool or stagnant body of water should be placed in a jar or pan, covered with water, and allowed to stand. A varied growth will result, most of which is valuable in the diet of young fish. If no standing pond or ditch water is available a little hay should be placed in a small receptacle, covered with water, and placed where it will receive only a limited amount of light. Within a short time a scum will appear on the surface, and inside of four days myriads of infusoria will have developed. Preparations for the production of infusoria, as well as the dried product, can be purchased from dealers in aquarium and goldfish supplies.

During the early stages of their existence goldfish should be fed from six to eight times a day, only a small quantity of food to be given at each feeding. In addition to the infusoria the fish may be given a small quantity of rice flour, the dust from soda or graham crackers, or a small amount of blood pressed from raw beef. Other acceptable foods consist of the yolk of a hard-boiled egg finely divided by straining it through cheesecloth, oatmeal broth, finely scraped beef, or a mixture of dried daphnia and dog biscuit, the materials being reduced to a powder and prepared in the proportion of two-thirds daphnia to one-third biscuit. A small amount of this powder sprinkled on the water two or three times a day will be eagerly taken by the fish. After the first six weeks the fish may be fed on various materials, such as small crustaceans, mosquito larvæ, boiled and strained oatmeal, and other cereals of any kind. The number of feedings may also be gradually decreased until one meal a day is being given at the end of three months.

If collections of crustaceans and mosquito larvæ are made from ponds for a food supply, the material must be carefully strained through a fine sieve to obviate the possibility of water beetles, leeches, and dragon-fly larvæ gaining access to the fish and preying upon them.

Only a few fish can be reared successfully in an ordinary fish globe. An attempt to carry as many as 100 newly hatched goldfish in a gallon of water would result in the gradual disappearance of all the fry. Therefore, if only a small vessel is available for the purpose it would be unwise to attempt to rear more than a dozen fry, as the crowding together of an appreciably larger number would undoubtedly end in complete failure.

AQUARIUM CEMENT

In the manufacture and repair of its aquaria the Bureau of Fisheries has for many years successfully used a cement composed of 5 parts of putty, 1 part red lead, and 1 part litharge. These ingredients are mixed to the proper consistency for glazing by the use of boiled linseed oil and a few drops of dryer. A sufficient amount of lampblack is added to change the color from red to slate. After applying the cement allow it to dry thoroughly before putting water in the aquarium.

PONDS

The first requisite for the rearing of goldfish in outside ponds is a temperate climate, one that is not subject to protracted periods of extreme heat or cold. If the work is to be conducted on an efficient basis, a site should be selected in a part of the country having natural conditions similar to those in Maryland, Virginia, New Jersey, and Delaware, where settled weather may be depended upon from about the middle of May to the end of September.

The second factor for consideration is the water supply. This should be constant and under control so far as possible at all times. Too much stress can not be laid upon the importance of the latter point. The pond site should be located where it will not be in the path of destructive freshets, and in the construction of the ponds every effort should be made to bring the supply under complete control. Even under the best of arrangements a sudden downpour of rain will often flood a pond system and cause the loss of fish.

The most favorable source of water supply for a pond system is a good spring, but in its absence successful results may be expected by piping water from a neighboring stream, provided it is of suitable volume for the work and of good quality. The source should be at a sufficient elevation to permit the water to flow by gravity from one pond to the succeeding pond below. In this connection a slight slope in the contour of the pond site is a great advantage, as it is always desirable to provide for a fall of 5 to 6 inches between each pond, thus making it possible to use the same water over and over throughout the series. As a rule the last pond of a series is used for the cultivation of daphnia and other varieties of live fish food.

Some soils are not suited to pond construction, among them being sand and gravel, through which the water seeps rapidly away. The best soil is one with a clay bottom, as this acts to retain water. In the event that a site of this character is not available the excavation may be made slightly deeper than the intended depth of the pond and a 6-inch coating of clay plastered on the sides and bottom. To insure against loss of water through the porous ground near the surface it is advisable to insert boards in the pond margins and fill in the spaces behind them with clay.

All ordinary requirements in goldfish culture will be met by providing three ponds—the first and head of the series to serve as a spawning inclosure, the second as a nursery, and the third as a rearing pond. To these may be added storage and winter ponds, if desired. The spawning pond, which is the first to receive the water supply, may be formed, if desired, by dividing the rearing pond into two compartments. This may be done by fastening 1-inch mesh galvanized wire screen to a framework sunk into the mud in the bottom of the pond and made to extend about 1 foot above the water level. One advantage of this arrangement over a separate pond is that any young fish that develop from undiscovered eggs will be saved, the current carrying them from the spawning compartment into the rearing pond.

The rearing pond should be much larger than the spawning pond. Some goldfish breeders recommend an inclosure 8 by 20 feet in area as the most suitable for rearing purposes. The floor of this pond should slope from a water depth of 6 inches at one end to 24 inches at the opposite end, with the deepest part at the outlet to permit of drawing off the water when desired. Suitable plants should be rooted in the soil of this pond. Aquatic vegetation serves to oxygenate the water and also provides excellent hiding places for small fish and attracts insect life, thus constituting a source of supply of natural food for the fish.

Being required merely for the holding of fish intended for sale, the size of the storage pond should be governed by the requirements in this respect. Other than this its mode of construction need not differ materially from that of the other ponds.

The winter pond, whose purpose is the carrying of brood fish during cold weather, should be located near the spring or other source of water supply to prevent freezing, and when stocked with fish it should be kept under careful observation so that any ice forming on the surface may be promptly broken. If the weather is not too cold, goldfish may be held in open ponds throughout the year. In a severe climate the brood stock may be transferred indoors and held in barrels or tanks. Being very inactive during the winter, they require but little food. It is said that a compartment 4 by 8 feet and 4 feet deep will carry approximately 50 fish 8 to 10 inches long throughout the winter.

CONCLUSION

Cleanliness, good light, plants well distributed over the bottom, proper food in moderate quantity, scavengers, prompt removal of sick fish, and avoidance of overstocking are the essential factors for the maintenance of a successful aquarium. Thousands of goldfish have been killed by lack of observance of a few simple rules, and many are lost through mistaken kindness. The globe in the sunlight is a veritable torture cell. The fact that goldfish can endure a great deal in the way of unwholesome environment is not an excuse for torturing them. Moreover, with proper care they will thrive and attain a great age.

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ARTIFICIAL PROPAGATION OF SHAD[1]

By Glen C. Leach, *Assistant in Charge of Fish Culture*

CONTENTS

DESCRIPTION

The shad is anadromous, a member of the herring family (Clupeidæ), and is closely allied to the river herring or alewife (Pomolobus). Two species, *Alosa vulgaris* and *A. finta*, are indigenous to European waters, while in American waters three species have been recognized. Two of these, *A. alabamæ*, of certain streams of the Gulf of Mexico, and *A. ohioensis*, of the Ohio River, have little or no commercial value and are not artificially propagated; but the third, *Alosa sapidissima*, is the shad of commercial importance, and it is with this species that this paper deals.

The shad is the largest, best known, and most valuable member of the herring family in the United States. Its sides are silvery, and it is white below. When fresh from the ocean, it is dark bluish or greenish above, but this is largely lost after the fish enters fresh water at spawning time. There is a dark blotch behind the gill opening, frequently succeeded by a series of similar spots in one or two longitudinal rows, which are more plainly to be seen after the scales have been removed. The ventral fins often have black or dusky edges. The body is covered with large, silvery scales, easily detached, 52 to 64 of which occupy the lateral line. The ventral edge of the body is provided with bony scutes or modified scales giving the abdominal line a strongly serrated appearance. Twenty-two to twenty-four of these scutes occur in advance of the ventral fins and 12 to 16 behind them. The fins are small and weak; the dorsal is much nearer

[1] Appendix VIII to the Report of the U. S. Commissioner of Fisheries for 1924. B. F. Doc. No. 981. This document represents a revision and enlargement of the chapter on "The shad" from A Manual of Fish Culture, Based on the Methods of the United States Commission of Fish and Fisheries, with Chapters on the Cultivation of Oysters and Frogs, revised edition, published in 1900.

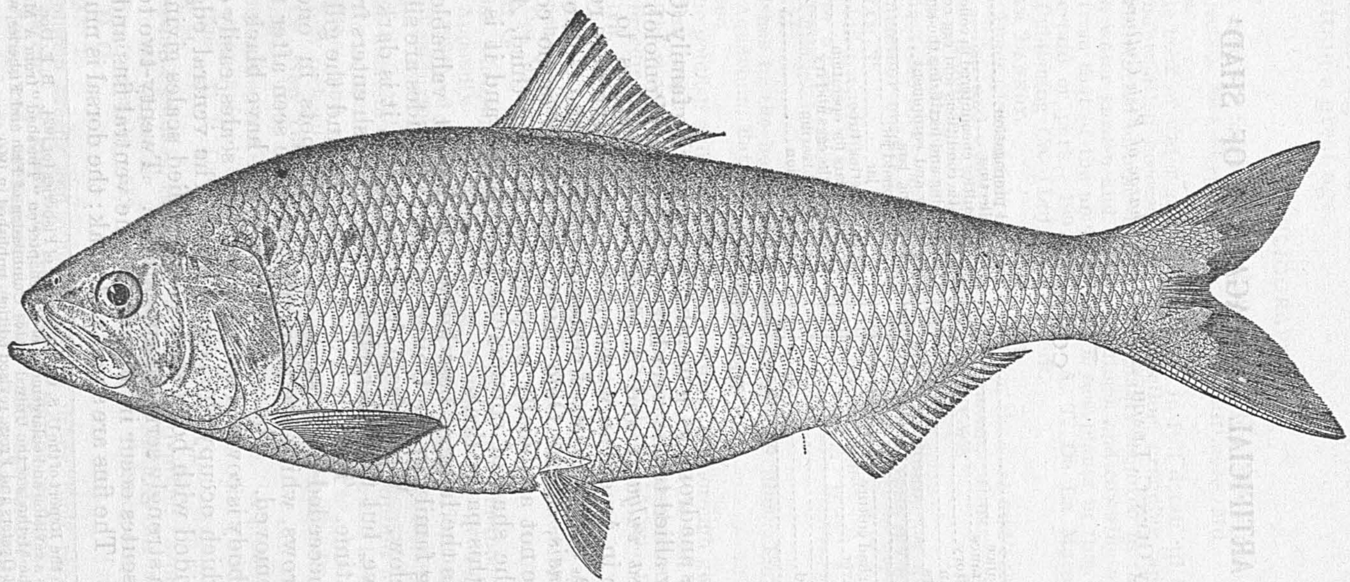

FIG. 1.—The shad (*Alosa sapidissima*)

the snout than the base of the caudal and is composed of 17 to 19 rays; the anal has 19 to 21 rays. The body is comparatively deep and compressed, the depth varying with sex and spawning condition. The head is also deep, with the free portion of the cheek deeper than long. The jaws are about equal in length, the lower one fitting into a deep notch on the tip of the upper in adult fish. Teeth are present in the young, but are not found in the jaws of the adult. The gill rakers are long, slender, and numerous, numbering from 93 to 120 on the first arch in adult fish. The numerous pinlike bones are chiefly several series of intermuscular bones, which support the muscle segments above the ribs. The peritoneum is white, and on the side of each body wall lies a narrow strip of dark muscle.

The shad may readily be distinguished from the other clupeoids with which it is frequently associated in the rivers. In all of these, except the hickory shad or hickory jack (*Pomolobus mediocris*), the cheek is longer than deep. In the latter two species it is about as long as deep, but the projecting jaw closely resembles that of the shad in shape. The river herrings, or alewives, are much smaller than the shad, have fewer and shorter gill rakers and larger eyes. In the branch herring (*P. pseudoharengus*) the peritoneum is pale, while in the glut herring (*P. æstivalis*) it is black.

Perhaps the most prominent and constant distinguishing marks, particularly in the young, where other differences are frequently less pronounced, are the differences in the shape of the cheek and the structure of the lower jaw. In the shad the cheek is deeper than long, whereas in all other clupeoids it is at least as long as deep and usually longer than deep. In the herrings the lower jaw is bent sharply upward from its tip, forming a prominent angle midway of its length, while in the shad this character is much less pronounced, the line of the lower jaw being comparatively straight.

The female shad is larger than the male, the average difference in weight being more than a pound. The mature males taken in the fisheries of the Atlantic coast weigh from 1½ to 6 pounds, the average being about 3 pounds; the females usually weigh from 3 to 6 pounds, the average being about 4½ pounds. The general average for both sexes is between 3¾ and 4 pounds. In the early history of the fisheries shad weighing 11, 12, and even 14 pounds were reported, but 9-pound shad are now very rare on the Atlantic coast and 10 pounds seem to be the maximum. In some seasons an unusual number of large shad (7 to 9 pounds) appear in certain streams. On the Pacific coast shad average a pound or more heavier than on the Atlantic, occasionally attaining a weight of 14 pounds; many have been reported weighing 9 to 12 pounds.

RANGE AND ABUNDANCE

The natural range of the shad is the Atlantic coast of North America, from Florida to Newfoundland, its center of abundance being from North Carolina to Long Island, N. Y. In the early history of the country its numbers excited astonishment. Nearly every river on the Atlantic coast was invaded by immense schools, which in their upward migration furnished an ample supply of good food.

Remarkable success has attended the stocking of the waters of the Pacific coast with shad. In 1871, 12,000 shad fry from the Hudson

River were liberated in the Sacramento River by the California Fish Commission, and in 1873 the United States Fish Commission made a second deposit of 35,000. Subsequent plants in the Sacramento, aggregating 609,000, were made by the United States Fish Commission from 1876 to 1880. From these small colonies the shad have multiplied and distributed themselves along nearly 3,000 miles of the coast from southern California to southeastern Alaska. They reached Rogue River, Oreg., in 1882, and were taken in the Columbia as early as 1876 or 1877. About 1881 or 1882 they appeared on the coast of Washington, reaching Puget Sound in 1882. They were taken in the Fraser River, British Columbia, in 1891; in the Stikine River, near Wrangell Island, Alaska, the same year; and are now found along the entire coast from Los Angeles County, Calif., to Chilkat, Alaska, covering 22° of latitude. Their distribution from the standpoint of commercial importance is from Monterey Bay to the Columbia River.

On the northern part of the coast shad fry were first introduced in 1885, the number being 60,000. Of these, 50,000 were deposited in the Willamette River and 10,000 in the Snake River. The following year 850,000 were introduced into the Columbia River.

The first run of shad in California waters, after the young fry were liberated in 1871, appeared during the spring of 1877, and several thousand were sold in San Francisco. In 1886 it was estimated that 1,000,000 mature shad were taken from the waters of the State and sold in local markets. By 1912 shad had become so plentiful as to be almost a nuisance. In 1915, 33 carloads of fresh shad were shipped to eastern markets, and in addition to the number shipped it is estimated that the local markets absorbed 4,000,000 pounds, while 700,000 pounds of shad roe were sold fresh or put up in ½-pound cans.

Owing to heavy fishing, signs of depletion were already in evidence. The number of shad entering the Sacramento River in 1915 was estimated at 60 per cent of the run of the previous year, and the run in 1916 was estimated at 40 per cent of the run for 1915. This depletion was apparently due to extreme overfishing. The use of large meshed gill nets permitted the escape of large numbers of male fish but few females. In 1915 the males outnumbered the females 20 to 1 in the San Joaquin River, and in 1916 nearly 40 to 1. At the present time the annual catch of shad in California is considerably less than 1,500,000 pounds.

The shad is now one of the abundant fishes in the rivers of California. As a result of the liberation of the first two consignments adult shad were caught in 1874, and by 1876 this fish had become numerous. In 1880 specimens of all sizes were taken in the Sacramento River and Monterey Bay, and it was evident that the shad had begun to multiply, its increase up to 1883 being very great. On the west coast it is most numerous in San Francisco Bay and its tributaries, where, contrary to its habits in Atlantic waters, it is found throughout the year. In the Columbia it is regularly found as far upstream as the Cascades, about 150 miles above the mouth of the river.

The principal shad fisheries of California are in upper San Francisco Bay and in the delta regions of the Sacramento and San Joaquin Rivers. The vast delta basin of the San Joaquin has proved an ideal spawning place. Shad are taken occasionally in Monterey Bay, but these are utilized by the fresh markets, for they are here taken when they are not running in large numbers in the rivers. Shad ascend the Sacramento River for 300 miles or more. Here they are caught in bass or salmon nets. Because of the inconvenience of shipping from this district and because of the low prices prevailing, extensive fishing here is hardly warranted, and often after the fish are caught they are dumped overboard.

Large numbers of shad fry have been liberated in tributaries of the Gulf of Mexico, but without results. Between 1873 and 1892 several million fry were experimentally placed in Great Salt Lake, Utah Lake, and Bear Lake, Utah, and from 1884 to 1886, 3,000,000 fry were liberated in the Colorado River at Needles, Ariz., but these experiments were unsuccessful.

The history of the shad fisheries indicates that as early as 1880 there had been a marked decrease in the yield from nearly every river on the eastern coast. This was before the results of artificial propagation had any effect. Following is a summary of production for various years:

	Pounds
1880	19, 400, 000
1888	38, 100, 000
1896	50, 398, 860
1908	25, 941, 000
1918–1922	15, 138, 989

These figures indicate that in recent times the maximum yields were attained in the nineties, and that the catch has since declined below the level of 1880.

The abundance of the anadromous fishes is too easily overestimated. Crowding as they do at one particular season into the restricted watercourses of our coastal slopes, they become an easy prey to man's pursuit, and unless the greatest foresight and restraint is exercised in connection with the fisheries their numbers are likely to diminish rapidly and their complete extinction is perhaps a matter of only a few years. On the Atlantic coast the commercial fisheries are, in many instances, concentrated at or near the mouths of the rivers, this tending to prevent an adequate escapment to the spawning areas in rivers. The erection of dams entirely cuts off large spawning areas, and the destruction of spawn and fry by sewage and other trade and industrial wastes and the large amount of sediment carried by the rivers at flood stage have made heavy drains upon the natural abundance of the shad. In many streams of the Atlantic seaboard the shad have been destroyed entirely by these combined agencies; in the others the number of shad that reach their spawning areas has been so diminished that natural reproduction is becoming yearly less effective in keeping up the supply.

COMMERCIAL IMPORTANCE

The shad is one of the most palatable and popular of fishes. Its flesh is rich but not oily, and the roe is considered a great delicacy. Since the days of George Washington and John Marshall "planked shad" has been regarded as one of the most delicious of dishes for the table. In value, it is the most important fish of the rivers of the Atlantic coast and, next to the Pacific salmon, the most important anadromous species of North America. Among the fishes of economic value in the United States only the salmon and cod exceeded it in value for many years, and, considering all branches of the fishing industry, only the whale fishery and oyster fishery, in addition to those mentioned, were financially more important than that of the shad.

In 1908 the catch of shad of the Atlantic seaboard was approximately 25,941,000 pounds, representing a value of $2,091,500 to the fishermen. According to recent canvasses, the catch of shad by States, in pounds and value to the fishermen, was as follows:

Date and locality	Pounds	Value
New England, 1919:		
Maine	414, 455	$28, 393
Massachusetts	62, 337	4, 309
Connecticut	463, 203	86, 637
Total	939, 995	119, 339
Middle Atlantic, 1920-21:		
New York (1921)	115, 692	27, 128
New Jersey	168, 637	44, 460
Pennsylvania	18, 872	5, 834
Delaware	86, 836	16, 312
Maryland (1920)	1, 867, 196	355, 217
Virginia	7, 293, 805	1, 145, 106
Total	9, 551, 038	1, 594, 057
South Atlantic, 1918:		
North Carolina	1, 657, 036	$376, 696
South Carolina	167, 462	29, 085
Georgia	100, 510	26, 960
Florida	963, 606	135, 844
Total	2, 888, 644	568, 585
Pacific, 1922:		
Washington	48, 039	769
Oregon	578, 003	11, 332
California	1, 133, 270	55, 513
Total	1, 759, 312	67, 614
Grand total	15, 138, 989	2, 349, 595

HABITS AND LIFE HISTORY

Notwithstanding the economic importance of the shad and the attention that has been devoted to its artificial propagation for so many years, there is an extreme paucity of explicit knowledge as to its habits and life history. The extent and direction of the migrations of anadromous fishes are factors of vital interest. How is the run in one river affected by the fishing operations in another, and in what degree does artificial propagation at one point yield returns of value in another? The question also arises as to the origin of the "sea shad" which are a feature of the local markets on the northeastern coast. Are they bred in the southern rivers or are they a distinct race?

SHAD IN THE OCEAN

The shad passes most of its existence at sea, and little is known of its habits and movements when out of the rivers. The ocean areas to which it resorts are unknown, and what its salt-water food consists of has not been determined. In the Gulf of Maine it is known to associate in large numbers with mackerel and herring during the months of June, September, and October, being most numerous in June. It has been taken at North Truro, Mass., in the fall, when the ocean temperature was from 43° to 49°; in the month of November it has been found on the west side of Sakonnet River, R. I.; in May and June it has been captured with mackerel a few miles northeast of Cape Cod Light. Some instances of capture indicate that under certain conditions the adults may remain in the fresh-water rivers a whole year. In November, 1890, 600 were taken in the Chesapeake

Bay. It has been found in the Potomac River occasionally, in limited numbers, in August and September, and even during the last week in December. Its movements are apparently largely controlled by the water temperature. It is believed that it seeks to occupy an area having a temperature of 60° or 70°, and that its migrations are determined by the shifting of this area.

SHAD IN THE RIVERS

The annual migration of the shad from the ocean to the rivers is for the sole purpose of reproduction. It ascends to suitable spawning grounds, which are invariably in fresh water, occupying several weeks in depositing and fertilizing its eggs in any given stream.

Its migrations from the sea are in quite a regular succession of time with relation to latitude. It first appears in the St. Johns River (Fla.) about November 15, the season of greatest abundance being February and March. In the Savannah River (Ga.) and the Edisto (S. C.) the run begins early in January and ends the last of March. In the North Carolina rivers these stages of the migration are a little later. In the Potomac River advance individuals appear late in February, but the fish is most numerous in April. In the Delaware River the maximum run occurs about May 1. It reaches the Hudson River the last of March, and is found in the Connecticut toward the end of April, is most abundant the last of May, and leaves the stream late in July. In the Kennebec and Androscoggin Rivers (Me.) it is first taken in April and has left by the middle of July. In the St. John River (New Brunswick) it appears about the middle of May, and in the Miramichi River (New Brunswick) late in May.

The main body of shad ascends the rivers when the temperature of the water is from 56° to 66°, the numbers diminishing when the temperature is over 66°. The movement of the shad up the rivers is not constant, but in waves, causing a rise and fall in the catch. Successive schools enter the Potomac from February to July, the males preceding the females. Of 61,000 shad comprising the first of the run received at Washington, D. C., from March 19 to 24, 1897, 90 per cent were males. Toward the close of the season males are extremely scarce.

The erection of impassable dams along the rivers and streams was probably the first thing to curtail the natural spawning grounds of these fish and to seriously check their natural increase.

As shad enter the rivers only for the purpose of spawning, the fisheries are necessarily prosecuted during the spawning season and often upon the favorite spawning grounds. The increase of population has created a larger demand for these fish, and an increased intensity in the fishing has resulted. The number of shad that reach fresh water has therefore been greatly curtailed by assiduous fishing with all kinds of contrivances in the estuaries and in the mouths and lower parts of rivers.

From spawning until their return to the rivers shad eggs and fry are preyed upon by other fish, so that the majority of the young do not survive their few months' sojourn in fresh water, and of those that leave the rivers each season a very small percentage reaches maturity to deposit its eggs and contribute to the perpetuation of the species. In the rivers striped bass, white perch, black bass, and other predacious fishes devour the young, and when they reach salt water sharks, horse mackeral, kingfish, etc., undoubtedly destroy many adults. It has been observed by North Carolina porpoise fishermen that as the shad swim close along the shore the porpoises follow and feed on them until they pass into fresh water. In the rivers the adult shad is comparatively free from enemies.

FOOD

After entering the rivers the shad-takes but little, if any, food previous to spawning but after casting its eggs it bites at flies or any small shining object and has been known to take the artificial fly. The mouth of the adult is practically toothless, and its throat contains no functionally active teeth. The water that passes through the branchial filter—the gill rakers—is deprived of the small animals that are too large to pass through its meshes. It is a common remark with fisherman and others that food is rarely found in the stomach of the adult shad in fresh water, but examinations have shown that the shad does, in some instances, eat small Crustacea, insects, etc. The only substance commonly found in its stomach in fresh water has the appearance of black mud. It is held by some that the shad swims with its mouth open and may unintentionally swallow the small organisms found in its stomach under such circumstances, but as far as observation of fish in aquaria and experiences of net fishermen go the shad does not swim with its mouth open.

SPAWNING

Shad in spawning condition may be found anywhere above brackish water, and under favorable temperature conditions spawn whereever they happen to be, but in some river basins they exhibit a well-defined choice of spawning places, preferring localities below the mouths of creeks, where the warmer water of creeks mingles with the colder channel water. The shad lays its eggs during the highest daily average temperature, a condition realized about sunset, when the warmer shoal water commingles with the colder channel water, establishing a balance. The principal spawning occurs from 5 to 10 p. m. Observations on the Potomac River show that of the eggs from shad caught in a seine only 11 per cent were taken between midnight and noon, the percentage in the morning being 14 one year and 8 another.

The eggs in the ovaries remain in a compact mass until they ripen, at first occupying but a small space but gradually increasing until they distend the whole abdomen, the average weight of the ovaries being about 13 ounces. Close examination at the approach of the spawning time will disclose large maturing eggs of rather uniform size and others smaller and of variable size. Whether the latter are the forming eggs for the next year, for two or three succeeding years, or for the lifetime of the fish, has not been determined, nor is it known whether shad spawn every year. The small and shrunken ovaries of a spent fish are found still full of these eggs of different sizes. Shortly before spawning, transparent eggs of large size, contrasting strongly with the opaque golden hue of less mature ones, will be found scattered through the still compact ovarian mass, gradually becoming more and more numerous. The mature eggs are finally freed from the remainder of the ovary and extrusion begins, a liquid stream of eggs and mucus flowing from the oviduct on the slightest pressure of the abdomen.

Freshly deposited shad eggs are of a pale amber or pink color, and are transparent. They are about $\frac{1}{14}$ inch in diameter and somewhat flattened and irregularly rounded in form. The egg membrane is much wrinkled and lies in close contact with the contained vitellus. Immediately after fertilization the egg becomes spherical through the absorption of water and apparently gains very much in bulk, measuring about $1/7$ of an inch in diameter; but this gain is only the distended egg membrane, the vitellus or true germinal and nutritive portion not having increased. The vitellus is heavier than water, and a large space filled with fluid now exists between it and the membrane, the vitellus rolling about and changing its position as the position of the egg membrane is altered. No adhesive material is found on the outside of the membrane, though when first extruded the eggs are covered with a somewhat sticky ovarian mucus.

In a state of nature the shad deposits its eggs loosely in the rivers without building a nest, the two sexes running along together from the channel toward the shore and the eggs and milt being ejected simultaneously. On quiet evenings, at the height of the season, spawning shad may be heard surging and plunging along the shores. By fishermen this is termed "washing."

Shad are prolific, but much less so than many other food fishes. The quantities of eggs taken by spawn takers do not represent the actual fecundity, for many are cast in advance of stripping. The average number is not more than 30,000. Single fish have been known to yield 60,000, 80,000, 100,000, and 115,000 eggs, and on the Delaware River, in 1885, one yielded 156,000. Many eggs fail to be fertilized, and but a comparatively small percentage of those impregnated are hatched. After being extruded the eggs sink to the bottom, where they remain until hatched subject to the attacks of fish and other water animals. Eels are very destructive to shad spawn and often attack shad caught in gill nets, devouring the undeposited eggs and sometimes mutilating half the catch of a gill-net fisherman.

The development of fungus is one of the greatest dangers to shad eggs in a natural state, and another potent agency for their destruction is the mud brought down by heavy rains, burying and suffocating the eggs.

After spawning, shad are denominated "down-runners," "racers," and "spent fish." They are then very lean and hardly fit for food, but they soon begin to feed and have become fatter by the time they reach salt water in the summer or fall.

YOUNG SHAD

In the Middle Atlantic States the young fish remain in the rivers until the cool weather of fall comes; then they begin to drop downstream, and by the last of November have passed out into the oceans or bays and are lost sight of until they come back, 3 or 4 years later, full-grown and ready to spawn. They leave the Potomac River when the water falls to about 40°, by which time they are about 3 inches long. They have been observed in great abundance about

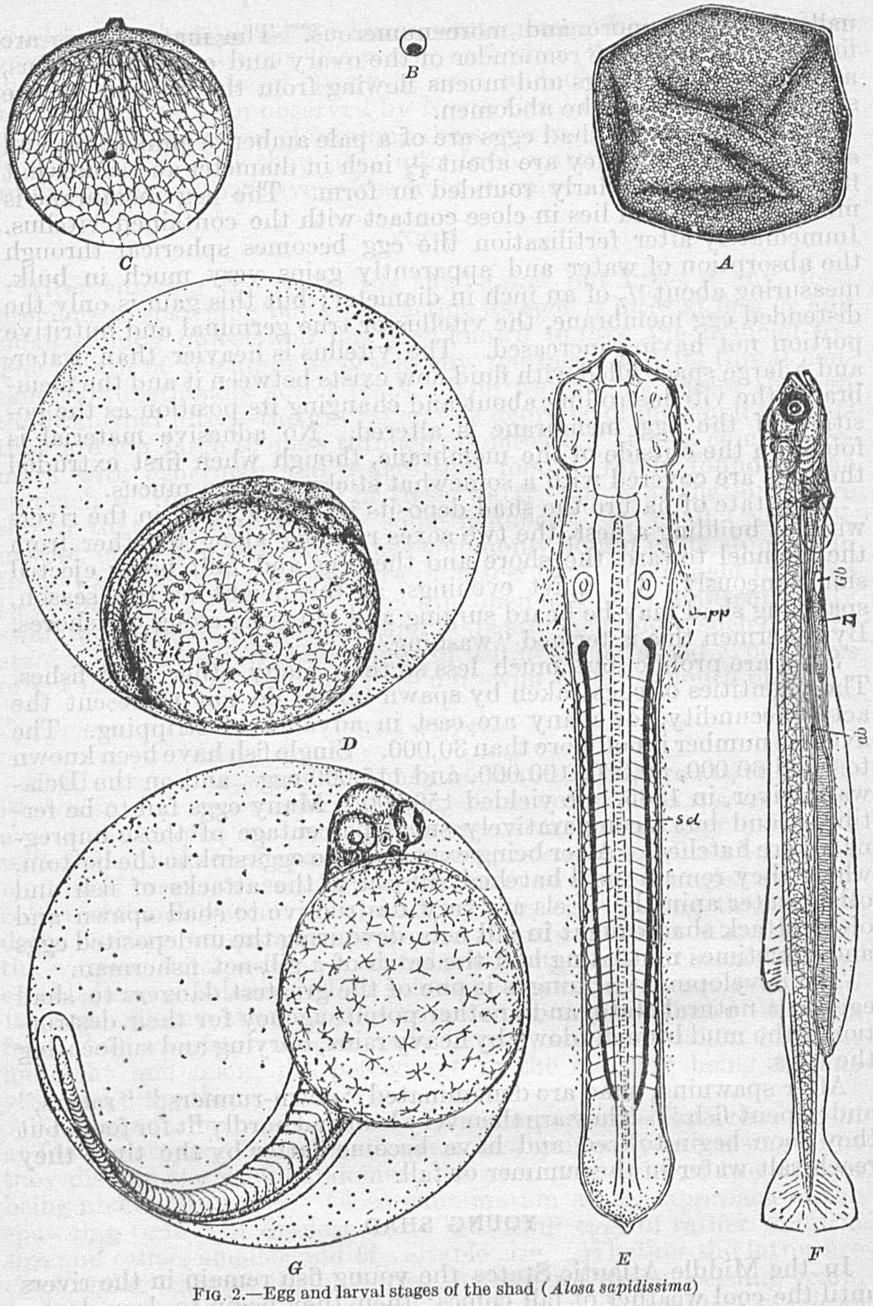

FIG. 2.—Egg and larval stages of the shad (*Alosa sapidissima*)

A. Freshly extruded egg enlarged, showing its envelope much wrinkled.
B. Shad egg, showing vitellus and distended egg membrane, natural size.
C. Shows the gradual accumulation of germinal matter at one pole of egg, the polar prominence externally, and presence of plasmic processes extending down through the vitellus.
D. Embryo shad in its natural position in its spacious enveloping membrane. From a photograph.
E. Diagrammatic representation of an embryo to show course of segmental ducts *sd* and extension outward of pectoral plates *pp*, which are intimately concerned in the development of pectoral fins.
F. Side view of a young shad 13 days old, viewed as a transparent object. *ab*, rudimentary air bladder; *L*, liver; *Gb*, gall bladder.
G. An embryo in its envelope, on the third day of development, nearly ready to hatch.

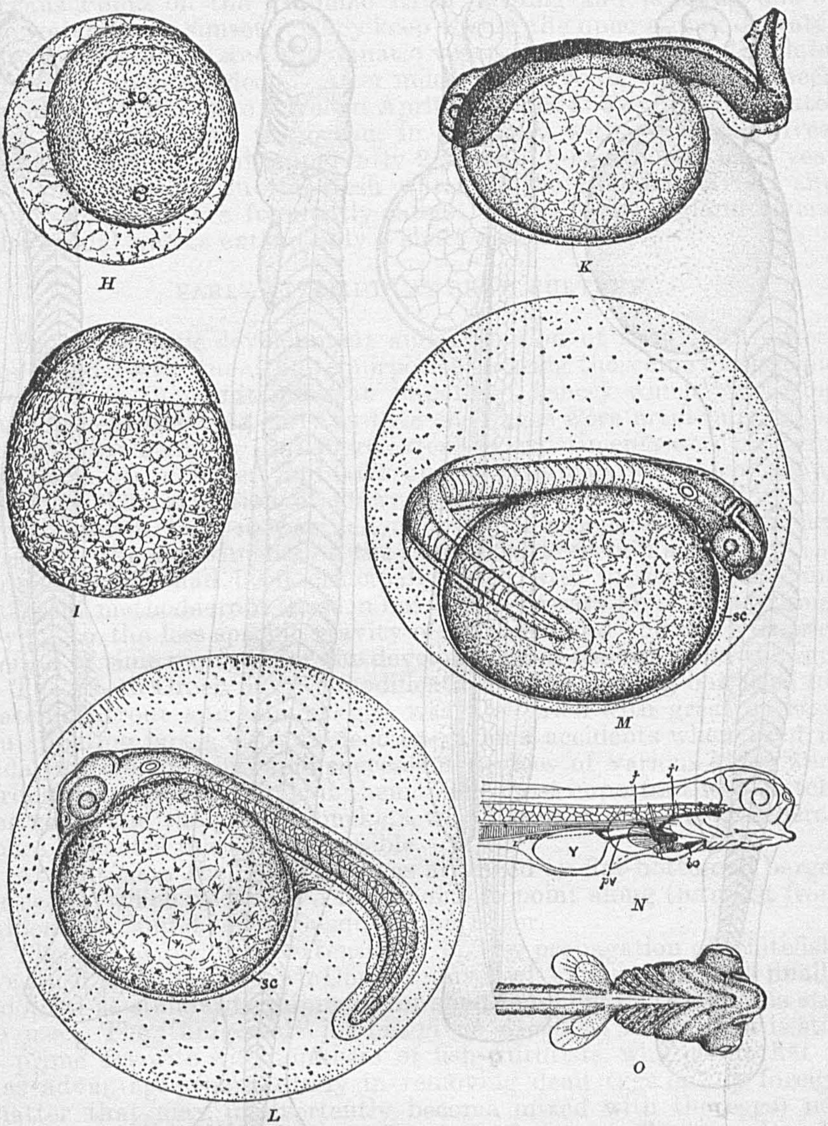

FIG. 3.—Egg and larval stages of the shad (*Alosa sapidissima*)

H and *I*. Two views of an egg after the blastoderm has spread considerably and the embryonic area *e* is well defined.
K. View of unhatched embryo, which developed in a temperature of 45° F., producing distortions of tail.
L. An egg envelope with its contained embryo, 44 hours after impregnation, viewed as a transparent object.
M. An egg envelope with its contained embryo at the beginning of the third day of development. From a photograph.
N. Anterior portion of a young fish on fourth day. To show relations of liver *L* to yoke *Y*, over which the portal vessel *pv* passes forward to empty into the venous sinus, in common with the anterior and posterior jugulars *j'* and *j*, *ba* bulbus aortae, *ve* ventricle.
O. View of fore part of a young fish 17 days old, from ventral side.

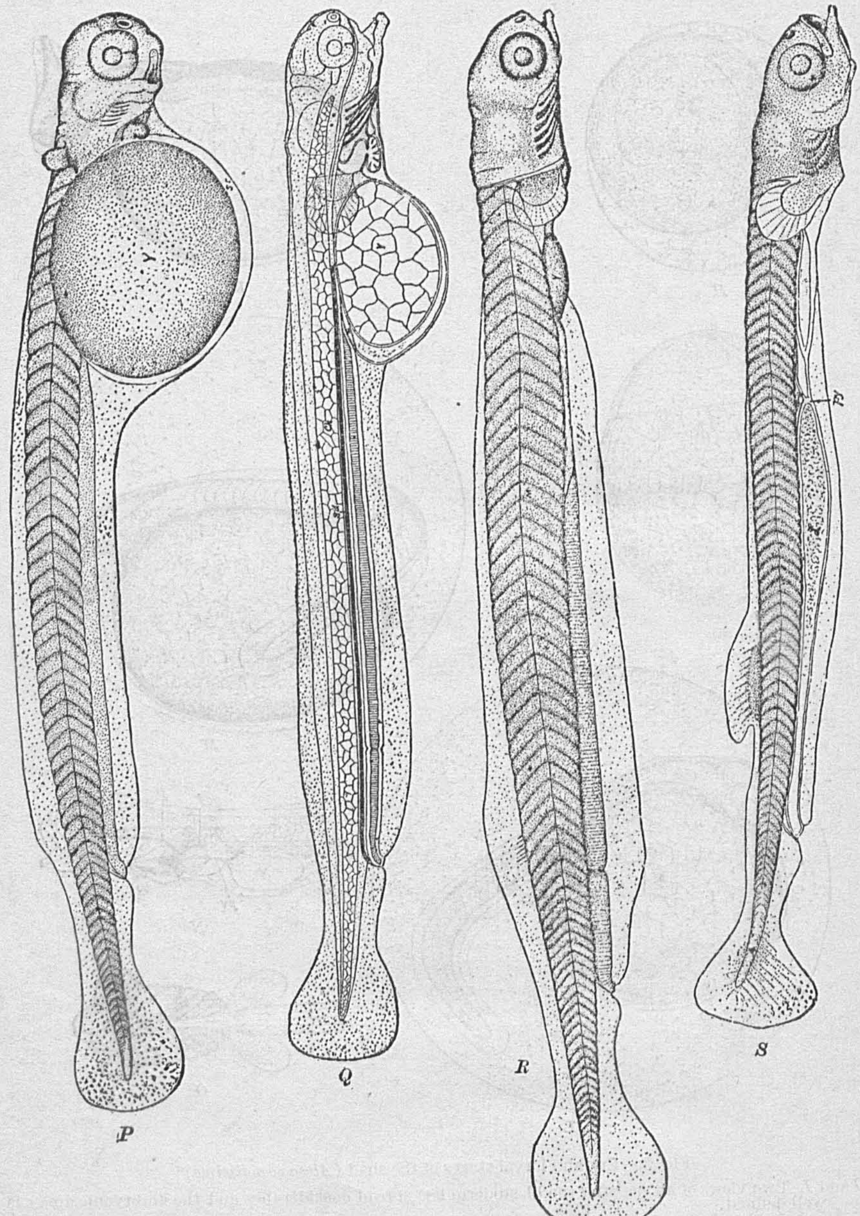

FIG. 4.—Larval stages of the shad (*Alosa sapidissima*)

P. Young fish immediately after hatching, viewed as an opaque object and somewhat obliquely from one side, to display the relations of branchial and hyomandibular arches, and position of pectoral fin.
Q. Young fish third day after hatching, viewed as a transparent object to show extention of segmental duct forward; chorda *ch*.
R. Young fish 5 days after hatching, very much enlarged, and viewed as an opaque object. Only a slight remnant of the yolk sac *Y* remains.
S. Young fish 17 days after hatching, viewed partly as an opaque and partly as a transparent object; *py*, pylorus and rudimentary air bladder above it; *I*, intestine, filled with the remains of ingested food. The opercula are already so far developed as partly to conceal the gills.

Bryans Point, on the Potomac River, feeding and jumping out of the water about sunset. They keep within the open streak of water between the shores and the aquatic vegetation that covers the flats, in water 2 to 5 feet deep. After mild winters young shad have been found in the Potomac River in April, 30 miles above brackish water and 160 miles from the ocean, in company with young alewives. Some immature shad, apparently 2 years old, are caught each year in seines operated in the fresh water of the Potomac River, and undersized shad are frequently caught in the New England rivers, where tidal waters extend only a short distance.

EARLY ATTEMPTS AT SHAD CULTURE

The systematic development and extension of shad culture were undertaken with the definite purpose of testing the value of artificial propagation in maintaining an important fishery which was being rapidly depleted. As early as 1848 shad eggs were artificially taken and fertilized, and in 1867 more extensive experiments were made on the Connecticut River, and later on the Potomac, with encouraging results. The attention of many States was thus attracted to the work, and in 1872 it was taken up by the General Government. Prior to the experiments on the Connecticut, certain species of the salmon family had been principally dealt with in fish-culture, and different methods from those in use were necessary for shad hatching, owing to the less specific gravity of shad ova and the much shorter period of time required for the development of the fish from the egg.

The "Seth Green box," a modification of the floating box used for hatching trout and salmon eggs, was first tried with great success, but floating boxes were subject to various accidents when used in tidal waters, and in rapid succession devices of various kinds were brought forward to supplant them. The most important were hatching cones and the plunger buckets, which, though imperfect, rendered more extended operations possible.

At that time the apparatus was arranged on flat-bottomed barges or scows, which were towed from point to point along the coast from Albemarle Sound to the Susquehanna River.

The Chase jar, used extensively in the propagation of whitefish, was also tried, but the McDonald universal hatching jar was finally adopted as standard equipment for shad hatching in 1882 and is still in use. The "universal" jar has given excellent results and is still a prime favorite with numbers of fish-culturists, who claim that it has advantages (particularly in removing dead eggs or any foreign matter that may inadvertently become mixed with the eggs) not possessed by any other type. In view of the excellent results obtained from the use of the Chase and other types of open-top jars, their greater simplicity in operation, absence of complicated parts and fittings, and their lower cost, it is doubtful that the "universal" jar possesses advantages over the other types that would warrant its installation in equipping a new hatchery.

During the years of experimental work, from 1872 to 1880, 97,471,700 shad fry were planted, beginning with 859,000 in 1872, while in 1880, 28,626,000 were distributed. Prior to 1880 deposits of a few hundred thousand each were made in as many different streams as possible, but the increased production of young fish made it possible to ship and plant the fry by the carload, and by 1884 shad culture was established on a large scale, barge operations were abandoned, and the work conducted on shore. The basins of the Chesapeake Bay and Delaware River had meanwhile been selected by the United States commission as the natural seat of operations, though the State commisions from Massachusetts to South Carolina were actively engaged on their own account. At the present time Maryland and Connecticut are the only States actively engaged in shad culture.

Every river on the Atlantic coast from Massachusetts southward has been examined by the agents of some State commission or the United States, or by both, in order to determine the natural spawning grounds of the shad. On nearly every stream hatcheries have been operated at one time or another, but usually eggs were not obtained in sufficient numbers to justify continued operations.

In certain river stretches, apparently favorable, no ripe fish were found; for example, in the Roanoke River for 15 miles above its mouth, where 10,000 to 15,000 shad were taken annually, mature eggs were not found, though the fish were spawning just below there, as they did many miles above at Weldon. In the Sutton Beach seine, the one in North Carolina waters that had afforded the most spawn, only about one spawning shad to each 100 was caught, and the annual catch of this seine was 30,000 to 75,000 per annum. In view of such facts, it is not remarkable that difficulty has been experienced and time consumed in deciding on permanent locations for hatcheries.

The spawning period varies widely in different seasons; in some years shad are numerous and in spawning condition two or three weeks after the time when they have ordinarily disappeared. They deposit eggs at some point along the coast for six continuous months.

The following streams have been occupied by hatcheries, as two of them are now, and it will be observed that the approximate spawning periods, beginning early in the South, become gradually later toward the North.

Waters	Place	Period
Edisto River	Jacksonboro, S. C.	Mar. 5 to 26.
Albemarle Sound	Avoca, N. C.	Apr. 1 to 30.
Potomac River	Below Washington, D. C.	Apr. 15 to June 10.
Susquehanna River	Below Havre de Grace, Md.	Apr. 17 to June 15.
Delaware River	Gloucester, N. J.	May 10 to June 20.
Hudson River	Below Albany, N. Y.	May 15 to June 30.
Housatonic River	Birmingham, Conn.	Do.
Connecticut River	Holyoke, Mass.	June 15 to July 5.
Merrimac River	North Andover, Mass.	June 1 to July 15.

The more important points at which the Bureau of Fisheries has conducted shad-cultural operations in the past are at Battery Island, near the mouth of the Susquehanna River, and at various points on the Delaware River, principally at Gloucester N. J.

SUSQUEHANNA RIVER

The shoal water in the neighborhood of Battery Island was an extensive and valuable spawning ground. The station was conveniently located on the island and the possibilities for egg collecting appeared to be almost unlimited. Hundreds of gill-net fishermen were engaged, and large seines were operated within easy distance. As early as 1886 the egg collections exceeded the capacity of the hatchery and numbers were diverted to other points. In 1888 over 105,000,000 were taken, and in 1898 the egg collections totaled 209,992,000. Both egg collecting and hatching were carried on, and the establishment was complete in itself. Work at this point was first undertaken in 1877, and in 1880 a permanent station was established, which was continued in operation during each shad season up to and including the season of 1916.

DELAWARE RIVER

The steamer *Fish Hawk* was employed in shad hatching on this river nearly every season from 1887 to 1910, the egg collecting and other labor being performed by the crew. An interesting feature of the work was the large yield of eggs per fish. Eggs from this river were saved regularly from seines, but the available product among the gill-net fisherman was never fully ascertained. The eggs collected by the *Fish Hawk* numbered 51,983,000 in 1899.

The abandonment of the work at both of these places was brought about by the conditions already mentioned. At the present time two stations are maintained for shad culture—on the Potomac River at Bryans Point, Md., and on Albemarle Sound, N. C.

POTOMAC RIVER

The Potomac River immediately adjacent to Fort Washington (12 miles below Washington, D. C.) was and continues to be more productive of ripe shad eggs than any other place of equal area. This was discovered as early as 1880, and a station was soon developed there with full equipment. In March, 1892, the station was moved to its present location at Bryans Point, on the Maryland side of the river opposite Mount Vernon.

As shown in the following table, there has been considerable fluctuation in the numbers of eggs that have been available for artificial propagation each year at the Potomac River hatchery since the inception of the work at that point.

Year	Number of eggs taken	Year	Number of eggs taken
1880	20,749,000	1902	45,971,000
1881	43,200,000	1903	86,370,000
1882	21,800,000	1904	34,636,000
1883	24,274,000	1905	23,649,000
1884	19,000,000	1906	12,695,000
1885	22,576,000	1907	39,278,000
1886	36,362,000	1908	30,559,000
1887	59,435,000	1909	13,080,000
1888	81,177,000	1910	34,796,000
1889	58,233,000	1911	30,526,000
1890	35,202,000	1912	88,727,000
1891	32,980,000	1913	30,913,000
1892	13,446,000	1914	29,808,000
1893	9,423,000	1915	16,012,000
1894	32,393,000	1916	63,815,000
1895	66,065,000	1917	77,580,000
1896	64,788,000	1918	40,231,000
1897	39,707,000	1919	50,487,000
1898	68,724,000	1920	42,570,000
1899	49,283,000	1921	15,620,000
1900	67,904,000	1922	47,478,000
1901	33,321,000	1923	17,627,000

It appears to be the concensus of opinion that abnormally high or low temperatures affect the runs of fish. If the temperatures are high, the fish tend to leave the main channels and scatter over the shallow-water areas of the bay, where they are more easily taken by the traps, thus reducing the numbers that ultimately reach the spawning areas. If the temperatures are low, the fish tend to follow the deeper channels, and thus a larger number reach the spawning areas and the take of eggs is correspondingly larger.

Egg collections at other points where artificial propagation has been undertaken gradually dropped from large numbers (200,000,000 representing the full capacity of the hatchery for several seasons on the Susquehanna River) to a point where hatchery operations were no longer practicable. The causes effecting this condition are, of course, more or less conjectural, but it is noteworthy that the shad fishery of the Potomac River has had, in addition to the benefits of artifical propagation, some protection from the excessive fishing to which other areas have been subjected, by the enforcement of the regulatory measures of the War Department maintaining lanes unobstructed by fishing apparatus for purposes of navigation.

ALBEMARLE SOUND

The hatchery on Albemarle Sound was permanently located in 1900 near the town of Edenton, adjacent to what was one of the most important shad-fishing grounds in the country. This region for a number of years yielded annually upward of 8,500,000 pounds of shad, valued at about $350,000, and contributed the principal part of the shad of the northern and eastern markets in winter and early spring. The egg collections at this station are indicated in the following table:

Year	Number of eggs taken	Year	Number of eggs taken
1881	5,727,000	1911	74,630,000
1897	27,901,000	1912	115,617,000
1898	12,334,000	1913	138,912,000
1899	21,267,000	1914	42,885,000
1900	10,404,000	1915	39,040,000
1901	75,400,000	1916	16,060,000
1902	37,987,000	1917	7,625,000
1903	36,320,000	1918	4,223,000
1904	10,276,000	1919	31,323,000
1905	6,748,000	1920	21,607,000
1906	25,643,000	1921	21,710,000
1907	23,614,000	1922	35,201,000
1908	55,806,000	1923	17,877,000
1909	59,685,000	1924	16,452,000
1910	69,233,000		

PACIFIC COAST

With the appearance of the shad as an important feature of the commercial fisheries of the Pacific coast, the desirability of artificial propagation was recognized, and as early as 1906 shad culture was undertaken at points on the Willamette River, Oreg. The work was continued on this river, principally at Willamette Falls and St. Helens, Oreg., until the summer of 1920. It was discontinued at that time because, by action of the proper State authorities, fishing was prohibited entirely on the principal spawning areas of the river. The spawning season in this river extends from late May to early June.

ARTIFICIAL PROPAGATION

In the Potomac River, where it is still possible to conduct shad-cultural operations successfully, the average annual catch for the five-year period, 1919 to 1923, was 543,000 fish. The average take of eggs for this period was 34,756,400 per annum. The egg take on the spawning areas in proportion to the catch of fish in the entire river was 64,000,000 eggs per 100,000 fish. At the present time, under existing conditions on the Potomac River, a maximum egg take is secured. Assuming that similar conditions would obtain in other streams, it is obvious that there are very few streams on the Atlantic coast with a sufficiently large run of shad to warrant the establishment of propagating stations; in such streams the rehabilitation of the fishery must be secured by other means. To this end it is desirable that the shad be unmolested on the spawning areas, that a proper escapement be provided for, and that the commercial fishermen strip the ripe fish caught in their nets, fertilize the eggs, and return them to the water to develop under natural conditions.

The methods hereafter described are those in use at the Bryans Point (Md.) hatchery, though they do not differ in any material way from those employed elsewhere.

EGG COLLECTING

For a number of years it was the custom to employ spawn takers to visit the seines or gill nets employed in the commercial fishery for the purpose of obtaining any mature eggs that might be available in the catch of shad. In recent years, with the advent of the motor boat and the more general use of gill nets, the fishery is no longer concentrated but is extended over a much wider area than formerly. Under these conditions the employment of a sufficient number to cover the work is impracticable and the method has been entirely abandoned on the Potomac River, though it is still followed to some extent in the work on Albemarle Sound, N. C.

On the Potomac River the commercial fishermen take shad eggs for artificial propagation, fertilize them, and deliver them on the fishing grounds or to collecting boats sent out for the purpose. In advance of the spawning season all fishermen operating within a reasonable distance of the hatchery are provided with pans, dippers, and other necessary equipment to take and care for the eggs, and each day's collection is promptly delivered by the fishermen. After the eggs have been in the hatchery for 48 hours (at the expiration of which time mortality has practically ceased) all good eggs remaining are carefully measured, and each fisherman receives compensation at the rate of $22.50 per million eggs, the measurement being based on 28,000 eggs to a fluid quart.

DIFFICULTIES ENCOUNTERED IN COLLECTING EGGS

A peculiar characteristic of the shad is that fish in prime spawning condition are rarely taken by any form of fishing appliance except between the hours of 4 and 10 o'clock p. m. Eggs in fish taken during the morning hours seldom are sufficiently advanced to respond to artificial treatment, and fish taken after 10 p. m. are usually spent or partially so.

As a rule, the best eggs are secured from the gill nets. Eggs from fish taken in the large seines usually are of an inferior quality, but those from the smaller seins, which are landed very soon after the fish have been surrounded, are of a better grade. The eggs from fish held in pound nets for several hours are valueless for artificial propagation, since shad die very soon after capture and the eggs rarely are susceptible of fertilization longer than 20 minutes after the fish have been taken from the water. This peculiarity is, perhaps, one of the most deterrent factors against large egg collections.

Gill nets are most effective at night and are customarily lifted during the last stages of the ebb tide and the beginning of the flood. Therefore, while other conditions may be favorable, but few eggs are obtained unless the proper stage of the tide coincides with the spawning hours of the fish, since at other times they are not in good condition for stripping.

A scarcity of male fish toward the end of the season often cuts short operations when eggs are plentiful. Unsuccessful attempts have been made to capture the males at such times by using gill nets having a mesh smaller than that in the nets used by the market fishermen. Attempts have been made, also, to pen the adults, but without success, as the fish become diseased and their eggs spoil within them.

CLIMATIC CONDITIONS AND EGG COLLECTIONS

During their migration up the rivers to the spawning grounds shad are very responsive to climatic conditions. During a very warm season the fish attain spawning condition earlier than under normal conditions, while an unusually cold season will have the opposite effect. A water temperature of 80° has been known to result fatally to shad eggs, not only to those under incubation but also to the eggs in the parent fish. The same effect will be produced by an abnormally low water temperature or sudden fluctuation in either direction.

Early in March the mean water temperature of the Potomac River at Bryans Point, Md., is normally between 36° and 40°; by the middle of April, when the spawning season usually opens, it is between 52° and 58°; and by the close of the spawning period, at the end of May, the average is from 65° to 70°. Freshets, unusual turbidity of water, and the direction and velocity of the wind all are influential factors in the movements of shad.

STRIPPING AND FERTILIZING THE EGGS

In stripping the eggs the shad is lifted with the right hand and caught above the tail with the left. All slime and loose scales are removed by going over the fish two or three times in quick succession with the right hand. The head is carried to the left side under the arm and there retained by the arm, the tail being bent slightly upward with the left hand. When the fish is properly adjusted, its head is nearly concealed. The fish is held firmly over a moist pan, and with a moderate downward pressure of the right hand the eggs will flow freely if mature. Two fish may be stripped into each pan. Even with the utmost care it is impossible to preserve the life of the fish during the stripping process. When taken from the water, the shad is a very muscular fish, and if not firmly held while obtaining the eggs it is very likely to slip from the operator's grasp and flounder into the pan of eggs, probably throwing a large portion of them out and causing damage to those that remain.

The first half teaspoonful of eggs should be pressed out into the palm of the left hand and inspected. Skilled operatives usually discern ripeness by general outward appearance. A slow but almost positive test consists in running some of the eggs into water, when, if dead, they will have the appearance of boiled rice. Bad eggs are sometimes beyond the detection of the most skilled fish-culturists, however. If the eggs are white, opaque, or of milky appearance, the fish is put aside. Immature eggs are white, small, and adhering in clots, or they may be transparent and yet unyielding to pressure.

The former are valueless, while the latter can sometimes be utilized by putting the fish aside to soften. Both ripe and green eggs sometimes occur in the same fish, but only expert operatives can hope to take the one and leave the other. If eggs are mature, but little pressure is necessary to start them; and if not, they are only injured by squeezing, and will either not flow at all or will come away with difficulty in clotted masses and generally with a little blood.

To obtain the milt, the spawn taker catches the fish by the back, taking hold of the underside with the right hand. Without relaxing pressure at any point the milt is forced out with the thumb and forefinger. Good milt is so thin that it flows in a steady stream, and from some fish it can be ejected widely over the surface of the eggs, but in fish that have been dead some minutes the milt is lumpy and flows only in drops. After the milt has been applied, from half a pint to a pint of water from the river is added and the pan given a slow rotary motion, continued until the milt is thoroughly mixed, when the water will have a milky appearance.

Shad eggs have not the same strong adhesive tendency displayed by eggs of most of the Salmonidæ immediately after fertilization. Nevertheless, the adhesive tendency is apparent, and it is important that the eggs and milt be thoroughly mixed by movement of the pan as described above; otherwise a large portion of the eggs comprising the lower strata in the pan will not expand with the absorption of water and will fail entirely of fertilization.

In one minute after thorough mixing the milt may be washed off with safety, but usually several pans are to be looked after, when the milt may be allowed to remain 5, 10, or even 15 minutes. After the last pan of eggs has been fertilized they are rinsed, beginning with those first taken, by pouring in a quart of water. The stream of water should be directed between the eggs and the sides of the pan, as the eggs may be injured if the water is poured directly upon them. Then the pan is tipped, the water being drained over the edge slowly. The operation should be repeated, and the third time the water should be left upon the eggs. The eggs must be well stirred with the inflowing water.

There need be no fear of applying too much milt. The amount obtained from one fish may be ample for the eggs from two, but it is always better to employ two males. Eggs may look promising for two or three hours, yet never expand to full size or produce fish. They lie at the bottom underneath any good ones that may be in the pan; they stick to the fingers, while the good ones will not, nor can they be successfully removed from hatching jars until after several days. Unskilled spawn takers are liable to the mistake of stripping eggs without having the necessary milt to impregnate them, for several spawners may be taken over a period of 10 or 20 minutes without the capture of a male fish. In such cases (of great frequency late in the season) the female fish must be placed conveniently, backs down, to prevent the eggs from running out, and the males may have to be obtained from other boats. When ripe shad are taken in seines two or three large baskets should be in readiness to receive them.

Good eggs are transparent and so soft and light that they are not apparent to the touch when the fingers are moved among them. When the temperature is about 70° no change is observed for about 12 or 13 minutes after the milt is added, but about this time a careful movement of the fingers in the pan discloses their presence, and in a little more than 20 minutes from the time the milt is applied they feel like shot against the fingers and to an experienced eye are observed to increase slightly in size; when a day old they will not break if dropped to the floor. In transferring the eggs to other vessels the rim of the smaller pan should be gently immersed beneath the water surface in the larger one and the pouring take place gradually. To prevent splashing in boats, a small pan should be put on the water surface of the larger pan. Sudden jars must be avoided, all foreign substances excluded, and the pans be free from grease and salt. After the application of milt they expand to full size in 20 to 60 minutes, depending partly on temperature, and at this stage they may be doubled up in the larger pans, the question of safety in moving them being determined by their hardness.

If the eggs have absorbed sufficient water in the spawn pan, they swell and adhere to each other, forming a compact mass, and are ready to be transferred to the hatching jars, but if they are not sufficiently expanded or "water-hardened" they must remain in the pans, from 30 to 60 minutes being required for their full expansion.

In transferring the eggs to the hatching jars a small screen is placed over the throat of the egg funnel mentioned on page 482, which serves to remove any fish scales or other foreign matter that may have become mixed with the eggs.

HATCHERY AND EQUIPMENT

The building intended solely for a shad hatchery need not be of elaborate construction, since it will be used for only a short period of time during the year, but ample space, light, ventilation, and arrangements for moderate heating are essential. At the Bryans Point hatchery the water supply is obtained from the Potomac River, being delivered through steam pumps to elevated tanks, from which it is distributed to the hatchery. During periods when only a small number of eggs are in the hatchery a sufficient amount of water is supplied through a pump operated by a gasoline engine. This pump has a 4-inch suction and is connected with the main suction line by the use of a tee joint. The suction pipe, of 6-inch galvanized iron, is carried into the river on a pier approximately 170 feet long. The end of the pipe is held some distance from the river bottom and is provided with a protecting screen. At this station the tanks are elevated to a sufficient height to provide a pressure of 8 pounds per square inch at the top of the hatching jars, and each jar requires approximately 3 quarts of water per minute for its successful operation.

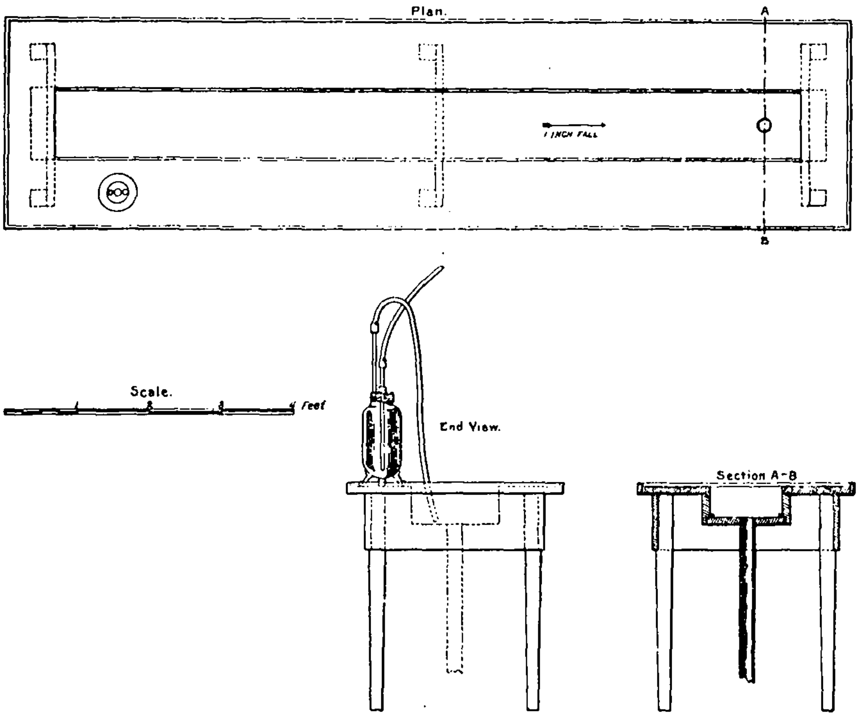

FIG. 5 Shad-hatching table

Upper figure shows view from above.
Lower left-hand figure is an end view showing hatching jar in position.
Lower right-hand figure shows a cross-section of the drain pipe and trough in center of table.

In exceptional cases water may be obtained from a municipal water supply, but as such water is frequently sterilized with chlorine or other agents, and as these sterilizing agents have been found, even in very dilute solution, to have a decided toxic effect on the ova, embryos, and young of many fish, such a source of water supply for hatching purposes must be viewed with suspicion.

The hatching jars are arranged on tables, as shown in Figure 5. The tables usually are 16 feet long by 3 feet wide and of an appropriate height for convenience in the manipulation of the jars. A table of the dimensions given will accommodate 24 jars in a double row—12 on each side of the rectangular tanks placed in the low center section of the table to receive the fry—and into which the discharge water from each jar enters. The fry tanks in general use are of glass, though wooden tanks are entirely satisfactory. A 1½-inch iron pipe, connected with the main water supply, is extended lengthwise over the center of each table. In this pipe, on either side, are inserted ¼-inch brass pet cocks, one for each jar, from which water is supplied to the jars through ½-inch rubber tubing. The overflow from the fry tanks is taken care of by a standpipe, 1¼ inches in diameter, running through the bottom of the tank and secured by a lock nut. Inside the tank the pipe is entirely surrounded by a frame, either square or circular, covered with wire gauze, which excludes the fry from the overflow. At one end of the table a pipe of suitable size is fastened to convey waste water to the drainage system.

In view of the comparatively short incubation period of shad eggs and certain other considerations, shad-hatching operations have been conducted on the type of table herein described. Should it become expedient, because of an increased number of eggs, to curtail space in the hatchery or to conserve the water supply, the simpler forms of the "single battery" used in pike-perch work could be used successfully for shad.

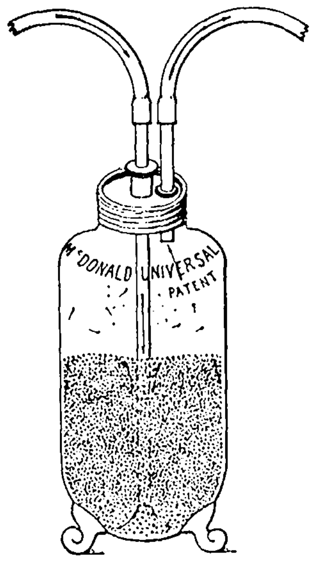

FIG. 6.—McDonald automatic hatching jar

HATCHING JARS

Very early in the development of its fish-cultural activities the Bureau of Fisheries was confronted with the necessity of dealing with the eggs of shad, whitefish, and other species in immense numbers. If the work was to be of practical value, eggs by the hundreds of millions, not by thousands, must be handled. After successive experiments the McDonald automatic hatching jar was devised, and it is still in favor with many fish-culturists. The Chase and Downing jars, which are also in general use, are simplified modifications of the McDonald jar.

Perhaps the most meritorious feature of these jars is that they prevent the development of the saprolegnious fungus, which caused so great a mortality in some other forms of hatching contrivances in which all the ova were not in continual movement. The very gradual, gentle, and continual rolling movement of the ova upon each other in the jars apparently prevents the spores of the fungus from adhering. The cleanliness of the apparatus is also advantageous, and as the material of which they are made is glass the progress of development can be watched satisfactorily from the outside of the jars.

McDonald jar.—This jar (fig. 6) is a cylindrical glass vessel of about 7 quarts capacity, with hemispherical bottom, supported upon three glass legs. The top is made with threads to receive a screw cap. It is closed by a metallic disk, perforated with two holes ⅝ inch in diameter—one in the center admits the glass tube that introduces the water into the jar, the other, equally distant from the central hole and the edge of the metal plate, admits the glass tube that carries off the waste water. The central tube is connected by ½-inch rubber tubing with the petcock, which regulates the supply of water. A groove in the inner surface of the metallic plate carries a rubber collar, and when the plate is in place the tightening of the metallic screw cap seals the opening hermetically. Both the inlet and outlet tubes pass through stuffing boxes provided with gum washers and binding screws. The central or feed tube is provided with stuffing boxes, one on the top of the disk and one on the bottom, the better to hold it to a true center. The outlet tube is provided with only one stuffing box, and the binding ring is beveled.

This type of jar works very satisfactorily with shad or other semi-buoyant eggs. The outlet tube may easily be shoved down into the jar, so that the dead eggs may be siphoned off. Its first cost is about twice that of the open-top jars. The open-top jars may be arranged in batteries or tiers, thus giving greater hatching and incubating efficiency for the same floor space. The open-top jars are easier to set in place, and the breakage is also less. The contour of the bottom of the McDonald jar causes the dead eggs to separate from the good eggs very readily.

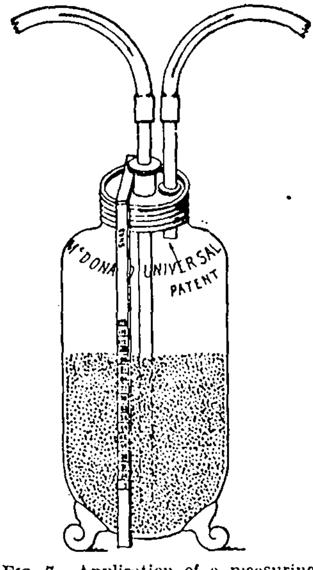

FIG. 7.—Application of a measuring scale to a jar of shad eggs

Chase jar.—The Chase jar is similar to the McDonald type in egg capacity. In shape it differs at the bottom, being more pointed and having a solid base (fig. 7). The main point of difference is at the top, which, in the Chase jar, tapers in slightly from its greatest diameter near the bottom. The top is open and is fitted with a metal band, from which extends a spout about 3 inches long, 2 inches wdie, and ¾ inch deep. In operation the jar is placed in such a position that the spout will discharge directly into the fry tanks, thus delivering the overflow water with the fry directly into the tank. Its egg capacity is equal to that of the McDonald jar.

All open-top jars cost less to purchase than the closed-top type. The open jars require slightly more water to operate them successfully. The contour of the bottom of the Chase jar is such that the eggs readily segregate, the dead ones rising to the top, where they may be removed.

The other types of open-top jar, including the Downing jar, are similar to the Chase jar, with the exception of the metal band and spout, which are not used, the glass being molded to form the overflow channel. Another point of difference in jars of the McDonald and Chase types is the contour of the bottom, which is so shaped as to permit of an even regular motion of the eggs through the action of the inflowing water. In the other types of open-top jars the shape of the bottom is more pointed, making it extremely difficult to obtain a uniform motion, so desirable and essential in the successful incubation of shad or similar eggs.

SELF-CENTERING TUBE

In place of the glass tube held rigidly in position by the fittings in the closed top of the McDonald jar, through which water is supplied, a metal tube (fig. 8) is substituted in the open-top jars. This tube, which is usually of tin, is 18 inches long and ¾ inch in diameter. Fastened to one end are four triangular pieces of tin, on which the tube rests in an upright position. The shape of these "feet" is such as to raise the end of the tube about ¼ inch from the jar bottom, permitting an even escape of water and causing it to rest automatically at the lowest point in the center of the jar. The rubber tube from the water supply is inserted in the upper end of the metal tube, and the flow of water is controlled by the petcock. In place of this metal tube a glass tube, connected with the water-supply petcock by a rubber tube, may be used, in which case the desired level of the tube in the jar is regulated by the length of the rubber-tube connection.

Another type of tube has been pronounced as more efficient. It is approximately 18 inches long and ¾ inch in diameter; at the bottom is a cone 3½ inches long and 2½ inches in diameter at the base. Three legs are soldered to the cone to keep it about ¼ inch from the sides of the glass jar and to permit the water to escape. The theory is advanced that this cone reduces the velocity of the water at its outlet and does not cause the eggs at this point to be set in rapid motion, as is done when the straight tube is used. The velocity of the water apparently does not affect the eggs while they are in the tender stage, and for this reason the cone tubes have not come into general use.

PREPARING JARS FOR OPERATION

In preparing the McDonald jar for work the side tube is fitted first. The glass tube should be wet, the gum washer slipped on the tube about an inch from the end and introduced into the opening. Holding the tube perpendicularly to the face of the plate, press fairly on the tube, and the washer, rolling on itself, will fall into the seat provided for it. Screw on the binding ring, and test by seeing that the tube slides freely back and forth in the stuffing box; if not, it should be refitted with a heavier or lighter washer, as may be required. Glass tubes of absolute uniformity in size can not be procured. Water is the only lubricant that should be used about the jar fittings.

The jar after being washed clean is filled with fresh water. A shallow tin funnel with a perforated rim is inserted, so that the water will stand as high in the funnel throat as possible.

The requisite number of eggs being in the jar, it is put in position and closed, care being taken that both the inlet and outlet tubes slide freely in their stuffing boxes. If the tubes become gummed, let water trickle down around the binding screws. To close the jar, turn on the water, place the feed tube in the jar, and turn off the water immediately after the feed tube has passed beneath the surface of the water in the jar, thus expelling all the air from the feed tube; otherwise it would rise in bubbles, throwing a portion of the eggs out through the outlet tube.

With a proper quantity of semibuoyant eggs in the jar and the water turned on and regulated, the movement of the current establishes a regular boiling motion in the mass of eggs, which brings each in succession to the surface. This motion may be regulated without altering the quantity of water. By loosening the upper binding screw of the central stuffing box and pushing the feed tube down until it almost comes in contact with the bottom of the jar the motion of the eggs is increased. If the jar is working properly, the dead eggs when brought to the surface remain on top, forming a distinct layer, and by pushing the outlet tube a suitable distance they are carried off by the escaping current.

When the water is turned on for the first time, the jar should be watched closely until a regular motion has been established. When eggs have stood 15 or 20 minutes in the jar before the water is turned on, they do not readily yield to the boiling motion but tend to rise in a solid mass to the top of the jar. By quickly starting and stopping the current the mass is readily disintegrated. The degree or intensity of motion of the eggs varies not only with their age and condition, but also with the condition of the water. If the water is muddy, the motion should be rapid enough to prevent mud settling either on the eggs or in the bottom of the jar. Ordinarily the best motion is that which readily brings the dead eggs to the surface. After the hatching has progressed far enough to dispose of a portion of the eggs there is less resistance to the current, and it should be reduced by shutting off part of the supply or by slightly lifting the central tube. If the motion is not reduced from time to time as the hatching progresses, shells will be carried over into the receiving tank with the fish and, being very light, will be drawn against the outlet screen, causing an overflow. The motion should be so gentle at the time of the greatest hatching as barely to induce the fish to swim out of the jar and leave their cast-off shells behind.

If the connection of the jar must be broken, it is essential that the rubber feed tube does not drop down and siphon the eggs from the jar.

In reconnecting, the air may be expelled with the metal top screwed down in position. To effect this, draw both glass tubes up to the top of the jar and turn on a full head of water, when the air will be forced out in bubbles above the eggs, the bubbles escaping through the outlet tube. The central tube is now restored to its former position. The automatic action permits entire separation of bad from good eggs, though some days may be required to accomplish the full result. The dead become lighter from gases arising from decomposition. A net small enough to enter the mouth of the jar easily and fixed to a handle several inches longer than the jar is convenient for removing particles of foreign matter.

At the approach of the hatching period a careful watch must be kept on the screens guarding the overflow in the fry tanks to prevent clogging through an accumulation of eggshells carried over from the hatching jars. The application of a stiff brush to the inner surface of the screen is the best way to overcome this difficulty. Usually a surplus quantity of the shells will remain in the jars, forming a cloudlike layer above the moving mass of eggs. This may be eliminated from the McDonald jar by manipulating the outlet tube, as already indicated, or, in the case of the open-top jars, by the siphon described below.

In the case of the Chase or other type of open-top jar the eggs are installed in the manner described. The tube through which water enters is inserted and the flow regulated at the petcock, to give the desired motion to the eggs. For the removal of dead eggs and shells a piece of rubber tubing is used as a siphon. A short piece of glass tube is inserted in the end of the rubber tube to be introduced into the jar.

Shad eggs are semibuoyant. The usual period of incubation is from 6 to 12 days in a water temperature 52 to 65° F. These figures represent very nearly the limits of temperature range for the successful incubation of shad eggs. In a temperature of 50° the incubation period is prolonged to 12 days, while at 75° it is shortened to 3 days, but in neither case can healthy fry be produced. While water temperature appears to be the governing factor in the incubation period, other circumstances, not well understood, may also have an influence. Continuous dark and cloudy weather appears to retard and strong light to accelerate development.

When hatched, fry are about 0.37 inch long. They have been measured at intervals of from 5 to 15 days, from late in May to the middle of October. Toward the middle of August the rate in growth diminishes. When 9 days old, they are about 0.62 inch long. Fry 0.5 inch long July 20 were 0.75 inch long 8 days later; on August 14, 2 to 2.25 inches; September 20, 3 to 4 inches; October 1, 4 to 4½ inches; November 4, 5 to 7 inches. Some years they grow faster than others, and in some streams more rapidly than in others. From the State fishponds at Raleigh, N. C., 33 were removed in November, 1884, which measured 8 to 9 inches. Their usual size in the Potomac in the fall is 3 to 4 inches.

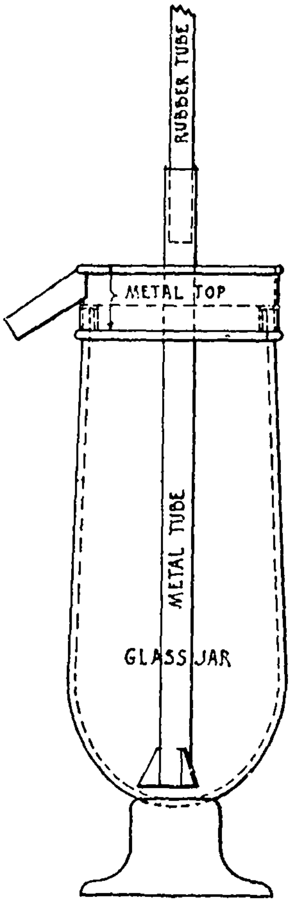

FIG. 8.—Chase open-top hatching jar

MEASURING THE EGGS AND FRY

To estimate the number of eggs and young fry was for years rather a difficult matter to accomplish satisfactorily. The standard made use of at the outset was undoubtedly much too high. The scale most used at present is a light square, made of wood, the longer leg being 15 inches and the shorter 7½ inches long (fig. 8). The material is ½ inch wide and ¼ inch thick. The graduations are on the longer leg and read from the lower end upward The first line is at a height corresponding to the level attained in the jar by a measured half-pint of water, and the succeeding lines are determined by the introduction of additional half-pints of water. When the scale is being constructed, the central glass tube is stopped at the lower end, that it may displace an amount of water equal to the amount of eggs it will displace in practice. Each line on the measuring stick registers 7,000 shad eggs. The number of eggs in a liquid pint is established by actual count. The eggs are at rest when measured.

The jar contents are determined by placing the short leg of the measuring stick over the top, with the other pointing downward and touching the side of the jar. The number is indicated on the scale at the point opposite the surface of the bulk of the eggs. Scarcely any semibuoyant eggs die, under proper conditions, after hatching has commenced, and a close approximation to the number of fry may be obtained from the last measurement, which is made after the careful removal of all dead eggs and the bursting forth of the first young.

FEEDING AND REARING

The young shad swims vigorously, by rapid and continuous vibration of the tail, from the moment it leaves the egg. It is colorless, transparent, and gelatinous. Several hundred in a dipper are scarcely discernible. It has a relatively large yolk sac, but supports it with ease during the first 4 or 5 days after hatching, the small quantity remaining after this time not being visible externally, although found in shad fry 14 to 16 days old. Minute conical teeth make their appearance on the lower jaws and in the pharynx about the second or third day after hatching. The jaws at 3 months are armed with teeth slightly curved.

Young shad feed on other minute organisms, such as exceedingly small crustaceans. Food has never been observed in the alimentary canal until 10 or 12 days after the young fish had left the egg. At about the middle of the second week considerable may be seen, but the intestine is then not often very densely packed. At the age of 3 weeks an abundance of food is found. They have been known at this early age to eat their own kind, and later the young carp and salmon. When cold, raw winds drive the crustaceans into deeper water, the young shad follow them, and in aquaria they take Crustacea freely. In salt-water aquaria they may be fed upon chopped oysters and canned herring roe.

Experiments with young shad were carried on for several years at Central Station in salt-water aquaria. On one occasion about 250 were received in October, at which time they were about 5 months old. They were put in brackish water (specific gravity 1.005), which was added to from day to day for nearly a week, when it was brought up to 1.018, or the same specific gravity as that of the water used in the marine aquaria. At the time that these were placed in the brackish water others were put into fresh-water aquaria, but the latter died within 3 days. Those in salt water began in 2 or 3 days to take food, consisting of chopped oysters, clams, and beef, the preference being for oysters. At first they would take food only when it was sinking, later they began taking it off plants where it had lodged, and finally from the bottom. Nearly all remained healthy, plump, and active for 6 months, some living until about midsummer.

For a number of years two or three million shad fry were reared annually at the fishponds, Washington, D. C. A 6-acre pond was used, the water supply being taken from the city waterworks. The depth was from 2 to 3 feet, and throughout the whole extent there was a dense growth of water plants, among which crustacean food multiplied, new supplies being brought in from the water pipes. Fingerling shad are so tender that the numbers annually liberated could not be ascertained. They can not stand the handling consequent upon counting, not even undergoing transfer in dippers of water, and their scales drop off on being touched. Consequently, at high tide they were liberated into the Potomac through a sluice gate with an outlet pipe about 2 feet in diameter. They required some days to make their escape. By conservative estimate 50 to 60 per cent were safely held until about October. Owing to the difficulty in obtaining suitable rearing ponds, and the necessity of providing the ponds with a water supply that will produce sufficient natural food, the Bureau of Fisheries prefers to liberate the young shad, soon after hatching, on their natural spawning grounds.

TRANSPORTATION

Good, healthy fry will pass from the jar to the collector tank as fast as hatched; they sometimes crowd on the side nearest the strongest rays of light. As many as 500,000 to 800,000 are collected in each tank. In transporting they must be kept in vessels with a smooth surface, about 2,000 to 3,000 fry to a gallon of water. The water in the cans must be well aerated and kept at 58° to 65°, though in rivers and ponds the fry endure a temperature of 80° F.

For a number of years the bureau followed the policy of making plants of shad fry regularly in most of the important shad streams of the Atlantic seaboard, but the results did not justify a continuance of such efforts, partly, at least, because of conditions mentioned herein. Finally, in order to maintain the diminishing numbers at points where artificial propagation is conducted, it has been found advisable to discontinue all shipments of shad eggs or fry to outside points and to return the entire product of the hatcheries to local spawning grounds.

The inadequacy of supply in waters where shad are now propagated makes it impracticable to distribute eggs or fry to other areas. It is important that the fishery be rehabilitated, and to do so more adequate conservation measures must be provided by the individual States.

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