

Baird's Legacy:

The History and Accomplishments of NOAA's National Marine Fisheries Service, 1871–1996

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Fish.

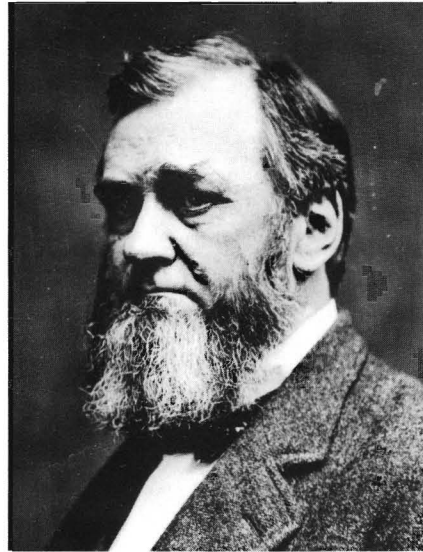
The word evokes many thoughts and images—deep-fried shrimp, a tuna sandwich, cod fillets, oysters on the half-shell. Or, a salmon tugging on the line, a leaping marlin, or maybe just the slap of the waves and the brisk sea air.

But for the Nation, fish have always been important, first for food and trade, often for recreation, and even as a key component of National security.

So it should not be too surprising that the Nation's first Federal conservation agency, initiated in 1871, was devoted to the protection, study, management, and restoration of fish. This agency was the United States Commission of Fish and Fisheries, usually just called the "Fish Commission." Later it was renamed the Bureau of Fisheries, and still later it became the Bureau of Commercial Fisheries. Today its direct descendant is NOAA's National Marine Fisheries Service (NMFS).

The year 1996 is thus a major milestone for the NMFS—its 125th Anniversary as the Nation’s oldest Federal conservation and environmental research agency. Some of its activities have been well known: Fish culture and marine mammal protection and restoration, for example. Less known are the Fish Commission/NMFS roles in initiating and promoting basic and applied oceanographic and marine biological and ecological research, food product development, fishery development, and many other important tasks.

The U.S. Commission of Fish and Fisheries was created by Congress on February 9, 1871, and charged with studying and recommending solutions to an apparent decline in New England’s fishes. Its first Commissioner was Spencer Fullerton



Spencer Fullerton Baird

Baird, Assistant Secretary of the Smithsonian Institution and an internationally acclaimed scientist.

Baird was already well aware of the New England fishermen’s concerns. Most important, though, he recognized that there would be no simple answers to the problems he

had been directed to investigate. Except in the areas of sounding and charting of the sea coasts, knowledge of the Nation’s seas, and especially its fish and fisheries, was scant.

Keenly aware of those deficiencies, Baird quickly initiated the Nation’s first marine ecological studies. As he put it, studying only the fish “. . . would not be complete without a thorough knowledge of their associates in the sea, especially of such as prey upon them or constitute their food. . . .” He also sought data on “. . . the temperature of the water taken at different depths, its varying transparency, density, chemical composition, percentage of saline matter, its surface and under currents, and other features of its physical condition” because these were “likely to throw more or less light upon the agencies which exer-

cise an influence upon the presence or absence of particular fishes.”

In short, Baird sought to explore the “physical, natural, and economical features of the sea” as fully as possible. In so doing, he laid important groundwork for an agency of immense productivity. In sum, the Fish Commission/NMFS has provided 125 years of conservation and environmental leadership while conducting a broad spectrum of basic and applied research into fisheries and marine biology, food science and technology, marine ecosystems, environmental health and contamination, marine mammal science, and much more.

Actually, the roots of the U.S. Fish Commission lie deep in the Nation’s history. Secretary of State Thomas Jefferson discussed the Federal interest in fisheries in 1791, noting how fishermen had been devastated during the Revolutionary War and reviewing their importance in trade and as “a nursery for forming seamen.”

Jefferson was not the only Founding Father or President inter-

ested in fisheries. Benjamin Franklin had made early observations of marine life, and his charting of the Gulf Stream allowed mariners to greatly cut travel time to and from Europe. And later, in 1822, John Quincy Adams collected and published a volume on “The Duplicate Letters, the Fisheries and the Mississippi” for the treaty negotiations at Ghent where protection of U.S. fishing rights had been of prime importance.

CHRONOLOGY OF NOTABLE DATES

1782

Preliminary Articles of Peace between England and the United States are adopted. Article 3 deals with the U.S. rights to fish on the Grand Bank and other Newfoundland banks in the “Gulph” of St. Lawrence and elsewhere.

1791

Secretary of State Thomas Jefferson delivers the Nation’s first comprehensive fisheries report to the U.S. Congress on February 2nd, noting the “superiority of our mariners in skill, activity, enterprise, sobriety and order” and recommending

tax relief, a retaliatory tariff on foreign products, and promotion of free markets abroad.

1811

Christopher Barker and John Tallman “... commenced the business of making oil out of menhaden fish, with the use of two iron pots, upon the shore, a few rods south of what was then called the Black Point wharf, near Portsmouth, R.I.”

1815

“Neither nature nor art has partitioned the sea into kingdoms, republics or states ... the ocean and its treasures are the common property of all men, and we have a natural right to navigate the ocean and to

fish in it, whenever and wherever we wish.”—John Quincy Adams.

1819

Canning is introduced into the United States by Ezra Daggett and Thomas Kensett who pack oysters and other seafood in New York.

1822

John Quincy Adams publishes his book “The Duplicate Letters, the Fisheries and the Mississippi,” relating to the negotiation of the Treaty of Ghent where he was one of the U.S. Commissioners.

1823

Spencer Fullerton Baird is born on Febru-

By the time that Spencer Baird was named Assistant Secretary of the Smithsonian Institution in 1850, interest was also stirring in the European rediscovery of trout and salmon culture. Many believed that fish culture would help repopulate New England waters with Atlantic salmon, trout, shad, and other depleted species. And by the middle 1860's, a handful of New England states had set up small state "fish commissions" to explore the possibility of fish culture.

Baird began his own marine studies at Woods Hole, Mass., in 1863, and his later coastal excursions made him acutely aware of the fishermen's concerns about fish declines. In 1870, he persuaded Smithsonian Secretary Joseph Henry to allot \$100 for his summer marine study with a 30-foot sloop borrowed from the Treasury Department. Later that winter, Baird drew up a plan for a Federal inquiry into New England's fishery problems, which led to the creation

of the new U.S. Commission of Fish and Fisheries, at first a Commission of one—Baird in an unsalaried position and operating out of his own home.

Congress' first charge to the Fish Commission in 1871 was to study the reasons for the decline of several New England and lake fishes and recommend solutions. But just a year later Congress gave it a new task—fish culture—and \$15,000 to study and promote it.

ary 3rd. He eventually will become an internationally recognized systematic zoologist, ornithologist, author, Smithsonian Secretary, and in 1871, the first Commissioner of the U.S. Commission of Fish and Fisheries.

1831

"... all of us went up the Tulpehoclan on the 4th of July to go afishing, we caught 8 catfish and 2 sunfish, they fired the 2 brass cannons off in our street and broke your office window."—Spencer Baird, age 8, in a letter to his attorney father.

1850

Baird, now professor of natural history at Dickinson College, is hired as Assistant

Secretary of the Smithsonian Institution by Secretary Joseph Henry.

1853

Lorenzo Sabine delivers to the Secretary of the Treasury his thorough and well-documented treatise "Report on the Principal Fisheries of the American Seas."

1857

"It should not be surprising that the subject [of fish culture] is attracting the attention of some of the best minds in our country; more especially when we consider the impoverished condition of our rivers and streams, many of which are susceptible of being inhabited by innumerable salmon and trout, and since replen-

ishment is now no longer problematical."—Dr. Theodatus Garlick, the first U.S. trout culturist.

1864

The first successful U.S. salmon cannery begins operation at Sacramento, Calif.

1867

Shrimp is first canned commercially near Louisiana's Grand Terre Island.

Alaska, with its vast but untapped marine and anadromous fishery resources, is purchased from Russia for \$7.2 million. Furs, rather than fishes, were the most prominent resource, and later the U.S. Fish Commission would move to protect

the northern fur seal from high-seas killing.

1870

The Federal government assumes management of the Pribilof Islands' fur seal resource.

The American Fish Culturist's Association (now the American Fisheries Society) is formed in New York City.

1871

The United States Commission of Fish and Fisheries, formed on February 9th, is the first Federal agency concerned with natural resource conservation. Spencer F. Baird, Assistant Secretary of the Smithsonian, first U.S. Fish Commissioner, soon

hires Vinal N. Edwards, as the first permanent Commission employee.

The Fish Commission is directed by Congress "... to determine whether a diminution of the number of food-fishes of the coast and lakes of the U.S. has taken place; and, if so, to what causes the same is due; and whether any and what protective prohibitory or precautionary measures should be adopted in the premises...." Baird immediately initiates a broad spectrum of ecological research.

Baird and a party of eminent zoologists establish the Commission's first summer station at Woods Hole, Mass.; others conduct research at Cape Hatteras and on

(Cont. on page 7.)

Baird
shoves
off for a
collecting
trip in New
England waters
with Goode in the bow.



By then, interest in fish culture had been growing for 20 years, and it was widely seen as a panacea for decimated New England Atlantic salmon and shad runs. Much of the Commission's efforts to promote fish culture were rooted in the concept as expressed by Baird's assistant, George Brown Goode, that it was far better to make fish abundant and cheap so they could be fished with fewer restrictions than to just pass stricter laws to protect fewer and fewer fish.

A related drive, fish "acclimatization," introducing new fishes to new waters, was also growing, and the new U.S. Fish Commission would play a major international role in both enterprises. In fact, fish culture would command the lion's share of the Fish Commission's program for nearly a century.

The new U.S. Fish Commission not only gave American fish culture a strong boost, it also spurred the establishment of state fish commis-

sions. In 1871 there were only 11 small state fish commissions, but just 6 years later 26 state fish commissions were operating. In large part, this growth was due to Baird's advocacy of state commissions for more effective fish cultural work.

In addition, Baird and the U.S. Fish Commission became a hub of fish culture information and a major source of fish and fish eggs for distribution not only in America and Europe, but as far away as Australia and New Zealand. In a very real sense, then, part of Baird's legacy lives on in today's spectacularly successful fish farms for trout, salmon, crayfish, shrimp, catfish, and many other species—a fast-growing multi-million dollar international industry.

The First Years: 1871–1896

When the U.S. Fish Commission began, America's primary fishing areas were situated off the east coast and in parts of the Great Lakes. The great fisheries of the Pacific coast states and the Territory of Alaska were virtually unmapped and untapped, and most major U.S. southeast and Gulf of Mexico fisheries were awaiting exploration and study by Fish Commission scientists.

Baird quickly organized the Commission's work into three categories:

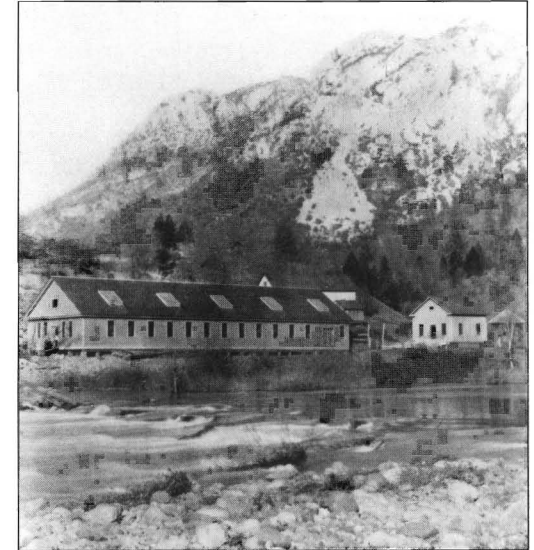
- Systematic studies of U.S. waters and fishes and their biological and physical problems,
- Studies of past and present

fishing methods and compilation of fish catch and trade statistics, and

- The introduction and propagation of "useful food-fishes" throughout the Nation.

The first part comprised the Commission's pioneering biological, ecological, and oceanographic studies. First pursued off New England and in the Great Lakes, they would later expand to the Southeast, the Pacific coast, and across the Pacific into Asian waters.

Studies of fishing methods had more practical aspects. As Goode put it in 1880, "Fishery methods and apparatus must be examined and compared with those of other lands, that the use of those which threaten the destruction of useful



The Commission's first hatchery on California's McCloud River.

fishes may be discouraged, and that those which are inefficient may be replaced by others more serviceable." Similar research today is producing better fishing nets and techniques to harvest only the species wanted and to exclude and protect creatures like sea turtles and marine mammals.

Likewise, the fish catch and trade statistics generated by Baird had practical applications—particularly for Congressional reviews of international treaties or in the imposition of tariffs, and also as marketing guides for the fishing industry and for educating consumers.

But it was the third element, fish culture and introductions, that quickly assumed prominence. Congress' initial 1872 fish culture ap-

propriation was \$15,000, three times the amount allotted for the New England and Great Lakes studies. In addition, its scope was nationwide, and it fostered corollary research into fish physiology, embryology, diseases, and more.

To cope with the lack of Atlantic salmon eggs, Baird sent prominent fish culturist Livingston Stone to California in 1872 to search for a source of eggs of the “quinnat” or chinook salmon which was renown-

ed for its great size and abundance. Stone soon built the first Federal fish cultural station on California's McCloud River from which salmon eggs were sent not only to the east and Gulf coasts but also around the world.

By 1880, the Commission's fish culture work was famous worldwide. At the International Exhibition in Berlin that year, the first-honor prize, a gold medal from the Emperor of Germany, was awarded

the Great Lakes. Baird personally investigates the alleged decrease of southern New England fisheries, taking testimony from many witnesses.

1872

In March, northern fur seal research on the Pribilof Islands begins when Henry Wood Elliot of the Treasury Department is sent to the islands to supervise fur seal management. Under Baird's direction, Elliot conducts the first seal studies, and his watercolors illustrate every aspect of seal life.

The Commission's summer station is set up at Eastport, Maine, and a special herring study is made.

On August 30th, Livingston Stone makes the first collection and fertilization of salmon eggs at Baird Station on the McCloud River in northern California and ships them to the east coast by rail. He is also appointed Secretary of the American Fish Culturist's Association.

On October 23rd, 30,000 chinook salmon eggs are shipped from California to the East Coast; all but 7,000 die in transit. About 200–300 hatch and are raised to fingerling size and planted unsuccessfully in the Susquehanna River in March 1873.

1873

The Fish Commission's summer research

station in Portland, Maine, is augmented by the loan of an 80-ton steamer from the U.S. Navy. Outer waters between Mount Desert and Cape Cod are also explored with the U.S. Coast Survey steamer *Bache*.

In January, Stone plants Great Lakes whitefish into Clear Lake, Calif., the first of many such unsuccessful efforts there.

Stone, with a special railway “California Aquarium Car” leaves Charlestown, N.H., for the Pacific coast on June 3rd. Approximately 300,000 fish, including catfish, eels, bullheads, perch, bass, trout, and lobsters, are accidentally planted in Nebraska's Elkhorn River when a railroad

bridge collapses. Stone and his assistants swim to safety, but three people die in the accident.

On July 2nd, Stone releases 35,000 Hudson River shad into the Sacramento River. Shad transplants continue for several years, and the Atlantic species becomes well established on the Pacific coast.

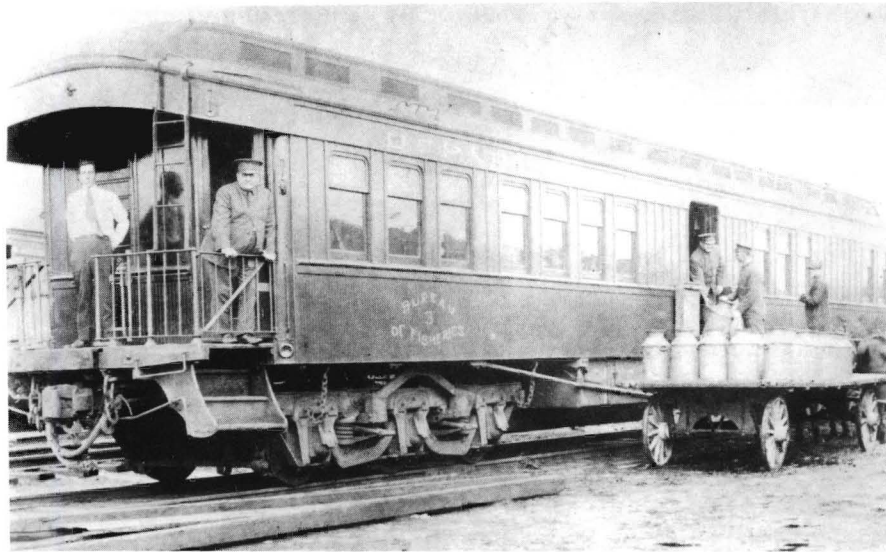
Baird publishes the first of the annual USFC reports on the Commission's operations and research. The series provides a much-needed outlet for scientific reports on the Nation's fisheries and oceanographic studies. The first edition details Baird's findings on “The Condition of the

Sea Fisheries of the South Coast of New England in 1871 and 1872.”

1874

“Baggage-masters will allow agents of the [U.S. Fish] Commission to ride in the baggage-cars [and] to attend to the tanks which they have charge.”—A. J. Cassett, Pennsylvania Railroad Company.

The Baird Hatchery on the McCloud River is recognized as a permanent station of the Fish Commission. From it, fertilized salmon eggs are shipped around the world. The hatchery site now lies under the waters behind Shasta Dam.



One of the Commission's "fish cars."

to Baird partly to commend the Commission's exhibit but also to honor him as "the first [premier] fish culturist in the world."

Thus, the Commission's first few years set a research agenda which, with few modifications, served it well for over a century. In fact, many of the types of work started in the Commission's first decade are still fruitfully pursued

1874-75

The Commission's research work is centered at Noank, Conn., and an attempt is made to introduce shad to European waters.

1875

Federal and private funds are used to renovate a shed into a more permanent, two-story laboratory at Woods Hole, complete with a windmill for pumping seawater to research aquaria.

1876

The Fish Commission presents a large exhibit of fish culture methods and aspects of American fisheries at the Philadelphia International Exhibition; carp are

first imported from Germany.

1877

"To conductors and Baggage-masters. You will permit his [Fish Commission deputy's] cans of living fish to be carried in the baggage cars."—Gen'l Superintendent, Lake Shore & Michigan Southern Railway Co., Cleveland.

"The War Department furnished the [Baird] station a military guard this year, which proved to be a very valuable acquisition."—Livingston Stone.

The first successful U.S. east coast sardine cannery is started at Eastport, Maine, 43 years after the world's first

sardine cannery began operating in Nantes, France.

Fish Commission investigations resume at Salem, Mass., and later at Halifax, Nova Scotia. Federal carp ponds are established in Washington, D.C.

The Halifax Fishery Commission is charged with settling the amount of compensation to be paid by the United States for the privilege of fishing off the eastern Canadian Provinces, and Commissioner Baird is summoned to testify. Baird's assistant, G. Brown Goode, reports that "The information at that time available concerning the fisheries was found to be so slight and imperfect that a plan for systematic

investigation of the subject was arranged and partially undertaken." The full study of America's fisheries and their history and status would later be published as part of the Tenth U.S. Census.

The first salmon cannery in Alaska is established at Klawok.

The first major monograph on the menhaden, a prolific and widely useful species, is published by G. Brown Goode, Assistant Fish Commissioner. The menhaden is still one of the Nation's most important fisheries, and research into its ecology and utilization continues today.

J. R. Shotwell, in a letter to Baird, de-

scribes the efforts of a New Jersey gas company to remove harmful products from distilled coal waste before dumping it into the Delaware River.

1878

The U.S. Fish Commission occupies a permanent station in Gloucester, Mass., to supplement fish propagation studies at the Woods Hole Station. This would eventually become the first seafood technology laboratory in the United States.

The first clam cannery in the United States is established at Pine Point, Maine. Also, crab is first canned at Norfolk, Va.

The breeding of cod and haddock is



A U.S. Fish Commission fisheries and aquaculture exhibition display of the late 1800's.

in the protection and restoration of the Nation's fisheries.

For the first few years, the Commission conducted marine studies from a series of summer stations, the first set up by Baird at Woods Hole, Mass. Later summer stations were set up at Eastport and Portland, Maine; Noank, Conn.; Salem and Gloucester, Mass.; Newport, R.I.; and other east coast and Great Lakes sites.

accomplished at Gloucester, Mass.

The Commission publishes six annual or biannual reports totaling 5,650 pages during 1871–78, and they provide a much needed outlet for fisheries and oceanographic research papers and reports.

1879

Commissioner Baird initiates a landmark study on the composition of fish to determine their food and nutritive values. The research, conducted by W. O. Atwater and Charles Woods, provides important benchmark data, many of which are still useful today.

The field of fish technology opens with

investigations of methods for freezing fish, and in 1882 net preservatives are studied.

The Fish Commission's summer station is located at Provincetown, Mass.

Oyster propagation is accomplished cooperatively with the Maryland Fish Commission and under the direction of Major Ferguson. Distribution of the German carp is also initiated—a move later rued.

One hundred and fifty east coast striped bass are successfully transplanted by Livingston Stone to the Pacific near Martinez, Calif.

The Fish Commission, cooperating

with the Superintendent of the Tenth U.S. Census, dispatches specialists to all parts of the Nation to study and record the biological, statistical, and practical aspects of all U.S. fisheries. The results are published in 1887 as a huge, comprehensive seven-volume work on "The Fisheries and Fishery Industries of the United States."

The Fish Commission's first research vessel, the 156.5-foot *U.S.S. Fish Hawk* is launched. The coal-burning steamer is built to serve as a floating hatchery in coastal waters for shad, herring, and striped bass production.

1880

The Fish Commission's summer station is

at Newport, R.I., where the *Fish Hawk* operates for the season. Over 50 Commission investigators are in the field.

Spencer Baird receives the "first-honor prize" at the Berlin Exposition from the Emperor of Germany, not only for the excellence of the Commission's fisheries display, but also owing to the international regard of Baird who was widely seen as the preeminent fish culturist for his successful promotion of fish culture and fish acclimatization—exchanging fish and fish ova throughout the world.

Prof. Addison E. Verrill estimates that in just 10 years, research, mainly by the Commission, has added 1,000 new spe-

cies to the list of known marine creatures in New England waters—not including finfishes. About 100 newly discovered finfishes were added during the same period on the Atlantic coast.

Despite having a very stylish Washington address (1445 Massachusetts Ave.), Baird is characterized in an article "Celebrities at Home," as "dressing in the plain and slightly old-fashioned style of a well-to-do country English farmer."

This is "... a most wonderful fauna, vastly exceeding in richness and extent on anything known to science."—S. F. Baird, on results of explorations of the Gulf-

Growth and change for the Commission accelerated in the 1880's. To pursue the Nation's high-seas fishery and oceanographic studies, Baird also needed a large, specialized research vessel. Thus, he inaugurated construction of the *Albatross*, a new state-of-the-art research vessel, launched in 1882, whose pioneering studies over the coming decades would open up new fisheries on both coasts and truly globalize U.S. biological and oceanographic research.

Further growth in the Commission's work also required a permanent research facility. Thus, the Fish Commission's new Woods Hole Laboratory, completed in 1885, became the first U.S. marine science station and the second such in the world after Anton Dohrn's famous research station at Naples, Italy. Initially, the Woods Hole Laboratory was a combination research station and cod hatchery.

Finally, in 1887, a great era in American science came to an end when Commissioner Baird died at the Woods Hole Laboratory on August 19th. He was succeeded temporarily by his assistant, George Brown Goode, and a few months later, permanently by noted fish culturist Marshall McDonald, the first full-time, salaried U.S. Fish Commissioner.

As interest grew in Pacific coast fisheries, the *Albatross* was dis-

stream slope 80 miles south of Martha's Vineyard, Mass.

More than 260,000 fertilized rainbow trout ova are shipped east from California for distribution to state fish commissions.

1882

The Woods Hole Station receives its first presidential visit from Chester A. Arthur who is taken for a collecting cruise in the Commission steamer *Despatch*.

In March, the 234-foot U.S.S. *Albatross*, the first U.S. research vessel built exclusively for fisheries and oceanographic research, is launched. The iron-hull, twin-screw vessel was designed to

conduct its marine investigations in any part of the world's seas.

Volume I, for 1881, of the Bulletin of the United States Fish Commission is published "... for the purpose of utilizing and of promptly publishing the large amount of interesting correspondence of the Fish Commission in reference to matters pertaining to fish culture and to the apparatus, methods, and results of the fisheries...." Parts of the text were distributed "signature by signature, the remainder in bound [annual] volumes." Now the quarterly, peer-reviewed journal *Fishery Bulletin*, this series has been in continuous publication for 115 years.

1883

Woods Hole, Mass., property is deeded to the U.S. Government for the construction of the Commission's first full-time research laboratory.

Baird suggests that purer forms of salt be used to solve the problem of "red" cod, a discoloration found in cured cod.

1884

Construction of the laboratory building at Woods Hole begins.

1885

The new Woods Hole Laboratory is completed in February, built with a combination of Federal and private funds. The

building remains in use until 1958. The Commission's research vessels *Fish Hawk* and *Albatross* begin using the permanent facility as a base.

In summer, Atlantic shad are transported in a railroad car to the Pacific coast and planted in Washington Territory and Oregon waters. On return, clams, *Tapes staminea*, are collected and brought back to Woods Hole.

Baird writes excitedly about acquisition of female and male pygmy sperm whales taken from Atlantic waters. These whales had been known to exist only in the Pacific Ocean.

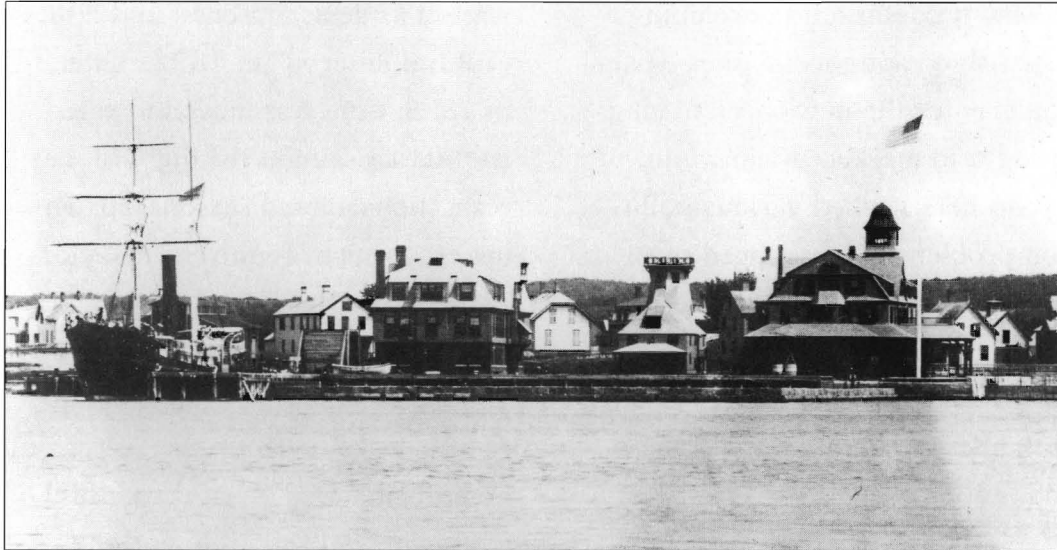
1886

The *Grampus*, another Commission research ship, is completed, providing a revolutionary new fishing vessel design.

1887

On August 19th, Spencer F. Baird, first Commissioner of Fisheries, dies at Woods Hole, Mass. Confined to a wheelchair in his latter days, he reportedly requested that he be wheeled around the station "for final contact with his handiwork." He is buried at Oak Hill Cemetery, Washington, D.C.

"... There rises again the thought that kept recurring then, that the sea is very ancient, that it ebbed and flowed before



The Wood's Hole Laboratory and the *U.S.S. Albatross* (left). In the center is the main laboratory, and the large building to the right is the residence for researchers.

patched in 1888 to conduct research from California to Alaska, along the South American coast, and into Asian waters as well. In addition, the *Albatross* was indispensable for patrolling and protecting fur seal herds in the North Pacific.

An immense and pioneering work on the nutritional values of fish—another field in which the Commission and its successor agencies became deeply involved—was published in 1888 by W. O. Atwater.

man appeared on the planet, and will ebb and flow after he and his words have disappeared; and a singular, indefinite impression, as if something had passed that was, in some fashion, great and mysterious, and ancient like the sea itself.”—Edwin Linton, speaking of the day of Baird's death.

The Marine Biological Laboratory (MBL), a private research facility, is established at Woods Hole, and staff are given free access to Commission facilities.

Rainbow trout, a western species, is doing so well in eastern U.S. fish culture stations that shipments of them from the west are discontinued.

In September, George Brown Goode temporarily succeeds Baird, but he resigns after 6 months to devote full time to his duties as Director of the U.S. National Museum.

The huge and extensive five-section, seven-volume review of the history and conditions of U.S. fisheries is published by the Commission. Edited by George Brown Goode, it is titled “The Fisheries and Fishery Industries of the United States.”

1888

On January 20th, Congress establishes the U.S. Fish Commission as an independent agency of the Federal government and terminates its administrative relation-

ship with the Smithsonian Institution. Marshall McDonald is appointed Commissioner at a salary of \$5,000 per year.

The *Albatross* sails to the Pacific Ocean where it is used for fisheries and oceanographic research and for marine mammal (fur seal) law enforcement patrols until 1914.

On July 4th, the first Federal efforts in fishery studies along the North Pacific coast begin as the *Albatross* leaves San Francisco to collect marine samples and observe fish and other aquatic life. It conducts fisheries investigations off the coasts of California, Oregon, Washington, and Alaska.

W. O. Atwater publishes the 200-page report on the nutritive values of various fishes in the “Report of the Commissioner of Fisheries for 1888–1889.” It provides a basic reference on proximate composition of fish and shellfish and remains valuable today for comparison of composition ranges in relation to species size and distribution.

The Pacific halibut fishery is inaugurated as a sailing schooner returns to Seattle with its catch.

1889

H. V. P. Wilson publishes his classic fish embryology paper on sea bass, based on his work at the Fish Commission laboratory.

Pacific halibut is shipped to the east coast by rail, and as the market develops and demand grows, the fishery gradually expands farther offshore.

The *Albatross* is ordered to escort the Dawes Commission along the Pacific coast.

Livingston Stone likens the Pacific salmon of Alaska to the buffalo and calls for the formation of a “National Salmon Park.”

1890's

The *Albatross* carries two presidentially appointed commissions to study the plight of the fur seal; their reports confirm that

(Cont. on page 13.)

Also that year, the Fish Commission was fully separated from the Smithsonian Institution. Goode had set up four formal divisions: Administration, Scientific Inquiry, Fish Culture, and Statistical Inquiry, and the latter was soon renamed the “Division of Fisheries,” working on fishery methods and, later, on fish technology and marketing. Still, the agency’s overall administrative framework would last almost unchanged for nearly 60 years, adding only an Alaska Division in 1911 and a Law Enforcement Division in 1930.

Much early Commission work was devoted to exploring the Nation’s virtually untapped fisheries. This ranged from experimental fishing to helping develop new or improved fishing gear and techniques, perfecting new ways of preserving, packaging, and marketing

fishery products, and developing new fish cooking techniques—particularly for the new species being brought to market. Meanwhile, researchers studied various pollution problems. This ranged from helping fish processors properly dispose of fish wastes to studying the effects of industrial wastes and pesticides on aquatic organisms, and more.

In the 1890’s, Livingston Stone, who had ranged the Pacific coast seeking the best sites for salmon culture, grew disillusioned about the prospects for the yet abundant Pacific salmon. Fearing they would go the way of the buffalo, he had proposed in 1889 a “National Salmon Park” for Alaska, and, on the basis of his recommendation, part of Alaska’s Afognak Island

was set aside as a “Forest and Fish Cultural Reserve” in 1892. Later, in 1896, Congress moved to regulate Alaska salmon fishing with net restrictions, closed seasons, spawning escapement requirements, etc.

Concerns also mounted in the 1890’s for the future of the northern fur seal. In 1893, the Fish Commission was given responsibility for fur seal research, and the *Albatross* patrolled the Pribilofs and the high seas to ward off poachers.





A fur seal breeding colony, Pribilof Islands, Alaska, in the late 1800's.

Unfortunately, the *Albatross* was just one vessel in a vast northern sea, and law enforcement remained a problem.

up, and new laws were passed to protect the Nation's fish and wildlife resources, notably the Lacey Act and the Black Bass Act.

A New Century: 1897–1921

The turn of the century—the Nation's "progressive conservation movement" era—brought many advances: national wildlife refuges and national forests were being set

For the 30-year-old U.S. Fish Commission, it brought a new home. Formerly independent, the agency was renamed the U.S. Bureau of Fisheries (BOF) in 1903 and placed in the newly established U.S. Department of Commerce and Labor. A year earlier the Nation's second Federal marine science laboratory

seal populations are being seriously harmed by pelagic (high-seas) seal hunting.

1891

September 6th, Vineyard Haven, Mass.: "About 7 o'clock last evening, during the southeasterly storm, United States Fish Commission schooner *Grampus*, bound to Woods Holl (sic) from Hyannis, ran ashore on L'Hommidieu shoal, Vineyard Sound. United States Fish Commissioner Col. McDonald, his wife and daughter, Assistant Commissioner Capt. J. W. Collins, and Drs. Bean and Patten, left the schooner in a dory, and succeeded in making a safe landing at Falmouth." The *Grampus* was later refloated.

1892

Based on Stone's recommendations, Afognak Island, Alaska, is set aside as a Forest and Fish Cultural Reserve.

The last of four carloads with 1,000 specimens of fish representing 40 species is delivered by the Commission to the Chicago World's Fair for a fish culture exhibit.

A contract to complete a fishway at Great Falls, Va., on the Potomac River is accepted for \$15,000.

1893

The U.S. Fish Commission becomes responsible for northern fur seal research.

1895

The Commission's Division of Propagation and Distribution of Food Fishes is established.

1896

Salmon research from the *Albatross* leads Congress to regulate Alaskan salmon fishing with net restrictions, closed seasons, spawning escapement requirements, etc.

The first successful Pacific coast sardine cannery is established at San Pedro, Calif.

The rainbow trout is now successfully acclimatized in almost every state east of the Rocky Mountains.

1897

The Fish Commission publishes "A Manual of Fish Culture," and 60 years later it is still considered "the most complete text on the subject."

1898

In response to commercial obstruction of Alaska's Karluk River, Congress passes its first salmon protection law.

1899

The U.S. River and Harbors Act allows Alaska fishermen to secure a permit granted by the War Department to buy salmon traps. The War Department's sole interest in the matter is to assure that the traps would not obstruct navigation.

For the first time, total Commission production of fish eggs, fry, and larger fish exceeds one billion.

Early 1900's

The western-style purse seine is first used in the Pacific herring fishery, gradually replacing the Norwegian style of oar-propelled seine boats.

1900

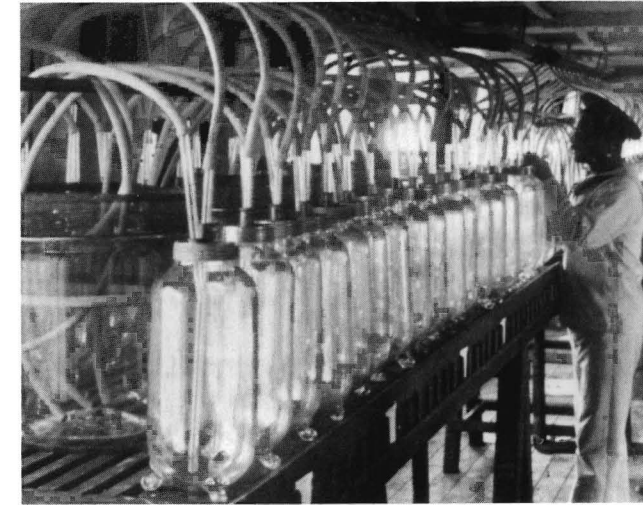
President Theodore Roosevelt signs a law for construction of the second Federal fisheries laboratory in the United States at Beaufort, N.C. Its first director is Henry Van Peters Wilson, a University of North Carolina professor.

had been built at Beaufort, N.C., and in 1905 the first Federal fish hatchery in Alaska was set up at Yes Bay.

Pacific coast fisheries and oceanographic research had greatly expanded with entry of the *Albatross* into the Pacific and saw further growth in 1909 as a Pacific Fishery Investigations group was set up at Stanford, Calif., under ichthyologist Charles H. Gilbert. And as Alaska fishery research and management progressed, the Bureau's "Alaska

Fishery and Fur Seal Service" was upgraded to an operating Division in 1911. Then, in 1913, Congress separated the Departments of Labor and Commerce, with the Bureau of Fisheries remaining with the Department of Commerce.

While the Bureau had long worked to improve fishery marketing and product development, the onset of World War I and associated food shortages accelerated those studies.



"McDonald jars" were used for hatching shad, cod, and other fishes.

(Cont. on page 16.)

1901

Charles B. Wilson begins summer work at the Woods Hole Laboratory that culminates in publication of "The Copepods of the Woods Hole Region Massachusetts," a standard reference in copepod biology.

The Commission employs a fish pathologist on a part-time basis.

1902

The American Fisheries Society places a granite monument to Baird at the Woods Hole Laboratory, where it remains today in a public park.

The Nation's second Federal fisheries laboratory, in Beaufort, N.C., is occupied

on May 26th. Though not yet complete, it provides a laboratory, aquarium, office, 12 bedrooms, storerooms, etc.

1903

By Act of February 14th, the U.S. Fish Commission and the Office of the Commissioner of Fish and Fisheries are placed in the Department of Commerce and Labor which is also created by the new Act. The transfers take place on July 1st.

The formerly independent Fish Commission is named the U.S. Bureau of Fisheries. The new Bureau retains the scientific responsibilities of the Fish Commission and incorporates other fishery-related functions: i.e. jurisdiction, supervision,

and control over the fur seal of Alaska are assumed from the Department of the Treasury.

David Starr Jordan is chosen to head a committee appointed by President Theodore Roosevelt to investigate the causes for the decline in the salmon fisheries of Alaska.

The first salmon-marking experiments are begun by Fred Chamberlain of the Bureau of Fisheries in southeastern Alaska.

1904

One million whitefish, 100,000 brook trout, 53,000 lake trout, and 50,000 landlocked salmon eggs leave New York harbor for

Argentina. Losses are later reported as only 10% except for lake trout which began hatching en route.

1905

The first Federal hatchery in Alaska is established on a lake at Yes Bay in southeastern Alaska.

"In 1905, the fishing on New England banks was revolutionized by the introduction of the otter trawl ... [which] met with a great deal of opposition from many members of the industry."—Herbert W. Graham, writing in 1952.

1906

Bureau testing begins on a new wooden

shipping case that holds 24 trays of fish eggs. Each tray can hold 192,000 lake trout eggs.

The Sponge Act is passed as the first assertion of Federal authority to manage marine fisheries. It set conservation rules for taking sponges from the Gulf of Mexico and Straits of Florida.

During a raid on the Pribilof Islands (Alaska) seal rookeries, five poachers are killed by Bureau personnel acting in self-defense, and a dozen others are jailed.

The *Albatross* sails on a lengthy research cruise to the Aleutian Islands, Japan, and Korea, making extensive bio-

logical collections and discovering hundreds of new genera and species of fishes. The Captain, Lieutenant Commander LeRoy Mason Garrett, U.S. Navy, thrown from the vessel in a violent storm on the return trip, is lost at sea.

1907

Rachel Louise Carson is born on May 27th. The famed conservationist, author, marine biologist, and Bureau employee wrote "The Sea Around Us" (1951), "Silent Spring" (1962), and other books that heightened public environmental awareness.

The *Albatross* leaves San Francisco for a 2½ year cruise to Midway, Guam, Philippines, Borneo, Dutch East Indies, and Formosa.

1907-08

The second Federal hatchery in Alaska is built at Litnik Lake on Afognak Island, near the site selected in 1889 by Livingston Stone and on the reserve established earlier by Presidential proclamation.

1908

A. E. Verrill completes his study of the specimens collected during surveys that began at the Woods Hole Laboratory in 1871. The project forms the basis of hundreds of scientific papers on invertebrates. The collection includes some 2,000 species taken from 3,000 locations in New England and is eventually given to the Museum of Comparative Zoology at Harvard University with duplicates to the Peabody Museum of Yale University.

In thanking the Bureau for its generous assistance, the Chief Inspector of Fisheries for New Zealand writes, "Formerly a country devoid of fresh-water fish of any value, [our] rivers are teeming with fish of the finest quality for sport and food."

1909

Charles H. Gilbert, an associate of D. S. Jordan, is named scientist in charge of the Bureau's Pacific Fishery Investigations group which is based at Stanford University for the next 22 years as the agency's

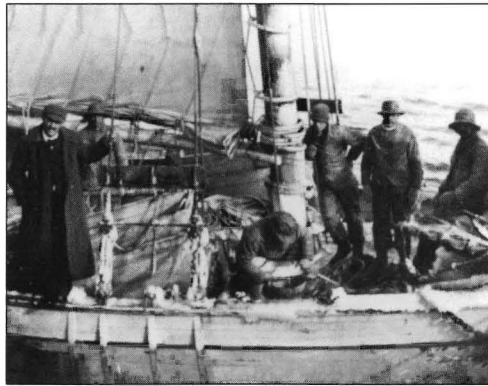
fisheries research hub for the Pacific coast and Alaska.

1911

On July 7th the United States, Great Britain (for Canada), Japan, and Russia conclude a convention for the protection of

Division of the Bureau of Fisheries.

The *Albatross* returns to San Francisco after a trip along the California coast in which six yearling elephant seals, thought to be extinct, are captured and sent to the New York Aquarium.



One source of Atlantic cod eggs was the catch of market fishermen. Here, a turn-of-the-century spawntaker collects ripe eggs on a commercial fishing vessel.

the North Pacific fur seals that had been virtually decimated by overhunting on the high seas. This provides a sound basis for managing the species.

The Alaska Fishery and Fur Seal Service is separated from the Division of Scientific Inquiry and made an operating

1912

H. B. Bigelow begins 16 years of research on the oceanic fisheries in the Gulf of Maine. This fundamental work, along with extensive investigations with W. B. Schroeder, results in the 1953 treatise "Fishes of the Gulf of Maine," a standard reference in the field.

The eruption of Alaska's Mount Katmai covers a Bureau salmon hatchery with nearly a foot of volcanic ash.

1913

The Bureau of Fisheries publishes the results of a massive bottom sampling program operated out of Woods Hole, describing the distribution of about 250 animal and plant species at several hundred sampling stations.

The Department of Labor is separated from the Department of Commerce, which retains the Bureau of Fisheries.

A study on age determination of Pacific salmon is begun by Charles Gilbert, initially using the scales of fish collected from the Columbia and Fraser Rivers.

1914

A small office opens in Seattle's historic Smith Tower Building as an administrative center for the Bureau's Pacific coast operations.

1915

William F. Thompson, an early student of David Starr Jordan's, begins his study of the halibut fisheries of the North Pacific; later he will become the director of investigations for the International (Halibut) Fisheries Commission, the International Pacific Salmon Fisheries Commission, and the Fisheries Research Institute of the University of Washington. This halibut research is the first scientific study made on the Pacific coast fishery that is aimed at fishery management.

Congress approves the appointment of a full-time fish pathologist to the Bureau staff.

1915-21

The *Albatross* conducts research off Oregon, Washington, and California, including tuna studies off southern California and Baja California. However, during World War I, the *Albatross* is placed under U.S. Navy direction and patrols the Gulf of Mexico and Caribbean Sea region.

1917

The *Albatross* undergoes repairs for a November transfer to the U.S. Navy for the duration of WWI. It is returned to the Bureau in 1919.

Research emphasis at the Woods Hole Laboratory changes from general interests to concentrate on the immediate increase of aquatic food supplies—a move precipitated by the onset of World War I. During this time, the Navy occupies the lab.

Fire destroys the fisheries laboratory building at Fairport, Iowa, with total loss of a collection of rare scientific papers related to freshwater mussels.

1918

The U.S. Navy takes over the Bureau's Beaufort, N.C., fisheries laboratory in World War I to study the fouling of ship bottoms, and returns it to the Bureau in 1920.

Funding is approved for the first fishery products laboratory in Washington, D.C., to house rooms for drying, smoking, canning, and refrigerating of fish. An experimental kitchen is also built.

The first of 125 nationwide cooking demonstrations begins in Seattle to show consumers the best and most economical ways of preparing and cooking fish.

The Supreme Court confirms its prior opinion enjoining Alaska Pacific Fisheries "from maintaining, and compelling it to remove, a fish trap erected by it in Annette Island Waters, Alaska."

1919

The Bureau reports that, "In no branch of the fisheries is there greater need for exhaustive study than in the methods or preservation of fishery products."

1920

Jurisdiction over all land fur-bearing animals, except those of Alaska and the Pribilof Islands, is transferred from the Bureau of Fisheries (Commerce Depart-

Bureau scientists at Woods Hole and other research sites emphasized the immediate increase of aquatic food supplies. In addition, Bureau research on the healthful and nutritive values of fish oils began during this era. Meanwhile, the U.S. Navy commandeered the *Albatross* for WWI Gulf of Mexico and Caribbean Sea patrols and occupied the Bureau's Woods Hole and Beaufort Laboratories for specialized war-related research.

Depression and War Years: 1922–1946

This was an important era with new challenges for the Bureau of Fisheries, coming at the end of WWI and including the Depression years and WWII. Now the Federal government was promoting commercial fishing and wider use of fish as economic and health measures and to improve food production in a Nation under siege.

Research on oyster culture and the nutritive and vitamin content of fish oils continued to advance, as did concern for Pacific salmon fisheries. Congress passed the White Act in 1924 in an effort to reduce the salmon catch with fish traps in Alaska; that new law also set “escapement levels” to allow enough salmon to move upstream to spawn.

Research also began in the 1930's on ways to pass salmon safely around new dams and water

ment) to the Agriculture Department.

Mussels reared in Iowa are successfully planted along the Potomac River at Harpers Ferry, W.V.

Fire destroys the dining hall, kitchen, and laundry room of the Woods Hole Laboratory.

With cooperation of the Naval Aviation Service and Chesapeake Bay fishermen, the Bureau inaugurates use of “aeroplanes” to locate menhaden.

1921

The *Albatross* is decommissioned and retired from service on October 29th, but the

scientific research into as well as the naming and cataloging of the many hundreds of thousands of specimens it has collected will continue for decades.

For the first time, Bureau of Fisheries scientists begin research to determine fat constants of fish oils at its Washington, D.C., laboratory. Such research would continue during 1926–30 at a Reedville, Va., laboratory on menhaden oil manufacture. Later Bureau research would target the vitamin content of fish oils and other healthful and nutritional attributes of fish oils.

Pacific salmon studies by Willis H. Rich, in cooperation with the Oregon Fish

Commission, begin on the Columbia River. Meanwhile, salmon studies by Charles Gilbert begin in Bristol Bay and on Karluk River and Karluk Lake in Alaska.

1922

Willis H. Rich, former student of David Starr Jordan, becomes chief of the Bureau's Division of Scientific Inquiry. He later heads the Pacific Fishery Investigations at the Bureau's Stanford station, and is Director of the Montlake Laboratory in Seattle.

Over 180 million fish are rescued in the Mississippi Valley and relocated from overflow ponds and lakes. The practice is abandoned in 1939 owing to improved

flood control measures.

1923

Herbert F. Prytherch makes his first report on his work with artificial propagation of oysters. He works in facilities provided by the Connecticut Oyster Farms Company of Milford, Conn. Increased interest in molluscan culture for stock enhancement and direct sale eventually leads to establishment of a full-scale research facility at Milford which concentrates on pollution effects on marine life and molluscan and finfish aquaculture.

1924

Congress passes the White Act in an effort to deal with the use of fish traps in

the Alaska salmon fishery. It sets a 50% escapement level for streams where fish could be counted or reliably estimated, giving the Commerce Secretary authority to limit catches and set seasons, but it does not allow the limitation of the amount of gear in the fishery.

N. A. Cobb begins to spend his summers working at the Woods Hole Laboratory. Cobb would become an international authority on nematodes, and his outstanding contributions included using these animals to study such biological problems as heredity, phylogeny, adaptation, and parasitism.

Henry O'Malley, Bureau Commissioner

diversion projects on Pacific coast streams. And in 1930 the Sockeye Salmon Fisheries Convention was signed to address conflicts between U.S. and Canadian fishermen.

Fish marketing and promotion efforts also increased in the 1930's.



An early salmon trap in Alaska.

and a member of the Halibut Commission, sends Harlan Holmes to Seattle to find working space for the Bureau. A small staff of Bureau employees work at the University of Washington's Fisheries Hall Number 4 until construction of the Montlake Laboratory is completed in 1931.

1925

Paul S. Galtsoff begins his lifelong work with the Bureau on the American oyster which culminates in the extensive classic "The American Oyster," published by the agency in 1952.

1926

The Bureau's steamer *Fish Hawk* is decommissioned. Shortly after, the Navy's ocean tug *Patuxent* is renamed the *Albatross II* and outfitted for Bureau research.

Pacific salmon studies are conducted in Chignik, Alaska, under the leadership of Harlan Holmes, while herring studies in southeastern Alaska and Prince William Sound begin under George Rounsefell.

1927

Elmer Higgins, former student of David Starr Jordan, becomes chief of the Bureau's Division of Scientific Inquiry.

1928

The Bureau begins studying problems and methods of fish passage at various water diversion projects along the Pacific coast.

1929

O. E. Sette becomes director of the Woods Hole Laboratory and begins his pioneering work tagging and reporting on the schooling of mackerel.

New investigations begin on the sockeye salmon in Bristol Bay under Alan Taft and on the Copper River under Seton Thompson. Investigations on the pink salmon of southeastern Alaska begin under Fred Davidson.

Enforcement of Pacific salmon regulations is emphasized, and the Bureau employs 228 agents using 24 vessels and the Bureau's first airplane.

Planting of oak brush in Georgia's lower Duplin River proves successful for collecting oyster spat.

1930

The Sockeye Salmon Fisheries Convention is signed to address conflicts between U.S. and Canadian fishermen in Puget

Sound and the Strait of Georgia, where they compete for sockeye salmon bound for the Fraser River in B.C. Despite the Convention, questions remain unresolved, including the role of the Commission in regulation of the fishery, the division of catch between the fishermen of the two countries, and the agencies responsible for investigations. Bureau studies of the fishery would begin in 1931.

Although law enforcement work has long been a part of many U.S. Fish Commission and Bureau activities, an official "Division of Law Enforcement" is not set up until this year.

On May 21st, the Preservation of Fishery Resources Act (Mitchell Act) is passed to provide for the conservation of the fishery resources of the Columbia River.

A new Act (H.R. 7405) is approved, authorizing construction of more than 25 Bureau fish culture stations, three new laboratories, and two fish distribution railroad cars over the next 5 years.

1931

Victor Loosanoff is hired by Woods Hole Laboratory director Paul Galtsoff to con-

duct oyster research at Milford, Conn. Loosanoff, like Galtsoff, would eventually become a world-class expert on oyster culture.

Rachel Carson is hired by the Bureau's Chesapeake Bay Investigations Division as a biologist.

Biologist William C. Herrington begins his haddock studies in the Gulf of Maine, incorporating both fishery dependent and independent information. This work is the foundation for the long time-series of information on haddock response to fishing effort in this highly productive region.

The Woods Hole Oceanographic Institution (WHOI) is established with H. B. Bigelow as its first director.

The Bureau's Montlake Laboratory opens on May 22nd in Seattle. Present at the Open House are Henry O'Malley of the Bureau; Miller Freeman, editor of the *Pacific Fisherman*; and U.S. Senator Wesley Jones, author of the Jones Act; as well as local Bureau staff members and International Fisheries Commission (commonly known as the Halibut Commission) staff. A 1931 report by O'Malley states:

"... Personnel and equipment of the Stanford field station were transferred to the new Fisheries Biological Laboratory in Seattle, along with all of the Bureau's Pacific biological investigations dealing with Pacific coast fishery problems, except shellfish and the cooperative work on California trout."

The Halibut Commission moves to the Montlake facility in July.

A study of the biology of Puget Sound runs of sockeye salmon begins under the direct supervision of Montlake Laboratory director Joseph Craig.

A small, short-term Rogue River steelhead trout tagging operation is started in the winter of 1930-31 and completed in 1931.

An extensive herring tagging program begins in southeastern Alaska using the new metal "belly" tag which can be recovered by a magnetic detection system on the conveyor belts at processing plants. Ed Dahlgren's ideas led to the development of this tag, and he also devised and developed the electronic and magnetic systems for recovering the tagged herring or the tags as they passed through the reduction plant.

More than 4,100 flounder are tagged and released during an investigation into their migratory patterns near the Woods Hole Laboratory.

1932

The Bureau's long-sought experimental station for fish disease research is set up at Leetown, West Virginia.

1933

A cooperative project between the Bureau, Cornell University, and the State of New York results in an experimental laboratory for fish nutrition research at Cortland, N.Y.

The Bureau's Beaufort Laboratory is

A new fishery market news service was set up, including publication of a monthly *Fishery Market News* journal. In addition, the growing role of law enforcement led to creation of a “Division of Law Enforcement” in 1930. Another major west coast Bureau facility, the Montlake Laboratory, opened in Seattle in 1931, and in 1934 the Columbia River Investigations Program was initiated to study salmon problems associated within the region’s water developments.



Researcher in the U.S. Bureau of Fisheries Laboratory, Washington D.C., 1930.

seriously damaged by a hurricane on September 16th; later, the Public Works Administration provides funds to hire workers and restore buildings and equipment.

Lauren Davidson is appointed Montlake Laboratory director and focuses on statistical analysis of fisheries research. He hires a statistical analyst, and, at about the same time, the Halibut Commission begins to apply Baranof’s theory of fishing to the regulatory problems of the halibut fishery.

The Alaska Territorial Civil Works Administrator is authorized to furnish the Bureau with 198 unskilled laborers to improve salmon spawning streams in southeast Alaska.

1934

Temporary field facilities for pink salmon survival studies are built on Sashin Creek near the Little Port Walter Field Station in southeastern Alaska. They include the weir cabin, built in Seattle, barged to Alaska, and still in use in 1995.

The Columbia River Investigations program begins at the Montlake Laboratory and is closely associated with the water-use development program for the Columbia River basin. An early and major part of the program is a comprehensive survey of all accessible salmon streams in the Columbia system.

Bureau coho salmon researchers in

Puget Sound, Wash., study the relationship between the release time of young salmon from the hatcheries and the ultimate number of returns of adults.

On March 10th, Public Law 732 is enacted to provide for the mitigation of losses to fish and wildlife caused by Federal government construction.

1935

The Bureau begins large-scale tagging experiments on white shrimp, and Peterson disc tags are used to determine growth rates and alongshore movements. Later, scientists would use biological stains and numbered internal plastic tags to mark the shrimp.

Initiative 77 is passed by the Washington State Legislature to eliminate all fixed fishing gear (i.e. traps and set nets) from state waters and divide the Puget Sound fishing area into an inner area for gill nets and an outer area for all remaining legal gear.

Rachel Carson is recruited by Henry Higgins, head of the Bureau’s Division of Scientific Inquiry, to write scripts for some Bureau radio broadcasts on marine life. She would serve with the Bureau until 1952.

1936

The Sockeye Salmon Fisheries Convention between the U.S. and Canada is ratified by the U.S. Senate; ratification docu-

ments are exchanged between the countries in 1937.

Frederick F. Fish, stationed at the Bureau’s Leetown, W.V., hatchery, reports that an epidemic of blue sac is causing heavy losses among the brook and brown trout fry.

1937

By Congressional mandate, the Bureau establishes the South Pacific Investigations Program at Stanford University to study the decline in the California sardine fishery. This program is the foundation of the California Cooperative Sardine Research Program which would later become the California Cooperative Ocea-

By the late 1930's problems in the large California sardine industry led to establishment of the Bureau's California Current Resources Laboratory (CCRL) to study regional fishery problems. Also, just before the War, Congress appropriated \$100,000 for a 1-year study of the Alaska king crab, setting the stage for what would, after the war, become another important national fishery. The researchers also found enormous, latent reserves of sole and pollock off Alaska.



A BCF display illustrates the population changes in anchovies and sardines as recorded by its California Current Resources Laboratory between 1950 and 1965.



Research helped assess the fishery potential of Alaska's king crab resource.

anic Fisheries Investigations (CalCOFI) program.

California Current Resources Laboratory (CCRL), one of the forerunners of today's Southwest Fisheries Science Center, is established at Stanford University in Palo Alto, Calif., with O. E. Sette as Director.

The U.S. Congress appropriates funds for a Fishery Market News Service in the Bureau of Fisheries.

A U.S.-Canada treaty sets up the International Pacific Salmon Fisheries Commission to manage those regional fisheries and coordinate extensive salmo-

nid research programs. W. F. Thompson is Director of investigations.

1938

A hurricane and its accompanying storm wave demolish many of the Woods Hole Laboratory facilities, but equipment and boats are relatively unscathed.

An expansion of the Alaska fishery research program at the Seattle Montlake Laboratory begins with a large, comprehensive two-part program of study on the salmon runs in the Bristol Bay area of the Bering Sea. A field station and experimental area are established on Brooks River. One part studies the freshwater life history of the Bristol Bay sockeye

salmon and the environmental factors affecting their survival. The other part studies the ocean life history of salmon and is done in close cooperation with the U.S. Coast Guard using the cutter *Redwing*. The studies end in 1941 with the outbreak of WWII and Japan's invasion of the Aleutian Islands.

Congress authorizes \$25,000 to establish a fishery laboratory at Little Port Walter, Alaska.

1939

The Bureau's monthly publication *Fishery Market News* begins in January as "a review of conditions and trends of the commercial fisheries."

On April 3rd, the Commerce Department's Bureau of Fisheries and the Agriculture Department's Bureau of Biological Survey are transferred to the U.S. Department of Interior as part of the 1939 Presidential Reorganization Plan No. II.

Harlan Holmes, an expert on fish passage, becomes Biologist-in-charge of the new Hydraulic Engineering Section at the Montlake Laboratory. The section is to review all Federal power permit applications and develop, design, and restore needed fish-passage structures and devices including fish screens on the Columbia River.

The first trial marking of sardines re-

sults in a 10% recovery of 964 metal-tagged sardines recovered by magnets.

1940

The 1940 Reorganization Plan No. III, effective June 30th, merges the Bureau of Fisheries and the Biological Survey as part of the Interior Department's Fish and Wildlife Service; in addition, it provides for the establishment of five regional fisheries offices. The Bureau of Fisheries and Biological Survey groups would be separated again in 1956 as the renamed Bureau of Commercial Fisheries and the Bureau of Sport Fisheries and Wildlife.

The Little Port Walter Station opens, and as of 1995 is the longest continu-

Fundamental reorganization came to the agency in 1939: The Commerce Department's Bureau of Fisheries and the Agriculture Department's Bureau of Biological Survey were transferred to the Department of Interior. A year later the fishery and wildlife units of both Bureaus were merged as "divisions" within Interior's new "Fish and Wildlife Service."

Likewise, during World War II (and also the Korean War), the

agency's research aided crucial production of foodstuffs and other critical national defense missions and operations. Federal fisheries laboratories turned their studies to ways of supplying growing needs for protein, often from unusual forms of marine life, including sharks, sea lions, and other creatures of the sea. And with the onset of the nuclear age, agency scientists helped make new assessments of the environmental effects of radiation and began pioneering studies of the

peaceful use of irradiation to preserve seafood.

The World War II era marked another type of milestone for the U.S. and global fisheries. Whereas a few nations had begun moving into international waters to fish before the war, that fishing effort mushroomed once the war ended. Increased fishing by European and Asian vessels and factory ships just off U.S. coasts posed a challenge for

ously operating fisheries research facility in Alaska.

Between 1872 and 1940, the Fish Commission/Bureau plants and distributes 200 billion fish and other aquatic animals in national and international waters.

The U.S. Congress appropriates \$100,000 for a 1-year study of the potential of an Alaska king crab fishery. The report is favorable and provides many data on harvest areas, fishing gear, preservation, canning, and the fishery potential.

The Bureau's Alaska Technological Laboratory is set up in Ketchikan; it

moves to Kodiak in 1971.

A fisheries utilization laboratory operates for a few years in Mayaguez, Puerto Rico, during the 1940's.

1941

The Woods Hole Laboratory buildings are occupied by the U.S. Navy until the spring of 1944. Limited scientific work continues in space borrowed from the Marine Biological Laboratory.

William C. Herrington publishes his Circular entitled "A crisis in the haddock fishery" based on 10 years of sampling and biological work conducted in cooperation with the fishing industry. The

paper warns of the dangers caused by a developing market in baby haddock, a situation not unlike that caused by fish discards in the present era. Herrington maps out the likely results of removing large numbers of young fish with such precision that the description resonates in today's northwest Atlantic haddock fishery.

On October 23rd Japan terminates the international fur seal convention, but protection for the Pribilof herd is arranged by a provisional agreement between Canada and the United States.

Rachel Carson's first book, "Under the Sea Wind," is published just before Pearl

Harbor is bombed. She continues her Federal service as an aquatic biologist until 1946 when she would become an information specialist and, later, editor-in-chief of the Information Division of the Fish and Wildlife Service.

The first permanent research station at Milford, Conn., is built. After working out of a building donated and moved across the harbor by a local oyster company, the staff gets a real scientific laboratory.

1942

"Fish for war is the present aim of the fishery biological investigations of the [Fish and Wildlife] Service," states the Department's Annual Report.

Samuel F. Hildebrand moves to the Smithsonian Institution's National Museum to continue his fish systematics and taxonomy work for the agency. This is the beginning of today's NMFS National Systematics Laboratory, part of the NEFSC.

A 108-page supplement to the May issue of the *Fishery Market News* reviews "The Alaska King Crab," noting that Alaska waters hold "... an enormous reserve of edible fish—notably 'sole' and pollock—which is at present wholly unutilized."

"In every major war fought by the United States, the fishing fleet has



From the June 1943 cover of
Fishery Market News.

scientists, commercial fishermen, and diplomats as well. It was an entirely new era that, 25–30 years later, would result in new Federal laws, particularly the Magnuson Fishery Conservation and Management Act (MFCMA) of 1976, to protect U.S. fishery interests and resources. But until then, it required far more research into the species fished and potential fishery problems.

At the close of the war, President Harry S Truman issued a proclamation asserting U.S. jurisdiction “. . . over the natural resources of the continental shelf under the high seas contiguous to the coasts of the United States and its territories, and providing for the establishment of conservation zones for the protection of fisheries in certain areas of the high seas contiguous to the United States.”

formed a second line of naval defense, fishing boats and fishermen being employed in various capacities—for patrol, as mine sweepers, in supplying protein food to the armed forces and the civilian population.”—Charles E. Jackson.

1943

During World War II, the agency’s Ketchikan Laboratory is asked to investigate potential emergency sources of marine foods in case military activities in Alaska cause food shortages. It studies various sharks and the Steller sea lion, as well as groundfish and shellfish.

1944

A second hurricane ravages Woods Hole,

destroying the docks, part of the seawall, and much of the roofs, windows, porches, and outer skins of the laboratory buildings.

The War Food Administration frees sperm whale oil from restricted civilian use, allowing it to be used for grinding oils, carbon paper, mimeograph inks, typewriter ribbon, etc.

The War Manpower Commission emphasizes the need “for encouraging employees to adapt more fishing jobs to the employment of women ... women can do much of the work in fish processing plants that formerly was considered for men only.”

Selective Service State Directors are given authority to recommend draft exemptions for 18–25-year-old captains of fishing vessels of 20+ gross tons.

Of the 600 fishing boats requisitioned for emergency use by the U.S. Army, Navy, and Coast Guard, 142 are released to the War Shipping Administration by the military; 13 are returned to their original owners.

The dogfish shark, once considered a pest, becomes the nation’s chief source of vitamin A.

1945

President Harry S Truman issues a procla-

amation asserting U.S. jurisdiction “. . . over the natural resources of the continental shelf under the high seas contiguous to the coasts of the United States and its territories, and providing for the establishment of conservation zones for the protection of fisheries in certain areas of the high seas contiguous to the United States.”

The September issue of the agency’s *Fishery Market News* publishes a warning to the fishing industry about a new pesticide: “In spite of its apparent usefulness in improving sanitary conditions in such [fishing industry] plants, DDT may have undesirable and even dangerous effects unless its use is properly controlled....” Rachel Carson would later draw on such

early Federal research in writing her acclaimed volume “*Silent Spring*.”

Lionel Walford becomes Director of Research and reorganizes the entire fisheries research program.

A study on the population dynamics of salmon spawning in the tributaries of the Columbia River begins with funding by the U.S. Army Corps of Engineers.

1946

Operation Crossroads, the nuclear testing at Bikini Atoll, begins, and Woods Hole Laboratory oyster expert Paul S. Galtsoff is an invited scientist on the project.

Progress and Change: 1947–1971

The late 1940's and 1950's brought additional programs, studies, and progress to the Federal fisheries agency. Many new fishing grounds were discovered, and better ways were found to fish them. Healthful benefits of fish oils continued to be discovered, as were pitfalls with such pesticides as DDT—for example, their toxicity to fish and other

aquatic life, particularly during early stages of life.

But perhaps the most important facet was international: Fisheries were fast becoming globalized. The United Nations was set up in 1945, as was its Food and Agriculture Organization (FAO). Foreign fishermen found that they could use huge factory trawlers in “international waters” just 3 miles from U.S. coastlines, and two new international fisheries commissions were soon

organized: the International Commission for the Northwest Atlantic Fisheries (ICNAF) and the Inter-American Tropical Tuna Commission (IATTC). These new developments brought added responsibilities for enforcement.

In addition, U.S. fishermen opened their own distant-water Pacific fisheries, targeting tuna, and the 80th Congress, in 1947, declared a policy of developing and maintaining the enormous fishery

1947

Rebuilding after the hurricane at Woods Hole begins, and a small number of investigations resume.

A new fisheries technological laboratory is set up in Boston; it would move to a new building in Gloucester, Mass., in 1959.

While progress in establishing conservation zones in the Pacific and other waters to protect salmon and other fisheries is temporarily suspended, the State Department advises of its “Firm intention to resume attention to this highly important matter at the earliest possible opportunity.”

The 80th Congress declares the policy of developing and maintaining the enormous and untapped high-seas fisheries resources of the tropical and subtropical Pacific territories. Public Law 329 leads to the formation of the Pacific Oceanic Fishery Investigations (POFI) unit and the construction of the agency's Honolulu Laboratory.

1948

The *Albatross III*, formerly a steam trawler in the New England groundfishery, is commissioned in ceremonies at the Boston Fish Pier.

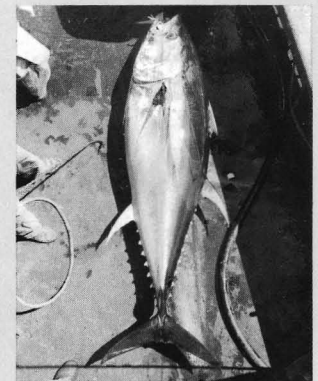
The Boston Technological Laboratory initiates a major study of freezing fish at sea.

The Columbia River Fishery Development Program begins.

The final draft is made of the convention forming the International Commission for the Northwest Atlantic Fisheries (ICNAF) which will govern fishing in international waters of the North Atlantic until the middle 1970's.

1949

The California Cooperative Oceanic Fisheries Investigations (CalCOFI), a consortium of industry, university, state, and Federal agencies, is established to investigate causes of the collapse of the Pacific coast sardine fishery.



resources of the tropical and subtropical Pacific Territories. Thus, the Bureau's Pacific Oceanic Fishery Investigations unit (POFI) was set up at Honolulu, Territory of Hawaii, to explore, investigate, and develop those high-seas fisheries.

Fish promotion and "home extension" type work brought the Bureau added recognition, as its staff home economists created thousands of new fish recipes, put on countless

fish cookery demonstrations, and helped large food service groups (schools, hospitals, military units, etc.) learn to use fish. Other technological research initiatives included a major study on freezing fish at sea, work on the still untapped walleye pollock in the Bering Sea, and a new technological research laboratory set up in Boston.

New mobile research laboratories, devised for special on-site investigations, were deployed from



Above, a Bureau home economist demonstrating ways to prepare fish. Below, a slide show emphasized the work done by Bureau home economists on radio and television.

Rachel Carson, now chief editor of Fish and Wildlife Service publications (FWS), and Marie Rodell become the first women to spend more than a few hours aboard a U.S. fisheries research vessel. They report on a 10-day cruise to Georges Bank.

Delegate E. L. Bartlett of Alaska introduces a bill in Congress to provide for the gradual reduction and ultimate elimination of salmon traps in Alaska waters; a Department of Fisheries is created by Alaska's Territorial Legislature.

1950

The International Commission for the Northwest Atlantic Fisheries (ICNAF), a

treaty organization, is set up on July 3rd to study and report on fisheries activities and fish stocks in more than two million square miles of ocean outside the territorial waters of the nations rimming the northwest Atlantic. Research activities for areas of U.S. interest are largely headquartered at the Woods Hole Laboratory.

The Tuna Conventions Act of 1950 is passed to enforce international agreements on fishing rights, fishery management, and preservation.

The CCRL establishes a field station at Pt. Loma in San Diego, Calif., for CalCOFI ichthyoplankton work.

Columbia River research is focused almost exclusively on problems of fish passage at dams, especially in the diversion of downstream migrants away from turbine intakes and other sources of mortality.

A sixth regional fisheries office is established in Alaska to facilitate administration of the Territory's fisheries.

The *John N. Cobb* is commissioned with a public open house at Seattle, Wash.

A field station at Pascagoula, Miss., is established for fishing and gear research and to catalog marine fauna of southeastern regional waters.



the College Park, Md.; Boston; and Seattle Technological Laboratories. Also in 1950, the agency's Pascagoula, Miss., field station was set up for Gulf fishing and gear research. Studies located new brown and pink shrimp fishing grounds, discovered a new royal red shrimp fishery, and helped establish a longline fishery for tuna and swordfish in the Gulf.

Meanwhile, Federal fishery research in the northwest Atlantic in 1951 found commercial quantities

of tunas, leading to a new and growing east coast tuna industry. On the opposite coast, the Columbia River Fishery Development Program began, concentrating on fish passage problems at the river's large hydroelectric dams.

The middle 1950's was another period of progress and change. On the east coast, a British vessel, the *Fairtry*, became the first of the large foreign factory trawlers

to fish in then international waters on the Grand Banks in 1954. Its success brought many other high-volume fishing vessels that spurred later declarations of 200-mile zones by northwest Atlantic nations.

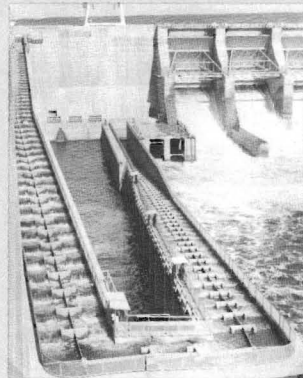
That same year, the Saltonstall-Kennedy Act was passed. Under this law, money was earmarked for fishery-product and market research; fisheries development, including development and implementation of voluntary grade standards for fish-

Significant benefits from early Gulf of Mexico exploratory research surveys include extension of the brown and pink shrimp grounds, discovery of a royal red shrimp fishery, and establishment of a longline fishery for tuna and swordfish.

The RV *Oregon* becomes the first research vessel designed for exploration of marine fauna of southeastern waters; it pioneers marine research in the Gulf of Mexico, Caribbean Sea, and tropical western Atlantic.

1951

Tuna investigations begin in the northwest Atlantic, leading to a new and growing east coast tuna industry.



1952

An oceanographer with the Honolulu Laboratory, Townsend Cromwell, discovers a major new ocean current, now named after him, in the tropical Pacific. It is about 3,000 miles long and carries more than 1,000 times the volume of the Mississippi River.

The first ICNAF meeting is held at Woods Hole, Mass.

1953

National Tuna Week, November 5-14, celebrates the 50th Anniversary of the tuna canning industry. In 1903, the entire U.S. tuna industry consisted of one cannery in San Pedro, Calif., supplied by a few boats fishing nearby waters.

Preliminary explorations for salmon in the offshore waters of the Aleutian Islands are made by the *John N. Cobb*, mainly to develop techniques for fishing salmon with gill nets on the high seas.

The International Convention for the High Seas Fisheries of the North Pacific Ocean establishes the International North Pacific Fisheries Commission (INPFC).

1954

Hurricane Carol strikes Woods Hole and destroys much of the laboratory and its environs, the saltwater pipes and pumps, and closes the public aquarium for several years.

ery products; and other fisheries research.

Protection of North America's Pacific salmon from foreign fishing on the high seas became increasingly critical, particularly since little was known of the salmon's ocean travels. A major study of salmon distribution in the eastern North Pacific Ocean began in 1955, and within 5 years their general distribution was firmly established and vital protective measures were

initiated. Continuing talks with Japan led to an agreement in 1958 that Japan would abstain from catching salmon in the North Pacific east of long. 175°W; research continued to determine the proper dividing line to separate stocks of Asian and North American salmon.

In yet another major reorganization, the Fish and Wildlife Act of 1956 reestablished two Bureaus within a new U.S. Fish and Wildlife

Service—the Bureau of Sport Fisheries and Wildlife and the Bureau of Commercial Fisheries (BCF), the latter with an Office of the Director, an Office of Loans and Grants, and four Divisions: Administration, Biological Research, Industrial Research and Services, and Resource Management. Thus, the BCF was reformed with most of the types of units and duties of the original Fish Commission and Bureau of Fisheries, except for freshwater fish culture and sport fish research.

Extensive population studies of sea scallops are begun by J. A. Posgay.

The British factory trawler *Fairtry* first appears in international waters on the Grand Banks, ushering in the era of high-tech, high-volume fishing vessels that play a major role in declarations of 200-mile Exclusive Economic Zones (EEZ's) by nations of the northwest Atlantic.

The 83rd Congress passes Public Law 466, popularly known as the Saltonstall-Kennedy (S-K) Act, which sets aside funds for fishery-product and market research, fisheries development, and other research.

The Cooperative Game Fish Tagging

Program begins at the Woods Hole Oceanographic Institution; it later will be transferred to the NMFS Southeast Fisheries Science Center.

1955

Congress appropriates money to rebuild the hurricane-damaged Woods Hole Laboratory.

The first survey to determine the distribution of salmon in the eastern North Pacific Ocean is made in the spring by the *John N. Cobb*, and is followed later this year by similar cruises with two chartered halibut schooners, the *Mitkov* and the *Paragon*. The general distribution of North Pacific Ocean salmon will be firmly

established by 1961.

The first coastwide samples from the Atlantic menhaden reduction fishery are acquired; sampling is continuous during the next 40 years.

1956

The new Fish and Wildlife Act creates the United States Fish and Wildlife Service (USFWS), including two Bureaus: the Bureau of Commercial Fisheries (BCF), the descendant of the original U.S. Fish Commission, and the Bureau of Sport Fisheries and Wildlife (BSFW). Federal responsibility for pinnipeds and cetaceans is given to the BCF, while responsibility for sea otters, manatees, and walrus is

assigned to the BSFW, along with most freshwater fish hatcheries. The Act also declares a National Fishery Policy recognizing the Nation's fish, shellfish, and wildlife as a valuable renewable natural resource.

All biological research associated with the Alaska finfish fisheries (except that being performed for the International North Pacific Fisheries Commission) is transferred from the Montlake Laboratory in Seattle to Juneau.

From 1956 through 1964, the Montlake Laboratory studies and defines the biology and populations of king crab in the eastern Bering Sea.

1957

Scripps Tuna Oceanography Research (STOR), composed of Scripps Institution of Oceanography (SIO) oceanographers and largely supported by BCF, is established in La Jolla, Calif.

Following full reorganization of the USFWS early in the year, Donald L. McKernan is designated Director of the new BCF. The Bureau now has a headquarters and five regional organizations including 80 field installations, plus the Pacific Ocean Fishery Investigations office in Hawaii.

On February 9th a new interim North Pacific Fur Seal Convention is concluded

The new Fish and Wildlife Act specifically charged the BCF with helping the U.S. fishing industry by locating new fishing grounds, promoting trade and marketing fish, developing new foods and products from fish, assisting with new fishing technologies and vessel financing, and more. The Fisheries Loan Fund, for example, created in 1956, was increased in 1958 from \$10 million to \$20 million.

BCF work in the late 1950's identified new tuna fishing grounds in the northwest Atlantic, led to more efficient two-trawl rigs for the Gulf shrimping industry, and found new fishing grounds for Pacific ocean perch off Alaska and for shrimp off the Pacific Northwest and Alaska.

On the international level, the first U.N. Conference on the Law of the Sea was held in Geneva in early 1958. And for the United States, a new interim convention to protect

the northern fur seals and a new protocol to further protect sockeye salmon of the Fraser River were also concluded.

Finally, in 1959, the Bureau's long-term management of Alaska's territorial fisheries ended as the new State of Alaska assumed that responsibility. BCF research and law enforcement activities, however, continued, as did its protection and management of the northern fur seal.

by Canada, Japan, the USSR, and the United States similar to the 1911 Convention. Japan had withdrawn from the 1911 convention in 1941.

The Bureau's new Fisheries Loan Program begins operation late in the year, initially with assistance from the Small Business Administration.

BCF exploratory longline fishing in the North Atlantic reveals several species of tunas in an area north of their previously known winter ranges and within 15 hours' sailing time of Massachusetts' Nantucket Lightship.

By the end of the year, a large number

of Gulf of Mexico shrimpers have converted from single-trawl to the more efficient two-trawl rigs.

A new protocol to the U.S.-Canada Sockeye Salmon Convention of 1930 becomes effective in July, extending the same type of protection to the pink salmon fisheries of the Fraser River system as that provided the Fraser's sockeye salmon runs.

Bureau exploratory fishing operations off Alaska locate new Pacific ocean perch and shrimp resources.

For the first time, shrimp discovered off Washington in earlier BCF research

cruises by the *John N. Cobb* are fished commercially and landed.

BCF assumes the administration of the Columbia River Fishery Development Program which had begun in 1948. Construction begins on three new salmonid hatcheries and two major fishways. Program hatcheries release 65 million salmon and steelhead trout.

Exploratory research in the central, eastern, and northern Pacific reveals that Japanese and American fishermen are exploiting the same stocks of albacore.

Successful redfish tagging at Eastport, Maine, provides the first direct evidence

that the growth rate of this species is extremely slow, less than one-sixth inch in 9 months.

BCF research shows that the yield of sea scallops in the North Atlantic can be materially increased by regulating the sizes of the rings used in the scallop dredges.

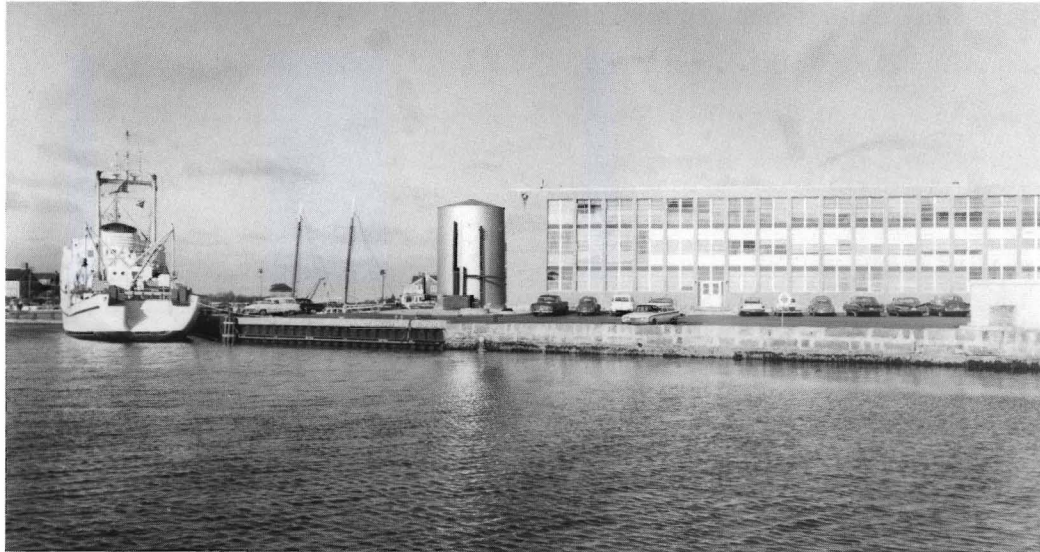
New markets are found for Lake Erie rough-fish, as the pet-food and mink-food industries take nearly the entire catch of freshwater sheepshead.

Bureau research conclusively shows that improved processing and packaging techniques can extend the storage life of

frozen fishery products by many months. Bureau technologists publish a comprehensive five-part manual on handling, processing, freezing, storing, and distributing fresh-frozen and precooked and frozen fishery products, the only authoritative reference on all phases of the frozen fishery product industry.

Bureau home economists develop a thorough series of fish and shellfish recipes for use by the Food Service Division of the Army and Air Force and by the Quartermaster Food and Container Institute of the Armed Forces.

With fishing industry help, the Bureau organizes a safety program to reduce the



Construction of the Bureau's new Woods Hole facility began in 1958. The original facility was completed in 1885.

By 1960, the Bureau's original Woods Hole Laboratory moved into new buildings. The original structure, occupied in 1885, had served for nearly 75 years. The early 1960's also saw new research laboratories opened at La Jolla, Calif.; Sandy Hook, N.J.; and Milford, Conn. Meanwhile the number of fisheries attachés posted overseas increased to three, and the foreign fishery reporting program received regular fishery reports from about 90 U.S. embassies and consulates.

number of accidents on fishing vessels.

The Bureau begins participation in the International Geophysical Year (IGY) operations as its Pacific Oceanic Fishery Investigations unit occupies an oceanographic station off Oahu, Hawaii.

The Bureau's Honolulu Biological Laboratory initiates a program to study tuna behavior in their natural environment.

1958

Construction of a new Woods Hole laboratory begins with demolition of the old buildings.

The Bureau moves its laboratory in

Annapolis, Md., to Oxford, Md., to be better sited to study "MSX," the disease which has decimated Chesapeake Bay oyster beds.

A new laboratory is established in Pascagoula, Miss., for regional fisheries utilization research.

A July article in the Bureau's *Commercial Fisheries Review* by Charles Butler, entitled "Nutritional value of fish in reference to atherosclerosis and current dietary research," notes the early interest in heart disease and the eating of fatty foods, and discusses the implications of current knowledge of atherosclerosis as applied to the marketing of fish. An S-K

study is initiated on the relationship of fish oils to circulatory diseases.

Congress passes the Alaska Statehood Act, and the new state will eventually be responsible for its fish and wildlife resources.

Japan agrees, under terms of the North Pacific Fisheries Convention, to abstain from salmon fishing on the high seas of the North Pacific east of long. 175°W while research continues to determine the proper line to divide Asian and North American salmon stocks equitably.

The first United Nations Conference on the Law of the Sea convenes in

Geneva during February–May, with 86 nations participating. The U.S. delegation uses background documents on U.S. and world fisheries during the deliberations. For the first time, broad agreement is reached on a system of rules to guide nations toward preserving marine species. A fishery attaché post is established in Tokyo in conjunction with the State Department Foreign Service Program.

Research shows that red salmon of the North American type appears to predominate in the North Pacific as far west as long. 175°E.

The Bureau's Biological Laboratory at Stanford, Calif., obtains indices of air cir-

culatation changes over the North Pacific for a 32-year period (1926–57) and studies their effects on sea temperatures, upwelling, and fish populations.

A new fleet headquarters opens at Kewalo Basin for the 10-year-old Honolulu Biological Laboratory.

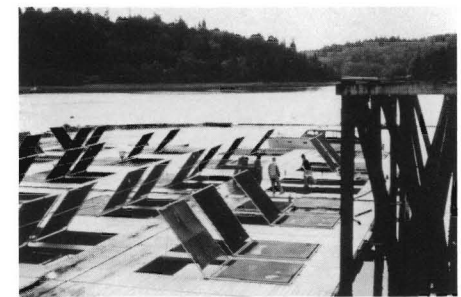
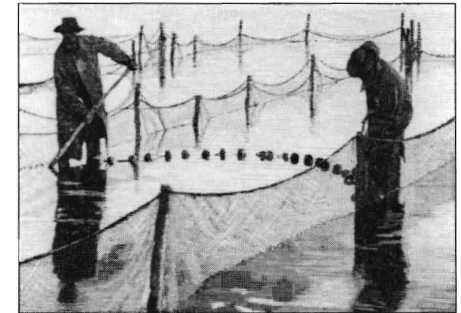
Research begins in Honolulu on the use of paper chromatography to identify adult tunas and tuna larvae. Bureau scientists continue their IGY participation by studying the Pacific Equatorial Undercurrent (Cromwell Current), a newly discovered easterly flow beneath the Equator of about 30,000,000 m²/second.

The 1960's also ushered in an even more aggressive era of foreign factory trawler fishing near U.S. coasts. However, cooperative research between Bureau scientists and those of other nations to assess the fisheries and identify potential problems and solutions also grew.

Salmon culture and research, early mainstays of the Fish Commission and Bureau of Fisheries, remained important, but for different reasons: emphasis swung to resto-

ration and maintenance of runs on the Columbia and other western rivers, and also moved into salmon ranching and net pen culture studies, the latter now an important source of fresh salmon.

(Cont. on page 36.)



Salmon propagation from two centuries: Above, Atkin's method of penning salmon, in Maine, from about the late 1870's. Below, salmon-rearing pens in Puget Sound, Wash., in the 1970's.

The Bureau's Galveston Biological Laboratory successfully tests a new shrimp-marking technique using vital stains which remain with the shrimp even as they molt. Research shows that Everglades' bays are an important nursery area for the Tortugas pink shrimp and that brown and white shrimp peak in abundance at different seasons of the year.

Beaufort Biological Laboratory scientists develop a method for estimating the relative abundance of each new year class of menhaden prior to its entry into the commercial fishery, allowing accurate catch predictions for each year class.

Woods Hole Biological Laboratory sci-

entists develop a method to determine the age of scallops using marks on the shell and ligament as annual rings.

A fluorinated nitrophenol chemical, discovered the previous year, is used to treat eight streams entering the Great Lakes. Developing lamprey larvae are killed, bringing hope for an effective control of this fish predator.

A prototype automatic deicing and weighing machine is developed and tested by Bureau technologists to increase efficiency of unloading fish at the dock.

Bureau scientists show that introducing fish oils into the diet markedly reduces

high serum-cholesterol levels; test animals also show more rapid growth rates than control animals. The researchers also develop an accurate method for measuring the nutritive value of fish meals through controlled-diet feeding studies.

A tilapia rearing program in Honolulu to provide baitfish for tuna vessels produces over 1,000,000 tilapia fry.

A new Biological Laboratory is set up in Washington, D.C., to study the mechanisms by which the elements of the marine environment affect commercially important fishes and invertebrates.

1959

Two new fishways are completed on Columbia River tributaries for a total of 20 major fishways constructed since the Columbia River Fishery Development Program began in 1948.

La Jolla Biological Laboratory researchers design a high-speed plankton sampling device to study the continuous distribution of plankton in the environment of the sardine. And, using erythrocyte antigens as genetic indicators to study subpopulations, they find three sardine blood systems, designated A, B, and C.

An underwater viewing chamber is installed in the stern of the BCF vessel

Charles H. Gilbert to facilitate tuna behavior studies.

Bureau insecticide reports show that DDT is toxic to adult white shrimp at concentrations of 15 ppb; endrin and lindane are toxic to postlarval shrimp at 0.5 and 2.0 ppb, respectively; and endrin is also highly toxic to fish, killing the sailfin molly at 2.5 ppb.

Exploratory fishing operations off North Carolina find an extensive commercial hard-clam bed and sizeable concentrations of calico scallops.

A new test method to determine shrimp quality is developed at the College Park,

Md., Technology Laboratory and is put to use in the Bureau's inspection and certification service.

Bureau technologists at the Gloucester Laboratory demonstrate the practicality of using refrigerated sea water (RSW) to store whiting prior to processing.

On October 13th the "Don McNeil Breakfast Club Show" includes a "fish for health" message to 30 million listeners, announcing a major "nutritional breakthrough" resulting from Bureau-sponsored research which indicated the value of fishery products in lowering blood cholesterol levels.

"Outdoor Fish Cookery," a Bureau-financed motion picture, is honored with a showing at the 1959 American Film Festival.

A new Biological Laboratory is established at San Diego, Calif., to investigate tuna ecology and tuna fishing operations in the eastern Pacific and to apply specific oceanographic and biological findings to problems of the west coast tuna industry.

The South Atlantic fisheries exploration and gear research program begins.

The Bureau is called upon to intensify fishing treaty enforcement and foreign fishing surveillance in international waters, especially off the Alaska coast where Japan and the Soviet Union have concentrated their greatest fishing efforts.

Federal management of Alaska's commercial fisheries ends on December 31st as the new state's agency assumes that responsibility.

1960's

Research at the BCF Seattle Technological Laboratory on composition and

taste of various sharks finds wide variability in palatability between shark species.

1960

A newly recruited team of biologists, histologists, and parasitologists begins a long-term study of mollusk diseases, including MSX, at the Oxford Laboratory in Maryland.

The Bureau's new Woods Hole Laboratory facility is completely reopened.

The Nation's first saltwater sport fish laboratory is established at Sandy Hook, N.J., and Lionel Walford is its first director.

The Bureau's northern fur seal and whale research studies are combined in Seattle and designated as the Marine Mammal Biological Laboratory.

The Auke Bay Laboratory near Juneau opens to house the Alaska fisheries research programs.

The Pacific Northwest trawl fleet begins catching bottomfish off Washington on grounds newly discovered by the BCF research vessel *John N. Cobb*.

In February, the Honolulu Biological Laboratory makes the first successful transfer of skipjack tuna from the sea to a holding pool ashore; it is the first time that oceanic skipjack have been held for more than a few hours or have been induced to feed. In addition, albacore, bigeye, and bluefin tuna larvae, previously unknown, are tentatively identified, opening the way for studies of their seasonal and geographical distribution and abundance throughout the Pacific.

The Galveston Biological Laboratory announces significant advances in identifying specific penaeid shrimp lar-

vae; early larvae derived from known parents were obtained for three species, and comparable results are anticipated for several other species.

Bureau researchers discover extensive calico scallop fishing grounds over a 1,200-square-mile area off the Florida coast. Also 1,000,000 pounds of hard clams are taken by commercial vessels

A milestone in Great Lakes sea lamprey control is achieved with the chemical treatment of all lamprey-producing streams feeding Lake Superior. Treatment of Lake Michigan and Lake Huron streams to eradicate lampreys begins in cooperation with the Fisheries Research Board of Canada.

1961

Between February and April, more than 222,000 inches of newspaper food column space are devoted to fish topics, of which one-third is based on the Bureau's consumer-education releases to food editors.

Serological studies of the Pacific sardine show that there is a genetically distinct stock in the Gulf of California, the third sardine subpopulation to be found in the eastern Pacific.

The Bureau establishes the Tiburon Marine Laboratory near San Francisco, Calif., to conduct research on migratory gamefishes.

The Bureau's Biological Laboratory in Honolulu develops a new method for predicting the seasonal catch of skipjack tuna for the Hawaiian Islands based on the time of "zero" rate of temperature change of the ocean climate—the time and rate of warming and salinity change—occurring during late February and early March of each year.

Exploratory research locates promising fishing grounds off North and South Carolina for vermilion snapper, grouper, and scup.

The BCF research vessel *Delaware* tests the effectiveness of trawls with various parts made of polypropylene, finding these new nets to be more efficient than the standard manila trawls.

The first comprehensive program to study juvenile salmonid migrants in the Columbia and Snake Rivers is initiated.

Bureau research into the drastic declines of Lake Erie blue pike and walleye produces evidence of marked environmental changes, including increases of chemicals related to domestic and industrial wastes. Severe oxygen depletion is found over thousands of square



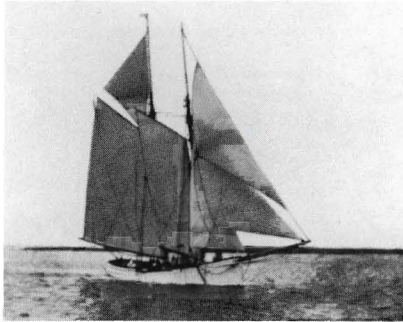
from a new bed discovered last year by Bureau scientists off North Carolina.

Spring dedication ceremonies open the Bureau's new Technological Laboratory in Gloucester, Mass.

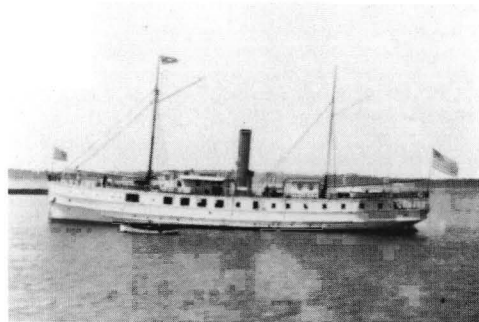
Researchers at Woods Hole find that oysters suspended from rafts on cultch strings reach commercial size in less than half the time needed by bottom-grown stock in the same areas, and mortalities are less than one-fourth of those grown under usual industry practices.

Bureau chemists demonstrate the use of thin layer chromatography for isolating and characterizing chemical classes of lipid compounds in fish oils, a new basic test procedure for chemical laboratories.

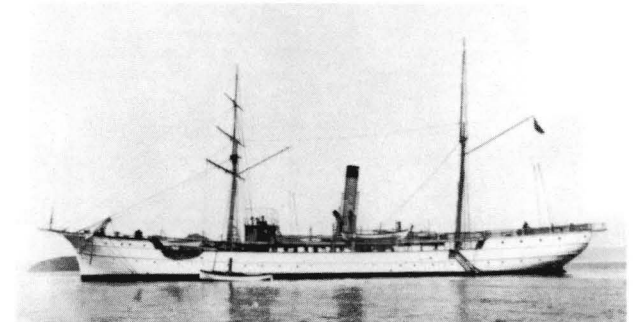
An Alaska fisheries exploration and gear research program is initiated, based at Juneau. Also, the use of radioactive materials in biological research is new, and a radiobiological consultant is assigned to the BCF Central Office to advise Bureau laboratories on use of radioactive materials in biological research.



The *Grampus* was built in 1886 as a research vessel and to demonstrate a safer and more effective vessel for commercial fishing. More seaworthy than its contemporaries, its design features were incorporated by many shipbuilders.



The *Fish Hawk* was used as a floating fish hatchery in the late 1800's, incubating eggs on-board and then planting the young fish in coastal Atlantic waters.



The *Albatross* (234 feet long), the world's first vessel built exclusively for marine research, was launched in 1882. Her research cruises ranged from the Atlantic to the Pacific and into Asian waters as well.

miles of the lake along with dramatic changes in the abundance of fish-food organisms living on the bottom.

Bureau researchers develop new analytical techniques to produce better fish oil fractions and devise new methods to determine rapidly the chemical components of such fractions.

The new Bureau-produced film "Fishing the Five Great Lakes" makes 20 such educational films in national distribution. Since 1946, the Bureau's educational motion pictures have earned 18 national and international film festival awards.

The Bureau begins a major study of

the manufacture of fish protein concentrate (FPC), a fine powder containing essential amino acids, minerals, and vitamins necessary for human health. The FPC is viewed worldwide as a potential human dietary supplement that could combat world hunger while creating a use for under- or nonutilized fishes.

In response to increasing numbers of foreign vessels fishing along U.S. coasts, the Bureau increases its surveillance efforts to ascertain possible effects on U.S. fisheries.

On August 30th, Congress authorizes construction at Milford, Conn., of a shellfish laboratory for research and training.

The Bureau's new 65-foot exploratory fishing and gear research vessel *Kaho* is commissioned in late October and based at Saugatuck, Mich., for Great Lakes studies.

1962

Congress approves a Geological Survey marine survey of the continental shelf and slope between the U.S.-Canada border and the tip of Florida. Woods Hole scientists process the benthic samples taken in this project for biological specimens. This is the first and last large-scale baseline benthic survey conducted in the U.S. Atlantic.

Former BCF biologist/writer/editor

Rachel Carson publishes her landmark environmental book "Silent Spring," drawing in part on BCF and other Federal and university studies on pesticides like DDT.

The *George B. Kelez* is acquired for the Seattle Laboratory from the U.S. Navy, and for the first time it allows the Bureau's oceanographic and high-seas salmon studies to be extended into the winter season.

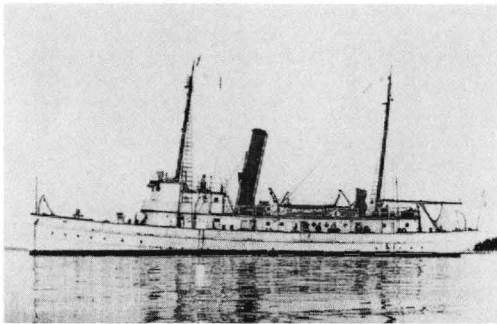
A new fishery for royal red shrimp begins off Florida's east coast and in the Gulf of Mexico, and 19 commercial trawlers are converted for it within the year. Bureau explorations first discovered the deepwater shrimp grounds in 1956.

An active commercial fishery for snow crab develops in southeastern Alaska waters as a result of Bureau explorations.

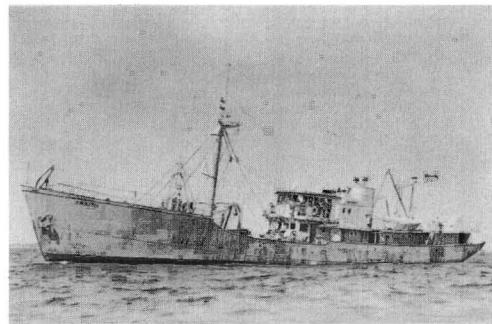
Congress, on October 9th, authorizes \$10 million for construction and operation of the "National Fisheries Center and Aquarium" in Washington, D.C., for fisheries research and displays.

The Bureau's foreign fishery reporting program expands, receiving regular fishery reports from about 90 U.S. embassies and consulates and the three full-time fishery attachés in Copenhagen, Tokyo, and Mexico City.

The Bureau makes its first whale



The *Albatross II*, formerly the U.S. Navy's ocean-going tug *Patuxent*, was acquired by the Bureau in 1926.



The *Albatross III*, commissioned in 1948, was formerly a steam trawler in the New England groundfishery.



The 187-foot *Albatross IV* was launched in 1962.

marking and observation cruise off southern California and northern Baja California to determine the condition of the North Pacific whale stocks and those pursued by the two U.S. whaling companies.

A 2-year emergency Alaska salmon research program concludes, having determined the carrying capacity of the freshwater spawning and nursery areas of the state, with a better understanding of the Pacific salmon runs and their management, and with data needed for renegotiation of the International North Pacific Fisheries Convention in 1963.

The Bureau's first winter high-seas salmon survey cruise in the North Pacific

finds a significant concentration of immature red salmon in a broad area about 200 miles south of Kodiak Island and helps toward understanding the distribution and survival of salmon at sea. Methods are also developed to distinguish between North American and Asian pink salmon.

Bureau scientists at the La Jolla Laboratory studying the early development of fishes use a temperature-gradient block to study the development of one group of fish eggs at 18 different temperatures simultaneously.

The new Biological Laboratory at Woods Hole, Mass., is dedicated on June 23rd. The 3-story building has 24,000

square feet of floor space devoted to "wet laboratories," as well as other laboratories, offices, a scientific library, and a conference room. A second building houses maintenance facilities and an aquarium.

Several insurance underwriters offer a 5% reduction in protection and indemnity insurance premiums for all New England fishing vessels that install new trawl wire level-winders on the main winches of the vessels as a result of the Bureau's fishing vessel safety program.

A new 187-foot research vessel, the *Albatross IV*, is delivered to the Woods Hole Laboratory in November; a contract

is also awarded for another new 158-foot vessel to be named the *Townsend Cromwell* for use in the central Pacific.

New shellfish genetics research begins at the Bureau's Milford, Conn., Biological Laboratory, and the goal is to produce strains of oysters and clams with better growth rates, disease resistance, and market qualities.

1963

A groundbreaking ceremony is held for the new BCF Fishery-Oceanography Center in La Jolla, Calif.

The cooperative shark tagging program of the Narragansett Laboratory be-

gins with about a dozen volunteer taggers. Today the program has several thousand volunteers worldwide and is the source of most of the data collected on shark migration, reproduction, growth, longevity, and exploitation in the Atlantic.

The Woods Hole Laboratory autumn bottom trawl surveys begin and are the source of the longest continuous time series of research vessel sampling data in the world. For the finfish survey, about 300 sites are randomly chosen in waters 2-200 fathoms deep from the Gulf of Maine to Cape Hatteras. Spring surveys are added in 1968.

The 565-ton *Townsend Cromwell*, a

158-foot research vessel, is completed. It has a top speed of 13.5 knots, a 10,000-mile cruising range, and can perform a wide variety of scientific missions anywhere in the world's oceans and under the most severe weather and sea conditions.

U.S. biologists are placed on some Japanese trawlers and factory ships in the Bering Sea and the Gulf of Alaska, obtaining data on the catch by species, area, and quantity, and on gear efficiency.

Bureau scientists confirm the successful use of tetracycline antibiotic marking of fishes with marked adult silver salmon returning in the fall to the Clatskanie Hatchery on the lower Columbia River.

Gulf gear research demonstrates that an electrified trawl net can significantly improve the efficiency of commercial shrimp trawling methods.

Bureau analyses of Atlantic coast shore-station sea-surface temperature records show a warming trend which started near the turn of the century and reached a peak in the early 1950's.

Use of a chemical toxicant in Lake Superior streams reduces lampreys there by over 80%, bringing a substantial increase in the average size, survival, and spawning populations of lake trout.

The Bureau participates in two international oceanographic expeditions: The International Indian Ocean Expedition (IIOE) and the International Cooperative Investigations of the Tropical Atlantic (ICITA).

Over 215 million pounds of fishery products are inspected and certified by Federal inspectors in 17 states nationwide. Since 1956, the Bureau has developed grade standards for 14 fishery products upon which the inspections and certifications are based.

Research programs to prevent botulism in smoked fish and salmonella are initiated when several consumers are

La Jolla, Calif., is dedicated on October 31st. BCF's CCRL and Tuna Research Laboratory, along with the Inter-American



A hammerhead shark is tagged.

stricken by those microorganisms.

1964

The new Fishery-Oceanography Center in

Tropical Tuna commission (IATTC), STOR, the CalCOFI Coordinator, and U.S. Geological Survey (USGS) field station personnel move into the new facility.

Construction begins on a new laboratory at Milford, Conn., to be occupied in 1967.

The BCF's Seattle Technological Laboratory initiates research on the Pacific whiting, then called "hake," another potentially large fishery.

The "Bartlett Act," Public Law 88-308, of May 20th, prohibits fishing in U.S. territorial waters by foreign-flag vessels unless allowed by treaty. Pre-MFCMA (1976) territorial waters were within 3 miles along most U.S. coastlines.

Scientists at the Bureau's Seattle Biological Laboratory use the results of pioneering studies in serology, or blood group analysis, to identify several subpopulations of salmon in the eastern North Pacific Ocean.

A new MPDI (Marine Products Development Irradiator) is dedicated at the Bureau's Technological Laboratory in Gloucester, Mass. By processing up to 1 ton of fish per hour at 250,000 rads, scientists can study the extension of seafood shelf life by using radioisotopes to destroy the bacteria that cause food spoilage.

The first coastwide samples from the Gulf of Mexico menhaden reduction fishery are acquired, and sampling is continued through the next 31 years.

1965

Sandy Hook Laboratory sportfish biologists begin long-term investigations into egg and larval fish surveys, red tide, and behavior of adult bluefish.

Regular surf clam and ocean quahog surveys begin at the Woods Hole Laboratory, providing a continuous time series of species information comparable to that supplied by the finfish survey sampling program since 1963.

After completing a BCF charter, the St.

Michael fishes Pacific whiting successfully in Puget Sound, Wash., taking about 100 tons in 13 tows; it is the first commercial fishing operation for this species in the North Pacific area and the beginning of a new regional fishing industry.

For the first time in a laboratory, blue king crab, *Paralithodes platypus*, are raised from the egg through four zoeal stages and one glaucothoe larval stage.

Seattle Biological Laboratory scientists find scale characters useful in distinguishing Asian from Bristol Bay, Alaska, sockeye salmon, and for identifying stocks of intermingled salmon in the Gulf of Alaska from various North American river systems. Pink salmon are also identified to their area of origin by scales.

The Biological Laboratory at Gulf Breeze, Fla., establishes a cooperative nationwide system to monitor nearly a dozen organochlorine pesticides using monthly analyses of clam, mussel, and oyster samples from 150 coastal stations.

An ecological benchmark of the distribution and abundance of groundfish on New England banks is completed, based on 3 years of intensive surveys with Bureau vessels.

The Bureau's comprehensive systematic and anatomical study of the giant tunas, genus *Thunnus*, is completed, and a study on systematics and distribution of sharks continues.

The Milford, Conn., Biological Laboratory begins a long-term study of the genetics of commercial mollusks aimed at hybridization and selective breeding.

The Honolulu Biological Laboratory establishes a sampling station on Palau for studies on the substantial skipjack tuna fishery in the Trust Territories of the Pacific Islands.

The Anadromous Fish Conservation Act is passed to conserve, develop, and enhance anadromous fisheries covered under international agreements and the fisheries of the Great Lakes and Lake Champlain.

The 171-foot *David Starr Jordan*, a new BCF research vessel, replaces the 35-year-old, 150-foot *Black Douglas* at the La Jolla, Calif., research center.

With an increase in the fishery demonstrated, California legalizes the taking of anchovies for meal and oil. The Bureau's research laboratory in La Jolla, Calif., shifts emphasis from sardines to anchovy.

1966

Marine resource concerns lead Congress, under P.L. 89-454, to authorize on June 17th the creation of the "Commission on Marine Science, Engineering, and Resources." Later chaired by Julius A. Stratton of the Ford Foundation, it is simply called the "Stratton Commission." P.L. 89-454 also sets up the National Council on Marine Resources and Engineering Development.

Sandy Hook Laboratory staff begin studies of experimental reef fisheries.

The new Tropical Atlantic Biological Laboratory (TABL) is set up at Miami, Fla., and is an expansion of the BCF's Biological Laboratory which had been moved to Miami from Washington, D.C., in early 1965.

On October 16th, the Narragansett Laboratory of Interior's BSFW is dedicated. It assumes some of the gamefish responsibilities of the Sandy Hook Laboratory, which begins to concentrate more on habitat and environmental studies.

A new law passed on November 2nd authorizes the development of economical processes for producing fish protein concentrate from unutilized and under-

utilized species of fish.

Congress recognizes the need for a comprehensive, long-range oceanography program and passes the Marine Resources and Engineering Development Act of 1966 (MAREDA) which sets up a National Council at the Secretarial level with a 15-member Commission. Later, Congress amends the MAREDA with the National Sea Grant College and Program Act of 1966.

Congress passes Public Law 89-658, extending the U.S. fisheries zone 9 miles beyond the 3-mile territorial sea, making a full 12-mile zone in which the United States will exercise the same exclusive rights in respect to fisheries as it has in its territorial sea. This is in response to the increased foreign fishing activity off the U.S. coasts.

Scientists with the Ketchikan Technological Laboratory discover a new method for peeling Alaska's pink shrimp quickly and maintaining their quality and color, thus overcoming a major obstacle to commercial production.

A biologist at the Auke Bay, Alaska, Biological Laboratory devises a new type of lightweight, simple, and inexpensive plastic driftcard to chart surface ocean currents. A patent on it is secured for the Bureau.

Bureau and contract personnel create a new model sonic tag to place inside fish. Tests on adult chinook salmon and steelhead trout at the Bonneville Field Station are positive.

The Bureau's California Current Resources Laboratory in La Jolla rears Pacific mackerel and sardines from the egg to an advanced juvenile stage in its experimental seawater aquarium.

The Honolulu Biological Laboratory completes the "Oceanographic Atlas of

11 dozen steamer clams 12 baking potatoes
12 ears of corn in the husks 12 live lobsters (1 pound each)
Lemon wedges Shelled butter in butter fat

Wash clam shells thoroughly. Wash potatoes and cut off ends. Remove corn silk from ears of corn and rub off husks. Wash lobsters in salt water. Wash butter in hot water. Drain and pat dry. Season for 1 hour. Remove lobsters. Crack lobster claws. Season with lemon wedges and melted butter. Serve 12.

Place potatoes in a large metal container, similar to a thirty-gallon galvanized garbage can, with a tight fitting lid. Season 3 buckets with boiling hot water inside to fill the container. The bottom of the bucket should be made of half-inch galvanized wire mesh. Place 3 about high shovels in the center of the container to a depth of about 3 inches. Place potatoes in a bucket and place on supports in the container. Finish filling container by placing corn in the next layer, lobsters in the next two layers, and clams in the top layer. Cover container and allow over a hot fire. Steam for 1 hour. Remove buckets. Crack lobster claws. Season with lemon wedges and melted butter. Serve 12.

A recipe from *Outdoor Fish Cookery*, a BCF publication promoting seafood for enjoyment and health.

the Pacific Ocean," providing a definitive summary of data from more than 50,000 oceanographic stations taken by various agencies between 1917 and 1964. It also describes the environment of every known and potential fishery resource of the Pacific Ocean.

The Honolulu scientists also develop evidence leading to the identification of one of the last large untouched tuna resources in the world in the Central Pacific Ocean, an intermediate size group, only a small portion of which is fished from Hawaii.

Bureau marketing personnel introduce such underutilized Gulf of Mexico species as mullet, Spanish mackerel, calico scallops, and soft clams to restaurant chains, state school lunch programs, and state institutions.

The Bureau's Environmental Oceanic Research Program in Washington, D.C., completes detailed bottom topographic mapping of the Middle Atlantic Continental Shelf and arranges for publication of the maps by the U.S. Coast and Geodetic Survey.

The first commercial shellfish hatchery opens on the Pacific coast; it and nine other private shellfish farms use data and techniques derived from research at the Bureau's Milford, Conn., Biological Laboratory.

A large study is completed into conditions causing drastic changes since 1900 in fish populations in Lake Michigan. Important factors include high fishing intensity and the explosive increase in the sea lamprey population in the 1940's.

In promoting fishery products, Bureau efforts produce over 74,000 column inches of space in newspapers and magazines with a total readership of over 300 million subscribers or purchasers. In addition, Bureau home economists develop and test 633 recipes during the year for consumers, as well as for institutional, school lunch, and restaurant use.

A new cooperative study is begun on the northern anchovy on the Pacific coast to assess the species' abundance, distribution of various life stages, and rates of fecundity and mortality, to facilitate its conservation.

Programs at the Bureau's Biological Laboratories at Galveston, Tex., and Pascagoula, Miss., help determine the feasibility of using crewed spacecraft to obtain natural resource information. Par-

ticular emphasis is on determination of sea-surface temperatures, current patterns, sea state, shoaling processes, bioluminescence, and productivity. Sensing devices being tested employ photography, radar, infrared, passive microwave, and spectroscopy.

The Fur Seal Act is passed to protect the fur seal herd and administer the Pribilof Islands in the Bering Sea.

The Jellyfish Act is passed to protect fish and shellfish resources in coastal water, promote water-based recreation, and to control and eliminate jellyfish and other aquatic pests.

1967

On January 9th, President Lyndon B. Johnson appoints the 15 members of the "Stratton Commission" who immediately begin their study of the Nation's marine problems and needs.

Two southwest laboratories (CCRL and the Tuna Research Laboratory) are merged into one, and the director, Alan Longhurst, also becomes EASTROPAC (Eastern Tropical Pacific) Director and launches the 4-year expeditionary EASTROPAC program which seeks to learn the distribution and abundance of skipjack tuna resources and to understand how fish distribution is related to the oceanography of the eastern tropical Pacific.

The Sandy Hook Laboratory begins studies of natural and artificial marine reefs, which lead to several national and regional programs to create new artificial reef habitat.

A new \$3 million 215-foot ocean research vessel, the *Miller Freeman*, is launched, and it is designed with laboratories and equipment especially for North Pacific oceanographic and fisheries studies. In addition, several field stations are established on the Columbia River and Puget Sound.

A salmon aquaculture program is established at the Bureau's Seattle Laboratory, with a field station at Manchester, Wash., on Puget Sound. The station soon demonstrates the



rapid growth of coho salmon in salt-water rearing pens from 0.3 ounces to a marketable 8-ounce size in just 6 months.

Studying immersion freezing of fish, the Bureau's Technological Laboratory at Terminal Island, Calif., finds that Freon 12 effectively preserves and maintains tuna quality and that residual levels of Freon

12 are low. Propylene glycol is also studied as a freezing agent.

Rearing of pelagic fish larvae, a problem for over a century, is improved at the

Bureau's Fishery-Oceanography Center in La Jolla, Calif., where sardine, anchovy, Pacific mackerel, and more than 20 other species are reared from egg to advanced juvenile or to adult stages.

Catfish culture production, which grew from just a few thousand pounds in 1963 to 15 million pounds in 1965, gets new impetus from the Bureau's cooperative technical assistance project which helps finance a technical assistance program for the industry in nine U.S. south-central states.

Biological studies begin on the culture of four shrimp species which have been hatched and reared to postlarvae in the Bureau's Galveston, Tex., Biological Laboratory.

Biological data acquired by scientists at the Bureau's Biological Laboratory at St. Petersburg, Fla., aids in obtaining the first denial of a dredge-fill permit by the Corps of Engineers owing to the effect upon living resources and based on provisions of the Fish and Wildlife Coordination Act.

The Bureau and three Gulf states begin an inventory of estuarine resources under the auspices of the Gulf States Marine Fisheries Commission.

The *Oregon II* replaces the *Oregon* as the research vessel at the Pascagoula, Miss., laboratory. It discovers new stocks of northern tilefish in the Gulf of Mexico which average 6-8 pounds—the first evidence of commercial concentrations of mature tilefish in the region.

A series of cooperative U.S.-U.S.S.R. fishery surveys are conducted in the Middle Atlantic Bight to provide a common base to estimate stock abundance and manage the harvests. Participating are the Bureau's vessel *Albatross IV* and a Soviet vessel likewise named *Albatros*.

Efforts by the Bureau and cooperating agencies to control the predatory sea lamprey in the Great Lakes shows more progress: Lake trout populations in Lake Superior increase almost 35 percent over 1960 levels.

Experiments at Bureau Technological Laboratories in Seattle, Wash., and Ann Arbor, Mich., show that the shelf life of perishable foodstuffs can be increased by placing them in gaseous environments that inhibit growth of spoilage organisms. Different ratios of the gases CO₂, O₂, and N₂ have been tested alone and in combination with irradiation.

A new program at the Honolulu Laboratory is designed to increase the yield and efficiency of the pole-and-line fishery for skipjack tuna as well as the efficiency of the Hawaiian longline fishery. Efforts are also under way to develop fisheries for high-seas skipjack tuna and for fish and shellfish other than tunas.

1968

The Sandy Hook Laboratory begins a special study to evaluate the effects on marine life of oceanic disposal of sewage sludge and dredged materials. Journalists dub the study area "the Dead Sea," and the research reports lead to legislation banning ocean dumping of sludge.

Two new research units are established at Seattle's Montlake Laboratory to study the physiology and biochemistry of fish and the effect of thermal and petroleum products (and other environmental contaminants) on fish.

During spring and summer, exploratory BCF fishing demonstrates the feasibility of using large steel pots to catch offshore New England lobsters in deep water, stimulating commercial fishermen to enter the fishery.

A contract is awarded in October to build a demonstration FPC plant in

Aberdeen, Wash., to show the commercial feasibility of FPC and to get operating and cost data for such an operation.

Scientists at the Seattle Technological Laboratory modify a refrigerated brine technique used to freeze tuna by incorporating dissolved CO₂ in it. The new technique increases the shelf-life of salmon by 10–18 days because the CO₂ inhibits bacterial growth.

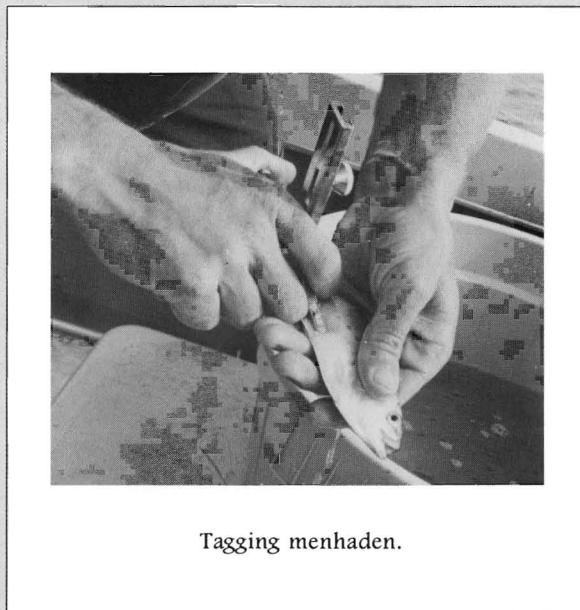
BCF and Japanese scientists cooperatively study several U.S. fish species as potential ingredients for "surimi," a frozen fish product used in Japan to make fish sausages and fish cakes. Studied are the spiny dogfish, starry flounder, and several Pacific coast rockfishes.

Seattle Technological Laboratory researchers demonstrate that otherwise wasted proteins can be inexpensively and simply recovered from diluted solutions in processing plant effluents. Comparative feeding tests (protein efficiency ratio) indicate that the nutritive value of the complexed protein is about equal to the value of the noncomplexed protein.

Honolulu Biological Laboratory researchers show that skipjack tuna of the western Pacific (which forms Japan's largest tuna fishery) differ genetically from those of the eastern and central Pacific, with the dividing line at about long. 155°E near Marcus Island. The discovery is based on chemical analyses of the tuna's blood systems.

The Pascagoula Technology Laboratory removes a roadblock to the marketing of snapper fillets: A newly devised chemical treatment with TDP and cryovac packaging prevents fillet and skin discoloration and curling during cooking.

Scientists at the BCF Beaufort Biological Laboratory conduct what is believed to be the largest fish tagging program in the world, tagging more than 844,000 menhaden in five areas off the Atlantic coast.



Tagging menhaden.

The 93,000 recovered tags provide much information on the species' migrations.

Scientists with the Gloucester Technological Laboratory conceive and bench-test a simple oyster-shucking procedure using microwave heating to open the shells. The technique later shows a 50% increase in shucking productivity without reduction in total meat yields.

The Gloucester Laboratory also discovers that the characteristic iodine flavor of the ocean quahog can be removed by several washings, allowing the species to

be used in such products as chowders or clam puffs.

1969

The "Stratton Commission" presents its final report on January 11th and recommends creation of a new Federal entity—a "National Oceanic and Atmospheric Agency" to include initially the BCF and other Federal marine and anadromous fishery functions, the National Sea Grant College Program, and other agencies.

The Gloucester Laboratory begins a pioneering study of fish irradiation to extend its shelf life.

The first rearing of larval tunas beyond the yolk-sac stage from eggs collected in the ocean is reported by BCF scientists at the Tropical Atlantic Biological Laboratory at Virginia Key, Fla.

Fish schools are first counted and measured by sonar off California from the BCF's research vessel *David Starr Jordan*.

Three BCF diver-scientists participate with the U.S. Navy, NASA, and other diver-scientists in the new TEKITE I project, spending 60 consecutive days on the ocean floor at a 50-foot depth.

Scientists at the Seattle Biological Laboratory provide estimates of growth, mortality, and other data for Pacific whiting and Pacific ocean perch; this research forms the basis for the U.S. position in discussions with the U.S.S.R. to reduce its whiting fishery.

Auke Bay Laboratory scientists provide U.S. negotiators and management agencies with background data on king crabs in the Bering Sea and Gulf of Alaska. The data help U.S. representatives obtain a 48% reduction in the king crab quotas of Japan and the U.S.S.R.

The Honolulu Biological Laboratory successfully tests another baitfish, the freshwater threadfin shad, to replace the native nehu. This shad is as effective as the nehu in the skipjack fishery and survives better in baitwells.

Honolulu Biological Laboratory researchers track a small tuna with an ultrasonic transmitter and find that it traveled farther at night than in daylight and was always at the surface at night—leading to the possibility of developing a night tuna fishery.

Artificial mid-water pup-tent-shaped structures placed off Panama City, Fla., in July attract commercial quantities of round scad, scaled sardines, and Spanish sardines—as much as 25 tons of fish—and consistently attracting 0.5–5.0 tons daily.

The New England haddock decline since 1966, due partly to heavy Soviet fishing, is accurately predicted by BCF scientists who have studied the fishery since 1931.

A new Remote Underwater Fisheries Assessment System (RUFAS) is developed by the Pascagoula Laboratory as a remotely controlled underwater sled equipped with television and motion picture cameras which can be towed at varying depths.

For the first time ever, tuna eggs, collected at sea, are hatched in a laboratory and the young survive about 3 weeks. Miami Biological Laboratory staff collected the eggs from a sample of mixed plankton from nearby waters.

Scientists at the Ann Arbor Biological Laboratory provide data on fish contamination that lead to banning or reducing the use of DDT in some states adjacent to the Great Lakes. The studies also show that the ordinary preparation of fillets of fish such as perch produces an edible product well within safe tolerance limits.

The Bureau establishes a small environmental forecasting unit at the U.S. Navy's Fleet Numerical Weather Center in Monterey, Calif., to identify the part of the Navy's vast oceanographic and meteorological data that can be used for related fisheries oceanographic forecasting.

The Bureau and the University of California study 175 female northern fur seals found at San Miguel Island, Calif.—the first confirmed record of these seals breeding on other than the Pribilof Islands.

In the late 1960's, of course, the Nation's interest in ecology and the environment began to grow. Concern over marine and atmospheric programs led Congress in 1966 to set up the "Stratton Commission," formally termed the "Commission on Marine Science, Engineering, and Resources." This group recommended a new "National Oceanic and Atmospheric Agency," leading to a wholly new era for the BCF.

With President Richard M. Nixon's Executive Order 11564, the new National Oceanic and Atmospheric Administration (NOAA) was indeed created in 1970 under the Department of Commerce to use a "unified approach to the problems of the oceans and atmospheres." The BCF was then renamed the National Marine Fisheries Service (NMFS), placed in NOAA along with Interior's marine sport fish research laboratories, and given a new mandate including the study and con-

servation of saltwater sport fishes and marine angling.

Primary NMFS functions were assigned to three areas: Resource Research, Resource Utilization, and Resource Management. And NMFS research was soon consolidated under four major units, the Northeast, Southeast, Southwest, and the Northwest and Alaska Research Centers, each with associated satellite laboratories.

The first meeting of the International Commission for the Conservation of Atlantic Tunas (ICCAT) is held in Rome, Italy, beginning a period of U.S.-foreign cooperation in research on important oceanic fisheries.

1970

Under Executive Order 11564, President Richard M. Nixon establishes the National Oceanic and Atmospheric Administration (NOAA) under the Department of Commerce. The new organization is directed toward a better understanding of the Nation's living marine resources, the environment in which they are found, and the interaction between the two.

The Bureau of Commercial Fisheries is transferred to NOAA on October 3rd and is renamed the National Marine Fisheries Service (NMFS). Also transferred are functions relating to migratory marine game fishes. BCF functions left with Interior are those related to certain Great Lakes fisheries, various freshwater fish culture stations, Missouri River reservoir studies, Trans-Alaska Pipeline studies, and the Gulf Breeze, Fla., Laboratory.

Bureau scientists in La Jolla, Calif., successfully spawn the northern anchovy in the laboratory, the first time any important commercial pelagic fish has been induced to spawn under artificial conditions.

1971

Robert White, first NOAA Administrator, establishes four major "offshore" fisheries research centers throughout the Nation: the Northwest and Alaska Fisheries Center (NWAFC), Southwest Fisheries Center (SWFC), Northeast Fisheries Center (NEFC), and Southeast Fisheries Center (SEFC). They report to NMFS headquarters. Three "coastal" fisheries research centers, which report to Regional Directors, are also established: Gulf Coast Fisheries Center (GCFC), Atlantic Estuarine Fisheries Center (AEFC), and Middle Atlantic Coast Fisheries Center (MACFC). The basic five-regional office structure is retained.

The Marine Fisheries Advisory Committee (MAFAC) is established by the Secretary of Commerce to advise on marine fisheries resource issues.

Research on fish protein concentrate production culminates in construction of an experimental plant (which began operation in March) and issuance of U.S. Patent 3,598,606 for a novel washing procedure that removes the bulk of the lipids.

Techniques to reduce mortality of porpoises caught accidentally in tuna fishing operations are evaluated by the SWFC.

Techniques are developed at the SWFC for rapid counting and aerial mea-

surement of fish schools by sonar.

NWAFC scientists successfully rear coho salmon in floating saltwater pens—a technique that shows great promise as a commercial salmon production venture.

Inexpensive and lightweight deep-water fish traps are developed at the NWAFC, found to be effective, and are adopted commercially.

NMFS Auke Bay Laboratory scientists survey prior to and after detonation of a nuclear device at Alaska's Amchitka Island; no significant damage to marine fauna or environment is found.

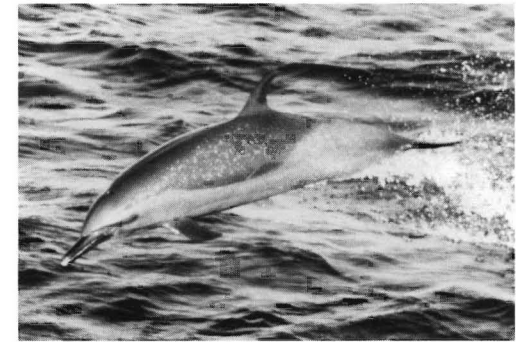
The Present Era: 1972–1996

As the Nation grew in environmental awareness, the holistic aspects of marine research and ecology, pioneered in the 1870's by Spencer Baird, gained added impetus. NMFS published large volumes on ocean variability and the relationship of the ocean's physical and chemical processes to fish distribution, abundance, and stock composition. In the middle 1970's the new

NMFS-wide Marine Resources Monitoring Assessment and Prediction (MARMAP) program began to collect uniform data for fisheries management and this information has been crucial to the ecosystems approaches later developed by the Fishery Management Councils.

New laws were passed to protect endangered species and the marine environment and its resources. These included the Marine Mammal Protection Act, the National Envi-

ronmental Policy Act, the Endangered Species Act, and others. Research advances also brought new concepts and better understanding of the resources and better ways to protect and manage them.



An international tagging program is reviewed by the NEFC Narragansett Laboratory which describes blue shark migration routes.

MACFC scientists find fin rot disease in fish to be caused by several pathogenic bacteria. Incidence of the disease appears to be related to environmental pollution.

Parasitic amoebae and bacteria from several fish and shellfish are identified and characterized by MACFC scientists.

SEFC scientists complete an atlas on the distribution of tunas and billfishes in the Atlantic Ocean.

SEFC scientists successfully test a low light level image intensifier system to locate fish schools at night by detecting the bioluminescent halo that surrounds them.

GCFC scientists determine optimum culturing techniques for larval shrimp and for diatoms used as shrimp food.

GCFC scientists document the rate that fish colonize newly constructed canals and assess the freshwater requirements of marine fishery resources in coastal Louisiana and south Florida.

AEFC scientists prove that the Atlantic menhaden resource is composed of one

stock of migrating fish. Gulf research indicates that menhaden populations east and west of the Mississippi River may constitute separate stocks.

AEFC scientists develop mathematical models that indicate that a large proportion of total marine productivity is required to support exploited fish populations.

The National Fisheries Engineering Laboratory is located at the National Space Technology Laboratories (Miss.) to launch a remote sensing program and to modify satellite technology to support fisheries research. It is renamed the Bay St. Louis Laboratory.

U.S. commercial whaling ends as of December 31st.

1972

NMFS Director Philip Roedel announces that the agency, under NOAA, has a much broader charter than its predecessor agencies and is now resource-oriented rather than user-oriented.

The Marine Mammal Protection Act is passed and establishes a moratorium on taking marine mammals in U.S. waters and by U.S. citizens on the high seas.

The Coastal Zone Management Act is passed to provide guidance, expertise, and funding to help states protect and

manage U.S. coastal areas.

Another "first," the spawning of haddock in captivity at the NEFC Narragansett Laboratory, is announced.

A program for reef fishery descriptions and analyses for southeastern U.S. waters begins.

The Bay St. Louis, Miss., Laboratory installs the first computer-based scientific data-logging system aboard the *Albatross IV*.

The GCFC is dedicated at Panama City, Fla., to study the biology and ecology of coastal marine fishes, with emphasis on sport species.

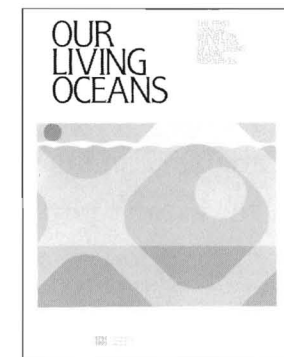
And in 1976, Congress passed the landmark Magnuson Fishery Conservation and Management Act—the first real step toward comprehensive management of marine fishes. The new law set up eight regional Fishery Management Councils to manage the Nation’s fisheries within the newly created 200-mile fishery conservation zone (FCZ).

Another new marine environmental research initiative was the Ocean Pulse and Northeast Monitor-

ing Program which was later expanded nationwide as NOAA’s Status and Trends Program in 1984–85. Others were the Fisheries Oceanography Coordinated Investigations (FOCI) program, the Southeast Area Monitoring and Assessment Program (SEAMAP), etc.

In 1985, the NMFS Woods Hole Laboratory was rededicated, celebrating a full century of marine fisheries and environmental research. And in 1991, NMFS published a new report,

“Our Living Oceans,” the most thorough assessment ever of the status and abundance of the fishes and marine mammals within the U.S. 200-mile EEZ.



The Central, Western and South Pacific Fisheries Development Act is passed to establish a program for the development of tuna and other fishery resources of those Pacific regions.

The Fisheries Loan Program receives more than \$2.2 million this year. Since 1956, \$31.3 million has been loaned to fishing vessel owners.

1973

The Endangered Species Act is passed to protect species and populations whose numbers are small or declining; NMFS is responsible for marine species under the law.

1974

The NMFS Atlantic Environmental Group is moved from Washington, D.C., to the NEFC Narragansett Laboratory.

Publication of large volumes begins on ocean variability within what will become the U.S. fishery conservation zone. Staff at the Narragansett Laboratory are in the forefront of mapping and tracking physical and chemical processes in relation to fish distribution, abundance, and stock composition.

The NMFS Gloucester Laboratory initiates a landmark program on quality assurance of fresh fish fillets, including a U.S. Department of Commerce Inspection

Program, which provides for quality assurance tests at dockside, at the processing plant, and at retail outlets.

Remote sensing applications to fisheries research in southeastern U.S. waters are stimulated when SEFC scientists find significant relationships between water color and Gulf menhaden distribution patterns.

The Auke Bay Laboratory (ABL) in Alaska becomes a part of the NWAFC.

A mandatory Marine Mammal Observer Program is implemented in the U.S. purse-seine fishery for yellowfin tuna in the eastern tropical Pacific Ocean.

In November, 30,000 young silver salmon reared at the NMFS Tiburon Laboratory are released. Many will return in 1976 to San Francisco Bay, which never before had silver salmon runs.

The NMFS-wide Marine Resources Monitoring Assessment and Prediction (MARMAP) program is established. The project forms the basis for uniform data collection necessary for fisheries management and critical to the ecosystems approaches now being developed by fishery management councils.

1975

The NMFS Tiburon Laboratory near San

Francisco becomes another element of the SWFC.

The Helgoland undersea habitat project is conducted in the Gulf of Maine to study spawning behavior of sea herring. The equipment is German, the project logistics are by Poland, and scientists on the study hail from five countries, including the United States.

Annual sea scallop surveys begin at the NEFC, providing a continuous time series of species information comparable to that supplied by the finfish survey sampling program since 1963.

Some 195 cases are investigated relat-

Summary

Over the past 125 years, the NMFS and its predecessor agencies have played a crucial role in the development, use, and protection of the Nation's marine resources:

- Its early work fostered and advanced the Nation's now huge aquaculture industry.
- Its research into fish biology and ecology has greatly im-

proved the assessment of fish populations and the ways to protect, manage, and restore them.

- It promoted the establishment of many state fish commissions and their fish cultural work, research, and management.
- Its assessment of the nutritional and healthful values of fish and fish oils have materi-

ally contributed to the Nation's food supply and health.

- Its work has greatly advanced the safety and preservation of fishery products through research to prevent botulism, detect and prevent red tide problems, and more.
- Its research into pollution and pesticide problems helped generate environmental awareness and protective measures.

ing to the Marine Mammal Protection Act as are 381 cases involving endangered species and related products including seizures of quantities of sperm whale oil and teeth, raw baleen, and scrimshaw.

1976

The Fishery Conservation and Management Act (FCMA) is passed and establishes eight regional fishery management councils and the 200-mile fishery conservation zone (FCZ).

The Pacific Environmental Group, now the Pacific Fisheries Environmental Group (PFEG) in Monterey, Calif., becomes another element of the SWFC.

The Polish Zooplankton Sorting Center in Szczecin, Poland, opens as a multinational effort to process marine life sampled in the massive research efforts during the ICNAF era. Scientists from the NEFC are instrumental in training staff to identify and classify zooplankton and in helping to establish laboratory procedures.

The NMFS Southeast Fisheries Center is reorganized to include the research that had been done under four smaller laboratories. Headquarters is in Miami, Fla., and additional research facilities are in Beaufort, N.C.; Charleston, S.C.; Miami and Panama City, Fla.; Bay St. Louis and Pascagoula, Miss.; and Galveston, Tex.

On October 1st, The Northwest Fisheries Center in Seattle officially becomes the Northwest and Alaska Fisheries Center (NWAFC).

Further NMFS consolidation on the east coast incorporates the Woods Hole, Sandy Hook, and Narragansett Laboratories with four regional laboratories into the Northeast Fisheries Center.

The Pacific Utilization Research Center is brought into the NWAFC and renamed the Utilization Research (UR) Division.

NMFS Pascagoula Laboratory Harvesting Systems Division develops the

first defined efficiency value (Q) for a sampling trawl.

NMFS agents investigate and assist with a "stranding" where 28 false killer whales are successfully "unbeached" and returned to sea at Dry Tortugas, Fla. All but one survive.

1977

A long-term environmental monitoring program is established by the NEFC in its Ocean Pulse and Northeast Monitoring Programs. This project is later expanded to a nationwide project, NOAA's Status and Trends Program, in 1984-85.

During the extremely cold winter of

1977-78, SEFC scientists first discover the apparent hibernation of sea turtles, finding loggerhead sea turtles overwintering and sheltered in the mud of the Port Canaveral, Fla., ship channel.

1978

NMFS scientists publish a paper proving that Spanish mackerel prevalent in the Gulf of Mexico and along the U.S. east coast are a species distinct from the Spanish mackerel known in Brazil.

The College Park Technological Laboratory is moved from Maryland to Charleston, S.C., and renamed the Charleston Laboratory.



Spencer F. Baird
1871–1887



G. Brown Goode
1887–1888



Marshall McDonald
1888–1895



John J. Brice
1896–1898



George M. Bowers
1898–1913

The first five leaders of the U.S. Commission of Fish and Fisheries.

The SEFC begins an extensive gear research and development program to reduce the incidental capture and mortality of sea turtles in shrimp trawls, leading to the development of various trawling efficiency devices (TED's).

NMFS conducts tests to develop "excluder panels" that keep turtles from being caught in shrimp nets while permitting shrimp harvest.

Loggerhead and green sea turtles are listed as threatened for all populations worldwide.

On April 1st, four NMFS biologists set up camp in snow caves at Cape Lisburne,

Alaska, to study and count endangered bowhead whales during their spring migration.

The Bay St. Louis Laboratory designs an at-sea porpoise impoundment system for marine mammal research in the Gulf of Mexico.

The NMFS Pascagoula Laboratory and the Engineering Laboratory at Bay St. Louis, Miss., are merged to form the "Mississippi Laboratories."

1979

In February, the NWAFC Marine Mammal Division is designated as the National Marine Mammal Laboratory.

The Mississippi Laboratories designs the prototype satellite-linked porpoise tracking tag which successfully charts the position of porpoises off Hawaii.

1980

On March 12th, scientists of the NWAFC Resource Assessment and Conservation Engineering (RACE) Division discover a large concentration of walleye pollock eggs in Shelikof Strait, Alaska, near Kodiak Island. In subsequent years researchers measure the spawning population and trace the movements of the eggs and larvae. This research has expanded into the Fisheries Oceanography Coordinated Investigations (FOCI) program, a joint effort with NOAA scientists at the

Pacific Marine Environmental Laboratory.

The original FCMA is officially re-named the Magnuson Fishery Conservation and Management Act (MFCMA) in honor of Sen. Warren Magnuson.

The Mississippi Laboratories achieves success with its prototype satellite-linked sea turtle tracking tag in the Gulf of Mexico.

The NMFS Mississippi Laboratories' Harvesting Systems Division develops the first turtle excluder device to prevent capture of endangered sea turtles in shrimp trawls.

1981

The SWFC promotes cooperative inter-regional rapport on west coast groundfish research and oversees an NMFS technical committee to plan a groundfish conference as an annual forum for reviewing and coordinating NMFS groundfish research with the states, academia, and Canada. The first "Groundfish Conference" is held in Gleneden Beach, Oreg., November 18–20.

NEFC staff become part of the Georges Bank boundary dispute that had been simmering between the U.S. and Canada in light of the 200-mile EEZ's claimed by both countries. Outlining species distribution, abundance, spawning areas, and traditional uses of commercial fishermen in the

When Spencer Baird set up the U.S. Fish Commission in 1871, the U.S. fishing industry was locally important, and fish harvests, preservation, transportation, and sales were limited. Lack of ice, cold-storage facilities, and rapid transit limited fresh fish sales to nearshore cities and local markets. Canned, dried, and pickled fish sales remained small. Most of the products we see now in our fish markets were nonexistent.

But the Nation's fishery potential was huge, awaiting research and development to unlock it. Progress in fishery development began to accelerate after 1900 and moved far faster after World War II. The U.S. tuna industry is just one example.

Serious tuna fishing began in 1903 in southern California when albacore was successfully canned for the first time. Eventually, U.S. tuna vessels would roam farther and farther south during the 1920's

and 1930's, finding the tropical tunas, yellowfin and skipjack, in great abundance, and by the 1930's, tunas were a major source of food. In addition, Atlantic Ocean tuna fishing became important.

Development of the U.S. tuna and other important fisheries has required exploration for new fishing grounds, creation of new fish products and markets, assistance in coping with foreign competition, finding better ways of chilling,

areas, the staff reports generated over several years form the basis of the International Court of Justice decision dividing the Bank.

A computer-based albacore fishery and resource modeling effort is undertaken by SWFC staff and University of Washington contract scientists.

A major compilation of the research on the chemical composition and nutritive values of fishes and fish products is published by SEFC Charleston Laboratory scientists.

The Southeast Area Monitoring and Assessment Program (SEAMAP) is initi-

ated. It is a collaborative State/Federal/University effort for collection, management, and dissemination of marine data from the U.S. Gulf of Mexico, South Atlantic, and Caribbean regional waters.

New Lacey Act Amendments are passed to make it illegal to trade in fish, wildlife, or plants taken in violation of any U.S. or Indian tribal law, treaty, or regulation.

The NMFS Northwest Regional Office moves to the first completed building at the new NOAA Western Regional Center at Sand Point in Seattle.

1982

The Northern Pacific Halibut Act is passed to enforce the terms of the U.S.-Canada agreement prohibiting fishing by unauthorized foreign vessels.

The Southeast Region's SEAMAP Resource Survey begins in cooperation with the Gulf States Marine Fisheries Commission.

1983

The SEFC begins a series of research cruises to develop an effective strategy to understand "latent" or underutilized fishery resources. The studies help generate new fisheries for the Gulf butterfish and other species. Coastal herrings and associated

species are estimated to have a potential yield of up to 5 million metric tons per year.

SEFC scientists develop yield-per-recruit models for the major species found along the southeastern U.S. coast and set the pattern for reef fish management by the Gulf of Mexico and South Atlantic Fishery Management Councils.

On March 10th, the FCZ is designated as the U.S. Exclusive Economic Zone (EEZ) by Presidential Proclamation.

On August 15-18, the NMFS sponsors the "Symposium on Ontogeny and Systematics of Fishes" in La Jolla, Calif., an

international symposium dedicated to the memory of its late scientist Elbert Halvor Ahlstrom.

1984

The NWAFC's Center Director's Office and its RACE and Resource Ecology and Fisheries Management (REFM) divisions move to the new NOAA Western Regional Center at Sand Point in Seattle. The National Marine Mammal Laboratory (NMML) also moves to the new facility.

On August 18th, a plane carrying four biologists from the National Marine Mammal Laboratory crashes into the frigid waters of the Arctic Ocean during bowhead whale surveys. Miraculously, all survive.

freezing, holding, and packaging fish, and more. In addition, Bureau and NMFS scientists studied the oceanographic processes that affect the fishes as well as fish biology and behavior—gaining information needed by commercial fishermen and for fishery management programs.

Today, American consumers are no longer limited to a few fish or fish products. Owing to NMFS re-

search, our own U.S. fish products are sold around the world in many forms, and our fish markets provide a broad variety of fresh, frozen, and prepared food products from species from around the globe. (Cont. on page 44.)



The Eastern Pacific Tuna Licensing Act of 1984 is passed to issue and enforce rules protecting designated species of tuna under the Eastern Pacific Tuna Fishing Agreement.

The Atlantic Striped Bass Conservation Act is passed to assist in the conservation, restoration, and management of the species and enforce compliance with the Interstate Fisheries Management Plan for Striped Bass.

Cooperative U.S.-Japan squid surveys in the Gulf of Mexico are initiated at the NMFS Mississippi Laboratories.

1985

An arsonist burns the Sandy Hook Laboratory building, destroying the research aquarium facilities, many records, and the library.

The NMFS Southwest Region signs the first Memorandum of Understanding between the U.S. Army Corps of Engineers and NOAA/NMFS for fisheries habitat enhancement.

The NMFS Northeast Fisheries Center's Woods Hole Laboratory is rededicated in August, celebrating its first century of research accomplishment and service.

SEFC scientists begin a new fish oil pro-

gram to help the biomedical community ascertain the effects of the omega-3 fatty acid subcomponents on human health.

1986

The SWFC develops strategic plans for the joint SWFC-SWR-California Department of Fish and Game Marine Recreational Fisheries Program.

The Congressionally mandated, 5-year program to survey dolphin populations in the eastern tropical Pacific is launched, and the first expedition is carried out using two NOAA research vessels.

Austin B. Williams of the NMFS National Systematics Laboratory publishes a

paper in the NMFS Journal *Marine Fisheries Review* (MFR) identifying various species of spiny lobster from the tails alone. This was to address difficulties military purchasers were encountering with buying "U.S. origin only." A large publishing house later reprints it as a mass-market illustrated guide.

NMFS petitions the U.S. Food and Drug Administration to seek affirmation of menhaden oil and partially hydrogenated menhaden oil as being Generally Recognized as Safe (GRAS), culminating 9 years of research into the chemistry of fish oils and the history of their safe use.

The Interjurisdictional Fisheries Act of

1986 is passed to distribute Federal money to the states for use in developing research programs to enhance the management of interstate fisheries.

1987

The SWFC plays a vital role in the development and signing of the MEXUS-Pacific agreement for fisheries cooperation between Mexico and the United States.

The South Pacific Tuna Treaty between the governments of certain Pacific Island States and the U.S. government is signed in Papua New Guinea, giving U.S. tuna fishermen access to over 10 million square miles of rich fishing grounds in the South Pacific.



A multi-year collaboration among NEFC scientific staff and outside colleagues results in publication by MIT Press of a comprehensive benchmark regional atlas entitled "Georges Bank."

NMFS signs a joint Memorandum of Agreement with the Port of Los Angeles for the largest wetlands restoration project (600+ acres) in southern California (Batiqitos Lagoon).

The Driftnet Impact Monitoring, Assessment, and Control Act is passed to monitor, assess, and reduce adverse impacts of driftnets on marine fisheries.

Using data collected by the Sandy

Hook Laboratory, the Environmental Protection Agency (EPA) closes the 12-mile sewage sludge dumpsite in the New York Bight.

1987-88

John Pearce of the NEFC chairs the New Jersey Governor's Blue Ribbon Panel on Ocean Incidents which leads to a "State of the Ocean" report, quelling rumors and misperceptions about the New York-Middle Atlantic Bight water quality.

1988

The SWFSC receives the Group Award for Excellence from the American Institute of Fisheries Research Biologists, in recognition of the Center's outstanding achieve-

ments in marine biological research.

The South Pacific Tuna Act is passed by Congress, implementing the treaty between the United States and various Pacific Island states, covering prohibitions and licensing procedures for tuna fishing and authorizing NMFS to carry out U.S. obligations under the treaty. The SWR establishes a field office in Pago Pago, American Samoa, to take species composition and length-frequency samples of U.S. catch from the Treaty area, inspect vessel logbooks, and facilitate the placement of observers aboard vessels.

The NWAFC is divided into the Alaska Fisheries Science Center and the North-

west Fisheries Science Center.

The Maurice Stansby Fish Oil Biomedical Test Materials Laboratory is dedicated at the NMFS Charleston Laboratory.

The first comprehensive film on shrimp trawl design and performance is produced by the Mississippi Laboratories' Harvesting Division.

NMFS receives a report of three gray whales trapped in ice near Barrow, Alaska. For three weeks, NMFS leads an international rescue operation that allows two of the whales to swim free from the ice on October 28th.

1989

The Coast Watch Program begins receiving satellite imagery of sea surface temperatures used to study and manage red tides and sea turtle/fishery interactions.

The winter run of chinook salmon in California's Sacramento River is listed as a threatened species.

1990

Clyde L. MacKenzie, Jr., of the NEFSC Sandy Hook Laboratory publishes "The History of the Fisheries of Raritan Bay," a modern classic of regional history combining information on fisheries and science in the *Marine Fisheries Review*. It is later republished by a major university press.

The Future

As NMFS moves into 1996, a review of its 125 years of science and service reveals some surprising similarities with its early years:

- The study of marine resources and ecosystems, home to our important fisheries, is just as important now as when Spencer Baird initiated such research in 1871.
- Working with the people—the commercial and sport fishermen, fish culturists and processors, and conservation and environmental groups—remains a top priority of the agency.
- Studying the biology, systematics, and environmental and habitat needs of the marine fishes, mammals, and other species continues to be important.
- Working with various research and management groups—Fishery Management Councils, State agencies, interstate commissions, and international bodies—remains a key part of protecting America's fishery resources.
- Researching and assessing the effects of various pollutants and disease organisms are still important agency tasks.

The Mississippi Laboratories' Harvesting Systems Division develops a protocol for the qualification of new turtle excluder devices using captive-reared turtles.

The Mississippi Laboratories' Harvesting Systems Division develops Bycatch Reduction Devices (BRD's), selective gear modifications to reduce catches of non-targeted species in shrimp trawls. It also develops new trawling technology for sampling and harvesting coastal pelagic species in the Gulf of Mexico.

"Monetary value of U.S. commercial fisheries landings [are] at over \$3.5 billion at dockside with economic value of recreational fishing an additional \$13.5 billion."

—Letter from American Fisheries Society to U.S. Senate Committee.

1991

At a special symposium, Sandy Hook Laboratory staff report the results of a 4-year study into the recovery of marine life and habitat at the 12-mile dumpsite off New Jersey. The intensive, multidisciplinary effort described changes in the physical oceanography, sediment processes, and biota.

The nationwide Coastal America Program (CAP) is established. The SWR chairs the first meeting of the CAP Southwest Regional Implementation Team, composed of representatives from the De-

partment of the Interior, EPA, Corps of Engineers, and NOAA.

1992

An interdisciplinary team of scientists headquartered at Woods Hole begins the first large-scale ecosystems study of Georges Bank. The resulting work will be the first attempt to describe and model the processes and marine life on the bank as a complete system.

The Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean is signed in Moscow by Canada, Japan, Russia, and the United States establishing the North Pacific Anadromous Fish Commission.

The North Pacific Anadromous Stocks Convention Act repeals the North Pacific Fisheries Act of 1954 and implements protective measures for salmon and shad.

A NOAA/NMFS lawsuit results in successful judgment prohibiting the Glenn-Colusa Irrigation District in California from violating the ESA by diverting Sacramento water during the endangered winter-run chinook salmon migration period.

The Central Valley Project (CVP) Improvement Act is passed to balance competing demands of humans, fish, and wildlife for use of CVP water throughout California.

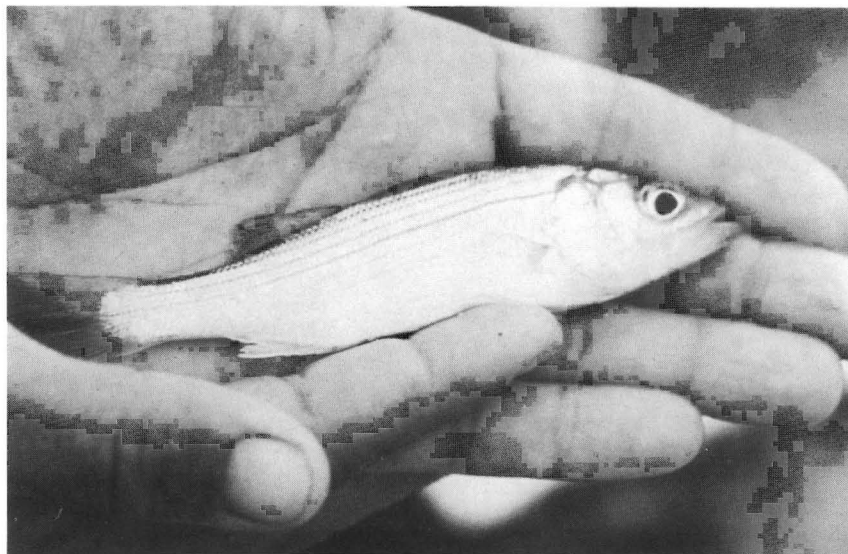
A ban is imposed on importation of shrimp caught with gear that harms sea turtles unless the country in question has a strong turtle conservation program in effect.

The High Seas Driftnet Fisheries Enforcement Act is passed to maintain a list of nations that allow large-scale driftnet fishing (which entangles protected mammals and fish as well as commercial fish) beyond their EEZ.

1993

The NEFSC Cooperative Shark Tagging Program marks its 30th anniversary. The value of the in-kind contribution of the volunteers is estimated at \$8 million annually.

Today, most U.S. fisheries are at a mature stage, requiring research, management, and in some cases restoration. With its solid background of 125 years of biological and oceanographic research and achievements, the National Marine Fisheries Service is well established and ready to meet the challenges of the 21st century.



The scientists begin to aggregate results of the program for a new benchmark publication on shark distribution and migration.

NMFS issues a biological opinion (with alternatives) concluding that long-term operation of the Central Valley Project in California will likely jeopardize the continued existence of the Sacramento River endangered winter-run chinook salmon.

The new NMFS facility at Sandy Hook, N.J., now named the James J. Howard Laboratory, is officially dedicated, replacing the one destroyed by arson.

1994

The SWR and other Federal and state resource agencies, working with public and private interests, reach a hard-fought, three-year "Bay-Delta" agreement on water quality standards to protect the Sacramento-San Joaquin estuary in California.

A South Korean fishing company, whose vessel was caught poaching fish from U.S. waters in the western Pacific, settles in U.S. District Court for a \$1 million fine and agrees to have its fleet of 17 fishing vessels tracked by satellite for 5 years. The provision allowing satellite tracking by U.S. authorities is unprecedented.

1995

Management of the Pacific halibut and sablefish fisheries off Alaska is converted from an open-to-entry "derby-style" system to individual fishing quotas, allowing an 8-month season, improved product quality, and availability of fresh halibut and sablefish to the consumer.

Florida State University and the SEFSC Panama City Laboratory sign an agreement to study new ways to increase stocks of declining fisheries. Seagrasses (which serve as fish nurseries) and sharks (which are dwindling) are early research targets.

Acronyms and Abbreviations

| | | | |
|-----------|---|--------|--|
| ABL | Auke Bay Laboratory | MARMAP | Marine Resources Monitoring Assessment and Prediction (program) |
| AEFC | Atlantic Estuarine Fisheries Center | MBL | Marine Biological Laboratory |
| BCF | Bureau of Commercial Fisheries | MFCMA | Magnuson Fishery Conservation and Management Act |
| BRD | Bycatch reduction device | MFR | <i>Marine Fisheries Review</i> |
| BSFW | Bureau of Sport Fisheries and Wildlife | MPDI | Marine Products Development Irradiator |
| CalCOFI | California Cooperative Fisheries Investigations | NEFC | Northeast Fisheries Center |
| CAP | Coastal America Program | NEFSC | Northeast Fisheries Science Center |
| CCRL | California Current Resources Laboratory | NMFS | National Marine Fisheries Service |
| CVP | Central Valley Project (in California) | NMML | National Marine Mammal Laboratory |
| CZES | Coastal Zone and Estuarine Studies (Division) | NOAA | National Oceanic and Atmospheric Administration |
| EASTROPAC | Eastern Tropical Pacific (research program) | NWFC | Northwest Fisheries Center |
| EC | Environmental Conservation (Division) | NWR | Northwest Regional Office of the NMFS |
| EEZ | Exclusive Economic Zone (200 miles) | OFIS | Office of Fisheries Information Systems |
| EPA | Environmental Protection Agency | PFEG | Pacific Fisheries Environmental Group |
| FCMA | Fishery Conservation and Management Act—original name of the MFCMA. | POFI | Pacific Oceanic Fishery Investigations |
| FCZ | Fishery conservation zone | RACE | Resource Assessment and Conservation Engineering (Division) |
| FOCI | Fisheries Oceanography Coordinated Investigations (program) | REFM | Resource Ecology and Fisheries Management (Division) |
| FPC | Fish protein concentrate | RUFAS | Remote Underwater Fisheries Assessment System |
| GCFC | Gulf Coastal Fisheries Center | RV | Research Vessel |
| GRAS | Generally Recognized as Safe | S-K | Saltonstall-Kennedy Act |
| IATTC | Inter-American Tropical Tuna Commission | SEAMAP | Southeast Area Monitoring and Assessment Program |
| ICCAT | International Commission for the Conservation of Atlantic Tunas | SEFC | Southeast Fisheries Center |
| ICITA | International Cooperative Investigations of the Tropical Atlantic | SIO | Scripps Institution of Oceanography |
| ICNAF | International Commission for the Northwest Atlantic Fisheries | STOR | Scripps Tuna Oceanography Research |
| IGY | International Geophysical Year | SWFC | Southwest Fisheries Center |
| IIOE | International Indian Ocean Expedition | SWR | Southwest Regional Office of the NMFS |
| INPFC | International North Pacific Fisheries Commission | TABL | Tropical Atlantic Biological Laboratory |
| MACFC | Middle Atlantic Coastal Fisheries Center | TED | Trawling efficiency device |
| MAFAC | Marine Fisheries Advisory Committee | UR | Utilization Research (Division) |
| MAREDA | Marine Resources and Engineering Development Act of 1966 | USFWS | U.S. Fish and Wildlife Service |
| | | USGS | U.S. Geological Survey |
| | | WHL | Woods Hole Laboratory of the U.S. Fish Commission, now part of the NMFS Northeast Fisheries Science Center |
| | | WHOI | Woods Hole Oceanographic Institution |

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A Word About NOAA

The National Oceanic and Atmospheric Administration (NOAA) conducts research and gathers data about the global oceans, atmosphere, space, and sun, and applies this knowledge to science and service that touch the lives of all Americans.

NOAA warns of dangerous weather, charts our seas and skies, guides our use and protection of ocean and coastal resources, and conducts research to improve our understanding and stewardship of the environment which sustains us all.

A Commerce Department agency, NOAA provides these services through five major organizations: the National Weather Service, National Ocean Service, National Marine Fisheries Service, National Environmental Satellite, Data, and Information Service, Office of Oceanic and Atmospheric Research, and numerous special program units. In addition, NOAA research and operational activities are supported by the Nation's seventh uniformed service, the NOAA Corps, a commissioned officer corps of 400 men and women who operate NOAA ships and aircraft, and serve in scientific and administrative posts.

For further information, contact: NOAA Office of Public Affairs, Room 6013, Herbert Clark Hoover Building, Washington, D.C. 20230. Phone: (202) 482-6090; Fax (202) 482-3154.

About the NMFS

The National Marine Fisheries Service (NMFS), an agency of the National Oceanic and Atmospheric Administration (NOAA) within the Department of Commerce (DOC), is responsible for the conservation of living marine resources and the protection of marine mammals, endangered marine species, and the habitats on which they depend.

The nearly 2,000 men and women of NMFS have some of the most challenging and exciting work in the Federal Government: managing America's ocean fisheries, guarding protected species and coastal habitat, and ensuring the quality and safety of the nation's seafood products.

The 1976 extension of U.S. Jurisdiction to 200 miles from shore ushered in the era of modern American fishery management. It also opened the door to increased demand for U.S. fishery resources and led to strong growth of the domestic fishing fleet.

U.S. fisheries are extremely valuable, contributing over \$25 billion annually to the nation's economy. Additional economic benefits are derived from subsistence fishing by Native American groups, from aquaculture, and from recreational viewing, such as "fish watching" on coral reefs. Nearly 300,000 men and women are full-time workers in American commercial fisheries, and nearly 100,000 commercial fishing craft annually ply U.S. waters. In addition, the opportunity for saltwater angling adds to the quality of life for over 17 million Americans.

NMFS, together with eight Regional Fishery Management Councils and the coastal states, manages U.S. fisheries under the authority of the Magnuson Fishery Conservation and Management Act, the Fish and Wildlife Coordination Act, and many other Federal statutes. Together with the states and the U.S. Coast Guard, NMFS also operates a stringent program to enforce fisheries and protected species laws.

NMFS serves as caretaker for many marine species protected under the Endangered Species Act and the Marine Mammal Protection Act. Some species of dolphins, whales, seals, sea lions, sea turtles, and (increasingly) stocks of Pacific salmon have declined in abundance so much that their future existence is now in jeopardy. NMFS works to recover these depleted resources, protecting species from activities that threaten their safety and critical habitat.

The continuing and alarming loss of U.S. wetlands due to development, pollution, subsidence, and dredging seriously jeopardizes fisheries productivity. NMFS monitors and protects the health of the nation's abundant coastal habitats—estuarine marshes, coral reefs, seagrass beds, and mangroves—that are vitally impor-

NMFS plays a key role in safeguarding the health of the nation's seafood consumers by assisting industry's production of wholesome, quality products. Together with the Food and Drug Administration, NMFS inspects hundreds of processing plants, distributors, and vessels, and works cooperatively with other nations to ensure that both domestic and imported fish and shellfish are safe to eat.

Since many U.S. stocks of marine animals are shared with other countries, Congress has approved international treaties and agreements to conserve and manage these resources. NMFS fishery managers and scientists are key participants in many worldwide organizations such as the International Whaling Commission, International Commission for the Conserva-

tion of Atlantic Tunas, Inter-American Tropical Tuna Commission, International Council for Exploration of the Seas, Pacific Halibut Commission, Convention for the Conservation of Antarctic Marine Living Resources, MEXUS-Gulf and MEXUS-Pacifico, and many others.

NMFS counts on many partners to help conserve and manage living marine resources. It works closely with industry, with hundreds of Federal, state, academic, and environmental organizations, and with many Native American groups. Guidance is provided by the Federal Marine Fisheries Advisory Committee (MAFAC), representing commercial and recreational fishing interests and fishery management agencies, the three Interstate Marine Fisheries Commissions (Atlantic States, Gulf States, and Pacific), conservation groups, and academia. NMFS encourages

the active interest of the American public in conserving and protecting its ocean heritage. If you would like more information about NMFS programs or activities, write: Office of Public Affairs, National Marine Fisheries Service, NOAA, 1335 East-West Highway, Silver Spring, MD 20910.

Serving Nationwide

Headquartered in Silver Spring, Maryland, near the Nation's capitol, NMFS carries out its duties in five regions: Northeast, Southeast (including the U.S. Caribbean), Southwest (including Hawaii and U.S. South Pacific territories), Northwest, and Alaska. Regions work with the Fishery Management Councils, made up of representatives of state governments, commercial and recreational fisheries, and environmental and consumer groups, to develop and implement Fishery Management Plans for all species under Federal control. Regions also conduct important economic analyses of the nation's fisheries.

Each NMFS Regional Office is served by a Science and Research Center that conducts the studies necessary to support management decisions. Research that contributes to this

important work is conducted at the 24 NMFS laboratories which collect fisheries statistics, perform resource and environmental surveys, study the biology and population structures of marine species, analyze the ecosystems that control the abundance and distribution of living marine resources, and investigate contaminants of the nation's seafood supply.

NMFS Science Centers work closely with other NOAA units—the National Ocean Service, Office of Oceanic and Atmospheric Research, National Weather Service, NOAA Corps, Coastal Ocean Program, Climate and Global Change Program, and the National Environmental Satellite, Data, and Information Service—to carry out NOAA's mission of monitoring, recording, and predicting changes in the Earth's oceans and atmosphere.

tant to living marine resources. Together with NOAA's National Ocean Service and General Counsel, NMFS shares management of NOAA's Damage Assessment and Restoration Program, which works to mitigate coastal habitat damage resulting from oil and chemical spills and other environmental disasters.

