REPORT OF THE BUREAU OF COMMERCIAL FISHERIES

FOR THE CALENDAR YEAR 1960

UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

National Oceanic and Atmospheric Administration

Report of the United States Commissioner of Fisheries

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UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

BUREAU OF COMMERCIAL FISHERIES

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Report of the Bureau of Commercial Fisheries for the Calendar Year 1960

This is the fourth report of the Bureau of Commercial Fisheries, an agency of the U.S. Department of the Interior's Fish and Wildlife Service. Section 9(a) of the Fish and Wildlife Act of 1956 requires that the Bureau make such a report annually in order to record the progress of its activities and make an account of administrative actions.

During the calendar year 1960, the Bureau continued its efforts to provide the research and services that will assist the Nation to utilize fully and wisely its fishery resources. These efforts cover a wide spectrum of activities, from basic research in such fields as fishery biology or fish oil technology to such practical applications as demonstrations of fish cookery in schools or the dissemination of news of the daily prices for fish landed in our principal ports.

This annual report serves as a summary of the principal activities of the Bureau during 1960; consequently it touches but briefly on phases of biological, economic, engineering, oceanographic, and technological research. It also discusses briefly the many service programs, such as those involved in fishery products inspection, fishery market promotion, market news reporting, statistics collection, vessel loans, and vessel safety promotion.

As in the previous 3 years, the Bureau continued to make steady progress toward its goal of providing the fishing industry and the Nation the maximum assistance in maintaining a thriving fishing industry.

Condition and Trends of the Fisheries

The commercial fisheries of the United States in 1960 landed 4.9 billion pounds of fish valued at $354 million (Appendix A). This was a decline of about 3.5 percent in volume of catch from that in 1959 but an increase of about 2 percent in value. Fish taken in considerably smaller volume included menhaden, miscellaneous fish taken for reduction, Alaska herring, salmon in the State of Washington, Pacific sardines, and cod. Fish taken in greater volume included

haddock, Atlantic herring, jack mackerel, salmon in Western Alaska, shrimp in the South Atlantic and Gulf States, crabs, and tuna. There was considerable variation between the various species and areas in the amount fishermen received for their catch as compared with 1959. California fishermen received about $4.5 million more for the fish and shellfish catch than in the previous year. The values of the salmon and shrimp taken by U.S. fishermen were each nearly $9 million more than in the previous year. The value of the New England catch, however, was down about $5.6 million. As a result of the sharp decline in the price of fish meal, the value of menhaden was about $6 million less than in 1959, and the small Puget Sound catch of salmon yielded fishermen about $4.5 million less.

San Pedro, Calif.—with landings of 360 million pounds, valued at $40 million—was the principal U.S. fishing port with respect to both volume and value. Other leading ports in order of volume of fish caught were: Lewes, Del.; Pascagoula, Miss.; Gloucester, Mass.; and Reedville, Va. Because it was the principal landing point for scallops—one of the higher priced species taken by domestic fishermen—New Bedford, Mass., was the second port in terms of the value of the catch.

For 3 consecutive years imports of edible fishery products into the United States had established record highs; however, the trend was reversed in 1960, and receipts of edible products from foreign countries showed a small decline. Important items received in smaller volume than in the previous year included groundfish fillets, frozen light-meat tuna, tuna canned in brine, fresh or frozen and canned salmon. Items received in notably greater volume than in 1959 included frozen albacore tuna, canned sardines, fresh or frozen northern and spiny lobsters, and shrimp.

The per capita consumption of fish and shellfish in 1960 was 10.5 pounds, down slightly from 1959.

Highlights of the fisheries of 1960 were:

1. The domestic pack of tuna canned in the United States, Puerto Rico, and American Samoa totaled a record 15 million cases—about 900,000 cases above the previous high canned pack in 1959.

2. Red salmon returned to Bristol Bay in Alaska in near-record numbers in 1960, and the Western Alaska pack of canned salmon exceeded 1 million cases for the first time since 1948. U.S. fishermen captured about 15 million salmon, and it was estimated that about 22 million reached the spawning grounds.

3. About 19.3 million pounds of scallop meats were landed at New Bedford, Mass., in 1960—exceeding the previous record landings at this port by about one-half million pounds.

4. Pacific halibut landings by United States and Canadian fishermen totaled 71.8 million pounds, a record for that fishery.

5. The Pacific sardine fishery catch of about 58 million pounds was the fourth lowest since 1915. Only the landings of 1952 (14.3 million pounds), 1953 (9.4 million pounds), and 1957 (45.9 million pounds) were lower.

6. For the third consecutive year whiting was the principal fish landed by Gloucester fishermen. It appears likely that it will become the dominant fish for these fishermen, replacing ocean perch which has been the mainstay of this port for about 25 years.

7. The Pacific Coast shrimp fishery, which has expanded rapidly in recent years, suffered a decline in 1960 with landings in Alaska, Washington, and Oregon, about 8 million pounds less than the 18.8 million pounds taken in 1959.

8. The South Atlantic and Gulf shrimp fishery, which was in serious financial difficulty in 1959, made a substantial comeback in 1960 with landings up nearly 17 million pounds. The increased catch and higher prices resulted in fishermen realizing nearly $7 million more for the 1960 catch than they received for the previous year's catch.

9. The U.S. supply of shrimp reached a new record in 1960 as a result of the increase in the Atlantic and Gulf catches and record imports amounting to about 118 million pounds (heads-off weight). The total supply (domestic production, plus imports) amounted to about 266 million pounds (heads-off weight)—an increase of nearly 12 million pounds over the previous record supply in 1959.

10. The 1960 production of frozen fish portions, used principally in institutional feeding, totaled 47 million pounds—28 percent more than the record production in 1959. Production of fish sticks totaled 65.1 million pounds—7.8 percent more than in 1959 and slightly above the previous high of 63 million pounds manufactured in 1955.

11. Prices for fish meal dropped sharply during 1960—averaging about $90 per ton to the producer compared with about $120 per ton in the previous year.

Developments in the Fisheries

Domestic Fisheries

During any year many developments occur in the fisheries. Often these result from some special condition, such as fluctuating fish supply, competition from similar products, or technological breakthroughs that change the pattern of operations. Some of the developments in the fisheries have long-lasting effects; others may have only a transitory effect on the fisheries of the future.

In 1960 there were some significant developments in the fisheries. It is too early to know whether their effects will long endure.

Menhaden

The menhaden fishery continued to be an immensely productive endeavor. One million tons of menhaden were caught in 1960—the third largest catch in the history of this fishery, which is one of the world's greatest. The big 1960 yield was made possible by the tremendous expansion of the menhaden fishery in the Gulf of Mexico where over 800 million pounds were caught. An even larger catch would have been taken if marketing facilities ashore had been able to handle more of these fish.

Weakening markets for the fish meal and oil resulted in a reduction of menhaden fishing effort along the Atlantic Coast also, particularly during the autumn. Large members of good-size menhaden were left undisturbed as much of the fleet became inactive.

Oysters

The production of oysters continued to decline. The 1960 yield was the smallest in well over 100 years. The major part of the decline occurred in the Chesapeake Bay oyster fishery. In New England, New York, New Jersey, and Delaware, the 1960 production of oyster meats was much less than 10 percent of the yield in 1950. The drastic decline in those regions had occurred during the past few years. In the Chesapeake area, there was fear that the fishery might yet suffer the same decrease. Intensive research efforts were initiated to discover the cause and possible remedy for the oyster decline.

Tuna

The outstanding development in the tuna fishery was the success of the tuna clippers that had been converted to purse seiners. The converted vessels made trips averaging about 30 days. In past years, the clippers had required 60 to 80 days to obtain a full load of fish. This greater productivity was reflected in lower costs and in increased demand for U.S. purse seine caught tuna. The catch of yellowfin tuna (190 million pounds) landed at California ports was only 18 million pounds under the 1948 record catch. There were 67 converted purse seiners operating by the end of 1960. The year was prosperous for domestic fishermen and canners.

Federal Legislation

Three bills pertaining to fishery matters were passed by the Congress in 1960 (Appendix B). Two of the acts concern the strengthening of the U.S. fishing fleet; the third will enable the Bureau to assist in cooperative training and research programs. A brief description of each act follows.

The purpose of the Act of June 12, 1960, is to assist certain de-

pressed segments of the fishing industry. It authorizes the Secretary of the Interior to pay a subsidy for the construction of a fishing vessel in shipyards of the United States providing the applicant for such loan is a U.S. citizen and his application meets certain specifications. These specifications are:

1. The plans and specifications of the fishing vessel must be suitable for use in the fishery in which it will operate and for use by the United States for National defense or military purposes during war or a National emergency.

2. The applicant must possess the ability, experience, and resources necessary to operate and maintain the vessel.

3. The vessel, according to the determination of the Secretary of the Interior, will aid in the development of the U.S. fisheries under conditions that are in the public interest.

4. The vessel, except under force majeure, will deliver all its catch to a U.S. port.

5. Only U.S. citizens or aliens legally domiciled in the United States will be employed on the vessel when completed.

6. The vessel will be documented under the laws of the United States.

7. Such other conditions as the Secretary may consider to be in the public interest.

The act provides that if the application meets all the specifications, then a subsidy may be granted for the construction of a fishing vessel that will be operated only in a fishery suffering injury for which escape clause relief has been granted under the Trade Agreements Assistance Act of 1951 but has been denied under section 7(c) of such act or in a fishery injured or threatened with injury from imports under certain conditions.

The amount of the construction subsidy shall equal the difference, to be determined by the Maritime Administrator of the Department of Commerce, between the cost of constructing such vessel in a U.S. shipyard, based upon the lowest responsible domestic bid, and the estimated cost of constructing such vessel in a foreign shipbuilding center, but in no way shall the amount exceed 33⅓ per centum of the cost of constructing such vessel in a shipyard in the United States based upon the lowest responsible bid. The Maritime Administrator shall determine and certify to the Secretary of the Interior the lowest responsible domestic bid. Any fishing vessel for which a construction subsidy is paid by the Secretary of the Interior will be constructed under the supervision of the Maritime Administrator.

This act further provides that in the event the United States, through purchase or requisition, acquires ownership of any fishing vessel on which a construction subsidy was paid, the owner shall be paid the value thereof, but it shall not exceed the actual depreciated

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construction cost together with the actual depreciated cost of improvements.

This act also provides that if any fishing vessel on which a construction subsidy was paid is operated during its useful life in any fishery other than the one for which it was designed, the owner shall pay to the Secretary of the Interior an amount which bears the same proportion to the total construction subsidy paid.

To carry out the purposes of the act, the Congress appropriated the sum of not more than $2.5 million annually. It also limited to June 12, 1963, the time that applications for subsidies could be accepted.

The Act of July 5, 1960, gives to the Secretary of the Interior the right to exercise authority formerly exercised by the Secretary of Commerce with respect to issuance of Federal ship mortgage insurance on fishing vessels. The execution of these functions was formerly a responsibility of the Secretary of Commerce under the Merchant Marine Act of 1936, as amended, but pursuant to the Fish and Wildlife Act, it is now the responsibility of the Secretary of the Interior.

The Act of September 2, 1960, authorizes the Secretary of the Interior to continue to enter into cooperative agreements with colleges and universities, game and fish departments of the several States, and with nonprofit organizations relating to cooperative research units for the purpose of developing research and training programs for fish and wildlife resources. The act provides that Federal participation in such programs be limited to Department of the Interior technical personnel and that the research units be supplied with needed equipment.

International Developments

The Bureau is being involved in an increasing number of international developments. As the principal fishing nations of the world become more powerful and ambitious, they compete with each other for not only the marine resources, but also the markets. To observe the developments in the world fisheries and to analyze their possible effects are responsibilities that the Bureau has assumed in order to assist the U.S. fishing industry to strengthen its position in the world.

Trade and Tariff Problems

Rapid strides made by many foreign countries in developing their fisheries, both for domestic use and for export, have created many problems for the U.S. fishing industry. During the year strong import competition was experienced in almost every important segment of the domestic fisheries, particularly in the shrimp and fish meal sectors. Also, in certain traditional export markets, U.S. pro-

ducers encountered greater competition from products of other foreign countries and increased protectionism through trade restrictions. In line with its responsibilities, the Bureau assists the U.S. fishing industry in attempting to solve these trade and tariff problems.

In 1960 in behalf of the U.S. shrimp industry, a "Report of the Secretary of the Interior to the President and the Congress on fresh, frozen, and processed shrimp" was issued in April. This report presented information on U.S. production, employment, prices, and sales in the domestic shrimp industry in relation to the increased imports that have resulted from rapidly expanding shrimp fisheries in many countries. The report had been requested by U.S. shrimp producers and processors for use in considering tariff legislation pending before the Congress.

A sharp drop in world prices for fish meal, caused primarily by enormous production in Peru, created concern in domestic fishery circles. A report on world fish meal production and trade was developed to assist domestic producers in their endeavors to counteract the adverse market situation. Careful study was made of the situation facing the U.S. industry, and action were taken to arrange an FAO conference of fish meal producing and consuming countries in 1961.

In connection with the President's program to promote U.S. export trade, a special conference of industry representatives was held in Washington to obtain the views and support of the fishing industry. At the conference, industry advised how the Government might assist in increasing sales of fishery products abroad. A report of the meeting was issued, and actions were initiated to seek remedies to the export problems reported.

Trade agreement negotiations conducted in Geneva by the General Agreement on Tariffs and Trade (GATT) required extensive preparations and participation by the Bureau. Proposals for a common fishery policy and increased duties in the Common Market were studied, and action was taken to seek improved trading conditions for fishery products. Reports were prepared on the "nontariff" measures used by other countries for the protection of their fisheries or in support of incomes of fish producers. These were for use of the U.S. delegation to the GATT meetings to determine ways of eliminating the many complex trade barriers that exist.

The Bureau's staff officer in charge of activities dealing with foreign fisheries and trade attended these meetings in Geneva, which began in September 1960. He consulted with the U.S. delegation on fishery aspects of the negotiations and developed and provided technical support on fishery matters considered by the U.S. delegation. He also consulted with Common Market officials to determine proposed Common Market trade policies and positions relating to fishery

products. The United States exports large quantities of fishery products (valued at $10 million annually) to Common Market countries, particularly West Germany and the Netherlands. Discussions during this period served to establish U.S. positions with regard to such fishery products as fish meal and oil; frozen fish and shellfish; and canned salmon, tuna, and other species.

Several trade restrictions were lifted as a result of the procedures of GATT. The United Kingdom lifted import restrictions on all fresh and frozen fish from the North American dollar area. Italy also announced that fresh and frozen fish and crustaceans could be freely imported from the dollar area.

Efforts were continued, in collaboration with industry, to solve problems in the marketing of canned sardines, mackerel, and squid in the Philippine market.

During the year, foreign fishing interests requested loans and financial assistance from the International Cooperation Administration, Development Loan Fund, Export-Import Bank, and International Bank for Reconstruction and Development. Consultations were held with these agencies to assure that the Bureau's interests for our fisheries were adequately represented.

The Bureau also assists the U.S. fishing industry in its trade and tariff problems by providing information and advice to the industry on foreign trade and fishery developments. This it does through its foreign service program in connection with that of the State Department and its foreign market news reporting service. During the year the Bureau took steps to achieve greater worldwide coverage of foreign fishery developments that were of importance to the U.S. fishing industry. The State Department agreed to establish a fishery attaché post to cover developments in European fisheries.

Fur Seal Research

The third annual meeting of the North Pacific Fur Seal Commission was held in Moscow, U.S.S.R., from January 25–27, 1960. The Bureau was represented by a commissioner and scientific advisors, as were the other party Governments—Japan, U.S.S.R., and Canada.

Results of fur seal research in 1959 were reviewed, and research plans of the respective countries for 1960 were generally agreed upon. Through this cooperative research program, much is being learned concerning routes of migration, predation habits, natural mortality factors, and the extent of intermingling among Asian and American fur seal populations. The ultimate aim of the Commission is to provide information to maintain the fur seal herds at a level of maximum sustainable productivity.

An important issue considered at the Scientific Committee meeting related to Japan's desire to continue the scope of its pelagic sampling

work in 1960 at the same level as in 1958–59. It was agreed by the Committee and recommended to the Commission that the scope of Japanese pelagic research operations be further reviewed at the 1961 meeting.

As a result of the Bureau's recommendation, the Scientific Committee accepted the U.S. proposal to take 17,500 female seals on the Pribilof Islands or as many more as necessary to remove the surplus in the interest of maintaining the fur seal herd at its present size.

As contemplated by the Convention, an exchange of research personnel between the U.S.S.R. and the United States was agreed upon. This was later accomplished by Russia's sending two scientists, Timofei Mikhailovich Kantatnow and Petr Georgievich Nikulin, and an interpreter, Leonid Vasilevich Kostin, for 2 weeks in September to study the fur seal herd on the Pribilof Islands and become familiar with the Bureau's fur seal research and management programs. Likewise, the United States sent two American scientists, Victor B. Scheffer and Eugene M. Maltzeff, to Robben Island, off the coast of Siberia, in September to make a similar 2-week study of the Russian fur seal resource.

The desirability of increasing chances of tag recoveries by increasing the scope of rookery tagging operations was also agreed upon. In this connection, the United States agreed to increase the scope of Pribilof tagging operations in 1960 from 50,000 to 60,000 pups.

International Mesh Regulations

The proposal made by the International Commission for the Northwest Atlantic Fisheries (ICNAF) that the regulations enforcing a 4½-inch minimum chafing-gear mesh size for trawl nets in Subarea 5 of the Northwest Atlantic Convention Area be applicable to Subarea 4 as well became effective on April 22, 1960. This followed approval by the five signatory nations in Panel 4.

Foreign Fishing Off Alaska

The Japanese and Russian fishing fleets were again active in the Bering Sea and North Pacific Ocean off the Alaska coast. The fleets were substantially larger than in 1959. The Bureau used one of its own vessels for the purpose of observing these foreign fishing activities and making sample catches to determine their composition. The U.S. Coast Guard also made periodic observations by airplane and surface vessel. It is believed that the principal species sustaining these foreign fishing operations are flatfish, cod, pollock, herring, and king crabs. These species have a great potential insofar as the future of the American fishery is concerned.

Accomplishments and Operations

Principal Accomplishments

Each year the Bureau's activities and responsibilities increase. Its accomplishments grow in proportion to the efforts expended in research and services. Following is an account of accomplishments and operations during 1960.

North Pacific

Marine mammal resource management.—In the Pribilof Islands, the new powerhouse on St. Paul Island was placed in operation. This 900-kw. unit will provide for the needs of the Aleuts and the administration of the fur seal industry. Licenses were issued to three land whaling stations, six whale catchers, and two secondary whale processing plants. Only three of the land stations and two of the catchers operated during the year.

Fur seal harvest.—In 1960 a total of 40,616 fur seals, both male and female, were harvested on the Pribilof Islands. This number was below normal, but at the same time a reduction in the number killed was expected. The year before the abundance of 3-year-olds was estimated to be less than average; therefore, a small return of 4-year-old fur seals to the Pribilof Islands in 1960 was foreseen. In addition, the supply of 3-year-olds returning to the Islands in 1960 was below expectations. For the second year in succession the take of male seals—only 36,320—was smaller than in all previous years since 1928. The small showing of 3- and 4-year-old animals, coupled with an unusually early molting, resulted in a decision to restrict the killing of females. Only 4,296 animals of that sex were taken from the herd.

Sales of 50,599 Pribilof Island sealskins at regular auctions in 1960 netted the United States $3,171,000. Gross sales of these skins by the Fouke Fur Company of St. Louis brought $4,756,435. For the first time sheared female sealskins were offered to the public, and 6,338 sold for $226,179, bringing a net profit of $100,134 to the United States. The Fouke Fur Company disposed of 481 other skins for $6,275.66, with a net profit of $3,972.49 to the United States.

Seal meal produced on the Pribilof Islands in 1960 was sold at public sale for $8,520 and the oils for $5,031. Low market demand for both items caused the total return—$13,551—to fall well below the average sales in recent years.

King crab research.—From 1953 through 1958 the eastern Bering Sea king crab fishery was relatively stable. In 1959 and 1960, however, the Japanese increased their fishing and processing efforts and added 10,000 cases to the quota of one mothership and authorized a second mothership operation. At the same time, the Russians entered the

fishery with a mothership and fleet of about 12 fishing boats. U.S. king crab fishermen also increased their fishing activities.

In anticipation of increased fishing pressure in the Bering Sea, Bureau scientists established in 1958 a systematic project for trawl sampling of king crab in the area near Amak Island. Quantitative sampling by trawls each year will provide annual estimates of the king crab population. Analysis of trawl samples taken in the area of the survey in 1958 indicated the presence of 16 million large crabs, of which 36 percent were females. Estimates will be made of the population size in future years.

In addition to the mathematical analysis of trawl data, research was continued on the growth and migration of king crabs. Large numbers of crabs were tagged and released at numerous points in the Bering Sea. Recoveries show crabs migrate from 0 to 10.6 miles per day with an average of 1.3 miles. This year there was some evidence of migration patterns.

Pink salmon fresh-water survival study.—Analysis of data on the factors influencing the fresh-water survival of pink salmon at Sashin Creek, Alaska, was completed. In this stream climatological conditions did not appear to be a controlling factor for salmon survival. One factor influencing survival was the stream gradient in which eggs were deposited. Measurements of fry production in 16 stream sections below the waterfalls in Sashin Creek indicated that the greatest survival occurred in sections of steepest gradient. Biologists found evidence that in years of moderately heavy escapements, a greater percentage of salmon use the steeper gradients. This tends to result in better than average survivals. Also, survival appears to be greater in years when spawning takes place earlier in the season. As spawning occurs early in the odd-year runs, this might explain the reason of higher production in odd years. These findings at Sashin Creek will be examined in other environmental areas. They are significant for the understanding they present of the reasons for the wide variations in fresh-water survival of pink salmon.

Commercial quantities of fish discovered.—The Pacific Northwest trawl fleet is catching bottomfish on grounds newly discovered by the Bureau's vessel *John N. Cobb* off the coast of Washington. After the inception of trawling off the Washington coast in the 1930's, these grounds were considered unsuitable for trawling because of the large number of boulders. Through the use of a high-resolution, research model echo sounder, combined with refined exploratory techniques, four separate dragging areas were found. Each of these grounds had commercial quantities of desirable fish. The *John N. Cobb* was also successful in locating suitable trawling grounds off Vancouver Island, British Columbia.

Columbia River Fishery Development Program.—This program, administered by the Bureau, entered its 12th year of operations. In 1960 construction of new salmon hatcheries was terminated after the completion of one new station. Under the program, 21 hatcheries have been built or rehabilitated. Construction of additional hatcheries is being held in abeyance until the success of present facilities can be evaluated—as recommended in the preliminary evaluation report prepared in 1959. The hatcheries operating during fiscal year 1960 had a total of 145 million salmon and steelhead eggs. Of special importance was the taking of more than 10 million eggs from over 9,000 adult silver salmon at the recently constructed Eagle Creek Hatchery in Oregon. This run of salmon has resulted from plantings of fish reared at the hatchery.

Screening of water diversions was continued with the construction and emplacement of 50 screens in the Salmon River basin in Idaho. Under the program, 60 screens have been installed in the Salmon River basin in addition to the 423 screens which were completed in prior years in the John Day River basin in Oregon. The construction of 1 new fishway raised to 21 the total number of major fishways which have been built.

Construction of an artificial egg incubation channel at Abernathy Creek, Wash., was completed and placed in operation. Early experimental results were encouraging, and further studies are planned to provide data for evaluating this means of incubating salmon eggs under controlled seminatural conditions.

The year witnessed the development and initiation of an operational studies program, designed to refine techniques for improving the efficiency and production of facilities constructed under the development program. Included are studies of predator control, improvement of natural habitat, development of fish cultural techniques, and controlled natural rearing. The latter investigations are proceeding with the construction, experimentation, and evaluation of five artificial ponds of varying size.

New screen facility for migrant steelheads.—The design and installation of a louver screen facility in Maxwell Canal, leading from the Umatilla River, Oreg., were completed. Experiments indicated a high degree of success in deflecting young steelhead migrants away from areas of irrigation diversion.

Water development and use projects investigations.—Proposed water-development projects were investigated, and 48 were reported on with recommendations for protective features. Several special studies in relation to water-use projects were continued and reported upon, including creel census of steelhead in North Fork Clearwater River, Idaho, spawning requirements of steelhead and their distribution in

the Clearwater River basin, and temperature data in the Middle Snake River area.

California

Sea temperature studies.—The staff at the Biological Laboratory at Stanford has made detailed comparisons of injection and surface temperature observations obtained aboard radar picket ships and Military Sea Transport Service ships in the Pacific. Results indicate that, in general, each ship has its own average bias of injection temperature, probably due to the construction and operation of the water injection system and the errors in the commercial grade thermometers used to measure temperature. The results were statistically analyzed to determine the average difference between the two kinds of temperature measurements and the standard deviation of the differences. Evaluation of these differences is important for the use of injection temperature data by oceanographers and fishery biologists.

Sardine population research.—The primary objective of the research program of the Biological Laboratory at La Jolla is to describe and understand variations in the abundance and distribution of the Pacific sardine, *Sardinops caerulea.* That requires knowledge of all phases of the life history and biology of the sardine and its fishery, plus an understanding of the effects of the physical oceanographic environment (temperature, salinity, currents, etc.) and of the biological environment (especially competitors and predators) on the survival of the sardine.

The possibility that the population of the Pacific sardine is made up of more than one group or subpopulation has been considered for some time. It appears now that the California population probably is composed of at least two subpopulations. The occurrence and types of parasites present in the sardine are being investigated as natural tags or aids in distinguishing subpopulations.

Sardine spawning studies.—With the advent of warmer water conditions in recent years, the sardine spawning pattern off southern California and northern Baja California has changed and now more closely resembles the pattern found formerly off central and southern Baja California in the following respects: (1) fish mature at smaller sizes; (2) the spawning season is more prolonger; and (3) ovarian development within the population is less uniform.

Comprehensive surveys of the distribution and amount of sardine spawning, which have been made at approximately monthly intervals since March 1949, are being reduced in number. Beginning in 1961, survey cruises will be limited to four per year, spaced at 3-month intervals. Sampling at the reduced schedule should provide information on major changes in spawning intensity and locations.

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Sardine larvae mortalities.—It has been known for some time that large mortalities of sardine larvae occur soon after the yolk sac is absorbed. A working hypothesis to explain these mortalities is based on the knowledge that energy is required for osmoregulation and on the premise that the sardine larva may be unable, under certain conditions, to provide enough energy for this process as well as for growth, development, and metabolism. The Laboratory staff at La Jolla have determined, however, that sardine larvae differ only slightly in body fluid osmolarity from adults and are able to osmoregulate readily. It appears that the larva needs about 5.4×10^{-4} calories per hour to maintain respiration alone, and more than this if it is to grow. The larva probably must eat more than 24 nauplii per day, or their caloric equivalent, just after the larval yolk sac has been absorbed in order to survive.

Sardine behavior.—The investigation of the behavior and availability of the sardine has included studies of the sense organs of this fish. When compared with shad, anchovy, jack mackerel, and Pacific mackerel, the sardine has the highest visual acuity and the lowest visual sensitivity and thus should be able to discriminate objects better than the other species in bright light but not as well as the others in dim light. Conversely, the anchovy has the lowest acuity and the highest sensitivity. The shad and the mackerels are intermediate in both respects. Differences in eye mobility, based on the development of the oculomotor muscles, suggest different feeding adaptations.

West Coast tuna research.—The purpose of the tuna research at the Biological Laboratory in San Diego is to provide information to the West Coast tuna fishing industry, with the ultimate aim of improving the efficiency of the American tuna fishermen. In addition to obtaining basic information on the oceanography and tuna resources of the eastern Pacific, the Laboratory is performing a number of services of direct benefit to the fishing industry. It has produced 8 of a planned series of 24 topographic charts of the eastern Pacific showing the locations of seamounts and other features of the ocean floor that have a bearing on tuna aggregation. It also issues monthly temperature charts to aid fishermen in locating tuna. There is considerable evidence that temperature has an important influence on tuna distribution. Such charts are also useful to fishery scientists, oceanographers, and meteorologists.

One objective of the research at the Laboratory in San Diego is to develop an optimum fishing strategy based on the integrated experiences of the several tuna fleets and the results of biological and oceanographic research. Special attention is being given to the operational practices of the new purse seine fleet and the changing character of the tropical tuna fishing operations.

Hawaii

Live skipjack handling.—In February 1960, the Biological Laboratory at Honolulu made the first successful transfer of skipjack tuna from the sea to a holding pool ashore. Although black skipjack and yellowfin tuna have been held in captivity for varying periods of time, this is the first time that oceanic skipjack have been held for more than a few hours or have been induced to feed.

The success of the transfer is attributed to the elimination of manual handling of the fish. Transportation of the fish from the ocean to the pool was accomplished in such a way that the skipjack were only out of water momentarily and were touched only by a barbless hook. A portable, steel, oval tank, 8 feet by 6 feet and 2 feet deep, was secured to the deck of a chartered commercial live-bait vessel. When a skipjack was hooked, the fishermen hauled the fish aboard and lowered it into the tank with enough slack in the line to allow the fish to shake off the hook. During transport, water was continually circulated within the tank. When the vessel reached shore, the tank was lifted from the ship and immersed in the pool. A hatch in the side of the tank was opened, and the skipjack was allowed to swim out of the tank into the pool. The pool is circular, about 23 feet in diameter and 4 feet deep, and receives a continuous flow of fresh sea water or saline water pumped from a well.

Additional tanks and associated instrumentation will be installed for studying skipjack behavior. Conditioned response studies which cannot be controlled readily at sea, such as those involving responses to sound, light, and various chemical extracts, will be performed in the shoreside pools and will supplement observations made at sea from the underwater viewing chambers of the Bureau's reseach vessel *Charles H. Gilbert.*

Skipjack population studies.—Serological studies of blood groups of skipjack indicate that this species consists of heterogeneous subpopulations associated with the major island groups in the Pacific and is not one far-ranging, oceanwide population as originally supposed.

Tuna identification research.—The larvae of albacore, bigeye, and bluefin tuna have been tentatively identified. The eggs and larvae of these species had been previously unknown. The larvae were identified from collections of the Danish research vessel *Dana* taken from the western Pacific and Indian Ocean and from those of the *Charles H. Gilbert* taken from the central Pacific southwest of Hawaii. These identifications have opened the way for a study of the seasonal and geographical distribution and abundance of larval tuna throughout the Pacific.

Gulf of Mexico

Trawling for industrial fish.—The seasonal occurrence and availability of industrial fish stocks on the Continental Shelf areas off the Louisiana and Texas coasts was further delineated during bottom trawling explorations by the Bureau research vessel *Oregon.* This information was made available to the Gulf industrial fish fleets.

Juvenile shrimp studies.—The Biological Laboratory at Galveston reports that in 1960 significant advances have been made in the specific identification of penaeid shrimp larvae. An inability to distinguish between species has been a major impediment in studies of the early life history of shrimp. For this study, early larvae derived from known parents have been obtained from three species with the prospects of obtaining comparable results from several other species.

Mark-recovery experiments circumscribing the pink shrimp (*Penaeus duorarum*) population fished commercially off southwest Florida continued during the year. The results have demonstrated that some, and probably most, portions of Florida Bay serve as nursery areas for broods contributing to the Tortugas fishery.

Pesticide research program.—The use of chemicals to control insects and other pests has resulted in contamination of fresh- and salt-water areas, and the effect on fish and shellfish has become a major source of concern. The Bureau has begun a research program to evaluate the effect of pesticide and insecticide chemicals on commercial marine life. The research is being carried on at various Bureau laboratories, but the entire program is coordinated under the Biological Laboratory at Gulf Breeze, Fla. There experiments are being made on juvenile and adult oysters. At the Biological Laboratory at Milford, Conn., experiments are being conducted on the eggs and larvae of bivalves and their foods. The Biological Laboratory at Galveston has directed its attention toward determining the relative toxicity of selected insecticides to species of aquatic life found commonly in the Galveston Bay area, particularly the two species of commercially important penaeid shrimp.

In the research at Galveston during the past year, five insecticides have been tested on white shrimp (*Penaeus setiferus*) ranging from 75 to 130 mm. in length. Thus far, DDT is the most toxic, killing at 15 parts per billion (p.p.b.), followed by sevin at 33 p.p.b., heptachlor at 43 p.p.b., aldrin at 50 p.p.b., and dieldrin at 60 p.p.b., respectively. Heptachlor and dieldrin were only slightly less toxic, killing at 11 and 15 p.p.b. The effects on postlarval shrimp deserve particular attention because they are commonly found in the brackish, upper waters of estuaries and coastal marshes—habitats most likely to be affected by chemicals washing out from treated areas.

Red-tide research.—The staff of the Bureau's field station at St. Petersburg, Fla., has made a valuable contribution to red-tide re-

search by systematically sampling since 1958 a limited area for numerous physical, chemical, and environmental factors. During the past year heavy rainfall, the appearance of large numbers of red-tide organisms, and some fish mortality have for the first time made it possible to secure detailed information concerning the complex hydrographic conditions preceding, accompanying, and following a red-tide outbreak. The Biological Laboratory staff at Galveston has developed a virtually inorganic culture medium to facilitate critical experiments on the nutrition of the red-tide organism. Over 4,000 chemicals have been screened in an effort to find a practical poison for the organism that will not be harmful to other forms of marine life.

Atlantic Coast

Scallop grounds revealed.—The Bureau's chartered exploratory fishing vessel *Silver Bay* discovered extensive calico scallop grounds off the coast of Florida. Large concentrations of these shellfish were found over a 1,200-square-mile area. It is anticipated that commercial production of this vast unutilized fishery resource will commence as soon as efficient mechanical shuckers are developed for the relatively small scallops.

Scallop study completed.—A special study was completed on the distribution and abundance of sea scallops in relation to temperature and depth along the Continental Shelf from Block Island, R.I., southward to Cape Hatteras, N.C. Fifty percent of the scallops came from depths of 20 to 30 fathoms, 45 percent from 30 to 40 fathoms, and the remaining 5 percent from depths less than 20 or over 40 fathoms. The average bottom temperature at 20–30 fathoms was 42.2° F., and at 30–40 fathoms it was 41.5° F. This study presents a clearer picture than formerly of the distribution of sea scallops along the Middle Atlantic Coast.

Oceanographic studies.—The Biological Laboratory at Brunswick, Ga., has in preparation a major report summarizing the principal features of the temperature and salinity data collected on nine cruises of the Bureau's research vessel *Theodore N. Gill* off the Middle and South Atlantic Coasts in 1953 and 1954.

Hard-clam bed provides new fishery.—Over one million pounds of hard clams were taken by commercial vessels from an extensive commerical bed off North Carolina. This new bed was located last year by the exploratory fishing vessel *Silver Bay.*

Menhaden catch sampling program.—The biologists at the Biological Laboratory at Beaufort conducted their usual sampling program on menhaden purse seine landings during the year. A weak 1959 year-class dominated the summer catch in the South Atlantic area and shared almost equally with a strong 1958 year-class in the

Chesapeake Bay fishery. For two successive seasons the 1958 year-class provided the bulk of the Middle Atantic catch and dominated the North Atlantic fishery in 1960.

Exploratory fishing off Rhode Island.—The Bureau's exploratory fishing vessel *Delaware* discovered two winter concentrations of whiting in commercial quantities south of Block Island, R.I., an area not previously fished by the industry.

New Laboratory at Gloucester.—In the spring of 1960, dedication ceremonies were held in Gloucester, Mass., marking the official opening of the Bureau's new Technological Laboratory.

New facilities for Woods Hole.—The Bureau staff at Woods Hole, Mass., moved into the new laboratory building during spring 1960. Construction of an aquarium building was nearly completed during the year, and a new research vessel was designed.

Evaluation of mesh regulation.—Studies relating to the management of the groundfish of the Northwest Atlantic are an important part in the Biological Laboratory's program at Woods Hole. In this connection, the Laboratory has been concerned during the past year with evaluating the benefit of mesh regulation on the Georges Bank haddock fishery and assessing possible benefit of uniform mesh size for the entire Convention Area of the International Commission for the Northwest Atlantic Fisheries.

The International Mesh Regulation has been in effect since 1953 and has been beneficial to the Georges Bank haddock fishery in many ways. Discard of small unwanted fish has been reduced to a negligible quantity on the vessels using the large mesh, alleviating the necessity of culling at sea. The catches are cleaner and contain fewer fish of unwanted species, such as hakes and herring. Fewer haddock are being caught at age 3, but increased yields of 4- and 5-year-old fish more than compensate, which was predicted when the regulation for the larger mesh gear was first recommended.

Investigation of benthic organisms on Georges Bank.—The benthic fauna on Georges Bank in relation to groundfish stocks was studied by biologists at Woods Hole. Many New England fishes of commercial importance, especially cod, haddock, and several species of flounders, depend upon benthic organisms for their food. Since an adequate quantity of suitable food is a basic necessity for survival and maintenance of these stocks of fish, knowledge of the kinds and quantities of food on the fishing ground is necessary for a better understanding of migrations, growth rates, and geographic distribution of the different races and species of fish. The results of the investigation showed that the principal areas where food organisms were abundant coincided with the areas where some of the major fisheries occur.

Oyster culture.—Experiments to determine whether eastern oysters would grow and develop better on cultch strings suspended from rafts

were carried on during the year by the Laboratory at Woods Hole. This method of oyster culture has been used in Japan for many years, but has never been practiced by the oyster industry of the U.S. East Coast. Results of the experiments indicate that oysters will reach commercial size in less than half the time needed for bottom-grown stock in the same areas. Mortalities were less than one-fourth as great as those grown under normal industry practices.

Herring studies.—Late in the year the Biological Laboratory at Boothbay Harbor, Maine, initiated a long-term study of the inshore habitat of herring, with special emphasis on distribution, movements, and abundance of larval and juvenile stages in relation to physical and biological conditions. The study will involve biweekly plankton and hydrographic surveys, otter trawl surveys, and interviews with commercial fishermen. The results will contribute to information about the life history of herring and one of its habitats about which little is now known.

Herring eggs were artificially fertilized and hatched out in the Laboratory. Attempts were made to rear herring larvae in specially designed tanks under controlled conditions.

Since 1947 the Laboratory staff have investigated a serious fungus pathogen (*Ichthyosporidium*) of herring. Several phases of this work have now been concluded. It was found that the disease can persist in chronic form for at least 1 year. Immature fish with chronic infections were markedly thinner than uninfected fish. Herring exposed to what appears to be the same fungus organism from redfish did not acquire infections.

Great Lakes

Exploratory trawling for bottom fish.—Exploratory trawling operations for bottomfish in Lake Michigan have demonstrated the feasibility of utilizing trawls to take bloater chubs.

Migration studies.—During the spring of 1960, 4,000 yearling walleyes were tagged and released at 10 different locations on the southwestern end of Lake Erie. By the end of the year over 8 percent of the tagged fish were recovered from United States and Canadian waters. Additional recoveries are anticipated in future years. From recoveries made so far it appears walleyes have a tendency to migrate northward in early summer. Significant was the finding that only two of the recoveries were made over 15 miles east of the boundary of release points. This tagging experiment, when completed, will provide a better understanding of the migratory pattern of walleyes. Limnological studies conducted concurrently may explain the environmental factors motivating walleyes to use certain migration routes.

Great Lakes lamprey-control program.—A milestone in the control of the sea lamprey of the Great Lakes was achieved in 1960 upon the

completion of the chemical treatment of all the lamprey-producing streams tributary to Lake Superior. During the past 3 years 72 streams have been treated, of which 52 were on the United States side of the lake.

The effectiveness of the chemical control program in Lake Superior will be apparent in summer 1962. Through the operation of a network of electrical barriers, a tally will be made of mature adult lampreys entering many tributary streams. This will enable a comparison of lamprey abundance in 1962 with that of former years.

Treatment of streams in Lakes Michigan and Huron got underway during the year. Lampricide was added to 14 streams. This is a cooperative effort with the Fisheries Research Board of Canada.

General

New method for classifying chemical compounds.—By demonstrating the use of thin layer chromatography for isolating and characterizing chemical classes of lipid compounds in fish oils, the Bureau's chemists have developed a new basic test procedure for chemical laboratories. The tremendous potential of thin layer chromatography as a laboratory tool is evident from the number of researchers who have indicated an interest in this new procedure. Some scientists using this Bureau-developed method have reported that it is fast and accurate for determining types of compounds other than lipids.

Fish oil research.—Research laboratories whose staffs are working in a variety of fields, such as adhesives, biochemistry, medicine, nutrition, and pharmaceutical metallurgy, have been supplied with samples of fish oil fractions that the Bureau's Technological Laboratory in Seattle has produced by means of a molecular still. These research laboratories have indicated that some entirely new concepts of using fish oil fractions are being attempted and that many fractions are producing remarkable results.

Ocean perch meal study completed.—A study of the chemical analysis, protein quality, metabolizable energy, and digestibility of ocean perch meal was completed by a research laboratory under contract with the Bureau. It has been shown that ocean perch meal, although a byproduct meal from fillet waste, has a nutritive value comparable to other types of fish meal. A fairly high percent of the total energy of ocean perch meal was found available as metabolizable energy in amounts comparable to that of other fish meals. The digestibility of the meal protein, the organic matter, and the fat was also found to be high in comparison with other fish meals.

New shipping rates.—Imported fish meal has enjoyed a competitive advantage over the domestic product because of a reduction in rail and freight charges from Gulf ports to midwestern points of dis-

tribution. The reduced rate lowered the cost of moving imported fish meal from $5 to $10 per ton below the cost of shipping domestic fish meal. In the interest of equalizing rates for both foreign and domestic fish meal, Bureau transportation specialists and industry representatives met with representatives of the western, southern, and eastern railroads. After several public hearings as well as informal meetings, the carrier ratemaking group approved new rates, effective October 4, 1960. The net effect of these new rates has been to reduce the freight costs for domestic fish meal and at the same time equalize rates to the level of the imported product.

Marketing studies.—To aid the fish meal industry in planning future production and marketing operations, the Bureau conducted a comprehensive study of feed mixers buying practices and purchase plans early in 1960.

The Bureau made a study for the Office of Isotopes Development of the Atomic Energy Commission (AEC) to determine the conditions under which radiation-processed fishery products should be marketed in order to provide the greatest overall benefits to the fishing industry—producer, processor, and distributor—and to the consumer. Bureau marketing specialists discussed the feasibility of marketing such fishery products with fish producers, processors, and distributors, along with retail food groups, newspaper food editors, home economists, and extension workers. The AEC had been reserving action on a number of research grants pending the outcome of this study. The resultant comprehensive analytical report, "Marketing feasibility study of radiation-processed fishery products," is proving of value to the AEC in planning its research and educational programs.

Seafood merchandising clinics.—There has been a great need at the retail store level, the final link in the chain from producer to consumer, for specialized instruction in properly handling fishery products to avoid quality loss and in merchandising techniques to sell more fish. To meet this need, the Bureau, in cooperation with the Office of Distributive Education of Temple University, held a series of seafood merchandising clinics for retail store personnel in the Philadelphia area. Similar clinics previously had been sponsored in the Boston and Metropolitan New York areas.

Inspection and certification service.—During 1960, at the request of the fishing industry, standards were developed and promulgated for three fishery products—frozen raw headless shrimp, frozen raw breaded portions, and frozen ocean perch fillets. At the present time there are 10 U.S. fishery product standards upon which the Bureau bases its inspection and certification service. This service is voluntarily subscribed to and financed by processors of fishery products. In December, 11 more processors joined the ranks of those under continuous inspection, making a total of 39.

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Lot inspection offices and facilities were also increased. Offices were established in Los Angeles, Calif., St. Petersburg, Fla., Chicago, Ill., and Brownsville, Tex., and services were made available to some processors in remote areas. Under a cross-utilization of services with other Federal agencies, it is now possible for processors in almost any part of the country to obtain Bureau inspection and certification services.

Fishing vessel safety program expands.—Through the efforts of the Bureau fishing vessel safety program in New England, Port Safety Committees for fisheries were established in New Bedford and Gloucester, Mass.

Refrigerated sea-water (RSW) unit constructed.—A refrigerated sea-water unit on a scale suitable for commercial operations has been constructed. Previous research, on an experimental basis, demonstrated that whiting when stored in RSW kept longer and stayed fresher than when stored in ice. Tests are now being conducted on commercial-size lots of whiting. Indications are favorable for use of this unit on a commercial basis.

New method for shucking calico scallops.—In the past small calico scallops have not been processed and marketed to any great extent because of technical difficulties involved in shucking. Bureau technologists developed a method whereby these scallops can be shucked quickly by unskilled laborers. This method should facilitate the large-scale processing and marketing of calico scallops in the near future.

Scallop promotion.—Early in 1960 the New England sea scallop industry, faced with heavy inventories, depressed prices, decreased market demand, competition from vastly increased imports, and the prospect of continued record landings, requested assistance in moving inventories into normal trade channels. The Bureau cooperated in the industry's market push during the month of May. Scallops were included on the U.S. Department of Agriculture plentiful foods list for May. Some movement was stimulated, but continued heavy production made additional intensive marketing efforts necessary later in the year. At the request of the sea scallop industry, the Bureau again cooperated in an "all-out" August "Scallop Festival" sales push. The U.S. Department of Agriculture again listed scallops nationally as a food in plentiful supply. The support of over 40 prominent food trade associations was also enlisted through Bureau efforts. As the result of this cooperative industry-Government sales effort, the scallop market was considerably strengthened. Promotional emphasis on scallops continued into the autumn selling season, and this product was featured in various Bureau consumer-education releases in connection with the annual industrywide "Fish 'n' Seafood Parade" promotion, October 17–23. By the end of 1960, demand for scallops

was good, inventories were at a manageable level, and prices had become higher.

Shrimp promotion.—Although industry-Government shrimp market promotion during October 1959 helped to alleviate the burdensome shrimp inventory to a marked extent, continued heavy production and imports made further marketing efforts necessary early in 1960. The Bureau, therefore, featured shrimp during the industry-Government "It's Fish and Seafood Time" Lenten promotion. Shrimp was listed on the March and April plentiful foods list of the U.S. Department of Agriculture, and several special-emphasis tie-ins, such as shrimp and eggs, shrimp and rice, and shrimp and lemons, were developed. The shrimp industry also increased its market promotion and advertising during the Lenten period. As the result of this cooperative industry-Government effort, the shrimp market returned to normal early in 1960 and remained so throughout the year.

Pacific halibut promotion.—The Pacific halibut industry was plagued by heavy inventories and requested Bureau assistance in selling halibut in the Midwest market. To focus maximum attention on this species, the U.S. Department of Agriculture April plentiful foods list in the Midwest region included halibut. The Bureau cooperated with industry in promoting the use of this product throughout the month of April, and as a result the market returned to normal.

Rough-fish market development.—Bureau efforts in developing markets for underutilized fish continued. Fish use in the pet-food and mink-food industries has been steadily increasing over the past few years as the result of aggressive followup of Bureau market-development activities by industry. This is aiding a number of distressed industry segments, particularly in the Great Lakes area, by diversifying their operations and thus broadening their market base.

Marketing assistance for buffalofish.—Late in the year, Arkansas fish farmers, faced with serious difficulty in marketing buffalofish produced in flooded rice acreage, requested Bureau marketing assistance. A Bureau marketing specialist and a fishery products technologist were detailed to Arkansas to assist the industry. By the end of 1960 the situation was improved.

Fish-cooking demonstrations.—Bureau home economists and marketing specialists conducted 231 fish-cookery demonstrations during 1960 as follows: school lunch, 74; institutional, 32; extension service, 69; homemaker (television), 45; other (including military), 11. Bureau home economists also participated in 30 radio and television interviews in 1960. School lunchrooms represent one of the major potential outlets for fishery products. Over 13.5 million pupils now are covered by the National School-Lunch Program. If each one of these pupils had but one fish lunch per week (2 ounces of fish protein)

during the school year, this would represent a potential sale for 68 million pounds of fishery products (edible weight) annually.

Consumer education.—"Fish for Health" was the theme of a number of Bureau consumer-education releases during 1960. Bureau marketing specialists and home economists stressed this aspect in personal appearances and in trade and mass-media contacts. Bureau educational materials were used extensively in the Chicago Board of Health's "Coronary Prevention Evaluation Program." The Chicago Board of Health has been emphasizing the use of unsaturated fats and has recommended that fish be served five or more times per week. Fish has further been recommended by this board for its protein, iron, and B-vitamins. Participants in this program have been receiving special instruction from Board of Health nutritionists on purchasing, handling and cooking of fish.

Bureau films are awarded.—"Outdoor fish cookery," a Bureau-financed motion picture, and "Salmon catch to can," an industry-financed motion picture, received CHRIS CERTIFICATE Awards from the Film Council of Greater Columbus. "Salmon catch to can" was also honored through "selection for exhibition" at the Edinburgh International Film Festival. Two Bureau-produced, animated, public-service television spots were among the winners of the American TV Commercials Festival and Forum Competition of the TV Commercials Council.

Market News Service expands coverage.—The Fishery Market News Service has broadened the uniform and systematic dissemination of fishery news to the fishery and allied industries. It has also increased coverage of prices and market conditions for frozen and canned fishery products. Its coverage of the fish meal, oil, and solubles market proved vital to the industry when the market was in a poor condition. Daily, monthly, and annual market news reports now include more summaries, tabulations, and consolidations of data pertaining to the domestic fisheries.

In 1960 the Boston Market News office started publishing weekly tabulations on fishery products packed under U.S. Department of the Interior continuous inspection and lot inspections in the North and Middle Atlantic regions.

Two reports of value because of their comprehensive coverage were published during the year by Market News Service offices. One of these was a special report issued by the Chicago office on the trends and developments in shrimp marketing at Chicago over a period of years. The Boston office issued a special report on the haddock fishery of New England and the marketing of haddock products (domestic and foreign). This report summarizes in one publication all the pertinent data scattered through many Market News Service reports and other publications for a period of years.

Fishery statistics.—In cooperation with the States of Maryland and Virginia, the Bureau began the collection, tabulation, and publication of monthly landing bulletins containing data on the volume and value of fish and shellfish taken in those two States. The publication of these bulletins and data from other sources provides monthly information on over 97 percent of the volume of fishery products taken by U.S. fishermen.

Fisheries Loan Program.—The Fisheries Loan Program was announced in October 1956. By December 31, 1960, a total of 848 applications (for $25,866,250) for loans under this program had been received by the Office of Loans and Grants. Of these, 184 ($4,805,604) were received during the calendar year 1960. At the end of the year, 459 loans ($11,107,203) had been approved and 30 applications ($8,805,339) were being processed. A total of 214 applications were declined, 74 were found to be ineligible, and 71 were withdrawn by the applicants.

Approximately 48 percent of the amount authorized was for refinancing of debts, 49 percent for vessel improvement or new vessels, and the balance for operating expenses. This shows an encouraging trend, for the percentage being used for refinancing is decreasing steadily and a larger proportion of the funds are being used to upgrade the fleet. Approximately 35 percent of the funds were loaned to fishermen in the New England and Middle Atlantic area, 32 percent to California fishermen, 15 percent to fishermen in the South Atlantic and Gulf area, 12 percent to fishermen of the Pacific Northwest, and the balance to fishermen in Alaska, Hawaii, and the Great Lakes area.

New Programs

In 1960 the Bureau started on several new programs. One program will be of worldwide interest in the years ahead. It deals with biological oceanography and was undertaken because of a report issued in 1959 by the National Academy of Sciences entitled "Oceanography 1960 to 1970." This report turned our Nation's attention to the sea. The greater use of the living resources of the sea is a major objective of the greatly expanded program in oceanography recommended in this report. The Bureau of Commercial Fisheries is the Federal Agency which has responsibility for this aspect of the oceanography program.

The Bureau plans an expanded program of biological oceanography in the Atlantic and Pacific Oceans and in Gulf of Mexico coastal and offshore waters. Ocean temperatures and currents will be studied to gain an understanding of the processes involved and their annual and seasonal variations, with the primary objective to determine how natural factors affect the supply of fish.

Tuna oceanography is one phase which will be stressed since impending international fishing regulations require that we have immediate knowledge on how the marine climate influences tuna distribution and availability. New taxonomic information will be sought as the basis for study of marine populations. Availability of offshore oceanic resources to commercial fishing will be determined. Coastal research will be concentrated on basic productivity and physiological requirements of marine organisms.

Another program concerns the effects of peaceful uses of atomic energy on marine life. A radiobiological consultant has been assigned to the Central Office. He is to advise the Bureau's laboratories on the use of radioactive materials in biological research.

An Alaska fisheries exploration and gear research program was initiated in July 1960. This program is based at Juneau, Alaska. Its purpose is to obtain greater knowledge of the untapped fishery resources off the coast of Alaska so that orderly development of these resources may take place. Initial efforts during 1960 involved trawling operations for bottomfish off southeastern Alaska.

Meetings

Each year Bureau representatives attend many meetings covering a wide range of interests.

Some meetings require the presence of Bureau personnel as representatives on international commissions of which the U.S. Government is a member. These commissions deal with international fishery problems, and the Bureau is charged with the responsibility for conserving the resources while protecting the interests of our own fishermen.

Many Bureau scientists are members of professional societies that hold meetings at which scientific papers are presented and the latest technical developments are discussed. It is to the Bureau's advantage to have its staff members profit by attendance at such meetings, where cross-fertilization of ideas provides a great stimulus for creative work.

Working closely with the fishing industry in many fields, Bureau personnel find it worthwhile to attend a wide variety of meetings that deal with the fisheries—for example trade associations and organized groups of fishermen and producers. There the Bureau employees are able to explain in detail the efforts that are being made to assist the fisheries and at the same time, learn more about the immediate and often local problems of the fisheries.

There are a great many meetings with other Government and State organizations, for the Bureau is only one of numerous agencies that are concerned with conservation.

Some of the more important meetings are discussed here.

Fifth International Congress on Nutrition

The Fifth International Congress on Nutrition, held in Washington, D.C., Sept. 1–7, 1960, brought together international authorities in nutritional research and public-health activities. Bureau technologists attending were afforded an opportunity to learn of the latest advances in the field of human and animal nutritional research. Among the more prominent subjects dicussed was that concerning the malnutrition of people throughout the world, especially those of underdeveloped countries. This was of special interest in view of the Bureau's efforts to provide much needed protein supplements to help relieve this international problem. Background information was also obtained which will prove useful in research planning and organizing subsequent meetings.

Great Lakes Fishery Commission Meeting

The annual meeting of the Great Lakes Fishery Commission was held at Cleveland, Ohio, on December 1 and 2, 1960. At the meeting the two research agencies of the Commission—the Fisheries Research Board of Canada and the Bureau of Commercial Fisheries—reported on the progress of sea lamprey control and research. The Scientific Advisory Committee of the Commission reported on the electrical barrier program. The Committee recommended maintaining the present barrier network, and the recommendation was subsequently approved by the Commission.

This meeting was important to the Bureau in a number of ways. It permitted administrators and scientists to participate in discussions concerning program changes and programs for future years. It allowed personnel from both research agencies an opportunity to discuss mutual problems on sea lamprey control and to make plans for implementing decisions made by the Commissioners.

Reports also were given by research administrators from Michigan and Wisconsin on the progress made in sea lamprey control in their States during the year. The Assistant Executive Secretary presented reports on the lake trout rehabilitation programs and a proposal for regulating the Lake Superior trout fishery. Several reports were presented on the newly developed trawling operations. Time was available for discussion following each of the foregoing reports.

International Commission for Northwest Atlantic Fisheries

The 10th annual meeting of the International Commission for the Northwest Atlantic Fisheries (ICNAF) was held in Bergen, Norway, May 30 to June 3, 1960. This Commission is interested principally in haddock, cod, and redfish. Its purpose is to achieve maximum sustained productivity of these stocks of fish, and its efforts have, for

the most part, been concerned with regulation of trawl mesh size to achieve the greatest yield. Another developing interest is the effect of environmental factors on variations in fishery production.

At the meeting, the U.S. delegation was particularly concerned with the work and reports of the Standing Committee on Research and Statistics. The Mesh Assessment Working Group met prior to and during the annual meeting and presented an important report on the effects of mesh regulations. The gains or losses to the industry and effects on the stocks resulting from the use of trawl nets of different mesh size were carefully defined. The Committee reviewed the work in progress on environmental studies and agreed that certain research programs should be given priority. It called attention to the shortage of oceanographers and how this was retarding the research programs. A number of problems connected with the collection and compilation of data on fishery statistics and on sampling of stocks were discussed and recommendations made. Plans were laid for a Symposium on Fish Marking to be held in conjunction with the 1961 annual meeting and one on the Influence of Environment on Distribution and Abundance of Groundfishes, to be sponsored by the Commission in 1962 or 1963. The United States reported on its new laboratory facilities at Woods Hole and a plan for construction of a stern trawler-type research vessel.

International Meeting on Safety of Life at Sea

This international meeting was held in London, May 17 to June 17, 1960, to study the entire safety problem with respect to ships at sea. Such topics as construction standards, inspection, cargo regulations, and the collision regulations were re-examined. The governments of 45 countries were represented by delegations, and 7 other governments and 8 international organizations sent observers. One of the principal topics of discussion was "Rules of the Road," or collision regulations, which are the traffic regulations of the sea. Revisions were proposed and made to clarify the regulations, especially in those sections dealing with fishing vessels. Attention was given to problems of fishing vessels, which are frequently involved in collisions causing serious damage and loss of life. The information gained from this meeting by the Bureau's participant was of value to the U.S. fishing industry.

International North Pacific Fisheries Commission

The Bureau of Commercial Fisheries, as research agency for the American Section of the International North Pacific Fisheries Commission, participates with Canada and Japan in the Commission's annual meetings. Meetings are held successively in Seattle, Wash.; Vancouver, British Columbia; and Tokyo, Japan. In 1960 the Com-

mittee on Biology and Research held meetings continuously during the weeks of October 23 and 31 at Harrison Hot Springs, British Columbia, and occasionally during the following week of Plenary Sessions in Vancouver, British Columbia. The purpose of the meetings was to plan, coordinate, analyze, and report the results of research on salmon problems raised by the Protocol of the Convention. These problems relate to the Japanese high-seas fishery for salmon in the North Pacific Ocean in areas where salmon of North American and Asian origin intermingle. The Committee also is concerned with the study of king crab populations in the eastern Bering Sea. During the meetings scientific papers were presented on various aspects of racial studies, salmon distribution, oceanography, and king crab research. Joint reporting groups, comprised of nationals of the three countries, met to discuss and outline reports assigned to them by the Committee.

Cooperation and Coordination With International, Federal, State, and Other Agencies

Cooperation and coordination between the Bureau and various foreign governments, other Federal agencies, States, universities, and private agencies are extremely beneficial to the participants. Such arrangements result in the best use of available research talent and facilities. The cooperation and coordination are accomplished through international agreements and treaties, formal and informal agreements with Federal and State agencies, and contracts and informal agreements with State conservation departments, universities, and private associations.

International organizations, such as the International North Pacific Fisheries Commission (INPFC), the Great Lakes Fishery Commission, the International Commission for the Northwest Atlantic Fisheries (ICNAF), and the Food and Agriculture Organization of the United Nations (FAO), are the media for cooperation involving the Bureau and other countries and for the coordinated research efforts aimed to solve mutual problems of the cooperating countries.

Formal agreements with the States are represented by commissions which coordinate the research and conservation efforts of the States involved in such compacts. Much of the coordinated effort is in large part based on scientific data provided by Bureau research. Two such commissions are the Atlantic States Marine Fisheries Commission and the Gulf States Marine Fisheries Commission.

The Bureau also cooperates closely with a number of national, regional, and local fishery and allied trade associations. Such cooperation embraces virtually all research, development, and service functions of the Bureau.

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The Bureau has formal and informal agreements with other Government agencies—the Atomic Energy Commission (AEC); Federal Trade Commission; Department of State; Department of Health, Education, and Welfare; Department of Agriculture; Department of Commerce; Weather Bureau; and various defense agencies.

Twice in 1960 the Bureau cooperated with the Federal Trade Commission on restraint of trade investigations. One problem concerned the activities of a State of Washington crab association, and the other, a group of Maryland clam diggers. Such cooperation is in line with a memorandum of understanding with regard to fishery cooperative practices which was consumated between the Bureau of Commercial Fisheries and the Federal Trade Commission on April 8, 1959.

In the latter part of 1960 the Bureau conducted a study for the AEC to determine the feasibility of marketing radiation-processed fishery products. This study is serving as a guide to the AEC in developing its long-range research and educational programs. Following completion of this study, the AEC contracted with the Bureau for a technological study on low-level radiation of fish.

The Bureau is conducting a study for the Office of Naval Research on shark repellants at the Technological Laboratory in Gloucester, Mass.

The U.S. Coast Guard cooperates with the Bureau in the enforcement of laws and regulations stemming from various international fishery treaties in which the United States is involved, for example, the North Pacific Fisheries Act of 1954, the Northwest Atlantic Fisheries Act of 1950, Northern Pacific Halibut Act of 1937, and the Whaling Convention Act of 1949. The Coast Guard also assists in fur seal protection.

The Bureau makes contracts with universities, State agencies, trade associations, and private organizations to use their best professional talent and research facilities to supplement research and service activities of Bureau personnel. Such contractual arrangements have been beneficial to cooperating groups by enabling them to expand their facilities and interest in fisheries matters. Appendix C lists the organizations with which the Bureau had formal contractual arrangements in 1960.

Organization, Employment, Budget, and Physical Property

Organization

In 1960 there were some organizational changes in the Bureau of Commercial Fisheries' Headquarters Office in Washington, D.C.

The Office of Loans and Grants was renamed the Branch of Loans and Grants, removed from the Office of the Director, and placed under the Division of Resource Development. For several years it

had been temporarily under the supervision of the Division of Industrial Research and Services (Appendix D).

There were still four divisions. Two of them assumed new names. The Division of Industrial Research and Services became the Division of Industrial Research. The Division of Resource Management became the Division of Resource Development.

Division of Administration.—There were no changes made in this Division.

Division of Biological Research.—The Branch of Anadromous and Inland Fisheries was split into two separate branches, the Branch of Anadromous Fisheries and the Branch of Inland Fisheries.

Division of Industrial Research.—From under this Division, the Branch of Market News and the Branch of Statistics were transferred to the Division of Resource Development. Also several branches of the Division of Industrial Research adopted new names:

1. The Branch of Exploratory Fishing and Gear Research became the Branch of Exploratory Fishing.

2. The Branch of Market Development became the Branch of Marketing.

3. The Branch of Special Reports became the Branch of Foreign Fisheries and Trade.

Division of Resource Development.—Besides acquiring the Branches of Loans and Grants, Market News, and Statistics, the Division of Resource Development was also assigned a new group—the Branch of Reports. The former Branches of Alaska Fisheries, Columbia River Fisheries, and Marine Mammals were combined into a single group called Branch of Resource Management.

In the field, the organization remained unchanged, five regional and two area offices. These and the territory included under each are shown in figure 1.

Employment

The total employment for the Bureau of Commercial Fisheries averaged 1,662 throughout calendar year 1960. Of this total average, 1,457 were permanent and 205 were seasonal employees. The peak employment for the year was reported for July, when there were 1,448 permanent and 398 seasonal employees, making a total of 1,846. The variation in the number of employees throughout the year and the relationship between the total number and the number of permanent employees and seasonal, or temporary employees, are shown in figure 2.

Budget

For the fiscal year 1960, $22.3 million were available to carry out the Bureau's program (Appendix E). Of this amount, $9.4 million were from annual appropriations; $5 million from Public Law 466

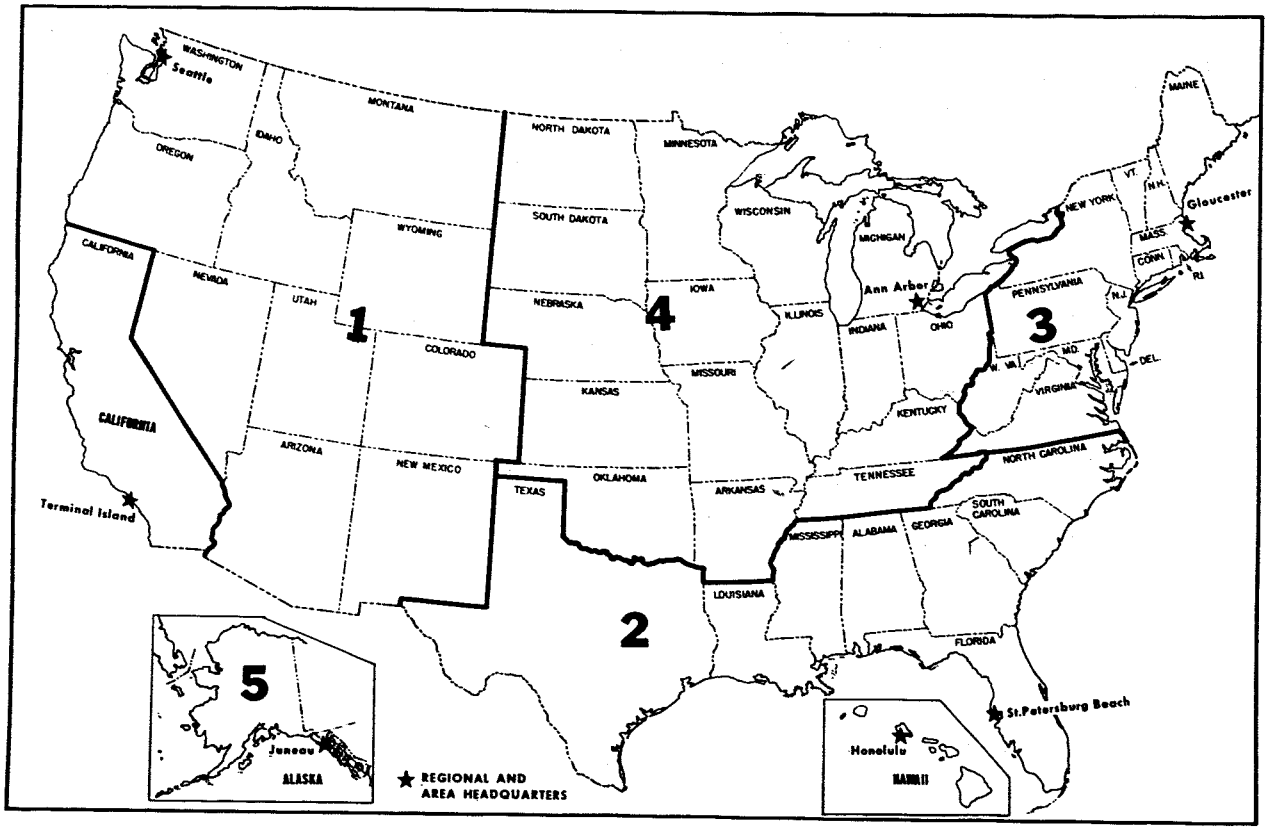


FIGURE 1.—Regions and areas, Bureau of Commercial Fisheries.

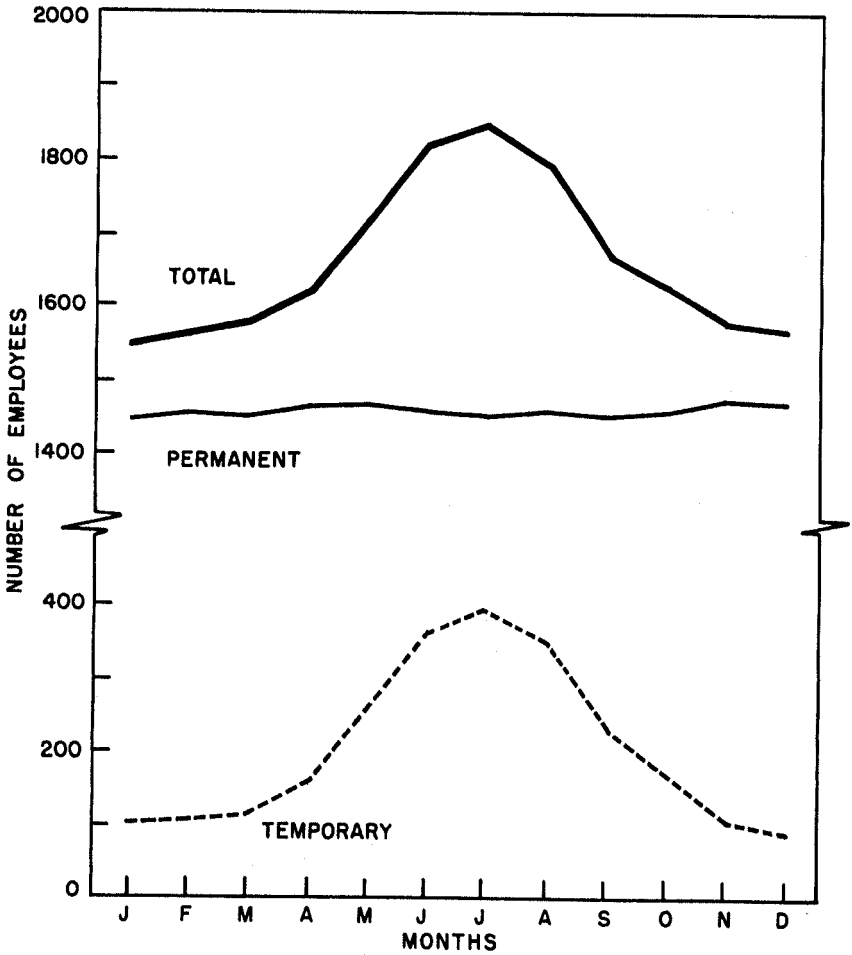


FIGURE 2.—Bureau of Commercial Fisheries employment totals, calendar year 1960.

(known as the Saltonstall-Kennedy Act) funds; $3 million from the fisheries loan fund, additional capital appropriated for this revolving fund; $3 million from funds transferred by the Corps of Engineers and the State Department, and $0.8 million made available to the Bureau by the Great Lakes Fishery Commission.

Physical Property

Field laboratories and stations, vessels, and installations on the Pribilof Islands are the principal physical properties of the Bureau (Appendix F). In the calendar year 1960, there were 24 large laboratories and installations, 68 smaller stations and offices, and 23 vessels of 40 feet and longer. One new major laboratory was acquired during the year. That was the Technological Laboratory at Gloucester, Mass. A new exploratory fishing and gear research base was opened in Juneau, Alaska, as well as a new statistical field office. Two new field research stations were put into operation at Pascagoula, Miss., and St. Paul Island, Alaska, and two exploratory fishing and gear research stations at Brunswick, Ga., and Erie, Pa.

Publications

Reflecting the wide range of the Bureau's interests, the 1960 publications covered activities in numerous fields that relate to fisheries: biology, chemistry, economics, engineering, marketing, and statistics. There was continued emphasis on publishing material of value to the fishing industry and the general public.

Exclusive of the 5 times-a-week Fishery Products Reports issued by the seven Market News Service field offices, a total of 775 publications (10,273 p.) were sponsored by the Bureau in 1960. In the Fish and Wildlife Service series were published 520 reports (8,364 p.); the remaining 255 (1,909 p.) appeared in nonservice journals and series. Bureau personnel wrote most of the articles; some were written by unpaid collaborators or members of research institutes under contract.

The 1960 publications can be divided into four principal classes which reflect the audiences for which they were written. First, there are the statistical reports of special interest to the fishing industry and fishery research workers. More than 48 percent of the 1960 publications were statistical in nature. Secondly, there are the contributions to scientific knowledge, particularly relating to fisheries; 30 percent of the 1960 publications fell in this class. Thirdly, there are the reports written especially for commercial and industrial fishery audiences; 16 percent were aimed at those groups. Fourthly, the popular audience was the object of 6 percent of the Bureau's publications.

Appendix G presents a description and partial list of the 1960 publications.

Appendix A—Fisheries of the United States

A–1.—*Employment, fishing craft, and establishments, calendar years 1960 and 1959*

Item	1960	1959
Persons employed:		
Direct:	*Number*	*Number*
Fishermen	130,431	128,985
Transporters	2,111	2,251
Shoreworkers	93,625	92,650
Indirect:		
Allied industries (gear, manufacture, boat building, processing equipment, etc.)	313,000	310,000
Total	539,167	533,886
Craft utilized:		
Fishing:		
Vessels (5 net tons and over)	12,018	12,109
Motor boats	56,889	54,735
Other boats	8,150	8,457
Transporting:		
Vessels (5 net tons and over)	891	883
Motor boats	203	282
Total	78,151	76,466
Vessels documented for fishing:		
First documentation	408	479
Redocumentation	24	34
Total	432	513
Fishery shore establishments:		
Pacific Coast States	515	545
Atlantic Coast and Gulf States	2,898	2,934
Great Lakes and Mississippi River States	772	872
Hawaii	22	21
Total	4,207	4,372

A–2.—*U.S. catch, calendar years 1960, 1959, and record year*

Species	1960		1959		Record catch	
	Million pounds	*Million dollars*	*Million pounds*	*Million dollars*	*Year*	*Million pounds*
Menhaden	2,018	20	2,203	26	1959	2,203
Tuna	298	38	286	37	1950	391
Shrimp	249	67	240	58	1954	268
Herring, sea:						
Atlantic	155	3	121	2	1902	201
Pacific	84	1	115	1	1937	263
Total	239	4	236	3	----	----
Salmon	235	45	202	36	1936	791
Crabs	222	17	175	15	1960	222
Ocean perch, Atlantic	141	5	137	6	1951	258
Industrial fish [1]	137	2	248	3	1959	248
Flounders	127	13	122	13	1948	139
Haddock	119	9	113	11	1929	294
Whiting	112	3	115	2	1957	133
Jack mackerel	75	2	38	1	1952	147
Oysters	60	29	65	29	[2] 1908	152
Sardine, Pacific	58	1	74	1	1936	1,502
Alewives	54	1	51	1	1908	90
Halibut, Pacific	51	6	54	8	1915	67
Clams	50	12	45	12	1960	50
Cod	46	3	60	4	1880	294
Mullet	41	2	41	2	1902	43
Mackerel, Pacific	37	1	38	1	1935	147
Anchovies	5	([3])	7	([3])	1953	86
Other	568	74	572	77	----	----
Total	4,942	354	5,122	346	----	----

[1] Unclassified species used for bait, reduction, and animal food.
[2] First year in which an oyster survey was made in all regions.
[3] Less than one-half million dollars.

A-3.—*Summary of manufactured fishery products by quantity and value, calendar years 1960 and 1959*

Item	1960		1959	
	Thousand pounds	*Thousand dollars*	*Thousand pounds*	*Thousand dollars*
Packaged products, fresh and frozen:				
Fish:				
Not breaded:				
Fillets and steaks, raw	153,166	48,437	147,248	46,174
Other (includes whale meat for animal feeding)	6,166	1,263	6,285	1,434
Breaded, raw and cooked:				
Sticks	65,142	28,671	60,377	28,611
Fillets, portions, and pan-dressed	51,924	18,965	37,956	13,377
Shellfish:				
Not breaded	191,749	138,022	172,355	119,702
Breaded	84,221	57,412	82,610	56,960
Fish and shellfish specialties	31,852	23,042	20,776	14,353
Total fresh and frozen	584,220	315,812	527,607	280,611
Canned:				
Fish and shellfish for human consumption:				
Tuna	301,388	172,679	282,192	159,143
Salmon	136,049	88,197	118,330	71,827
Sardines:				
Maine (sea herring)	46,744	16,700	41,024	14,902
Pacific	27,714	4,659	33,956	5,399
Mackerel	42,064	5,804	26,407	4,235
Clam products and specialties	47,013	14,183	42,644	13,640
Shrimp and specialties	14,469	17,294	14,010	16,999
Oysters and specialties	11,783	7,315	12,959	7,623
Squid	751	74	15,505	1,378
Other	33,091	15,842	35,123	15,116
Total for human consumption	661,066	342,747	622,150	310,262
Bait and animal food:				
Salmon eggs for bait	718	869	883	912
Animal food	421,772	43,979	346,102	37,077
Total bait and animal food	422,490	44,848	346,985	37,989
Total canned	1,083,556	387,595	969,135	348,251
Cured fish and shellfish:				
Salted, including lutefisk (from dried cod)	35,949	14,388	42,650	17,012
Smoked	31,512	27,557	29,650	23,316
Dried	858	900	322	291
Total cured	68,319	42,845	72,622	40,619
Industrial products:				
Meal and scrap	580,274	25,282	613,102	35,926
Oil, body and liver	209,143	13,386	187,334	13,092
Fish solubles and homogenized condensed fish	197,858	4,021	330,717	10,043
Oyster shell lime and poultry grit	941,650	6,821	798,676	4,937
Marine pearl shell and mussel shell buttons	[1] 1,949	3,253	[1] 2,770	4,313
Other		13,832		13,905
Total industrial products		66,595		82,216
Grand total		812,847		751,697

[1] Number of gross.

A–4.—*Foreign trade in fishery products, by quantity and value, calendar years 1960 and 1959*

Item	1960		1959	
	Thousand pounds	*Thousand dollars*	*Thousand pounds*	*Thousand dollars*
Imports:				
Edible:				
Fresh or frozen:				
Fresh-water fish (not fillets)	39,655	13,865	39,723	13,449
Salt-water fish (not fillets)	384,654	53,140	376,259	51,800
Groundfish and ocean perch fillets	155,550	33,265	184,837	38,759
Other fish fillets	61,713	20,955	64,802	21,012
Shrimp	113,418	56,406	106,555	52,306
Lobsters:				
Common	21,403	14,018	20,635	13,802
Spiny	32,346	30,750	28,092	24,833
Other fish and shellfish	14,827	5,598	12,453	4,407
Canned:				
Salmon	19,113	7,541	31,154	11,130
Sardines (in oil and not in oil)	27,377	9,115	22,163	8,370
Tuna (in oil and in brine)	51,755	19,142	56,134	21,688
Crab meat (includes paste and sauce)	4,507	5,514	7,304	7,947
Other fish and shellfish	52,185	21,306	67,045	23,524
Cured:				
Dried	1,228	608	1,574	692
Pickled or salted	80,645	14,282	79,627	13,055
Smoked	4,795	1,104	6,299	1,394
Other fish and shellfish	2,289	771	8,968	2,865
Total edible	1,067,460	307,380	1,113,624	311,033
Nonedible:				
Fish and marine animal oils	[1] 7,378	6,717	[1] 6,566	5,739
Fish meal and scrap	[2] 132	11,068	[2] 133	15,884
Other	----------	34,900	----------	33,844
Total nonedible	----------	52,685	----------	55,467
Grand total, imports	----------	360,065	----------	366,500
Exports:				
Edible:				
Fresh or frozen fish and shellfish	12,765	5,952	12,655	4,283
Canned:				
Mackerel	1,305	211	743	135
Salmon	11,924	9,830	13,826	10,639
Sardines (in oil and not in oil)	21,219	3,508	38,724	6,136
Other	12,630	5,161	13,236	4,736
Total canned	47,078	18,710	66,529	21,646
Cured	1,061	701	1,005	624
Other	550	259	499	194
Total edible	61,454	25,622	80,688	26,747
Nonedible:				
Fish and marine animal oil	[1] 145,060	10,835	[1] 146,009	12,044
Other	----------	7,708	----------	5,451
Total nonedible	----------	18,543	----------	17,495
Grand total, exports	----------	44,165	----------	44,242

[1] In thousand gallons.
[2] In thousand tons.

Appendix B—New Legislation

Fishing Vessel Construction Differential Subsidy

46 U.S.C. 1401–1413

Authorizes the Secretary to pay up to one-third of the cost of construction of a fishing vessel based upon the difference between foreign and domestic costs of contruction if the vessel, the owner, and the fishery in which it is to be used meet certain standards or situations. The law provides that applications for this aid will not be received after June 12, 1963.

74 Stat. 212; Public Law 86–516; Act of June 12, 1960.

Fishing Vessel Mortgage Insurance

46 U.S.C. 1275 Note

Provides that the Secretary of the Interior may exercise authority relating to the issuance of Federal ship mortgage insurance on fishing vessels comparable to that of the Secretary of Commerce under the Merchant Marine Act of 1936, as amended (46 U.S.C. 1271–1280) by reason of the transfer of authority to the Secretary of the Interior under the provisions of the Fish and Wildlife Act of 1956 (16 U.S.C. 742e).

74 Stat. 314; Public Law 86–577; Act of July 5, 1960.

Cooperative Research Units

16 U.S.C. 753a–753b

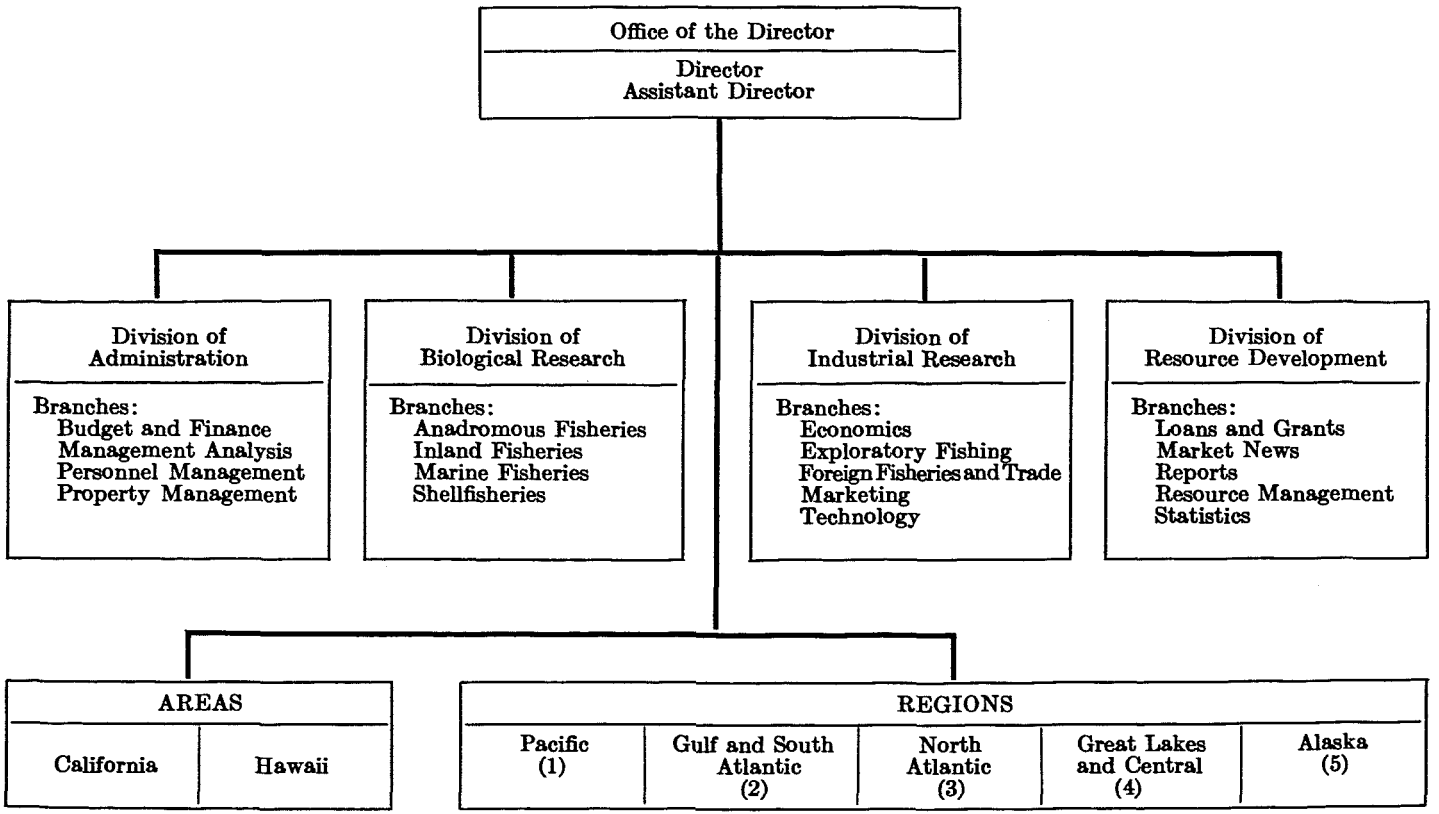
Authorizes the Secretary to continue to enter into cooperative agreements with colleges, universities, State fish and game departments, and with nonprofit organizations relating to cooperative research units by assigning Department of the Interior technical personnel for service with such units, by supplying units with equipment that may be available for such purposes, and by paying the incidental expenses of Federal personnel and employees of cooperating agencies assigned to the units.

74 Stat. 733; Public Law 86–686; Act of September 2, 1960.

Appendix C—Organizations With Which the Bureau Had Contracts in 1960

Alaska Department of Fisheries	Juneau, Alaska
Allied Record Manufacturing Company	Washington, D.C.
Barkley and Dexter Laboratories	Fitchburg, Mass.
Boston College (Bureau of Business Research)	Boston, Mass.
California, University of	Davis, Calif.
California, University of	Berkeley, Calif.
Connecticut, University of	Storrs, Conn.
Delaware, University of	Newark, Del.
Duke University	Durham, N.C.
Eastern Traffic Bureau, Inc	New York, N.Y.
Florida, University of (Bureau of Business and Economic Research).	Gainesville, Fla.
General Services Administration	Washington, D.C.
Gulf Coast Research Laboratory	Ocean Springs, Miss.
Idaho Department of Fish and Game	Boise, Idaho
Lime Crest Research Laboratory	Newton, N.J.
Miami, University of (Marine Laboratory)	Coral Gables, Fla.
Michigan, University of	Ann Arbor, Mich.
Minnesota, University of	Austin, Minn.
Minnesota, University of (Hormel Institute)	Austin, Minn.
National Fisheries Institute	Washington, D.C.
North Carolina, University of	Chapel Hill, N.C.
Oklahoma, University of	Norman, Okla.
Oregon Fish Commission	Portland, Oreg.
Oregon State College	Corvallis, Oreg.
Oregon State Game Commission	Portland, Oreg.
Oyster Institute of North America	Annapolis, Md.
Philip R. Park Foundation	San Pedro, Calif.
Rutgers, University of	Brunswick, N.J.
Sam Johnson and Sons, Inc	Duluth, Minn.
Scripps Institution of Oceanography	La Jolla, Calif.
Southern California, University of	Los Angeles, Calif.
Virginia Fisheries Laboratory	Gloucester Point, Va.
Washington, University of (Fisheries Research Institute.	Seattle, Wash.
Washington State Department of Fisheries	Seattle, Wash.
Washington State Department of Game	Seattle, Wash.
Woods Hole Oceanographic Institute	Woods Hole, Mass.

Appendix D—Organization Chart



Appendix E—Budget for Fiscal Year 1960

Function	Appropriations							Transferred funds			Contributed funds	Total
	Management and investigations of resources	Construction	General administrative expenses	Administration of Pribilof Islands	Payment to Alaska from Pribilof Islands receipts	Promote and develop fisheries [1]	Revolving fund, fisheries loan fund	Corps of Engineers		State Department, Passamaquoddy studies		
								Operation and maintenance	Construction			
Management	$320,000											$320,000
Marketing and technology	1,922,400					$1,989,290					$228,744	4,140,434
Research	3,375,600					2,753,485				$8,094	804,256	6,941,435
Research on fish migration over dams	291,200											291,200
Administration of Alaska fisheries	749,900											749,900
Construction and land acquisition		$400,000										400,000
General administrative services	33,900		$325,000			292,000		$49,300	$47,300		32,500	780,000
Administration of Pribilof Islands				$1,724,000								1,724,000
Fur seal research				216,000								216,000
Payment to Alaska					$813,919							813,919
Fisheries Advisory Committee						30,800						30,800
Fisheries Loan Fund							$3,000,000					3,000,000
Lower Columbia River:												
Operation and maintenance								1,700,700				1,700,700
Construction									1,152,700			1,152,700
Fishing vessel mortgage insurance	50,000											50,000
Total	[2] 6,743,000	400,000	325,000	1,940,000	813,919	5,065,575	3,000,000	1,750,000	1,200,000	8,094	[3] 1,065,500	22,311,088

[1] *Funds made available under Public Law 466, 83d Cong. (known as the Saltonstall-Kennedy Act of 1954).*

[2] *Includes $398,000 available from Pribilof Islands receipts.*

[3] *Includes $756,140 from Great Lakes Fishery Commission, $211,300 for inspection and grading of fishery products, and $71,496 from Marine Research Committee of California.*

Appendix F—Physical Properties

F–1.—*Principal laboratories and installations, calendar year 1960*

Location	Type	Principal use	Gross valuation [1]
Alaska:			
Juneau	Biological Laboratory, Exploratory Fishing and Gear Research Base, warehouse and shops.	Biological research, exploratory fishing and gear research, vessel maintenance, loans and grants.	[3] $212,000
Ketchikan	Technological Laboratory	Technological research	175,000
Pribilof Islands	Fur seal processing facilities and native villages.	Management of Alaska fur seals	2,327,000
California:			
La Jolla	Biological Laboratory	Biological research	[2]
San Diego	do	do	[2]
Stanford	do	do	[2]
Connecticut, Milford	do	do	80,000
District of Columbia:			
734 Jackson Pl., N.W.	do	do	[2]
U.S. National Museum.	do	do	[2]
Florida, Gulf Breeze	do	do	75,000
Georgia, Brunswick	do	do	[2]
Hawaii, Honolulu	do	Biological research, loans and grants.	314,000
Maine, Boothbay Harbor	do	Biological research, exploratory fishing and gear research.	[3] 110,000
Maryland:			
College Park	Technological Laboratory	Technological research, home economics.	81,000
Oxford	Biological Laboratory	Biological research	152,000
Massachusetts:			
Gloucester	Technological Laboratory	Technological research	235,000
Do	Exploratory Fishing and Gear Research Base.	Exploratory fishing and gear research.	45,000
Woods Hole	Biological Laboratory	Biological research	412,000
Michigan, Ann Arbor	Biological Laboratory, Technological Station, Exploratory Fishing and Gear Research Station.	Biological and technological research, exploratory fishing and gear research, market development.	[2]
Mississippi, Pascagoula	Exploratory Fishing and Gear Research Base, Technological Laboratory.	Exploratory fishing and gear research, loans and grants, market development, biological and technological research.	40,000
North Carolina, Beaufort	Biological Laboratory	Biological research, statistics	156,000
Texas, Galveston	do	Biological research	[2]
Washington, Seattle	Biological Laboratory, Technological Laboratory, Exploratory Fishing and Gear Research Base, dock and warehouse.	Biological and technological research, exploratory fishing and gear research, Pribilof Islands supply.	[3] 122,000
Puerto Rico, Mayaguez	Technological Laboratory	On loan to University of Puerto Rico.	27,000

[1] Figures shown are original acquisition or construction costs.
[2] Installation not owned by Bureau of Commercial Fisheries. Includes property held under leases, cooperative agreements, and use permits.
[3] Installations at this location are both owned and leased by Bureau of Commercial Fisheries.

F–2.—*Minor field research stations, market news offices, exploratory fishing stations, market development offices, and statistical offices, calendar year 1960*

Location	Type	Principal use	Gross valuation [1]
Alabama:			
Bayou LaBatre	Statistical and Market News Field Office.	Statistics and market news reporting.	[2]
Decatur	Field Research Station	Biological research	[2]
Alaska:			
Brooks Lake	do	do	$21,000
Juneau	Statistics Field Office	Statistics	[2]
Kariuk Lake	Field Research Station	Biological research	[2]
Kasitsna Bay	do	do	[2]
Little Port Walter	do	do	18,000
Pribilof Islands	do	do	
St. Paul Is	do	do	[2]

See footnotes at end of table.

F-2.—*Minor field research stations, market news offices, exploratory fishing stations, market development offices, and statistical offices, calendar year 1960*—Continued

Location	Type	Principal use	Gross valuation [1]
California:			
Mill Creek	Field Research Station	Biological research	$29,000
San Pedro	Market News and Statistics Office.	Market news reporting, statistics	(2)
Terminal Island	Marketing Office, Technological Station.	Marketing, technological research	(2)
Delaware, Millville	Field Research Station	Biological research	(2)
Florida:			
Apalachicola	Statistical and Market News Field Office.	Statistics and market news reporting.	(2)
Fort Meyers	do	do	(2)
Jacksonville	Marketing Office	Marketing	(2)
Key West	Statistical and Market News Field Office.	Statistics and market news reporting.	(2)
Miami	Statistical Field Office	Statistics	
St. Petersburg	Field Research Station	Biological research	(2)
St. Petersburg Beach.	Fishery Products Inspection Office.	Fishery products inspection	
Tampa	Statistical and Market News Field Office.	Statistics and market news reporting.	(2)
Georgia, Brunswick	Statistical Field Office, Exploratory Fishing and Gear Research Station.	Statistics, exploratory fishing and gear research.	(2)
Illinois, Chicago	Market News Office, Fishery Products Inspection Office.	Market news reporting, fishery products inspection.	(2)
Louisiana:			
Empire	Statistical Field Office	Statistics	(2)
Galfano	do	do	(2)
Houma	Statistical and Market News Field Office.	Statistics and market news reporting.	(2)
Morgan City	do	do	(2)
New Orleans	Market News and Statistics Office.	do	(2)
Port Sulphur	do	do	(2)
Maine:			
Eastport	Field Research Station	Biological research	(2)
Portland	Field Office	Statistics, market news, biological research.	(2)
Rockland	do	do	(2)
West Boothbay Harbor.	Statistical Field Office	Statistics	(2)
Maryland:			
Salisbury	do	do	(2)
Massachusetts:			
Boston	Market News Office, Marketing.	Market news reporting, statistics, biological research, marketing.	(2)
Gloucester	Field Offices	Statistics, biological research, market news, fishery products inspection.	
New Bedford	Field Office	Statistics, biological research, market news reporting.	(2)
Provincetown	Statistical Field Office	Statistics, market news reporting	(2)
Vineyard Haven	Field Research Station	Biological research	(2)
Michigan:			
Ludington	do	do	(2)
Marquette	do	do	(2)
Northville	Field Office	do	(2)
Rogers City	Field Research Station	do	(2)
Mississippi:			
Ocean Springs	Statistical Field Office	Statistics	(2)
Pascagoula	Field Research Station	Biological research	(2)
New Jersey, Toms River	Statistical Field Office	Statistics	(2)
New York:			
Bayport	do	do	(2)
New York City	Market News Office, Marketing Fishery Products Inspection Office.	Market news reporting, marketing, fishery products inspection.	(2)
Ohio, Sandusky	Field Station	Biological research	(2)
Oregon, Astoria	Statistical Field Office	Statistics	(2)
Pennsylvania, Erie	Exploratory Fishing and Gear Research Station.	Exploratory fishing and gear research.	
Rhode Island:			
Point Judith	Field Research Station	Biological research	(2)
Warren	Statistical Field Office	Statistics	(2)
South Carolina, Charleston.	do	do	(2)
Tennessee, Milan	do	do	(2)

See footnotes at end of table.

F-2.—*Minor field research stations, market news offices, exploratory fishing stations, market development offices, and statistical offices, calendar year 1960*—Continued

Location	Type	Principal use	Gross valuation [1]
Texas:			
Aransas Pass	Market News and Statistical Field Office.	Statistics and market news	[2]
Brownsville	Market News and Statistical Field Office, Fishery Products Inspection Office.	Statistics and market news, fishery products inspection.	[2]
Dallas	Marketing Office	Marketing	[2]
Freeport	Market News and Statistical Field Office.	Statistics and market news	[2]
Galveston	do	do	[2]
Virginia:			
Franklin City	Field Research Station	Biological research	[2]
Hampton	Market News Office	Market news reporting	[2]
Portsmouth	do	do	[2]
Weems	Statistical Field Office	Statistics	[2]
Washington:			
North Bonneville	Field Research Station	Biological research	[2]
Seattle	Market News and Statistical Office.	Market news reporting, statistics, loans and grants.	[2]
	Marketing, Fishery Products Inspection Office.	Marketing, fishery products inspection.	[3]
Wisconsin:			
Aconto	Field Research Station	Biological research	[2]
Ashland	do	do	[2]

[1] Figures shown are original acquisition or construction costs.
[2] Installation not owned by Bureau of Commercial Fisheries. Includes property held under leases, cooperative agreements, and use permits.
[3] Installations at this location are both owned and leased by Bureau of Commercial Fisheries.

F-3.—*Bureau of Commercial Fisheries vessel fleet, calendar year 1960*

Name of vessel	Home port	Length (feet)	Year built	Cost	Horsepower	Primary activity
Black Douglas	La Jolla, Calif.	152	1926	$75,000	325	Biological research.
Penguin II	Seattle, Wash.	148	1950	533,532	875	Pribilof Islands supply.
Delaware	East Boston, Mass.	147	1937	302,473	735	Exploratory fishing and gear research.
Hugh M. Smith	Terminal Island, Calif.	128	1945	150,000	500	Loaned to University of California Scripps Institution.
Charles H. Gilbert	Honolulu, Hawaii	112	1952	[1] 409,890	640	Biological research.
Alaska	Brunswick, Ga.	100	1947	300,000	600	On loan to University of California Scripps Institution.
Oregon	Pascagoula, Miss.	100	1947	300,000	600	Exploratory fishing and gear research.
John N. Cobb	Seattle, Wash.	93	1950	235,392	500	Do.
John R. Manning	Juneau, Alaska	86	1950	181,600	320	Biological research.
Murre II	Juneau, Alaska	86	1943	64,000	115	Do.
Pelican	Juneau, Alaska (On loan for 5 years).	75	1930	50,200	200	On loan to State of Washington.
George M. Bowers	Pascagoula, Miss.	73	1956	93,800	210	Biological research.
Rorqual	Boothbay Harbor, Maine.	65	[2]	[3]	230	Exploratory fishing and gear research.
Cisco	Bay City, Mich.	60	1950	85,000	175	Biological research.
Heron	Juneau, Alaska	58	1940	19,000	135	Do.
Musky	Sandusky, Ohio	53	1931	3,666	170	Do.
Siscowet	Ashland, Wis.	52	1946	[1] 81,000	170	Do.
Shang Wheeler	Milford, Conn.	50	1951	45,840	140	Do.
Alosa	Annapolis, Md.	48	1941	6,500	82	Do.
Kingfish	St. Petersburg Beach, Fla.	43	1954	24,500	150	Do.
J-1110	Beaufort, N.C.	40	1934	15,000	200	Do.
Phalarope II	Boothbay Harbor, Maine.	40	1932	8,000	225	Do.
Sockeye	King Salmon, Alaska.	40	1946	16,168	175	Do.

[1] The amount includes cost of alterations.
[2] Year vessel was built is unknown.
[3] Vessel is on loan from Army.

Appendix G—Fish and Wildlife Service Series and a 1960 List of Publications by Bureau Personnel

The regular, established series of the Fish and Wildlife Service in which Bureau of Commercial Fisheries publications appear are:

Fishery Bulletin.—Technical reports of scientific investigations of fishery biology. The Bulletin of the United States Fish Commission was begun in 1881; it became the Bulletin of the Bureau of Fisheries in 1904 and the Fishery Bulletin of the Fish and Wildlife Service in 1941. Through volume 46, separates were issued as Documents. (The last Document was No. 1103.) Beginning with volume 47 in 1931, each separate was issued as a numbered Bulletin. Fishery Bulletins 167 to 174, 176 to 180 (348 p.) of volumes 60 and 61 were issued in 1960. Bulletins are for sale by the Superintendent of Documents; they are distributed free to libraries and to a limited number of scientific cooperators.

Research Report.—Technical papers reporting the results of scientific investigations with emphasis on their practical application. Included are biological, technological, and economic subjects. These succeeded the Investigational Reports series. Only one dealing with Bureau of Commercial Fisheries projects was published in 1960 (No. 52, 32 p.). They are for sale by the Superintendent of Documents but are distributed free to libraries and to a limited number of cooperators.

Special Scientific Report—Fisheries.—Preliminary or progress reports and reports on scientific investigations of restricted scope. Established as Special Scientific Reports in 1940, Nos. 1 to 67 were issued from that date to 1949, when the new series, Special Scientific Report—Fisheries, with new serial numbering was started. In 1960 there were 38 (1,501 p.) of these reports published, No. 370 being the last. They are processed from typewritten text to speed publication and are distributed free to libraries and cooperators on a limited mailing list.

Fishery Leaflet.—Popular information on fishery subjects intended primarily for use in correspondence. Twenty-three leaflets (517 p.) were published during the year. They are distributed free on request.

Circular.—Popular and semitechnical publications of general and regional interest intended to aid conservation and management. Twelve circulars (543 p.) were issued in 1960. They are usually distributed to depository libraries.

Commercial Fisheries Abstracts.—A monthly abstract of world literature (chiefly English language) on fishery technology. Volume 13 in 1960 had 12 issues (316 p.). They have free, but limited distribution.

Commercial Fisheries Review.—A monthly presentation of developments and news of the domestic and foreign fishery industries. Volume 22 in 1960 had 12 issues (1,293 p.). They have free, but limited distribution.

Statistical Digest.—Annual statistics with detailed tabulations relating to fishery production, manufacture, and commerce. These succeeded the Administrative Report series. Four (659 p.) were published in 1960. They are for sale by the Superintendent of Documents; some are distributed free to a limited mailing list.

Current Fishery Statistics.—Current statistical information on fishery production, manufacture, and domestic or foreign trade, issued monthly, quarterly, or annually, by States, regions, or larger units. In 1960 there were 193 monthly landing reports (630 p.) for 17 States; 26 monthly reports of manufactured products (135 p.); and 34 annual reports of sectional and State operating units, catch statistics, manufactured products, and foreign trade (271 p.).

Fishery Products Report.—Daily (5 times a week), monthly, and annual—data on landings, receipts, supplies, prices, imports, and movements of fish and

fish products in local areas; market conditions; fishery developments in the United States and foreign countries. Also special Market News data reports are issued sporadically. Seven Market News Service field offices prepare and mail these free reports. During 1960 the daily reports totaled 6,298 pages; the monthly and annual, 1,595 pages; and supplementary, 104 pages.

Miscellaneous papers.—Forty-three miscellaneous papers, totaling 445 pages, were issued.

Audiovisual material.—In addition to the regular series of publications, the Bureau also produced some audiovisual materials—films and recordings to promote public interest in fish consumption. One 16-mm., a sound film short, and a recording were made in 1960. The film was Sponge—treasure from the sea; the sound film short, prepared for television, was Nutritional value of fish and shellfish, and the recording, prepared for the radio, was also entitled Nutritional value of fish and shellfish.

A detailed list of publications of the Bureau of Commercial Fisheries and its personnel or contractors during 1960 follows. The articles are listed by authors.

Publications[1]

AHLSTROM, ELBERT H.

Fish spawning in 1957 and 1958. *In* Part II, Symposium on *The changing Pacific Ocean in 1957 and 1958.* California Cooperative Oceanic Fishery Investigations Reports, vol. 7, p. 173–179.

Review of *Invertebrate Zoology* by Victor Schechter. Copeia, 1960, No. 4, p. 387–388.

AKANA, ALBERT K., Jr., HERBERT J. MANN, and ROBERT E. K. D. LEE.

Research vessel is fitted for underwater observation of fish. Pacific Fisherman, vol. 58, No. 8, p. 8–10.

ALBANO, G. A.

Receipts and prices of fresh and frozen fishery products at Chicago, 1959. U.S. Fish and Wildlife Service, Chicago Market News Office, 66 p.

ALDRICH, DAVID V.

Review of *The physiology of fishes*, edited by Margaret E. Brown. Vol. 1, Metabolism; vol. 2, Behavior. Transactions of the American Fisheries Society, vol. 89, No. 3, p. 316.

ALDRICH, DAVID V., and WILLIAM B. WILSON.

The effect of salinity on growth of *Gymnodinium breve* Davis. Biological Bulletin, vol. 119, No. 1, p. 57–64.

ALLEN, GEORGE H., and LEIGHTON G. CLAUSSEN.

Selectivity of food by brook trout in a Wyoming beaver pond. Transactions of the American Fisheries Society, vol. 89, No. 1, p. 80–81.

ALVERSON, DAYTON L.

A study of annual and seasonal bathymetric catch patterns for commercially important groundfishes of the Pacific northwest coast of North America. Pacific Marine Fisheries Commission, Bulletin 4, Portland, Oreg., 66 p.

Fishing vessels around the world. U.S. Naval Institute Proceedings, vol. 87, No. 1, p. 98–109.

Pin-pointing productive bottom with super-sounders and drags. Pacific Fisherman, vol. 58, No. 13, p. 23, 25.

The Japanese and Russian trawl fishery in the Bering Sea. Western Fisheries, vol. 60, No. 1, p. 12–14, 30–31.

[1] This list does not include Commercial Fisheries Abstracts, Current Fishery Statistics, and Commercial Fisheries Review, except a few articles for which the authors' names are given.

ALVERSON, DAYTON L., RICHARD L. MCNEELY, and HAROLD C. JOHNSON.
Results of exploratory shrimp fishing off Washington and Oregon (1958). U.S. Fish and Wildlife Service, Commercial Fisheries Review, vol. 22, No. 1, p. 1–11. [Also as Separate No. 574.]

ALVERSON, DAYTON L., and PETER G. SCHMIDT, Jr.
Two Pacific trawlers designed and timed to tomorrow's trend. Pacific Fisherman, vol. 58, No. 7, p. 29, 31–33.

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Fisheries industry. *In* Americana Annual 1960, p. 263–264. Americana Corporation, Chicago, Ill.

ARNOLD, EDGAR L., Jr., RAY S. WHEELER, and KENNETH N. BAXTER.
Observations on fishes and other biota of East Lagoon, Galveston Island. U.S. Fish and Wildlife Service, Special Scientific Report—Fisheries No. 344, iii + 30 p.

AUSTIN, THOMAS S.
Oceanography of the east central equatorial Pacific as observed during expedition Eastropic. U.S. Fish and Wildlife Service, Fishery Bulletin 168, vol. 60, iv+p. 257–282.
Summary, 1955–57 ocean temperatures, central equatorial Pacific. *In* Part II, Symposium on *The changing Pacific Ocean in 1957 and 1958*. California Cooperative Oceanic Fishery Investigations Reports, vol. 7, p. 52–55.

BEETON, ALFRED M.
Great Lakes limnological investigations. Proceedings of the Third Conference on Great Lakes research, 1959. Great Lakes Research Division, Institute of Science and Technology, University of Michigan, Publication No. 4, p. 123–128.
The vertical migration of *Mysis relicta* in Lakes Huron and Michigan. Journal of the Fisheries Research Board of Canada, vol. 17, No. 4, p. 517–539.

BELL, M. C., and C. H. CLAY.
Facilities for anadromous fish passage, Passamaquoddy project. Journal of the Fisheries Research Board of Canada, vol. 17, No. 4, p. 507–516.

BERRY, FREDERICK H.
Scale and scute development of the carangid fish *Caranx crysos* (Mitchill). Journal of the Florida Academy of Sciences, vol. 23, No. 1, p. 59–66.

BOYAR, H. C.
Fish swimming around in circles prove just how slow they are. Maine Coast Fisherman, vol. 15, No. 2, p. 13.

BOYAR, H. C., and F. E. SCHUELER.
A photoelectric current meter. U.S. Fish and Wildlife Service, Special Scientific Report—Fisheries No. 330, iii+7 p.

BRACKETT, LEE F.
Management techniques in an offshore fishery. Transactions of the Twenty-fifth North American Wildlife and Natural Resources Conference, p. 334–338.

BRIGHT, DONALD B.
Physical features of Kachemak Bay, Alaska, affecting the life history of the king crab, *Paralithodes camtschatica* Tilesius. Proceedings of the Tenth Alaskan Science Conference, August 25 to 28, 1959, p. 68.

BROCK, VERNON E.
Fisheries and the future. Proceedings of the Hawaiian Academy of Science, Thirty-fifth Annual Meeting, 1959–60, p. 3.

BROCK, VERNON E.—Continued
The introduction of aquatic animals into Hawaiian waters. Internationale Revue der gesamten Hydrobiologie und Hydrographie, Band 45, Heft 4, p. 463–480.

BROCK, VERNON E., and ROBERT H. RIFFENBURGH.
Fish schooling: a possible factor in reducing predation. Journal du Conseil Permanent International pour l'Exploration de la Mer, vol. 25, No. 3, p. 307–317.

BROUILLARD, KEITH D.
Complex problem faces Great Lakes. Fishing Gazette, vol. 77, No. 2, p. 22, 68.

BROUILLARD, KEITH D., and ROBERT G. PERSONIUS.
Changing Great Lakes fisheries require new fishing methods, research. National Fisherman, vol. 41, No. 7, p. 10, 26.

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Glucose metabolism in carp. Journal of Cellular and Comparative Physiology, vol. 55, No. 1, p. 81–85.

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Trawling gear designed for industrial fish production. Fish Boat Yearbook, 1960, vol. 5, No. 3, p. 18–21, 91–92.

BUMPUS, DEAN F.
Sources of water contributed to the Bay of Fundy by surface circulation. Journal of the Fisheries Research Board of Canada, vol. 17, No. 2, p. 181–197.

BUREAU OF COMMERCIAL FISHERIES.
A program of research and development for the Pacific coast tuna industry. U.S. Fish and Wildlife Service, Circular 87, ii+7 p.
Fishery motion pictures (list of). U.S. Fish and Wildlife Service, Fishery Leaflet 452, 21 p.
International North Pacific Fisheries Commission United States Section Meeting, March 1960. Papers presented before a joint session of the Alaska Legislature, Juneau, Alaska, March 4, 1960. U.S. Fish and Wildlife Service, Circular 85, iv+28 p.
List of fishery associations in the United States. U.S. Fish and Wildlife Service, Fishery Leaflet 254, 13 p.
List of fishery cooperatives in the United States. U.S. Fish and Wildlife Service, Fishery Leaflet 292, 5 p.
Special report: Tests prove variable pitch prop efficiency. Fishing Gazette, vol. 77, No. 12, p. 20–21.
Take a can of salmon. U.S. Fish and Wildlife Service, Circular 60, 17 p.

BUREAU OF COMMERCIAL FISHERIES, BIOLOGICAL LABORATORY, GALVESTON, TEX.
Fishery research, Galveston Biological Laboratory, fiscal year 1960. U.S. Fish and Wildlife Service, Circular 92, ii+77 p.

BUREAU OF COMMERCIAL FISHERIES, BIOLOGICAL LABORATORY, HONOLULU, HAWAII.
Honolulu Biological Laboratory, past (1949–1958), present (1959), future (1960–). U.S. Fish and Wildlife Service, Circular 83, iii+62 p.

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Report on the investigations by the United States for the International North Pacific Fisheries Commission—1959. *In* International North Pacific Fisheries Commission Annual Report for the year 1959, p. 79–116.

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Importance of the United States fisheries to the national economy, August 23, 1960, 8 p.

List of fishermen's and fish shore workers' unions in the United States. U.S. Fish and Wildlife Service, Fishery Leaflet 293, 8 p.

Manufacturing-plant food services as markets for fish and shellfish. U.S. Fish and Wildlife Service, Special Scientific Report—Fisheries No. 343, iv+31 p.

U.S. customs receipts from imports of aquatic products for calendar years 1958 and 1959, and list of duty free aquatic products, June 1960, 15 p.

Who buys canned salmon, and why? U.S. Fish and Wildlife Service, Circular 89, vi+46 p.

Who buys canned sardines, and why? U.S. Fish and Wildlife Service, Circular 90, vii+66 p.

Who buys canned tuna, and why? U.S. Fish and Wildlife Service, Circular 88, v+59 p.

BUREAU OF COMMERCIAL FISHERIES, BRANCH OF FOREIGN FISHERIES AND TRADE.

Report of the Secretary of the Interior to the President and the Congress on fresh, frozen, and processed shrimp. 100 p.

BUREAU OF COMMERCIAL FISHERIES, BRANCH OF LOANS AND GRANTS.

Federal fishing vessel mortgage and loan insurance. U.S. Fish and Wildlife Service, Fishery Leaflet 499, 12 p.

Fishing vessel construction differential subsidy. U.S. Fish and Wildlife Service, Fishery Leaflet 503, 11 p.

BUREAU OF COMMERCIAL FISHERIES, BRANCH OF MARKETING.

August is sandwich month. Special Fisheries Marketing Bulletin for food editors, 9 p.

Canned fish consumer purchases by family characteristics (October 1958–September 1959). U.S. Fish and Wildlife Service, Fishery Leaflet 478 *l*, 53 p.

Commercial fisheries outlook, January–March 1960. U.S. Fish and Wildlife Service, Fishery Leaflet 336 *qq*, 45 p.

Commercial fisheries outlook, April–June 1960. U.S. Fish and Wildlife Service, Fishery Leaflet 336 *rr*, 44 p.

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Commercial fisheries outlook, October–December 1960. U.S. Fish and Wildlife Service, Fishery Leaflet 336 *tt*, 44 p.

Cranberries and fish—a fall food feature. Special Fisheries Marketing Bulletin for food editors, 1 p.

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Fish recipes for Lent. Special Fisheries Marketing Bulletin for institutions, 1 p.

Fish recipes for Lent. Special Fisheries Marketing Bulletin for restaurants, 1 p.

BUREAU OF COMMERICAL FISHERIES, BRANCH OF MARKETING—Continued

Fish recipes for Lent. Five Special Fisheries Marketing Bulletins for school lunch, each 1 sheet.

Fish 'n' seafood parade, October 17–23. Special Fisheries Marketing Bulletin for food editors, 36 p.

Fish 'n' seafood parade, October 17–23. Two Special Fisheries Marketing Bulletins for instutitions, each 1 p.

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Hampton, Virginia, 1610–1960. Special Fisheries Marketing Bulletin for food editors (issued in recognition of Hampton's tricentennial), 1 p.

Holiday issue. Special Fisheries Marketing Bulletin for food editors, 8 p.

Marketing feasibility study of radiation processed fishery products. U.S. Atomic Energy Commission, Office of Isotopes Development, Report No. 1030, Isotopes-Industrial Technology, December 1, 1960, 33 p.

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United Nations food day, October 24, 1960. Special Fisheries Marketing Bulletin for food editors, 1 p.

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Information and explanatory statement for daily New England Markets News Service "Fishery products reports," issued at Boston, 10 p.

New England fisheries monthly summary (1960). Twelve issues, January to December, total 276 p.

BUREAU OF COMMERCIAL FISHERIES, CHICAGO MARKET NEWS SERVICE.

Monthly summary of Chicago's wholesale market fresh and frozen fishery products recipes and prices (1960). Twelve issues, January to December, total 161 p.

BUREAU OF COMMERCIAL FISHERIES, DIVISION OF INDUSTRIAL RESEARCH AND SERVICES.

Inspectors' instructions for grading frozen halibut steaks, September, first issue, 1+25 p.

United States standards for grades of frozen cod fillets, March, first issue, 5 p.

United States standards for grades of frozen raw breaded fish portions, March, first issue, 7 p.

BUREAU OF COMMERCIAL FISHERIES, HAMPTON MARKET NEWS SERVICE.

Monthly summary of fishery products for Baltimore, Md. Twelve issues, January to December, total 101 p.

BUREAU OF COMMERICAL FISHERIES, HAMPTON MARKET NEWS SERVICE—Continued
Monthly summary of fishery products production in selected areas of Virginia, North Carolina, and Maryland (1960). Twelve issues, January to December, total 48 p.

BUREAU OF COMMERCIAL FISHERIES, NEW ORLEANS MARKET NEWS SERVICE.
Brokers and importers of fishery products, New Orleans, La., 1960, 3 p.
Gulf of Mexico monthly landings, production, and shipments of fishery products (1960). Twelve issues, January to December, total 137 p.

BUREAU OF COMMERCIAL FISHERIES, NEW YORK MARKET NEWS SERVICE.
List of primary receivers of imported fishery products and byproducts, New York City, 1960, 19 p.
New York City's wholesale fishery trade monthly summaries (1960). Twelve issues, January to December, total 273 p.
Shrimp scientific names in the United States and foreign countries, 1960, 2 p.

BUREAU OF COMMERCIAL FISHERIES, SAN PEDRO MARKET NEWS SERVICE.
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BUREAU OF COMMERCIAL FISHERIES, SEATTLE EXPLORATORY FISHING AND GEAR RESEARCH BASE.
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Voyage of the Venus. Nautilus, vol. 74, No. 2, p. 65–68.

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Accumulation of radioactive pollutants by marine organisms and its relation to fisheries. Biological Problems in Water Pollution. *In* Transactions of the 1959 Seminar, p. 8–14. U.S. Department of Health, Education, and Welfare, Public Health Service.
Biological aspects of disposal of radioactive wastes in marine environments. Disposal of Radioactive Wastes, p. 3–15. International Atomic Energy Agency, Vienna, Austria.

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Distribution of menhaden, genus *Brevoortia*, in the Gulf of Mexico. Transactions of the American Fisheries Society, vol. 89, No. 4, p. 338–343.

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Fishes taken in the menhaden fishery of Alabama, Mississippi, and eastern Louisiana. U.S. Fish and Wildlife Service, Special Scientific Report—Fisheries No. 339, ii + 10 p.

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