

to 90,000 cfs which is far below the normal range of flow in the spring. The relatively narrow range of flow volume resulted in only minor changes in current velocity, and no correlation between velocity change and catches was noted.

The unusual clarity of the river in

1973 could have had some influence on the fish distributions in this study. For that reason, additional depth distribution studies would be in order in future years to determine whether significant changes in orientation and behavior of the fish occur with increasing turbidity.

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NOAA/NMFS Developments

U.S. Seafood Consumption, Commercial Fish Landing Values Set Record Marks in 1973

Americans are eating more fish than at any time since the Federal Government began keeping records in 1909, according to data released by the National Oceanic and Atmospheric Administration.

The Commerce Department agency reported that the 1973 statistics indicate that the average per capita consumption of seafood was 12.6 pounds—an increase of slightly more than 2 percent, or 0.3 pound per person, over the 1972 figure. The 12.6 figure includes edible fish (fresh, frozen, canned, or cured) that entered usual commercial channels from all sources, and represents about 2.6 billion pounds of fish, edible weight. The increase can be attributed largely to a rise in consumption of fresh and frozen products, and to a lesser extent, canned fishery products.

The data collected by NOAA's National Marine Fisheries Service indicate that total U.S. commercial fisheries landings (products used for both edible and industrial purposes) were worth a record \$907.4 million to the fishermen. The total volume, approximately 4.7 billion pounds, was almost the same as in 1972, but the value was up about 29 percent from a year ago because of higher prices paid at dockside. The 1973 average value per pound of 19.2 cents for all species also was a record high.

Total imports of fishery products reached a record high value of \$1.57 billion, up from \$1.49 billion a year earlier. Imports of edible fishery products were 4.7 billion pounds, up from 4.4 billion pounds in 1972. Industrial fishery products imported by the

United States declined sharply from 4.6 billion pounds to about 800 million pounds. The drop reflects the world shortage of fishmeal, especially the decline in production by Peru which suffered a severe failure in its anchovetta fishery.

There were record U.S. harvests of anchovies, Pacific shrimp, surf clam meats, and snow crabs. Increased landings of bonito, Atlantic cod, croaker, Pacific sea herring, striped bass, pollock, rockfishes, scup, and whiting also contributed to the greater volume. Sharp declines occurred, however, in landings of yellowtail and Pacific flounders, Atlantic sea herring, jack mackerel, albacore tuna, bluefin and skipjack tuna, pink salmon, hard blue crabs, Dungeness crabs, Gulf shrimp, and squid. There were also slight declines in landings of haddock, Pacific

New High Seen in Gray Whale Trend Count

The 3,492 gray whales counted off the California coast from December 18, 1973, through February 4, 1974, during the annual southward migration represents the highest total since the count began seven years ago. The annual census is taken by the Commerce Department's National Oceanic and Atmospheric Administration at Yankee Point, near Monterey, California.

The whale count, done by NOAA's National Marine Fisheries Service, begins each year around mid-December as soon as whales are seen regularly during their southerly migration and the count continues until statistics indicate that most have passed the ob-

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halibut, menhaden, red salmon, and oysters.

The domestic shrimp fishery was the most valuable in the country. Landings of 372.2 million pounds worth \$219.4 million represented a decline of 3 percent in volume but an increase of 14 percent in value compared with 1972. Shrimp accounted for 24 percent of the total dockside value of U.S. landings.

Tuna landings of 342.1 million pounds at U.S. ports were down 35.5 million pounds, 9 percent lower than in 1972. An additional 173.5 million pounds of tuna were landed by U.S. fishing craft at ports outside the 50 States, principally in Puerto Rico.

Details of these and other preliminary data dealing with U.S. fisheries are included in Fisheries of the United States, 1973. Single copies may be ordered from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402, for \$1.50.

ervation point, and only an occasional straggler is sighted. Some gray whales begin leaving Arctic waters as early as October, moving toward the calving lagoons in Baja California.

The total number of gray whales counted this season (December 14, 1973, to February 9, 1974) was 3,919, but the year to year population trends are best illustrated by comparing the counts for the period of time included in each year's tabulation—December 18 through February 4, excluding Christmas and New Year's Day. For the comparable dates, the 3,492 whales counted were about 15 percent above the previous six year average.

Year	Count
1967-1968	3,120
1968-1969	3,081
1969-1970	3,064
1970-1971	3,034
1971-1972	2,588
1972-1973	3,304
1973-1974	3,492

The count this year was made under the direction of Allen Wolman of the NMFS Northwest Fisheries Center, Seattle, Washington. The "whale watch" is made from shore between 7:00 a.m. to 5:00 p.m. by two observers using powerful binoculars to count the whales which are sometimes seen in the surf but may be several miles offshore. NMFS scientists believe that the whales are more concentrated during the southward migration than at any other time and pointed out that other species of whales seldom mix with the gray whales during the migration.

The gray whales return to their northern habitat in large numbers in May and June as the ice breaks up, but while migrating northward off the California site, the whales are much farther offshore than during the southward journey.

The annual census taken by the NMFS is the most reliable indicator of the population trend of gray whales, but Mr. Wolman added that the count is in no way an accurate indication of the total gray whale population, only an index of relative abundance. He also pointed out that there are a number of factors such as weather conditions, visibility, and ocean currents that must be considered each year. Thus the higher count this season does not necessarily indicate an increase in the gray whale population.

The gray whale is on the U.S. endangered species list along with the finback, sei, sperm, bowhead, blue, humpback, and right whales, and is also protected under the International Whaling Convention.

Japanese Fishing Vessel Gets Heaviest Penalties

The heaviest penalties ever levied against a foreign fishing vessel encroaching in U.S. waters, a total of \$300,000, were assessed earlier this year against a Japanese vessel and its master after they were taken into cus-

tody for illegal fishing operations in territorial waters off Alaska, March 19. The Commerce Department's National Oceanic and Atmospheric Administration said that at a March 28 hearing in Federal District Court in Anchorage, a levy of \$290,000 was assessed against the vessel, and a \$10,000 fine imposed on its master.

Personnel of the U.S. Coast Guard Cutter *Midget*, accompanied by a fisheries enforcement agent from NOAA's National Marine Fisheries Service, boarded the 160-foot *Ebisu Maru No. 88* for using longline fishing gear 2.2 miles from the U.S. coast near Umnak Island, Alaska. The boarding party found about 50 tons of fish, mostly black cod (also known as sablefish), aboard the vessel.

The *Midget* escorted the Japanese vessel to Kodiak, Alaska, and the master was taken to Anchorage for the hearing. Following the legal action, the Japanese captain returned to Kodiak. His vessel was released and departed for open waters on the evening of March 28.

An NMFS spokesman said that previously the highest penalty ever assessed against a foreign vessel and its master for illegal fishing operations in U.S. waters was \$250,000 levied against a Soviet trawler fishing off Alaska in February 1974.

Sea Variables Tested With Lab-Reared Fish

Amid the glassware, particle counters, microscopes, and sampling nets loaded aboard the National Oceanic and Atmospheric Administration's (NOAA) research vessel, *David Starr Jordan*, as it prepared to leave San Diego for a one-week cruise off southern California recently was an unusual cargo. Carefully carried aboard ship were numerous glass beakers filled with sea water and tiny (less than 5 mm) anchovy larvae spawned in the experimental aquarium at NOAA's National Marine Fisheries Service laboratory in La Jolla, California. With this fisheries equivalent of carrying coals to Newcastle, Dr. Reuben Lasker, a physiologist at the La Jolla facility, hoped to test his idea that laboratory-reared anchovy could be used in lieu of naturally-spawned lar-

vae as an assay of conditions in the sea.

Dr. Lasker explained that this rare experiment may help to answer what is perhaps the most important and fundamental question in fisheries: What is the basic cause and effect mechanism(s) which determines how many young fish will survive the rigors of life in the sea to become reproducing adults? On the answer to this question may rest the ability of fishery biologists to predict the success of each year's brood of fish and ultimately how many tons of fish can be harvested by fishermen without endangering fish stocks. According to Dr. Lasker, food abundance may be the key to survival. Fishery biologists have known for some time that, on the average, there is not enough food available in the sea for fish larvae and have theorized that this scarcity of food may be an important cause of the large mortalities that occur at this early life stage of fishes.

The development of the anchovy larvae that Dr. Lasker took with him on the *Jordan* was controlled in the laboratory by manipulating temperatures so that all the fish would be at the first-feeding stage. Dr. Lasker intended to place the small fish in samples of sea water to find out with certainty whether there is sufficient natural food present in specific coastal areas of the ocean for larvae entering the independent feeding stage to survive.

Assisted by Ms. Eileen Setzler of the University of Georgia and Dr. Dale Kiefer of the Food Chain Research Group at the Scripps Institution of Oceanography, La Jolla, California, Dr. Lasker tested the surface water off southern California at a number of places with disappointing results. Finally, sampling instruments encountered an extensive layer or band of abundant green plant material at a depth of approximately 15 meters at five locations from Malibu to San Onofre, California. Anchovy larvae placed in these samples of sea water which contained high concentrations (40 to 400 cells per milliliter) of the dinoflagellate, *Gymnodinium splendens*, fed actively upon the tiny organism. At the higher concentrations some larvae filled their straight guts in a few hours, a result seen only before in laboratory experiments. Coincidentally, said Dr. Lasker *G. splendens* is

the same organism which was found earlier to support growth of anchovy larvae in laboratory-rearing experiments.

Dr. Lasker said these shipboard experiments confirmed earlier findings in the laboratory which had demonstrated that high concentrations of food organisms are needed for continued growth and survival of anchovy larvae. It was also demonstrated that there are large patches containing high numbers of *Gymnodinium* in long bands along the southern California coast at a depth of 15-20 m during the natural anchovy spawning season in the area.

Using a 16-channel particle-sizing and counting instrument, Dr. Lasker and his colleagues were able to show that feeding by anchovy larvae only took place when algal cells of 0.04 millimeters and larger were present (particularly *Gymnodinium*). Smaller particles, even though present in large numbers, did not stimulate feeding in anchovy larvae.

In commenting on this experiment, Dr. Brian J. Rothschild, Director of the NMFS Southwest Fisheries Center which is headquartered in La Jolla, said he believed Dr. Lasker's work was a breakthrough in fishery biology and showed conclusively that laboratory-reared anchovy spontaneously adapt to natural food, and the coastal waters explored by Dr. Lasker provide sufficient food for the survival of fish larvae over an extensive area, particularly during the spring when anchovy spawning occurs naturally in the ocean.

Cash For Tuna Tags

A French fisherman working on the Ivory Coast tuna seiner, *Trident*, and the captain and crew of the U.S. tuna seiner, *A.A. Ferrante* from Massachusetts, each won \$300 for their recovered tuna tags in the lottery for 1973 tag recoveries held by the International Commission for the Conservation of Atlantic Tunas (ICCAT) in Madrid, Spain on March 15, 1974, according to information received by Dr. Gary Sakagawa, fishery biologist at the National Marine Fisheries Service Southwest Fisheries Center laboratory in La

Jolla, California and U.S. tagging correspondent for ICCAT.

The purpose of the lottery, which is held annually, is to encourage persons recovering tags attached to tuna fish by scientists during tagging cruises or sport fishermen cooperating in marine game fish tagging programs to return these tags to the appropriate agency.

Winning tag TO4582 was recovered from one of 2,157 tuna fish tagged and released by ORSTOM, a French research organization, Pointe Noire, Congo, in 1973. This particular fish, a bigeye tuna, was reaped in the Gulf of Guinea on June 26, 1973. It was recaptured only four days later on June 30, 1973, at the same location, by Mr. Albert Marec on the *Trident*.

Winning tag 035819 was attached to a bluefin tuna by scientists from the Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, on September 6, 1972 off NE United States and was recovered 322 days later by the crew of the *A.A. Ferrante* on July 25 1973. During almost a year of freedom the fish had grown 12.4 cm.

Dr. Sakagawa explained that ICCAT was founded in 1969 on the basis of an international convention with the objective of maintaining the tuna stocks in the Atlantic Ocean at levels that will permit maximum utilization. The United States is one of 13 member countries participating in ICCAT. In order to achieve its objectives, the Commission conducts extensive joint international research on tunas. The tagging experiment is one of its most important research techniques since the tags recovered provide information on tuna population structures, area of distribution, migratory patterns, growth rates, and mortality rates, etc. Information from these tagging projects is also important to fishermen since it permits them to plan their activities better and to determine the most efficient fishing methods, grounds and seasons.

For the past three years, the ICCAT member countries have conducted joint tagging experiments in the Atlantic Ocean. In these experiments, scientists on board research ships catch tuna alive, attach tags to their backs and return fish to the ocean. The tags are small yellow tubes with dart heads,

and carry identification numbers and a forwarding address. A reward is paid for each tag returned and these tags are later entered in the ICCAT annual tag recovery lottery.

Dr. Sakagawa urged commercial and sport fishermen, cannery workers, and others who may handle tuna to cooperate in ICCAT's tuna tagging program and to report all tags promptly.

NOAA Announces More CZ Grants

Secretary of Commerce Frederick B. Dent has announced the award of \$1,152,050 in grants to California, Michigan, and Mississippi, to assist the three states in developing programs to manage their coastal lands and adjoining waters.

The grants are made by the National Oceanic and Atmospheric Administration as part of its responsibilities under the Coastal Zone Management Act of 1972, to encourage effective management, beneficial use, protection and development along America's sea coasts and Great Lakes shores.

The grants made available \$720,000 to California, \$330,486 to Michigan, and \$101,564 to Mississippi. Each state is contributing a matching share of the coastal zone management funds, which by law must amount to at least one-third of the total program cost. The first three grants in this program were made March 14 to Rhode Island, Maine, and Oregon.

The NOAA grant to Mississippi will be administered by the Mississippi Marine Resources Council, as designated by Gov. William L. Waller. The Council will coordinate the contributions of 17 state agencies, offices, and local organizations during the preparation of the management program, which is designed to produce an approvable program in three years. The first year's work will concentrate on identifying all the state activities and agencies bearing on the coastal zone, achieving full coordination of activities at the local and regional levels, and obtaining and evaluating the data necessary to develop a coastal zone management program. The Council is considering allocating portions of the grant to the Mississippi-Alabama Sea Grant Con-

sortium, the Southern Mississippi Planning and Development District, and the Gulf Regional Planning Commission for assistance in carrying out the work program.

The California grant will be administered by the California Coastal Zone Conservation Commission (CCZCC), which was designated by Governor Ronald Reagan as the applicant agency. The CCZCC, which comprises one State and six regional commissions, was created by the California Coastal Zone Conservation Act of 1972, and the commission is required to adopt by Dec. 1, 1975, a comprehensive plan for the long-range conservation and use of California's coastal zone resources. While the planning program—which must be submitted to the state legislature—is under way, the CCZCC has regulated development along the coastline through a permit system.

California's one-year work program involves five State departments, two universities, and seven other commissions and councils. It is designed to

take into account the needs of coastal land environment, energy, recreation, design, transportation, geology (including non-petroleum minerals), and the marine environment. Work previously carried on by the state's two Sea Grant programs will also be utilized.

The grant to Michigan will be administered by the State's Department of Natural Resources, as designated by Gov. William G. Milliken. The first "inland" state to be awarded a coastal zone grant, Michigan will use the initial funds in a two-year project to formulate a comprehensive program for the management of the state's Great Lakes shorelands. Among the studies planned to assist in the creation of this management program are those involving the definition of the shoreland zone boundary, an inventory of lake use, ownership, and other characteristics, a practical data management system, a navigation needs study, and the involvement of regional planning agencies.

of white marlin apparently spend the winter off the northern coast of South America, then migrate to the mid-Atlantic coast of the United States in summer and early fall. Another group appears to spend the summer in the northern Gulf of Mexico. Giant bluefin tunas tagged off the northeastern United States and recaptured off Norway provide documentation of transatlantic migrations by the species. Data from tagging studies also imply that fishing pressure on the bluefin tuna is heavy.

Some of the data obtained through tagging programs has gained significance in recent years as nationally renowned conservationists, sportsmen, and scientists have expressed increasing concern over the status of the tuna and billfish populations. The subject also was the focus of attention at an international conservation meeting held last year when the United States formally expressed its concern for northern bluefin tuna stocks of the Atlantic Ocean at the annual meeting of the 13-member International Commission for the Conservation of Atlantic Tunas. Cited as the reason for concern were indications of decreases in abundance of the wide-ranging tuna, as partially indicated by tag returns.

Frank J. Mather III, the Woods Hole biologist and internationally known sport fisherman who originated and managed the tagging program from its inception, continued in 1973-1974 to coordinate and direct tagging activities, from Miami (winter) and Woods Hole (summer). The present division of work between the northeast and southeast Atlantic is a natural consequence of both a geographical expansion of Mr. Mather's work and a substantial increase in the NOAA-NMFS involvement in game-fish investigations.

The cooperative program will be integrated with the Oceanic Game Fish Investigation program, in operation at the NMFS Southeast Fisheries Center for more than two years under the direction of biologist-sport fisherman Dr. Grant L. Beardsley. Fisheries scientists in the program collect catch and fishing statistics from big-game fishing tournaments throughout the western North Atlantic, Caribbean Sea, and Gulf of Mexico.

NOAA, Woods Hole Cooperate in Program To Tag and Track Atlantic Ocean Game Fish

Tagging of large Atlantic game fish for scientific study is now the dual responsibility of the Woods Hole Oceanographic Institution and the Commerce Department's National Oceanic and Atmospheric Administration.

The 20-year-old Cooperative Game Fish Tagging Program, pioneered in the Atlantic by the Cape Cod institution, was restructured in 1973 as a cooperative effort to be shared by private scientists and Federal investigators stationed at NOAA's National Marine Fisheries Service Southeast Fisheries Center, Miami, Florida.

Information collected through game-fish tagging programs is important to the study and evaluation of the life cycles of large, wide-ranging species, and eventually is translated into scientific recommendations for the rational management and conservation of a valuable natural resource. Tagging data also are useful to sport and commercial fisheries and to economic planners in coastal regions.

Marlins, sailfish, tunas, and other highly valued game fish have figured prominently in tagging studies undertaken since the early 1950's by the Cooperative Game Fish Tagging Program, and a significant body of information now exists concerning their biology, ecology, population dynamics, and migratory habits. Thousands of these fish have been tagged and released, and many have been recaptured over two decades of voluntary participation by Atlantic anglers and marine researchers, with the support of sport and scientific organizations. These include the Sport Fishing Institute, NOAA's Office of Sea Grant, the National Science Foundation, and the Bureau of Commercial Fisheries (which became the NMFS in 1970).

Recaptured tags, returned to project scientists from fishermen in widely separated regions, have made possible analyses of the migratory routes followed by many prized and hotly pursued sport and food fish. Findings reveal, for instance, that certain stocks