

Southwest Fisheries Center Administrative Report 41H, 1974

COUNTRY STATEMENT - U.S.A.

1. FISHERIES ADMINISTRATION

The primary functions of the National Marine Fisheries Service (NMFS) have been assigned to three major units, each headed by an Associate Director who reports to the Director of NMFS. These units are concerned with Resource Research, Resource Utilization, and Resource Management.

Large research vessels of NMFS and other components of the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA) were transferred in 1973 into a consolidated fleet operated by the Office of Fleet Operations (OFO) under the National Ocean Survey (NOS).

2. PLANNING

NMFS will devote major effort to the promotion of fish now little-used or discarded, will provide technical assistance in processing, and will materially expand its efforts in foreign and domestic marketing.

Basic planning was completed for the development of an alternative yellow-fin tuna management system for the eastern tropical Pacific, a management system for Atlantic tuna stocks, and a global tuna system computer model for quantitatively assessing the impact of management decisions on the world tuna system.

NMFS launched a survey to identify U.S. research projects aimed at the reduction of pollution caused by fishing activities. Information will be sought from wide-ranging fields including those that deal with the studies of harbors, byproduct utilization, and design of fish processing plants.

On October 18, 1972, Congress passed the Federal Water Pollution Control Act Amendments of 1972 (PL 02-500), which affected every seafood processor in the U.S. The intent of PL 02-500 is that by 1983, our waters will be clean enough to protect fish and shellfish and will be suitable for swimming and other recreational uses. By 1985, all harmful discharges into the nation's water will be eliminated.

2.1 MARMAP

The National program called Marine Resources Monitoring, Assessment, and Prediction Program (MARMAP), which was launched in 1970 under the direction of NMFS, continued to make progress in 1973. Samples and data collected by a multiship survey in the winter of 1973 indicated unusual concentrations of larval spotted hake, mullet, herring, weakfish, spot, and croakers along the mid- and south Atlantic coast, suggesting that these species could support expanded fishing operations.

2.2 State-Federal Fisheries Management Program

In 1973, in a positive effort to solve the problems of overcapitalization, economic inefficiencies, and stock depletion, the State of Alaska enacted the Limited Entry Act. Under this act, a State Commercial Fisheries Entry Commission was created and charged with the responsibility for promoting conservation, for maintaining economic health and stability in the various fisheries, and for regulating and controlling entry into the commercial fisheries. Limited Entry appears to be an ideal way to control Alaska's salmon fishing, but the policy decisions to determine who will be permitted to fish and who will be denied the right to fish are very difficult.

The Governor of the State of Washington also signed into law the State's first legislation limiting entry into its fisheries. The only practical effect at present, however, is on Washington's salmon fisheries. The bill limits at current levels all salmon gear including troll, purse seine, gill net, and reef net.

3. MARINE RESOURCES

3.1 Resource surveying, experimental and exploratory fishing, location of new fishing grounds

An instrument that is expected to locate commercially important fishery resources has been developed in the U.S. under the sponsorship of two units within NOAA--the NMFS and the Office of Sea Grant. Named RUFAS II (for Remote Underwater Fisheries Assessment System), the instrument is towed behind a research ship, dives on command to look at selected underwater features, and photographs the surrounding scene with video tape and 35 mm film. This second generation robot diver continuously televises its observations to the mother ship, can inspect the sea floor at great depths, and sends warning signals to the shipboard operators when underwater navigational hazards are detected. Diving as deep as 730 m, RUFAS II can ascend at a rate of 0.75 m per second and can be towed at speeds up to 6 knots by a cable more than 1.6 km long.

In 1972, an NMFS-chartered fishing vessel operating out of Honolulu, Hawaii, explored the possibility of developing commercial pole-and-line fisheries for skipjack tuna, Katsuwonus pelamis, in the Marshall Islands and American Samoa. Tuna resources in the Marshall Islands and American Samoa were impressive. Bait was plentiful in the Marshall Islands but scarce in American and Western Samoa. To conduct fishing trials in Samoan waters, the vessel obtained live bait in Fiji. Both tuna and bait were abundant around Fiji.

Large, undeveloped grounds of the little-harvested mollusk, the ocean quahog, was discovered by survey vessels of the Middle Atlantic Coastal Fisheries Center, Sandy Hook, in 1973. Abundance estimates placed the resource in coastal waters from New Jersey to Virginia at about 1.1 million metric tons. Off Long Island, the resource was estimated to be 1.5 million metric tons.

In 1973, the Inter-American Tropical Tuna Commission (IATTC) investigated the relationship between sea-surface temperatures in the spawning areas and skipjack tuna abundance in the fishing areas. The reasoning is that since the

number of skipjack tuna larvae increased with temperature, warm years in the central Pacific spawning areas may result in higher indices of apparent abundance in the fisheries of the eastern Pacific. Correlation between various indices of skipjack tuna abundance and those of sea-surface temperatures and atmospheric pressure one and a half years earlier were significant in 28 out of 31 tests.

3.2 Fisheries biology (including methodology and techniques), studies on age determination, tagging, population dynamics

A technique of counting lamellae which have been laid down daily has been developed to directly age fish. Scientists at the Honolulu Laboratory, Southwest Fisheries Center, have constructed growth models from larval stage to adult for the Hawaiian anchovy, Stolephorus purpureus, and skipjack tuna. Age and growth studies of skipjack tuna from other areas of the Pacific are in progress.

In studies on the population dynamics of the Palauan anchovy, Stolephorus heterolobus, a baitfish used extensively in the fishery for skipjack tuna in Palauan waters, it was determined that total mortality rate for a 19-month period was 6.0 per year. This means that 3 fish out of 1,000 live to be a year old. The average fishing mortality was 3.0 per year. The logistic model indicated a maximum sustainable yield of about 80,000 buckets with an effort of under 2,000 boat-nights. The study concluded that the bait fishery in Palau is currently operating at the optimum level.

Tagging experiments on yellowfin and skipjack tuna continued to receive considerable emphasis in 1973. With fishing effort for these species in the eastern Pacific expanding rapidly 1,000 to 3,000 km offshore, tagging studies concentrated on the extent of mixing among the fish of various inshore and offshore areas.

A number of projects underway at NMFS centers and laboratories dealt with the physiology of economically important marine species. Significant among them were the research at the Honolulu Laboratory, Southwest Fisheries Center, on sensory and other physiological reactions of tunas and tunalike fishes to their physical environment, and an acoustical survey of sockeye salmon in Lake Washington by the Northwest Fisheries Center, Seattle.

To support negotiations and apply effective management practices in international bilateral agreement and commissions and domestic State-Federal programs, NMFS centers prepared annual assessments of the conditions, changes in abundance, and predicted maximal yield levels for important species such as salmon, tuna, shrimp, halibut, cod, crab, flounder, hake, herring, haddock, mackerel, menhaden, and lobster. Special surveys of marine sport fish species by the Northwest Fisheries Center, Seattle, provided information on angling opportunities and fishing techniques for recreational anglers.

Marine mammals programs included studies on population dynamics, age structure, feeding habits, distribution, migration, and interrelationships with other living marine resources. Studies on reducing or possibly eliminating porpoise mortalities in the tuna purse seine fishery were fully augmented. Preliminary tests on a prototype net constructed of different taper and mesh

sizes were started to evaluate its effectiveness in removing porpoises from the seining operations. Concerning fur seals, St. George Island was set aside as a research control area of no harvest.

3.3 Management, laws and regulations, control of pollution

Results of assessments by the Northeast Fisheries Center, Woods Hole, of the total yields available from the fish stocks off New England and mid-Atlantic states indicated serious overfishing. This led to the agreement by all ICNAF member countries to reduce total catch of all species to allow for restoration of the stocks.

In 1973, the Northwest Fisheries Center, Seattle, initiated a program to place observers on Japanese trawlers in the Bering Sea. Data collected through this program will be used for developing an effective management rationale for the heavily exploited North Pacific fish stocks.

Concerning yellowfin tuna, studies at the Southwest Fisheries Center, La Jolla, showed that the Atlantic stocks were in good condition in 1973, but that the fishery was approaching or had attained a plateau. Furthermore, substantial increases in sustainable yield from this species cannot be expected by increasing fishing effort unless there are accompanying changes, such as spatial or temporal distribution of fishing effort, in the fishery.

NMFS environmental research in 1973 involved studies of the estuarine and nearshore ecosystem to establish baseline data to evaluate the environmental impact of manmade and natural alterations. Studies at the Atlantic Estuarine Fisheries Center, Beaufort, involved assessment of species structure, biomass, and energetics of the ecosystem; determination of pathways and rates of flow for contaminants, particularly heavy metals, radionuclides, and pesticides; and determination of the effects of various contaminants to which organisms are normally exposed. Studies at the Northwest Fisheries Center (Seattle), and the Southwest Fisheries Center (Tiburon Laboratory) are examining the relationships between oil and aquatic organisms. A chronic exposure facility was completed at the Middle Atlantic Coastal Fisheries Center, Milford, and studies there involved the effects of exposure of marine organisms to sublethal levels of various pollutants.

3.4 Research progress and institutions

The Congressional mandate which created the Sea Grant programs called for development of marine resources for economic and social benefits to the nation and for the education and training of personnel to carry out such development.

Among the accomplishments reported under the Sea Grant program was the new removal system which blasts barnacles from the hulls of ships while at anchor, resulting in savings of time and money. Two engineers from the University of Washington Sea Grant program collaborated with private industry to develop specially designed instruments which determined the shock level for efficient cleaning of a ship's hull. By keeping the explosive blasts within this range, cleaning was accomplished without any damage to the ship's structure.

An informal Tuna Baitfish Workshop, sponsored by the Southwest Fisheries Center, Honolulu, and the University of Hawaii's Sea Grant, was held June 4-6, 1974. Thirty-six papers were contributed to the workshop; 38 persons attended from the U.S., Japan, Papua New Guinea, Gilbert and Ellice Islands, American and Western Samoa, and the U.S. Trust Territory of the Pacific Islands. The workshop opened with a general session followed by concurrent sessions on natural stocks, cultured species, and baitfish transport-baitfish substitute. Recommendations arising from the workshop were based on problems and needs identified during the sessions.

At the Southwest Fisheries Center, Honolulu, attempts are being made to develop the technology needed for transporting live northern anchovy, Engraulis mordax, from California to Hawaii. A surplus 18,900-liter aircraft refueling tank was acquired and converted into a bait transport tank. Several trial shipments have been made with varying success. Development of a practical bait-transport system could help significantly to promote and expand pole-and-line fishing in the Pacific Islands.

4. AQUACULTURE

4.1 Intensive and extensive culture techniques--increase in yields

In 1973, the major emphasis in aquacultural research involved Pacific salmon and penaeid shrimp. Studies at the Northwest Fisheries Center, Seattle, evaluated a saltwater pen-rearing system for Pacific salmon, treatment of saltwater salmonid diseases, experimental feeds, stock development, and breeding. At the Gulf Coastal Fisheries Center, Galveston, studies involved developing a dependable method for maturing female shrimp in captivity, methods for recognizing, preventing, and treating diseases, and methods for intensive culturing of shrimp in a closed system.

Concerning salmon culture, a salmon farm in Wiscasset, Maine, has been using warm water discharged from a power plant to obtain rapid growth. Mortality from the hatch of 100,000 eggs was estimated at 29%. The farm operator expected to harvest 18 MT of pan-sized salmon during the period February to August 1974. The salmon were kept in cages which were confined to a warmwater pen area by a log boom.

Salmon farming technology developed by the Northwest Fisheries Center, Seattle, has accelerated growth of fish for eventual pen harvest (commercial operations) and open range harvest (catch mainly by sport fishermen). Although technology is still in its formative stages, four private salmon farms have been built in Puget Sound. Three of four farms harvested 139 MT of pan-sized salmon in January-March 1974. The fourth farm released 8 MT of pen-reared salmon into south Puget Sound for the benefit of the sport salmon enhancement program. In addition, another firm is in the commercial pilot plant stage and six more are seriously considering investment in salmon farms.

The continuous cycling method for culture of the giant freshwater prawn, Macrobrachium rosenbergii, continued to receive attention in 1972-73. The method, developed by scientists of the Hawaii Division of Fish and Game, was applied in a pilot operation to obtain consistent production. Tests on prawns

reared in the pilot pond showed production of 336 kg per hectare of marketable prawns per month. Studies have also been centered on formulating and testing inexpensive prawn feed.

Warm seawater, discharged from the heat exchangers of a giant steam electric power plant in California, was used to grow oysters. Test crops of eastern oysters, Crassostrea virginica, showed impressive growth rates when cultivated in warm water. Mature marketable sizes may be reached in about a third of the time required under normal conditions.

Cooperative research on catfish breeding continued at various laboratories in 1972-73. The results indicated that the young of hatchery-reared fish generally have lower survival rates than those young whose parents were brought directly from the wild. However, young fish from wild parents apparently do not grow as well in the pond environment as semidomesticated hatchery fingerlings during the first year. Crossbreeding of wild and hatchery stocks improved disease resistance.

4.3 Feeding, feedstuff

Nutrition studies included the analysis of pelagic red crab, Pleuroncodes planipes, to assess its value as a dietary component in salmonid diets. Pelagic red crab, which has a high carotenoid content ranging from 10 to 16 mg per 10 g of whole body weight, is a source of relatively inexpensive carotenoid for pig-menting pen-reared salmonids. Rainbow trouts were highly pigmented when fed diets containing 10%-25% red crab for 2 months. Other studies indicated that fractionation of red crab could produce a dry feed material and a chitinous residue for processing into derivatives such as chitosan.

5. INFRASTRUCTURE

5.1 Harbors

In a waterfront renewal project in Gloucester, Massachusetts, a 6,500 sq m building will be erected on a 2.5 hectare parcel of land. The huge plant will house eight firms and will be the first fresh fish processing center on the eastern seaboard. Included in the planning are finger piers to provide docking for 25-30 draggers. The proposal also calls for a freezer-cold storage facility with a holding capacity of 1,360 MT and 12 plate freezers capable of handling 18 MT of fish per hour.

6. FISH CAPTURE

6.1 New types of gear introduced into commercial fisheries

A promising improvement has been recently developed to further help the porpoise escape from the purse seine. The improvement is a corkline panel, which is a solid strip of vinyl-covered nylon wrapped around the corkline and extending down the side. Its function is to prevent porpoise from being snagged in the corkline by providing a ramp over which they can slide as fishermen herd them out of the net.

A new funnel-shaped bottom trawl that could significantly boost catches by New England fishermen has been developed at the University of Rhode Island. In tests conducted by two NMFS research vessels, the net, called the URI 340, caught more fish than the Yankee 37 trawl now used all along the east coast. The URI 340 is designed so the mouth or door end opens to a larger size than traditional trawls.

7. UTILIZATION

7.1 Improvement in fresh fish handling, distribution, ice supply

A refrigerated seawater (RSW) system, modified by addition of carbon dioxide (CO₂) to the brine, was developed for vessel use and found to be significantly more effective in preserving whole pink shrimp and halibut at sea.

Quality of pen-reared salmon and trout improved significantly when the fish were processed by immersing them immediately after harvest in low temperature water followed by bleeding.

A State-operated seafood control laboratory is planned for the port of New Bedford, Massachusetts. Under the supervision of the Department of Public Health, Food and Drugs Division, the laboratory, staffed by a chemist, bacteriologist, and two inspectors, will be responsible for quality control of all seafood processed in New Bedford. Eventually, it is hoped that the laboratory's services will include other important forms of technical assistance to the Massachusetts fishing industry.

7.2 Product development, new processing methods and equipment

In 1973, after more than 10 years of research, the program to develop methods to process fish into fish protein concentrate (FPC) was terminated and a comprehensive report prepared. Sufficient scientific evidence was presented to the Food and Drug Administration to permit it to remove all packaging restrictions on FPC.

A fishery for sea urchin has developed in southern California. Sea urchins, long considered a pest in California waters because of their overabundance, are prized for their roe, which is eaten in Japan and in many European and South American countries. Rather than destroy sea urchin, the Southwest Fisheries Center, Tiburon Laboratory, promoted the utilization of sea urchin roe and developed a fishery for these invertebrates. At present, the domestic market is firmly established and effort to export large quantities to other countries is continuing.

In shellfish research on underutilized species such as deep-sea red crab, Geryon quinquedens, and Jonah crab, Cancer borealis, NMFS scientists found that the yield of crab meat could be increased by optimizing cooking times, temperatures, and picking technique. In research on squid, an abundant but underutilized species in the U.S., NMFS has developed several mechanical methods of skinning and eviscerating squid and produced acceptable new products.

A technique for extracting protein and industrial chemicals from shellfish processing wastes on a commercially attractive scale was developed in the U.S. in 1973. The two principal shellfish products are chitin and its derivative chitosan. Industry and two government agencies, Sea Grant and the Environmental Protection Agency (EPA), cooperated in this venture. A big market possibility for these two products lies in municipal and industrial waste-water treatment. Chitin and chitosan are also proposed as additives in the paper making process, in baby food, in paint emulsions, stomach antacid, textile finishes, shoe polishes, synthetic fibers and as food thickeners.

In 1969, the geoduck, Panope generosa, the beef clam that ranges from Alaska to California was found in great abundance in Puget Sound. Commercial production of these clams became possible after a survey by the State of Washington Department of Fisheries revealed many millions were available in subtidal waters. Divers estimated that there were two or more siphons per 0.1 sq m. A water pump, wash-out nozzle with high water pressure, inserted deep alongside the clam, was approved and used for recovery of the geoduck. The stability of the market for geoduck was due primarily to the group of processors who launched a campaign to educate their markets, and tenderized and packaged their product attractively.

NMFS marketing activities included market development, market intelligence, and consumer education. Significant accomplishments of the market research and service program included a major effort to help industry develop new domestic and export markets for mullet and mullet roe. Utilization of mullet has increased in the U.S. and markets for mullet roe have been developed in Japan, Taiwan, and France.

7.3 Research activities and institutions

NMFS conducts microconstituent research programs at the Pacific Fishery Products Technology Center, Seattle, and the College Park Fishery Products Technology Laboratory, College Park. Designed to provide a sound and comprehensive data on the occurrence and significance of microconstituents, the program direction to date has been in heavy metals, other inorganic trace elements, and organic contaminants such as pesticides and PCB's.

In 1973, an extensive survey was initiated to obtain baseline data and to identify possible programs related to 15 inorganic elements in over 200 species from U.S. offshore and coastal waters. The results have shown that fish generally contain low levels of mercury, thus refuting the adverse publicity which implied that all fish are high in mercury. Data collected from these surveys will be handled by a computerized system and the results will be used to (1) assess changes in levels of microconstituents, (2) provide factual scientific evidence on microconstituents, and (3) provide evidence to the Food and Drug Administration on the establishment of guidelines on trace elements.