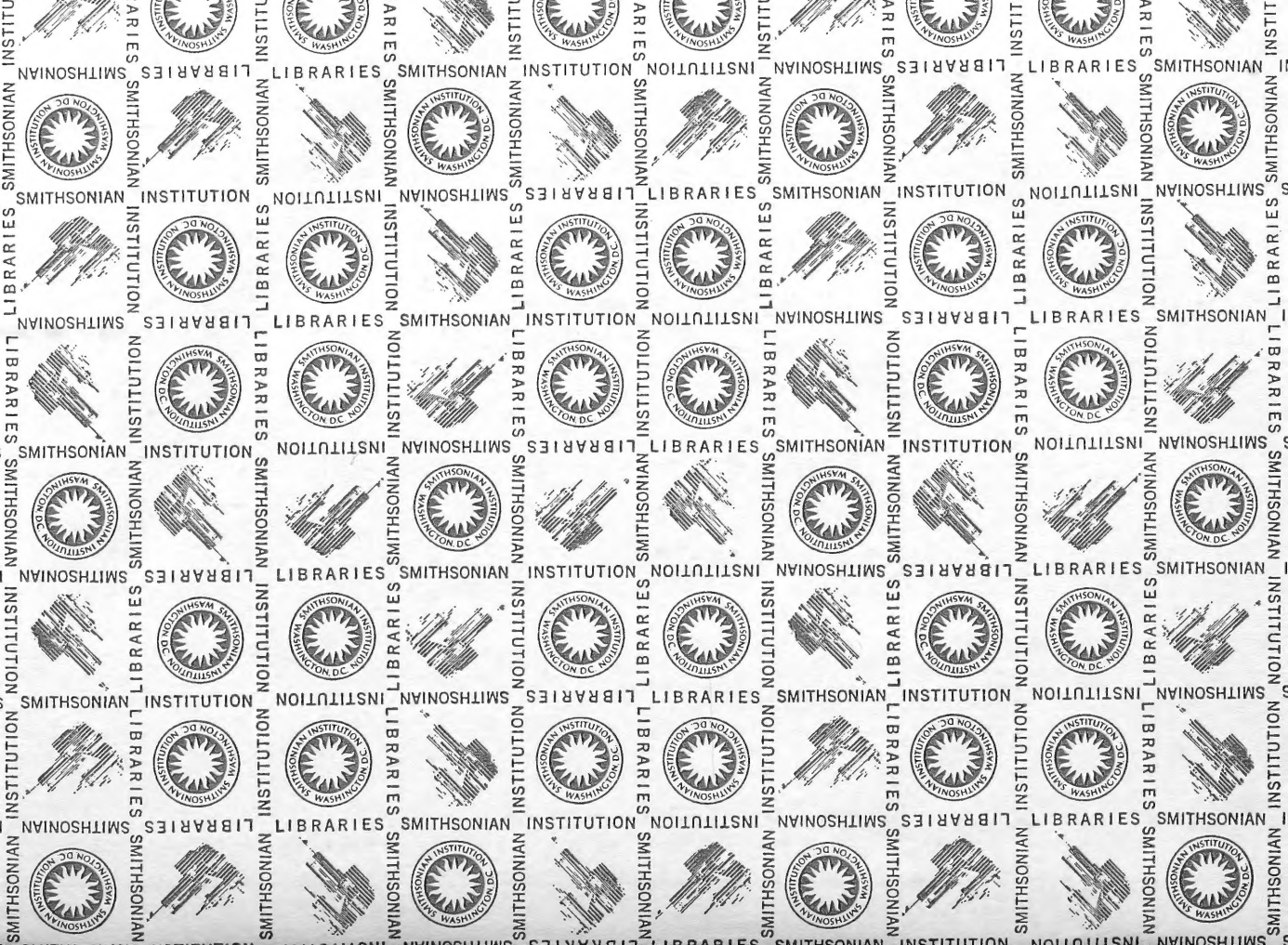

SMITHSONIAN INSTITUTION LIBRARIES

A UNITED STATES DEPARTMENT OF COMMERCE PUBLICATION

Commercial Fisheries

REVIEW

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

.-FEB. 1972
VOLUME 34
NUMBERS 1-2

Commercial Fisheries REVIEW

A comprehensive view of United States and foreign fishing industries — including catch, processing, marketing, research, and legislation — prepared by the National Marine Fisheries Service.

CONTENTS

COVER: The start of a set. Skiff has been dropped and net drum is free wheeling. See article p. 23.

(Photo: R. Green)

FISHERMEN'S MEMORIAL—GLOUCESTER, MASS.

U.S. DEPARTMENT OF COMMERCE
Peter G. Peterson, Secretary

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Robert M. White, Administrator

National Marine Fisheries Service
Philip M. Roedel, Director

Address correspondence and requests to: Commercial Fisheries Review, 1801 North Moore Street, Room 200, Arlington, Va. 22209. Telephone: Area Code 703-557-9066.

Use of funds for printing this publication was approved by the Director, Bureau of the Budget, April 18, 1968.

Editor: Edward Edelsberg

Production: Alma Greene

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price 60 cents (single copy). Subscription price: $7.00 a year; $2 additional for foreign mailing.

NMFS — NEW DIRECTIONS

Philip M. Roedel, Director
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

In the October 1970 issue of COMMERCIAL FISHERIES REVIEW, I discussed the new responsibilities the National Marine Fisheries Service would assume as we became part of the National Oceanic and Atmospheric Administration. At that time I promised to discuss with you, in a subsequent issue, what we would do to reshape our organization for its vital role in NOAA.

The year 1971 was one during which the National Marine Fisheries Service underwent major changes in organization. These changes responded in part to long-standing criticisms of the organization of NMFS' predecessor agency, the Bureau of Commercial Fisheries, and in part to our new role as an element of NOAA and our new responsibilities to marine recreational anglers.

ORGANIZATION

The restructuring of NMFS could have taken any one of a number of forms. The one adopted represents the consensus of those in NOAA and NMFS who are most concerned; its implementation is now virtually complete. The restructuring is not simply a matter of reshuffling. Rather, it represents departure from the past, and reflects a basic change in philosophy and a response to that change in terms of organizational structure.

The major aspects of the new organization are these:

1. The primary functions of NMFS have been assigned among three areas, those concerned with Resource Research, Resource Utilization, and Resource Management. Each is headed by an Associate Director.

2. We have created a small number of fishery research centers by combining the administrative and program functions of similar biological laboratories.

3. The centers concerned more with oceanic programs, national in nature, report to the Associate Director for Resource Research rather than to a Regional Director.

4. The centers and laboratories concerned chiefly with inshore programs, local in nature, report to the Regional Director concerned.

5. We have integrated into this system the marine game fish laboratories, which came to us from the Bureau of Sport Fisheries and Wildlife when NOAA was established.

6. We have placed the fishery products technological laboratories under the Associate Director for Resource Utilization.

7. Finally, we retained the basic regional structure with the Regional Directors continuing as the key NMFS representatives in their geographical areas of responsibility. The Directors of Centers who report administratively to the Central Office also serve as senior scientific advisors to the Regional Directors.

A major criticism of the old system was that there were too many small laboratories, some without sufficient budget or staff to operate effectively as independent units. Another major criticism was that the essentially regional approach to, and control of, research programs made development and implementation of national programs a monumental job. The center concept responds to the first criticism, and the national control of some of the centers to the second.

There are four major fisheries research centers concerned primarily with high-seas research carried out as part of nationwide programs designed to solve problems of a national or international nature. The lead laboratories of these centers are located in Seattle, Washington; La Jolla, California; Miami, Florida; and Woods Hole, Massachusetts. These centers, and the Atlantic Estuarine Fisheries Center at Beaufort, North Carolina, report to the Associate Director for Resource Research.

Two centers, with headquarters in our laboratories in Galveston, Texas, and Sandy Hook, New Jersey; and two laboratories at Tiburon, California, and Auke Bay, Alaska, are concerned chiefly with inshore and estuarine research and with programs and problems that tend to be regional in nature. These report to the Regional Directors.

MAFAC and NACOA

In March of last year the Secretary of Commerce announced formation of a Marine Fisheries Advisory Committee (MAFAC), composed of 27 leaders in both commercial and sport fishing activities and from the academic community.

The Committee, which meets three times a year, advises the Secretary on the Department's responsibilities for fisheries resources, and it reviews and advises him on the adequacy of our programs in NMFS and on related programs in NOAA. With such a limited number of members, not all facets of our fisheries can be represented on the Committee at any one time.

However, the Committee Charter specifies that the membership will rotate with vacancies occurring annually, and all segments will be represented over a period of about 3 years.

The second group was appointed by the President on October 19, 1971, to serve as members of NACOA, the new National Advisory Committee on Oceans and Atmosphere. William Nierenberg, Director of Scripps Institution of Oceanography, was designated Chairman, and William J. Hargis, Director of the Virginia Institute of Marine Science, Gloucester Point, Virginia, was named Vice Chairman. The Committee is charged with undertaking a continuing review of the progress of the Nation's marine and atmospheric science and service programs. It also advises the Secretary of Commerce with respect to the administration of NOAA. This group will submit its first report to the President by June 30 of this year. Several members of this Committee are from the fishing industry and one is also a member of the Marine Fisheries Advisory Committee.

So much for the reorganization and growing pains that have concerned NMFS during the past year. While the reorganization was taking place, we were simultaneously defining program areas. I would like now to touch on the more significant of these.

NEW PROGRAMS

Biological Research

Our biological research program is now undergoing what we like to regard as a healthy change from the past. We have recognized for a number of years that we lack adequate resource and environmental data for short-term and long-term assessments of the condition of our marine resources--and the physical, chemical, and biological events that affect their well-being. In an attempt to cope with this, we have recently launched a coordinated national effort called the Marine Resources Monitoring, Assessment, and Prediction Program (MARMAP). What we intend to do in MARMAP is to carry out intensive surveys of ichthyoplankton, groundfish, pelagic fish, and environmental conditions using standardized methods.

This program is designed to give us the basic data prerequisite to: (1) better management and allocation of resources, and improved regulation of exploitation to insure optimum yields and economic returns; (2) protection of resources from damage by pollution; (3) decisions on multiple uses of the marine environment; (4) utilizing new living marine resources; and (5) providing fishermen with real-time information on locations of fish concentrations to reduce search time and, as a result, reduce the cost of fishing.

MARMAP is thus designed--in combination with our population dynamics and other biological programs--to give us reasonably accurate estimates of the abundance, distribution, susceptibility to capture, and status of all stocks of actual or potential interest to American fishermen. Information of this sort is a prerequisite if we are to be successful at the international bargaining table and if we are to be able to develop rational management schemes at home.

While MARMAP is the largest single new element of the biological research program, it is not the only one.

Projects concerned with environmental quality will play a much larger role in the future of NMFS. MESA--Marine Ecosystem Analysis--is the NOAA-wide program covering this broad area. So far as living marine resources are concerned, we will be, among other things, gathering baseline ecological information with particular respect to nearshore waters, determining the effects of environmental changes on marine organisms, developing means of rehabilitating damaged environments and, most importantly, providing a review and advisory service in the general area of Federal water resources planning.

We are also increasing our efforts with respect to sport fish research. At present, we are concerned especially with the development of a sound statistical program and with augmentation of the more traditional studies of life history, migratory patterns, and the like.

State-Federal Program

The State-Federal Fisheries Management Program is now being implemented. I regard this program as the most significant new step of the National Marine Fisheries Service.

Specifically, the State-Federal initiative is our response to two matters of concern. The first relates to the common-property nature of fishery resources. In effect, this means that until they are captured fish belong either to no one or to everyone, depending on your social philosophy. The end result is the same: fishermen have no property rights to these resources. When this is coupled with the absence of limitations on the entry into a fishery, there is a natural tendency to overcapitalize a growing fishery. The result, particularly if the fishery declines, is too many units of gear, too many fishermen, too many boats, too much capital, or all of these.

The second problem stems in part from the first: in the United States, each State has reserved to itself the right to manage its living resources. This has led to a multitude of management systems--each tailored to the needs of a given State but very few tailored to the needs of the fish stocks, which are no respectors of State or national boundaries. Further, the managerial schemes tend to take the form of instituting inefficiencies thru such means as gear restrictions rather than dealing with the real problem of too many

fishermen pursuing too few fish. The State-Federal Fisheries Management initiative proposes to deal with these two problems by developing an effective management plan that will assure the rational use of fishery resources for both sport and commercial purposes.

We are dealing basically with allocation conflicts. Some of them involve different countries fishing the same resource. Some of them are between States in the contiguous fishery zone. Some of them involve disputes between commercial and recreational fishermen. Some of them are among groups of fishermen fishing the same resource but with different gear. And some of them are between fishermen of all sorts on the one hand and competitors for use of the environment on the other.

These conflicts may relate to individual States or local areas, but many of them involve more than a single State and are beyond the ability of the States alone to resolve.

Our present institutional arrangements for managing fisheries are simply not adequate. Everyone, whether he works at the local, State, national, or international level, is aware of these deficiences.

Until now, the approach of the Federal Government seems to have been one of accepting the institutional setting as it existed and of working within these constraints.

This approach has not worked, especially in commercial fisheries, and we are convinced it never will work. Unless we, in cooperation with the States and others, can bring about the necessary mechanisms to cope better with these growing allocation problems, we will continue to see increasing difficulties in controlling fishing effort and in preventing destruction of our resources.

I believe the reorganization we have undergone and the new programs we have initiated have made NMFS a viable and responsive organization. In the first years of our second century of service, with your help, we will make great strides toward fulfilling our mission.

The NMFS 'DAVID STARR JORDAN' will be used this year in the Eastern Pacific between Oregon and Mexico to conduct MARMAP Ichthyoplankton surveys. It will perform sonar assessments of pelagic resources and physiological studies of large pelagic fish.

DR. WILLIAM ROYCE NAMED NMFS ASSOCIATE DIRECTOR

Dr. William F. Royce, Associate Dean of the School of Fisheries, University of Washington, Seattle, since 1967, has been appointed NMFS Associate Director for Resource Research.

Dr. Royce has overall responsibility for managing resource research and development at NMFS Fisheries Centers--about 50 laboratories and field stations and 30 research vessels. More then 775 scientific, professional, technical, and support personnel are involved in resource research activities.

Dr. Royce served the Federal fishery service from 1942 until 1958. He left to become professor of fisheries and director of the University of Washington's Fisheries Research Institute. He has been adviser to developing nations in Africa, Latin America, and the Middle East, to the UN's Food and Agriculture Organization on fishery education and training programs in East Africa, and to the U.S. section of the International North Pacific Fisheries Commission in problems concerning salmon.

Dr. Royce, 56, was born in DeBruce, N.Y. He earned his B.S. in 1937 and Ph. D. in 1942 from Cornell University, Ithaca, N.Y. His major graduate study was vertebrate zoology. He did graduate work in mathematics at the University of Hawaii, and in statistics at the University of Florida.

He is author of 60 professional publications, including a textbook, "Introduction to the Fishery Sciences." He is a Fellow, American Association for the Advancement of Science, American Institute of Fishery Research Biologists, and the International Institute of Fishery Scientists. Dr. Royce is a member of 9 technical societies.

WHITELEATHER RETIRES FROM NMFS

Richard T. Whiteleather, who served the U.S. for 36 years, retired Jan. 14, 1972, as Director of the NMFS Southeast Region.

He was a specialist in fishery-resource development and an administrator. He had directed Federal fishery activities in 17 states, Puerto Rico, and the Virgin Islands.

The recreational and commercial fisheries of the southeast are the most valuable in the United States. More than 40% of U.S. seafood production comes from there. It is the center for research on several valuable coastal fishery resources, particularly shrimp and menhaden.

GEHRINGER REPLACES WHITELEATHER

Jack W. Gehringer, 48, has been named Director for the Gulf and South Atlantic Region of the National Marine Fisheries Service (NMFS). He served as an associate director there since April 1970.

Gehringer is a native of Papillion, Nebraska. He received his B.S. in fisheries from Colorado A&M College in 1950. He has spent his entire Federal career in the Gulf and South Atlantic Region. He began serving NMFS (formerly Bureau of Commercial Fisheries) in 1950 as marine biologist in the Galveston, Tex., laboratory. In 1952, he transferred to the Brunswick, Ga., laboratory, where he served as program leader, assistant laboratory director and, later, as acting laboratory director. Early in 1969, he was assigned to the regional headquarters in St. Petersburg, Fla., as acting deputy director.

NMFS RESEARCH LEADS TO WORLD'S NO. 1 PILOT SALMON FARM

Salmon research by scientists of the NMFS Northwest Fisheries Center (NFC) has led to establishment of the world's largest pilot commercial salmon farm near Seattle, Wash. The farm's winter-spring (1971-72) production is approaching 100 tons.

NFC has conducted research in marine aquaculture (mariculture) for 2 years at its Manchester, Wash., station, which opened July 1969. The station's most prominent research is on one NMFS mariculture program--the saltwater rearing of Pacific salmon in floating pens.

The research station is situated ideally for its mariculture research. It is about 10 miles from Seattle on Clam Bay along Puget Sound's west shore. The area boasts a variety of habitats: Beaver Creek, a freshwater stream; exposed tidal flats; and deep, well-circulated salt water.

The Researchers

Dr. Timothy Joyner is program supervisor. The salmon research is conducted by Conrad Mahnken, oceanographer; Anthony Novotny, fishery biologist; and James S. Johnson and Gunnar Safsten, fishery technicians. In 2 years, these researchers showed that it was economically feasible to rear coho and chinook salmon in saltwater pens. They grew coho in pens resting on the bottom in about 40 feet. They raised many coho through maturity. They cooperated with Washington State's Department of Fisheries to increase the number of salmon for Puget Sound's recreational fisheries.

Two-Phased Studies

There were 2 phases in the Manchester studies on the feasibility of rearing salmon for market. The first was pioneering research of NFC's salmon-culture project to develop an economical system for raising salmon from hatching to market size or maturity. The second was an experimental pilot farm financed partly by NOAA's Office of Sea Grant.

Scientists of the salmon-culture project concentrated on rearing coho salmon. In 1969, they put 10,000 fingerlings in a plastic, meshed cage and floated it in Puget Sound. The fish grew well in salt water; their survival was high. The food conversions were excellent: 1.5 lb of feed for 1 lb of fish weight on the Oregon Moist Pellet (OMP) diet until the fish reached 1 lb.

Would the market and consumer accept the larger coho? The NMFS Marketing Division studied this. It received enough favorable comment to justify a closer look at the commercial feasibility of raising on a large scale 8 to 12 oz salmon (dressed weight).

Many Firms Interested

This initial NMFS research stimulated interest by many firms in commercial culture of salmon. Ocean Systems, Inc. (OSI), a subsidiary of Union Carbide, asked support from NOAA's Office of Sea Grant for a pilot project in Puget Sound. It received $100,000 in matching funds for a 1-year study. The principal objective was to encourage the development of mariculture in Washington State by demonstrating the technical and economic feasibility of such an operation.

OSI purchased 700,000 coho salmon eggs from Washington State in November 1970. "The eggs were incubated and hatched, using water from Beaver Creek, at a small building donated to NMFS by the U.S. Navy. Incubation was accelerated by holding the temperature at 10°-12° C with an oil-fried furnace."

About 400,000 eggs hatched in the winter. In early February 1971, the fry were moved from the hatchery to a freshwater pond. An adjoining pond was stocked with about 464,000 fall chinook salmon fry obtained from the University of Washington. The coho were fed only dry diets; the chinook were fed dry and moist (OMP) diets.

Saltwater Nursery Pen

The chinook salmon at 80/lb were trucked back to Clam Bay in late May and placed directly into a saltwater nursery pen. The pen was 30 x 30 x 15 ft deep and held 385,000 fall chinook. The diet was OMP. Treatments with medicated (terramycin) feeds became necessary in early June when mortalities from Vibriosis, a bacterial disease, began to increase. In June, 10.5% of the fish were lost.

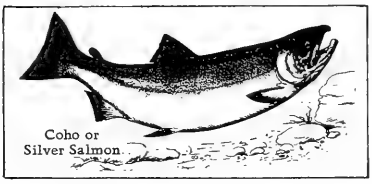
The coho salmon were graded in early July, when about 60% were smolted and weighed 25/lb. Then the coho were transferred to 4 growing pens (50 x 50 x 30 ft deep) designed for larger fish. In one pen, 158,000 coho reached a density of 1.8 lb/cu ft just before harvest began in late December; there were no adverse effects on survival, food conversion, or growth rate. The researchers say that at this density 700,000 lb of coho could be grown in 1 year in 1 surface-acre of water (30 ft deep), including the large raft support system; at harvest, their total weight would be about 2.5 million lb.

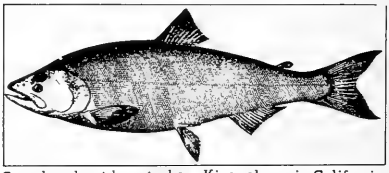
Conversion of feed by the coho salmon has averaged 1.1:1 (including mortalities) on a dry diet. Chinook salmon have not grown as rapidly. Conversion of feed by chinook throughout the study has averaged 1.7:1 (including mortalities) on mixed dry and moist feeds. Nearly a year after hatching (350 days) the coho are getting too large for market. During the peak growing period, September through November, a feed ration of 3% of body weight per day produced a 3% increase in weight per day. Many fish 13-14 inches long that weigh about 1.5 lb have been set aside for future brood stock.

Ready for Market

In December 1971, the first coho from the pilot farm were ready for market at a dressed weight of 11-12 oz. The chinook were expected to be ready in March 1972. The coho are being harvested at rate of 8,000 to 15,000 lb/week. The fish are killed in -1.5° C water and transported to Marysville, Wash., for processing by Pan-Alaska Fisheries, Inc. All fish are sold through Swiftsure Fisheries in Seattle. They bring $1.35-$1.70 per lb wholesale. Fish quality is excellent. There has been substantial interest among U.S. and foreign markets in 11-12 oz salmon. On Dec. 24, 1971, for example, Swiftsure received an order from a food service for international airlines for 5,000 lbs of salmon to be delivered as soon as possible, and for 10,000 lbs to be delivered each month thereafter.

In December 1971, also, Union Carbide announced plans to form a new subsidiary for its sea farming operations, effective Jan. 1, 1972. Dom Sea Farms, Inc., will operate independently of Ocean Systems, Inc., and concentrate exclusively on mariculture. Over 2 million salmon eggs purchased from Washington State are now hatching at Dom Sea's new freshwater facilities near Silverdale, Wash. Saltwater rearing schedules and past experience indicate a projected harvest of 400-500 tons in 1 year.





Oncorhynchus tshawytacha. King salmon in California, chinook in Alaska.

1971 ALBACORE LANDINGS DECLINE FROM 1970

Preliminary figures on west coast landings for the 1971 albacore season are about 54 million pounds (27,000 tons). In 1970, 58 million pounds (29,000 tons) were landed. The 1961-1970 average was 47 million pounds (23,500 tons). The following report was provided by R. Michael Laurs, Leader, Fishery-Oceanography Group, NMFS Southwest Fisheries Center, La Jolla, Calif.

Laurs states: "The relatively high 1970 landings probably reflect increased fishing effort. Although exact data are not available, rough weather during parts of the season and unavailability of fish near the normal end of the season tended to limit fishing activity and success for individual boats."

Preliminary California landings for 1971 were 30 million pounds, about the same as 1970. The aggregate Oregon, Washington, and British Columbia landings were 23.4 million pounds, down about 16% from 1970. British Columbia landings set a record.

	1971	1970	1969
California	30.0	29.9	14.7
Oregon	16.8	21.8	29.8
Washington	2.9	4.3	3.5
British Columbia	3.7	1.6	2.5

Highlights of 1971 Albacore Season

In February 1971, a small number of 2-3 pound albacore were caught near Uncle Sam Bank. These fish were thought to be young of albacore that remain in this area throughout the year. The first report of a migrating albacore caught in the West Coast fishery for 1971 was on June 25: Oregon State University's R/V 'Yaquina', on an oceanographic cruise, landed a 14-pound fish in 59° F waters about 420 miles west of Cape Blanco, Oregon. A day later, sport boats and private yachts reported albacore caught near the Sixty Mile Bank off San Diego, Calif. Sport boats off southern California continued to fish with success from San Clemente Island to the 213 fathom spot, and from 35 miles southwest of Point Loma to the dumping grounds on 12-18 pound fish. Sport boats out of San Diego had good fishing throughout July.

'Jordan' Checks Migration Route

The NMFS 'David Starr Jordan' left San Diego June 28 on a 19-day albacore-oceanography cruise. Its mission was to investigate the migration route of albacore when they enter the North American fishery near the season's beginning. Jordan made its first catches on June 30 about 200 miles west of San Diego on the cruise track to the study area, along longitude 135° W between latitudes 33° and 41° N. Catches along 135° W suggested a southerly distribution of fish.

On July 2, an albacore price settlement of $630 per ton delivered to the canneries was reached. Also, the canners agreed to pay $10 per ton for use in albacore research and scouting. Although the settlement was the earliest in 3 years, most of the fleet did not begin fishing until the second week of July.

As Season Developed

As the boats moved to the fishing grounds, two widely separated fishing areas developed. One was from San Clemente Island to Geronimo Island, Baja California; the most successful location was about 20-40 miles offshore, between Cape Colnett and Geronimo Island. The fishery off Baja California was the best in this area since 1967. On July 5, the 'Sunrise', on a chartered cruise for the Oregon Fish Commission, indicated commercial quantities of albacore 120 miles off Cascade Head to Reedsport in 57°-59° F waters. Boats had good catches there until July 13. The area off Grays Harbor also reported good fishing.

By the end of July, fishing was spotty off Baja California, though deep-running albacore were still present and some bait boats had days of good fishing during the last week of July. As fishing success decreased off southern California, catches increased 50-100 miles west of Eureka on 12-14 pound fish. Also, when weather permitted, boats reported good catches off central California. Fish catch off Newport and La Push increased during the last 10 days of July but dropped on August 1. At the end of July, about 4,000 tons of albacore had been landed on the west coast.

Fishing continued good from Eureka to Crescent City until August 12. Fishing again was reported off Grays Harbor, Cape Flattery, and some off La Push. Except for Cape Flattery area, the fishing in Oregon and Washington was spotty from mid-August until season ended. However, it was learned after the season that Canadian and some U.S. jig boats had very good fishing off Cape St. James on Queen Charlotte Islands for about 2 weeks in August, and good fishing off Vancouver Island's northwest tip during early September and off Estaban Point near end of September.

The Catches of August

By mid-August, the best fishing along U.S. coast was from Morro Bay to Farallon Islands on 9-11 pound fish. Weather continued to affect number of fishing days but, with better weather, a large fleet moved into this area. Average catches were good, but there were very few individual high scores, which was typical of this season's albacore fishery.

Other areas along coast had only spotty catches during last 2 weeks of August. Some fishing was reported in Gorda Seavalley area, but albacore fishing off the southern California area was over by end of first week in August. At end of August, total landings for west coast increased to 12,000 tons.

Most boats fishing off central California in early September were forced into port because of high winds. When winds abated, catches did not reach late-August numbers. Fishing was very spotty on 7-9 pound fish. Spotty fishing continued throughout September all along coast. In September, several boats unloaded fish caught earlier; at end of September, season's total landings were about 21,000 tons.

Albacore Research & Scouting

The American Fishermen's Research Foundation was established by the albacore fishing industry to administer a fund derived from the $10 per ton assessment paid by canners on albacore landed by U.S. fishermen. The Foundation chartered 4 jig boats for albacore research and scouting in cooperation with NMFS La Jolla Laboratory during October. The boats left San Diego October 4. Traveling in pairs, they worked waters out to about 250 miles off west coast between San Diego and San Francisco. Fish were located in relatively large numbers about 175-200 miles off Morro Bay, and in moderate quantities about 150 miles off Point Arguello; however, in most other areas, fishing was slow. The fish located off Morro Bay were small, about 7-9 pounds; those off Point Arguello were of mixed size. Besides trolling for albacore, the vessels collected oceanographic and weather data and tagged 912 albacore. Most of fish tagged, 72%, were 7-8 pounds; 11% were 12-16 pounds. Results of tagging should help NMFS fishery scientists assess proportion of albacore returns to enter U.S. fishery in later years--and what proportion enters Japanese fisheries in central and western Pacific and in coastal waters off Japan. Data collected by the four boats are being analyzed by scientists at the NMFS La Jolla Laboratory.

The albacore season was over by the end of October. Some boats continued to fish, but only small numbers of albacore were caught.

Although exact figures are not available, it appears that more boats fished this season than in past seasons, and that the season was shorter than in 1970. Although total west coast albacore landings were down only slightly from 1970, catches by individual fishermen were estimated to be 5-20% lower.

U.S. & CANADA TO STUDY LAKE ONTARIO

On April 1, 600 U.S. and Canadian scientists and technicians will begin a year-long study of Lake Ontario, the largest investigation ever undertaken of any of the Great Lakes. For 12 months ending March 1973, planes, vessels, buoys, weather stations and balloons will amass data about Lake Ontario and its drainage basin.

The study seeks to analyze completely the lake's biology and physical status--to see how much ecological damage man has inflicted on it, and how future damage can be minimized. The scientists selected Ontario because it is typical of the Great Lakes, excluding Erie. The latter is shallower than the others. What they learn from Ontario may help the other lakes.

The Great Lakes hold about a fifth of the world's supply of unfrozen fresh water.

Deterioration 'Alarming'

Dr. Robert M. White, Administrator of NOAA, which has primary responsibility for the U.S. share of study, said: "Their environmental quality has deteriorated to alarming levels. The Great Lakes and their basins are a high resource vital to the interests and well-being of our two nations. For this reason it is increasingly important that they be managed more effectively."

Lakes' Importance to Canada

J. P. Bruce, Canada Centre for Inland Waters, said 30% of Canada's population and 50% of her industrial production are concentrated in the Great Lakes and St. Lawrence basin. Because of the lakes' importance, they have been studied for at least 10 years, sometimes with U.S. participation.

Although these studies produced much useful information, Bruce noted, they pointed clearly to the need for a much larger effort.

The latest effort is named International Field Year for the Great Lakes. It will cost about $15 million.

U.S. headquarters will be in Rochester, N.Y.; Canada's in Burlington, Ontario.

Background

The project planners said the need for managing the Ontario basin was urgent because: 1) the lake's deterioration was advanced; 2) the coastal region, especially the Canadian, is one of the fastest developing areas of North America. Lake Ontario receives a large load of pollution, mostly from the U.S. side, from Lake Erie and the Niagara River.

Study Goals

The scientists hope that the study findings will lead to better control of pollution, weather forecasting, and better management of lake level and fisheries. Commercial fishing today is in poor condition.

The Study

Smallest of the Great Lakes, Ontario has an area of 7,340 square miles. More than 20 observation buoys and deep-water towers will span it. Five large research vessels--3 Canadian, 2 U.S.--will cruise it. Radar, balloons, and planes will gather data on the basin's atmosphere.

When all the data are processed, the scientists hope to prepare computer models that will predict the effects of proposed changes in the uses or environment of Lake Ontario. Also, they see an early-warning system applicable to the other lakes.

A Soviet Trawler on Georges Bank. (R. K. Brigham)

THE FUTURE OF NEW ENGLAND'S MARINE RESOURCES

Russell T. Norris

To meet our responsibilities in the Northeast Region, we operate research laboratories at Boothbay Harbor, Maine; Gloucester and Woods Hole, Massachusetts; Narragansett, Rhode Island; Milford, Connecticut; Sandy Hook, New Jersey; and Oxford, Maryland. Two high-seas research vessels, the 'Albatross IV' at Woods Hole and the 'Delaware II' at Sandy Hook, and several smaller inshore vessels are utilized by these laboratories. The scientific work in our laboratories is supplemented by such diverse service activities as Enforcement and Surveillance, Statistics and Market News, Economics, Marketing, Financial Assistance, State-Federal Relationships, Water Resource Studies, and Extension.

Although there are many problems facing those interested in the oceans and the utilization of marine resources, I shall discuss only a few of the more important ones--foreign fishing, environmental deterioration, and institutional constraints.

FOREIGN FISHING

We hear much about the great foreign fleets off our shores and probably there is no other single problem which has focused more attention on the ocean. It is indeed a serious matter. The total catch in the Northwest Atlantic increased from 1.8 million metric tons in 1954 to 3.9 million metric tons in 1968. The catch in 1969 decreased slightly, the first time since 1954. The increased catch is almost entirely due to increased fishing by European countries. The United States and Canadian catches in the same period increased from 1.2 million metric tons (67% of total) to only 1.5 million metric tons (38% of total).

Major Fish Stocks

Now what about some of the major stocks of fish? Cod, which has accounted for nearly half the catch in recent years, is now being fished at or beyond the level which will provide the maximum sustained yield. Herring catches increased from 184,000 tons in 1958 to 922,000 tons in 1968, and some stocks of this species are now overfished. In general, the total fish stocks in the Northwest Atlantic cannot withstand further increases in fishing without being overexploited to the extent of reducing actual yields. Specific stocks in waters fished by the United States, some of which form the primary markets in New England, have been affected greatly by increased foreign fishing. I refer especially to haddock and yellowtail flounder.

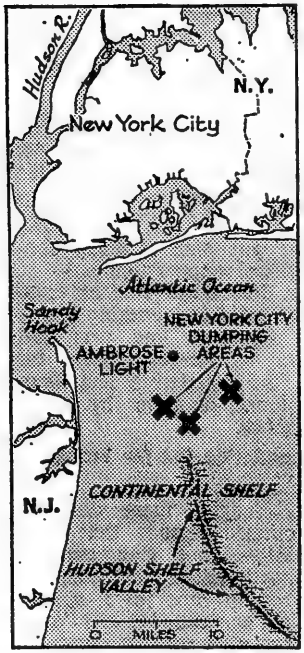
Haddock

The stocks of haddock off New England and southern Nova Scotia supported a U.S. fishery of prime importance since the late 1920s. The haddock population off New England, on Georges Bank, was of particular importance. From 1935 to 1964, the annual catch taken entirely by U. S. fishermen varied from 30,000 to 60,000 metric tons. By 1961, biological studies indicated that the maximum sustainable yield was about 50,000 metric tons, which was very near the actual catches at the time.

In 1963, production and survival of young fish were extremely good. This very abundant year-class entered the exploited phase in the second half of 1965. The high abundance attracted the Soviet Fleet and, over a period of 18 months, the Soviets caught 180,000 metric tons. A significant part of this catch in 1965 consisted of fish smaller than that taken by the regulation $4\frac{1}{2}$-inch mesh. Thus, the U. S. fishery, which did not start significant exploitation of this year-class until 1966 did not realize very much benefit in increased catch rate.

By 1964, Canada had also increased its fishery on Georges Bank haddock. So, during 1964-1966, the fishing mortality had doubled. Year-class production from 1965 to date has been very poor. The combination of heavy fishing and poor recruitment caused the stock to decline by 1969 to 25% of the level

The author is Regional Director, Northeast Region, NMFS. This article is nearly all of his talk at the Environmental Action Symposium, Museum of Science, Boston, Mass., Dec. 2, 1971.



that produced the 50,000 ton sustained yield. In 1969, the catch with unrestricted fishing was 25,000 metric tons. An international quota was established to limit catches in 1970 and 1971 to 12,000 metric tons. This will be further reduced to 6,000 tons in 1972. Even this limited catch is greater than current production--so no improvement in stock density is expected for several years at least.

Yellowtail Flounder

The stocks of yellowtail flounder off New England have supported a U. S. fishery since the late 1930s. It has been of increasing importance since the late 1950s. From 1961 to 1969, the U. S. catch ranged from 25,000 to 50,000 metric tons, exceeding, in some years, the maximum sustainable yield. Prior to 1969, the foreign catch was small. However, in that year, the foreign catch, essentially Soviet, was 20,000 metric tons. This caused the resulting effort to be double what the stocks can probably support. Strong 1966 and 1967 year-classes have been followed by lesser ones. The increased catch in 1969 would be expected to have reduced the stock size, and the 1970 survey cruises indicate this may be the case.

ENVIRONMENTAL DETERIORATION

Now let us focus on environmental deterioration and its effects on living marine resources. Unfortunately, most of my remarks will deal with areas outside New England, specifically the New York Bight, because our organization has been actively engaged there. However, I suspect that many of the same conditions prevail in New England.

For some time, the New York Bight has served as the ocean disposal area for unbelievable quantities of sewer sludge and contaminated dredging spoils. For example, every day one billion gallons of raw industrial and domestic sewage flows under the Verrazano Bridge (the world's longest suspension bridge connecting Staten Island to Brooklyn--Ed.). This current practice of disposal has had serious effects on the living resources of the Bight. Important bottom-dwelling forage species used as food by finfish have been eliminated from an area of over 20 square miles.

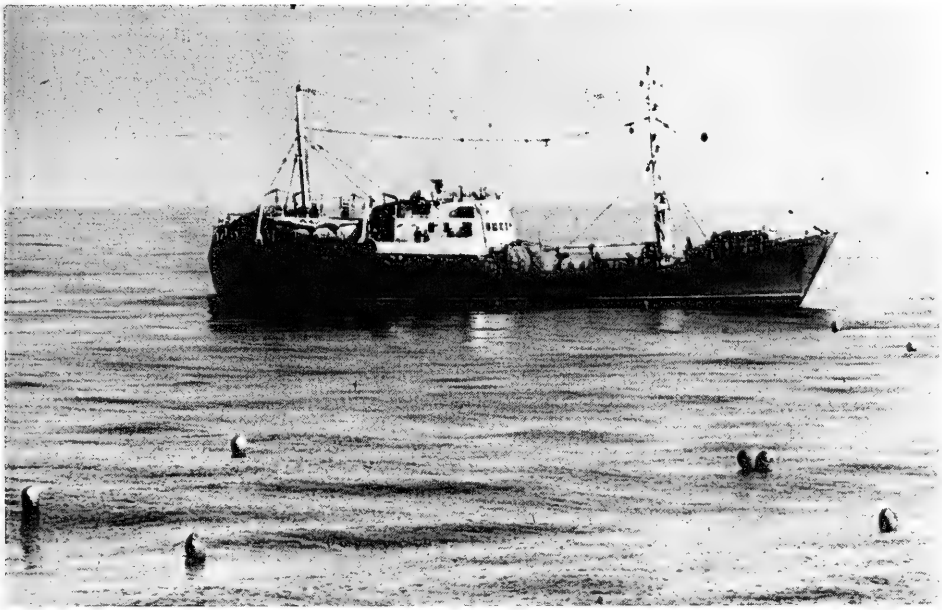
Recently, large areas have been closed to the harvesting of the surf clam, economically one of the Nation's most important shellfish. With its distribution limited essentially to the coastal waters of the New York Bight, this resource is very vulnerable to contamination and subsequent closure to harvesting.

Effects on Marine Life

Even more important than the public health effects of environmental deterioration is the continued gross decline of water quality in estuarine and coastal environments and its effect on their carrying capacity for marine life. This has not occurred without adequate warnings. Government publications in 1887 noted that water quality in Newark Bay (N.J.) had reached a point where fishermen could no longer sell finfish or shellfish taken there--they tasted of coal oil. Three decades later, a Rutgers University (N.J.) professor warned that unless the waters of Raritan Bay were cleared of industrial and domestic wastes--in particular, heavy metals--society would see the decline and disappearance of the oyster beds and other shellfish in that bay. Only a decade later, his prophecy was fulfilled.

Today we witness the exportation of these conditions to offshore coastal shellfish beds and environments. The New York Bight is characterized by sediments containing several hundred parts per million (ppm) of copper, chromium, lead, and zinc. The effects of these metals and other wastes on bivalves, lobsters, crabs, and other invertebrates are not thoroughly understood, but preliminary observations, measurements, and experiments indicate that something should be done now, not a decade from 1971. The earlier unheeded warning should be ample evidence for this.

In addition to the actual contamination of coastal waterways and estuaries in recent years, man has physically damaged these environments through dredging, filling, and



A Soviet drifter-trawler at the Northern Edge of Georges Bank hauls its gill nets. The large balloon floats visible on surface are attached to float lines of nets.

bulkheading activities. In doing this, he conspicuously removed breeding and nursery areas and disturbed shellfish beds. All of this was done in the name of progress or "improving" waste marshland.

Oil on Georges Bank

Coming back to New England, we hear much about oil on Georges Bank. Oil companies are apparently interested in exploring and possibly developing these resources. This is a very complex situation: the oil interests are looking at what are reported to be vast resources--and the fishing industry, already beleaguered with other problems, views oil exploration as a serious threat to its livelihood. It is concerned about possible spills and physical obstructions on the bottom. While these concerns are very real, fishing interests in the Gulf of Mexico have managed to co-exist with large oil and gas developments.

PROBLEMS CREATED BY INSTITUTIONS

The third problem area has received much attention of late in our organization. Certainly, something must be done to assure our fishermen access to the resources off our shores, and environmental quality must be improved and maintained. However, we in NMFS believe that major root problems of the commercial fishing industry, and to some extent the recreational fishery, are created by and are a part of the institutional arrangements within which we must function today. I refer broadly to the established laws, customs, traditions, organizations, and group behavior associated with the utilization and management of our fisheries.

Common Property

One element of this institutional setting which is particularly guilty of creating problems is the common-property basis for allocating fishery resources both among countries internationally and among users domestically. For many years in the past, this open-access principle posed no serious problems so long as there were relatively few people (or countries) interested in fishing what then appeared to be relatively plentiful resources. As the numbers of fishermen and countries who want to fish a rather fixed amount of resources have continued to increase, however, we have experienced some critical allocation problems. At worst, under these conditions of growing numbers of participants, our regulatory mechanism has failed us. We have been unable to control fishing effort and the result has been overfishing. At best, we have been able to control total effort, but we have accomplished this by applying increasingly severe regulations that impose inefficiencies and high costs on too many units of effort. The result has been overcapitalization and depressed economic conditions.

Constraints of Common-Property Status

The common-property status of the resource has constrained us in other ways. It has taken away much of the incentive of the individual in private enterprise to help protect or conserve the resource--for what is conserved by one fisherman will be taken by another. It has instilled in the individual an unwillingness or reluctance to abide by regulations because conservation regulations usually create inefficiencies and high costs and undermine the economic viability of commercial fishing. It has taken away much of the incentive to innovate or develop new technology. New technology usually means the ability to catch more fish. This, in turn, means the imposition of additional laws so that more fish will not be caught. Each technological development in practice has been rendered ineffective by the implementation of offsetting regulations, which are required to protect the resource.

For these reasons, the common-property mechanism for allocating fishery resources among countries, among states, and among individuals has failed us. It was for some of these same reasons that we broke away from this concept long ago in agriculture and created private property rights as a means of allocating land, grazing rights, and water rights. For these same reasons, in my view, we are going to have to break out of this tradition in allocating fishery resources also. I am willing to speculate that until or unless we do this, commercial fishing will be inclined toward depression, and allocational disputes will actually increase in number and in severity.

Jurisdictional Split In Managing Fisheries

Another institutional constraint that hampers the optimum utilization and management of fisheries is the jurisdictional split in managing fisheries. How can we possibly regulate a fishery resource when part of it may lie within the 3-mile territorial waters of two or more states, part may be in the contiguous zone where no one, to date, has exercised full jurisdiction, and part may be located beyond 12 miles where many countries can fish it. To this day, states generally have no power outside their narrow territorial waters over fishermen landing in other states or in other countries, although recent action by Governor Sargent would seem to indicate that Massachusetts would like to change this. The Federal Government has chosen not to exercise power over domestic fishermen outside 3 miles unless these fishermen are fishing a resource under international agreement. International organizations or agreements for managing fisheries are slow and awkward in their operations. Very seldom is there a regulation bold or timely enough to be fully effective. Most regulations that finally come out of this obsolete maze of jurisdictional complexity are a compromise where political considerations often outweigh conservation, economic, and social considerations.

FUTURE OF LIVING MARINE RESOURCES

Now what does the future hold for our living marine resources? Although the National Marine Fisheries Service cannot solve all the problems discussed here, I want to tell you what is being done, within NMFS and on other fronts.

First, the foreign fishing situation. Until 1961, Georges Bank, one of the world's richest fishing grounds located just off our shores, was almost exclusively fished by U. S. vessels, although Canadian scallopers were taking increasing amounts of that ocean shellfish. The exploratory vessels of the Soviet Union first appeared early in 1961. The Soviet fleet grew, along with vessels from other European nations. At times there have been about 300 vessels from 7 or 8 nations fishing these grounds at the same time. Reports from our most recent surveillance flights indicate substantial numbers there today. In fact, it is not uncommon to see a fleet of over 100 large vessels from half a dozen nations concentrated within a 10-mile radius competing for sea herring.

ICNAF Established

Over two decades ago, the International Commission for the Northwest Atlantic Fisheries (ICNAF) was established to investigate, protect, and conserve the fisheries of the Northwest Atlantic Ocean. Fifteen nations, including the United States, are now members. Mesh regulations for cod and haddock went into effect under ICNAF in 1953. These contributed to the conservation of the stocks for several years during a stable fishery. The regulations failed in 1965, however, with the dramatic increase in fishing pressure. Many New England fishermen do not think ICNAF has served their interests very well, and some have suggested that the United States withdraw. Some of us think this would be a mistake, for ICNAF, with all its deficiencies, is the best tool we have at the present time.

Can ICNAF Do More?

What more can be done under ICNAF? International quotas have been established. This is a step in the right direction, even though it is too late.

A new protocol is now nearing adoption within ICNAF which, among other things, will allow for national quotas. Schemes for allocating catches to nations based on historical fishing patterns, coastal state needs, and allowing for developing fishing countries have been generally accepted by the member nations. This will be a big advance in international fisheries management.

However, these actions, under ICNAF, both implemented and proposed, do not satisfy the demands of U.S. fishermen and conservationists. This is understandable because international machinery moves slowly, and these new tools are coming after much damage has been done to the stocks.

Pressure For 200-Mile Jurisdiction

Many people interested in the oceans and the fisheries advocate unilateral action by the United States to declare extended jurisdiction

to 200 miles, to the edge of the continental shelf, or to the 100-fathom curve. Fishing interests in New England particularly are adamant that such action must be taken. There is considerable support for the position in some other parts of the nation, but the fishing industry has not always been unanimous in supporting this position. For example, some of our distant-water fleets fish off the shores of other nations. Their operators and fishermen believe extended jurisdiction by the United States would trigger retaliatory action and restrict their fishing.

1973 Law of Sea Conference

A third Law of the Sea Conference is scheduled for Geneva in 1973. NOAA is playing a very active role in preparing the U. S. Government position. Members of the fishing industry are being consulted. It appears that industry in various sections of the country is nearing agreement on a position that will be acceptable to all. Of course, fishing represents only one small part of broad discussions at Geneva on uses of the oceans. For example, the Department of Defense becomes deeply involved when a proposed broadening of the territorial sea might restrict the movements of the U.S. Navy or Air Force.

It is my opinion that our Government will not take any action in the foreseeable future to extend jurisdiction beyond the present 12-mile fishing zone.

What NMFS Is Doing

Through a major realignment of programs in NMFS, we are directing substantial new efforts towards the problems I have mentioned. Our Woods Hole Laboratory is accelerating ongoing efforts, including joint research cruises with the Soviet Union, to assure that adequate information will be available for our negotiators at the conference table when national allocations of fish stocks off our shores are decided. Furthermore, we nearly doubled our enforcement and surveillance activities in New England in 1971 to get a continuing record of the foreign effort and to be better able to enforce ICNAF regulations. The recently adopted International Inspection System under ICNAF is a fine new tool that allows our agents to board foreign vessels.

We have recently reprogrammed substantial amounts of money, which is augmented by new appropriations for our laboratories in Milford, Connecticut; Sandy Hook, New Jersey; and Oxford, Maryland. These new programs will be aimed at determining the effects of environmental deterioration and alteration on marine sport and commercial fishes. Work has been underway for some time in the New York Bight. It will be expanded initially into Long Island Sound and, ultimately, into other areas. Since some species, such as bluefish and striped bass, are migratory in nature and may be found from Cape Hatteras, N.C., to north of Cape Cod, Mass., our studies have broad applicability.

Concerning the result of institutional arrangements, we in NMFS are placing top priority on a new initiative to attack these root problems of our fisheries. We hope this will be a fully integrated and cooperative effort with the several states. We believe it is the responsibility of state and Federal governments and of leaders in industry and the academic community to address these problems.

The overall mission of this cooperative effort is to seek workable alternatives to some of these institutional constraints--particularly the common-property problem, and the split jurisdiction over fishery resources. Any solution of these deep-rooted domestic problems will require simultaneous action regarding stabilization of the international situation. It is our intention to move forward on both fronts so, when some national allocation of ocean resources is agreed upon, we shall be ready to manage our domestic fisheries, both recreational and commercial, most efficiently.

Efforts Will Bear Fruit

While the future of New England's living marine resources does not appear bright at the moment, we in NMFS are moving ahead aggressively in several directions. I am confident that these efforts and those of others will eventually bear fruit--and that Americans, whether commercial fishermen or sport fishermen, will be able to share in the bounty of the sea.

U.S. SHRIMP FLEET'S RECORD-SETTING CATCHES CONTINUE

In 1971 U.S. shrimp fishermen caught about 10 million pounds more than they had in 1970. It was their third consecutive record year. The 1971 preliminary figure was a little over 234 million pounds, heads-off weight.

Shrimp catches in the Gulf of Mexico and the South Atlantic accounted for 66% of the 1971 catch. These areas have produced large catches during the past 5 years.

The Alaskan shrimp catch has increased over 300% since 1966 and now represents about 25% of the total.

3 States Produced 70%

Three States--Alaska, Louisiana, and Texas--produced 70% of the total.

About 6% of the shrimp are taken off the Northeast, and 3% off Washington and Oregon.

Three species--white, pink, and brown--form the catch in the Gulf and South Atlantic; only a smaller, different species of pink shrimp is taken off Alaska, the Northeast, and Oregon and Washington. In the Gulf, shrimp are an annual crop. Off Alaska, the Northeast, and Washington and Oregon, they are not harvested until they are 3 to 5 years old.

In some areas shrimp are landed with their heads on. The figures given here have been converted to heads-off weight.

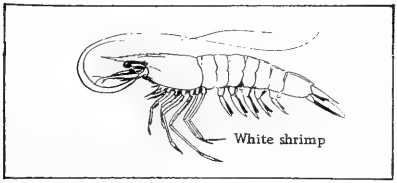
Most Valuable Species

NMFS Director Philip M. Roedel stated that shrimp are the most valuable commercial species--in 1971, worth $166.2 million to the fishermen.

"The increasing catch may be attributed primarily to an abundant resource, and to the growing number of vessels in the shrimp fishery, mostly in Alaska and in the Gulf of Mexico.

"However, it takes more than a plentiful resource and an aggressive fishing fleet to achieve the present status of the shrimp industry. Shrimp has long been one of our most popular seafoods, with more than a million pounds consumed every day in the United States. The processing and marketing segments of the industry have shown great imagination in providing consumers a wide variety of attractive products, including fresh, frozen, canned and breaded shrimp.

"All these factors contribute to the continuing strong market for shrimp and shrimp products."


White shrimp

ALASKA'S SHRIMP CATCH TOPS 100 MILLION POUNDS

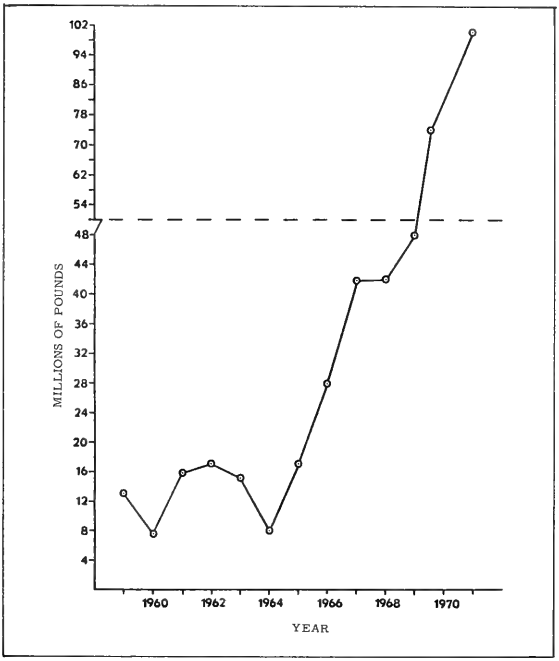
In 1971, Alaska's shrimp catch exceeded 100 million pounds. This climaxed a steady upward trend that started in 1964 (see figure).

Almost all the increase over the 1970 catch of 74 million pounds was due to the growth of the Kodiak Island pink-shrimp fishery. The number of shrimp processors in Kodiak increased from 4 in 1970 to 8 in 1971; the number of vessels from 20 to 40. The annual catch for some high-line vessels was close to 10 million pounds.

In April 1971, a 58-million pound annual quota was established in historic inshore shrimp-producing areas. This quota will not be met because most of the 1971 increase was from a nonquota area--the Marmot Bay region. The catch rate in this region through August 1971 was 4,459 pounds per hour.

Shrimp-Management Problem

Refined scientific methods for managing pandalid shrimp essentially do not exist in the circumpolar areas of the world where they are harvested. All pandalid shrimp change to females after spending the early part of their lives as males. This could lead to an unstable resource condition because the fishery operates almost exclusively on females, say NMFS Alaska Region personnel. "This condition may not be apparent, however, until it shows in depressed levels of future recruitment."



Annual shrimp landings in Alaska 1959-1971. Source: Alaska Department of Fish and Game, Nov. 1971.

ALASKA'S NO. 2 CATCH IS KODIAK SHRIMP

The shrimp fishery in the Kodiak Island, Alaska, area produced 80 million pounds in 1971, second only to salmon in Alaska's catch figures. The number of shrimp vessels rose from 16-18 in 1970 to 45-50 in 1971. Five new plants nearly doubled the processing industry's capacity.

In 1970, local fishermen recommended to Alaska's Department of Fish and Game that it establish a quarterly quota for shrimp catches in each major inshore fishing area. The Department did. It had 2 goals: to establish a basis for conservation, and to encourage exploration in new areas after inshore quotas were filled. Fishermen credit the quota system with providing the incentive that developed, in 1971, the new grounds in Marmot Gully, southeast of Kodiak Island.

Catch per unit of effort on established fishing grounds was somewhat less than in 1970; it was the highest on the new grounds. More than 20 million pounds of shrimp were taken from Marmot Gully in 1971. But as winter progressed, fishing became increasingly difficult in this exposed offshore area.

Concern About Stocks

Biologist are concerned that this catch already may exceed the maximum sustained yield for Kodiak stocks. They anticipate a rapid shift to new stocks. But where will new stocks be found? Results of joint research by NMFS, Alaska, and Soviet's 'Krill' in 1971 discouraged hope that significant new shrimp stocks will be found offshore, south of Kodiak Island on Albatross Bank. However, Soviet commercial efforts on Portlock Bank each spring in recent years suggest that offshore area beyond Marmot Gully may prove productive to those boats capable of fishing there. In 1972, NMFS plans to expand its research effort on northern shrimp. It will be coordinated carefully with industry and Alaska.

U.S. COOPERATES WITH USSR IN SURVEY OFF CALIFORNIA

On February 16, the 270-foot Soviet research vessel ALBA docked in San Pedro, Calif. It took aboard a U.S. scientist as an observer and its scientists discussed plans for the cooperative winter study of the distribution of hake spawning stocks off central and northern California. The vessel is operated by the Far Eastern Seas Fisheries Research Institute (TINRO) of Vladivostok. This was announced by Izadore Barrett, Acting Director of NOAA's National Marine Fisheries Service Southwest Fisheries Center in La Jolla, Calif.

The U.S. observer aboard the ALBA is James R. Trailkill, fishery biologist at the NMFS Southwest Fisheries Center. He is working with Soviet technicians to familiarize them with U.S. equipment and techniques for collecting samples and to assure standardization of sampling methods. The ALBA carries a crew of 72. Its scientific leader is Mikhail Stepanenko.

Continuing Research

Barrett said assignment of the ALBA to the 1972 research program was made at the annual meeting of U.S. and Soviet scientists in Seattle, Washington, November 1971. Both sides agreed on the necessity to continue studies on the life history, distribution, and abundance of the Pacific hake and Pacific ocean perch. These studies have been conducted cooperatively under the bilateral fisheries agreement since 1969.

ALBA's Role

The ALBA will conduct a fish egg and larva survey off Pt. Conception to the Oregon border for 15-18 days following tracklines supplied by the La Jolla Center. In addition to the ALBA, the NMFS research vessel, DAVID STARR JORDAN, the California Department of Fish and Game vessel, ALASKA, and the Scripps Institution of Oceanography research vessel, ALEXANDER AGASSIZ, will join in the cooperative survey, extending the area of exploration to south of Baja California.

In recent years, Barrett explained, hake have been fished by the Soviet fleet. Information about the resource is necessary to provide both nations with the scientific bases for agreements that will protect the fish.

NOAA WILL CHART ALASKAN WATERS & STUDY FISH RESOURCES

Twelve NOAA ships and an aerial photo plane will survey Alaskan waters this year, Howard W. Pollock, NOAA Deputy Administrator, announced on February 1. Purposes are to provide data for detailed up-to-date charts--and to conduct fish-resource studies for Alaska's increased marine activities and economic development.

NOAA's National Ocean Survey will operate 5 ships and the plane; NMFS will operate 7 ships.

New, large-scale, nautical charts of the narrow southeast Alaska waters are needed by all commercial and private vessels. The fishing, mining, forestry, and tourist industries have requested them.

NMFS Fish-Research Surveys

These NMFS vessels will conduct the fish-research surveys:

'Pribilof' will make 4 round trips between St. Paul in the Aleutians and her home port of Seattle, Wash., to transport supplies, return seal skins, and to carry high school students to and from winter classes.

'Oregon' will work out of Kodiak Island with special "separator" shrimp trawls around Shumagin Island in the Gulf of Alaska. These trawls are being developed to separate directly shrimp from small fish and other undesirable matter; now, the whole catch is brought aboard and separated by hand. Also, 'Oregon' will cruise to the Bering Sea to purse seine for salmon, test bottom trawls for crab and bottomfish, and take oceanographic observations.

'George B. Kelez' of Seattle will cruise south of Alaska Peninsula and to area of Aleutian Islands to assess salmon distribution. The information will be used to predict relative abundance of salmon and possible spawning-run strength.

'John N. Cobb' will work from Seattle into southern Alaskan waters to investigate groundfish abundance. This information will define further the relatively unused stocks of fish there.

'Miller Freeman' will be reactivated and may be able to conduct one survey of fish eggs and larvae in Alaskan waters during 1972.

'Murre II' will work out of Auke Bay, Alaska, and 'Cripple Creek' out of Kodiak Island in support of local biological and experimental fishing programs of their laboratories.

EXPERIMENTAL DRUM SEINING FOR WETFISH IN CALIFORNIA

F. J. Hester, D. A. Aasted, and R. E. Green

The authors consider the problem of operating a vessel profitably in a fishery for a fixed-price resource. They believe that more profit can be made by increasing the efficiency of vessel operation, thereby increasing landings, and by decreasing manpower through mechanization. In this study, purse-seining operations were mechanized by using a hydraulically powered drum to handle the net and a fish pump to load the fish. This increased operating efficiency by lessening time required to catch the fish--and by decreasing manpower required for the vessel operation. The experiments showed that the cost of mechanizing could be offset by recovery from the crew's share of the catch while increasing wages for the remaining crewmen.

THE PROBLEM

The San Pedro wetfish purse-seine fishery is the last major stronghold of the former California sardine fleet. Wetfish is a collective term for those species--anchovy, sardine, mackerel, and squid--used for canning and reduction that are bulk-loaded in the round, usually not refrigerated, and generally off-loaded with a suction pump. The vessels in this fishery are mainly ex-sardine seiners 45 to 90 feet long with carrying capacities of 25 to 150 short tons. About 24 of these vessels operate within a 100-mile radius from San Pedro, California. Perrin and Noetzel (1970) showed that this fishery was becoming increasingly unprofitable primarily because of rising costs of operations and demands for higher wages--while prices for the raw materials remained nearly constant. This situation is fairly common in countries where the standard of living is rising at a rapid rate and raw products prices, controlled by world markets, tend to rise at a lesser rate. The solution is to increase the productive efficiency of the operating units by increasing the production per unit of operating time and by decreasing the cost of operation. Such changes in efficiency can be realized in a number of ways, including increasing the size and speed of the vessels, changing fishing strategy, and mechanizing the operation to use manpower more efficiently. In the case of the San Pedro wetfish fleet, each of these approaches was considered.

The first was rejected for the time being because it was felt that the necessary capital for improved vessel design would not be forthcoming until the fishery's profitability was more apparent. The second could be a lengthy project, using operations research methods, and would require many logbook-type operating data over a long period. Such data are not now readily available (Petrich, 1965). It is the last of these three--mechanization--which will be reported here.

Cooperative Group Formed

In September 1969, a cooperative group known as the Wetfish Operation Pool was formed within the California Marine Research Committee. It comprises California's Department of Fish and Game, the Fishermen's Cooperative Association of San Pedro, the Fishermen's Unions, and the Operations

F. J. Hester is Director and D. A. Aasted is a Fishery Methods and Equipment Specialist, NMFS, Southwest Fisheries Center, Honolulu Laboratory, Honolulu, Hawaii 96812; R. E. Green is a Fishery Biologist, NMFS, Tiburon Fisheries Laboratory, Tiburon, California 94920.

COMMERCIAL FISHERIES REVIEW
Reprint No. 926

Research Group of the National Marine Fisheries Service, La Jolla, California. This pool, under a joint funding arrangement, chartered a San Pedro wetfish boat, 'Sunset', to experiment with mechanizing the fishing operation. The objective was to reduce by 40 to 50% the number of men required for working the vessel. Additional advantages sought were to decrease the time of the fishing operation, especially desirable for species available to the gear for only limited times during the day, and to develop a safer and less backbreaking method.

MECHANIZATION OF PURSE-SEINE OPERATIONS

A review of world purse-seining methods shows methods for handling the different phases of this fishing which, if combined, probably could achieve the desired results. These include a seine drum for reducing labor in handling the net, net modifications to permit easier handling of the catch, and pumping devices to load fish from net to vessel. It is hard to say what innovation has had the greatest effect upon purse seining but, quite likely, it would be one of the mechanical methods of handling the net.

Purse seining has developed from a completely mamual operation through an intermediate phase using powered roller to ease pulling the net--to, more recently, the introduction of side haulers, power blocks, or the net drum. The power block and the net drum originated at about the same time in the Pacific Northwest.

The power block, invented by Mario Puretic of San Pedro, California, revolutionized the handling of purse seines and has achieved worldwide recognition.

The drum seine, an invention of Nick Kelly from British Columbia (Philips, 1971), has not received the same acceptance for several reasons. The drum, because of its extremely rapid net-retrieving capability, was outlawed from the Alaskan salmon fishery as a conservation measure, whereas the Puretic block was legal and gained rapid acceptance. The drum was legal, however, in Canada and in the Washington salmon fishery, where it was accepted by boats that did not spend part of their time fishing in Alaskan waters. The power block has greater versatility with the type of net it can handle and is less costly to instal. However, vessels that used the drum have been very satisfied with its performance and recommend it over the block.

The drum appeared ideal for our needs with the San Pedro wetfish experiment. This was because the crew requirements were not dictated by the need for sufficient manpower to stand watches and repair gear on extended voyages. These vessels seldom are away from port for more than 24 hours. Second, the drum would reduce considerably the time in the set. It is a very important point because several principal wetfish species show near the surface only for a short time during day or night. The ability to make several sets in rapid succession may mean the difference between a partial or full load for the vessel.

Basically, the drum is a large reel powered either mechanically from the main engine or by a hydraulic motor. A purse seine is wound on the drum with the purse line left threaded through the purse rings. In addition to the drum, a mechanically or hydraulically driven level wind is used consisting of two upright rollers through which the net passes as it is retrieved.

In some vessels, the drum and level wind are installed on a rotating table so the net can be set over the stern and retrieved over the side. There are pros and cons to this innovation. Whether or not the benefits warrant the additional installation cost should be studied. We selected a drum installation consisting of a fixed drum with a level wind across the stern.

Fish Pump

The second major item of equipment gaining wide acceptance in purse seining is the fish pump. Several models are available. We chose for its ready availability the Marco[1] capsule pump. Fish pumps can load fish more rapidly than the conventional brailing net. Also, they require less manpower and eliminate the safety hazards of brailing.

[1] Use of trade names throughout this article does not imply endorsement by the National Marine Fisheries Service.

In addition to drum and pump, we incorporated into our experiment a hydraulically powered, reel-type pursing winch; a boom to handle corklines; and a "ring stripper" that automatically feeds the purse rings on to the drum during retrieval phase of operation.

DESCRIPTION OF SAN PEDRO INSTALLATION

The vessel made available to the Wetfish Operation Pool under a charter arrangement was M/V Sunset, a former California sardine seiner. It is of wooden construction with overall length of 90 feet, beam of 21 feet, and carrying capacity of approximately 150 tons. Sunset is powered by a 250-hp diesel producing a cruising speed of about 9 knots.

When delivered to us, she was rigged for wetfish seining with a power block driven by a small hydraulic pump running off the main engine. Other deck machinery included a mechanically driven double capstan winch for pursing and brailing. Because the existing hydraulic system was too small to handle the proposed additions to the machinery, the first modification was installation of an auxiliary engine and a 100-gallon per minute (gpm), 1800 psi hydraulic system. The auxiliary was a General Motors 160 hp. 6-71 diesel engine driving stacked 60- and 40-gpm hydraulic pumps off the power takeoff. In addition, a separate 30-gpm pump was mounted off the shaft. The 60-gpm pump was to drive the drum and fish pump; the 40-gpm pump was used for the winch, and the 30-gpm pump was used to operate the level wind.

The next modification was to attach a "beaver tail" (Fig. 1) to the shoe to protect rudder and propeller from the net. Beaver tails are commonly used in the Northwest

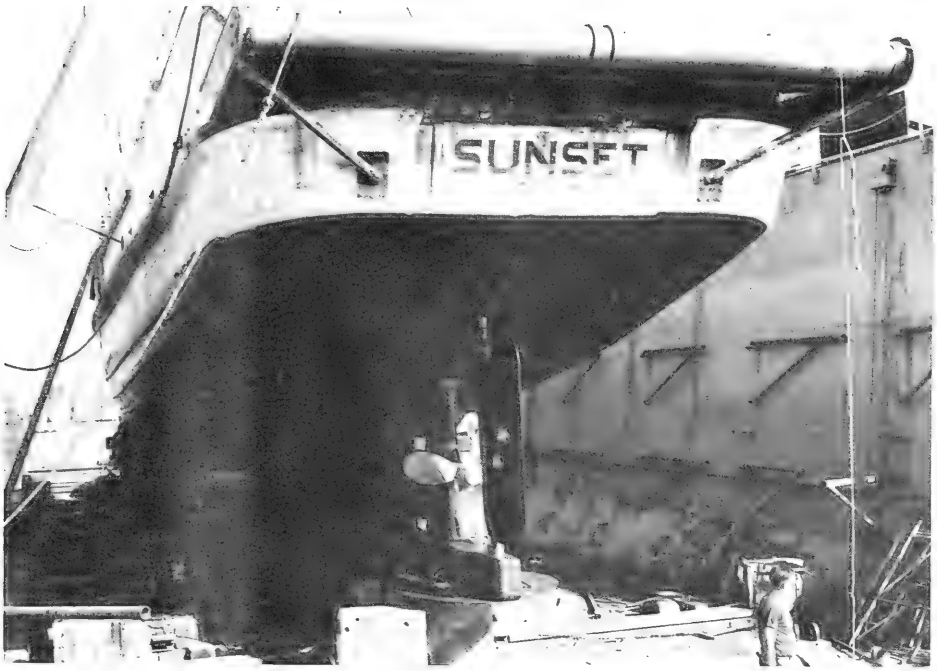


Fig. 1 - "Beaver tail" shown installed to bottom of shoe. Stern idling roller is also shown installed. (D. Aasted)

but have not found their way into our wetfish fleet. Because of the drum, the net passes over the counter and down the side of the vessel, and some protection is needed to keep the webbing from becoming tangled up in the propeller.

The third modification was to remove the turntable from the stern and to fabricate and instal in its stead the drum and level wind (Fig. 2). This unit was designed and built by Post Point Marine of Bellingham, Washington. The drum is aluminum with 8-foot diameter flanges and an 11-foot length core, 22 inches in diameter. The drum is driven by two Hydrostar hydraulic motors. The level wind consisted of two upright rollers mounted in a track across the stern. The level wind is driven by a chain and cable arrangement from a hydraulically powered sprocket. The controls for the drum and level line are mounted on the portside of the drum to allow operator a good view of the net. A complete hydraulic system diagram for Sunset is given in Figure 3.

The existing double capstan winch formerly used for pursing was removed and replaced by a hydraulically powered double drum dragging-seine winch. Because the tow line for the net is wrapped on the core of the drum, only two drums are needed for the pursing winch if the net is to be operated full-pursed; in practice, we operate the net half-pursed so that only one drum is used.

Fish Pump & Separator

The fish pump selected was a Marco U-235, 10-inch capsule pump. To handle it, we installed a 24-foot boom from which we also handled the corks of the fish bag. The wire basket-type fish-water separator was mounted on the starboard side adjacent to the opening to the fish hatch. This pump and separator had previously been tested aboard the vessels NEW ROMA, Monterey, California, and S. T. GUISSEPPI, San Pedro; it was satisfactory provided sufficient hydraulic capacity from the vessel was available.

Fig. 2 - Drum and level wind on M/V Sunset. (R. Green)

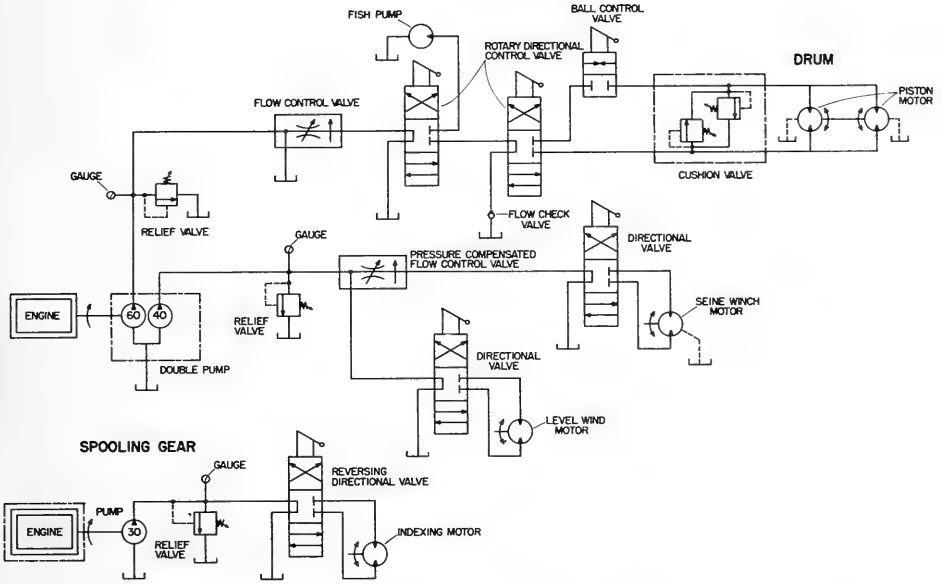


Fig. 3 - Diagram of hydraulics system installed on M/V Sunset.

A Whaley Engineering ring stripper was installed on the portside just aft of the pursing davit (Fig. 4). This ring stripper is described by Green, Perrin and Petrich (in press); it has replaced similar devices throughout the Northwest, including the "hairpin" in which the rings are suspended from the mast. When properly positioned, the ring stripper holds all purse rings during retrieval. It allows purse line to run freely through them while feeding off one ring at a time as net is retrieved.

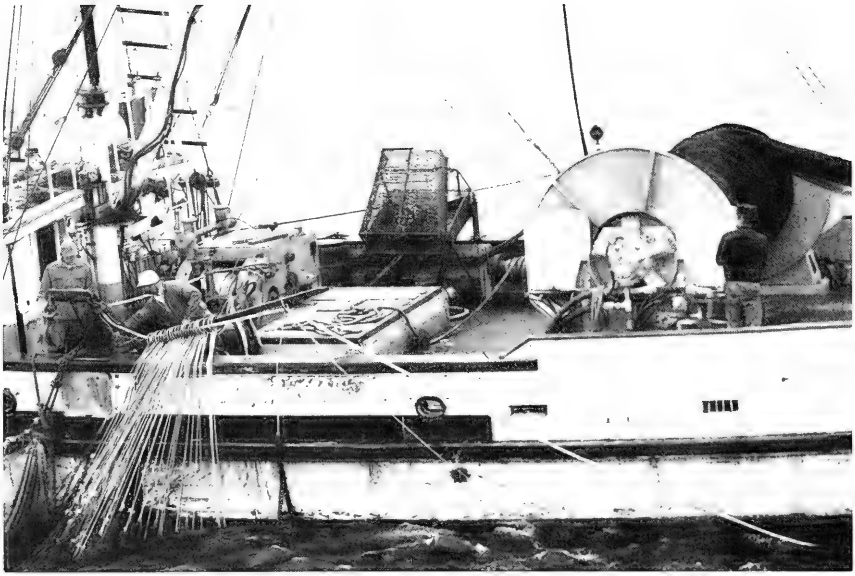
The Net

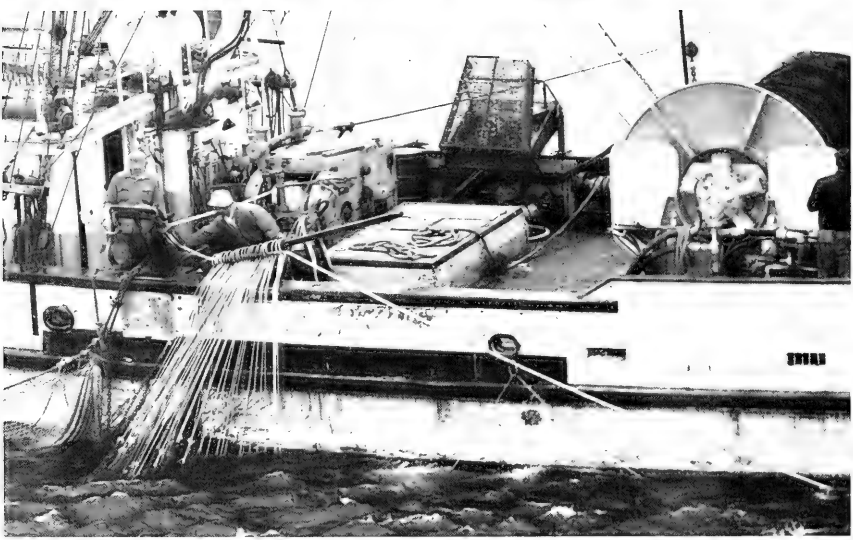
The net used by Sunset was designed for anchovy. Modifications to adapt it for drum seining involved replacing bridles with $\frac{1}{2}$-inch-diameter polydac rope, smaller diameter brass or stainless steel rings, and a synthetic rope purse line. The purse line consists of 50 fathoms of $1\frac{1}{4}$-inch-diameter braided nylon in area of main wear, followed by 150 fathoms of 1-inch diameter. The smaller brass or stainless steel rings are preferred because they are less abrasive to the synthetic rope than are iron purse rings. Rope bridles are preferred to chain because they reduce possibility of bridles becoming tangled in net as it is wrapped on the drum, and they do not rust. The chain leadline was left unchanged.

Because of the large compressive force on the part of the net near the core of the drum, it was necessary to remove the corks from that half of corkline and to mount them on a separate corkline to reduce breakage. We replaced the spongex corks with Sanyo, and later with Swedish floats, model 6215, which proved more resistant to the crushing forces. Finally, pucker rings were added to top of fish bag so floatline above bag could be gathered together and suspended from the boom; this obviated need for skiff to come alongside to support corks.

OPERATION

The initial problem of loading net on drum was attacked by stacking net on stern in usual fashion, setting it in a straight line, and reeling it onto the drum. The net, when stacked, presents an awesome pile which does not look





Figs. 4A & B - Ring stripper in operation. Ring on stripper in top photo (4A) has slipped in 4B. Purse line is feeding through rings. (R. Green)

as though it would fit on the drum. However, as the net winds on under tension, the volume is reduced by at least a third. When the net is set from the pile in a straight line, the purse line is allowed to run out, threaded through the rings so that both net and purse line can then be wound on drum. When setting from the drum (Fig. 5), a few fathoms of the bag are left free on deck and attached to seine skiff in usual fashion. Several seconds pass before inertia of the drum can be overcome and the net begins to pay out. The few fathoms of webbing in the water provides additional resistance that would not be available from skiff alone.

Fig. 5 - The start of a set. Skiff has been dropped and net drum is free wheeling. (R. Green)

When setting from the drum, the greatest hazard is the possibility of a backlash. It requires an alert operator to keep a slight tension on the drum at all times. Make sure that sticks and other stiff objects are not caught in the webbing where they could hold two layers of the net together on the drum. If these precautions are rigorously observed, chances of blacklash are very slight. However, because of this possibility, it is advisable to leave power skiff attached by its bow to the net until about a quarter of net is off the drum. Otherwise, if a backlash should occur while the skiff is turning and is broadside to the net, the skiff may be swamped. A tow line is wrapped on the core of the drum to allow setting in a larger circle than net will encompass.

Once tow line has been retrieved, the other end of purse line can be brought forward to the winch; or, if the net is partially pursed, as we have been doing, only one end of purse line is used for pursing, and the other end of net is wrapped on drum while pursing proceeds. With practice, the forward part of net will be pursed at same time that after part of net has been retrieved on drum. Then the rings are brought up and transferred to ring stripper. The balance of the net to the bag then is retrieved with the drum; the purse line is allowed to feed out from winch through rings on the ring stripper. The rings themselves pay out one at a time automatically as the webbing is retrieved (Fig. 4).

During pursing, the corks in bag are bunched and suspended from boom so that as bag is reached, the net is suspended by the last few rings on ring stripper with the corks hanging from boom. At this point, in the conventional manner, the net is passed forward of the drum and strapped in. When the fish are dried up, the pump is lowered into bag and the fish are pumped aboard. Once the bag is empty, the skiff comes alongside, takes the bag end and stretches it out in the water. The last few wraps of the drum are released to allow net to straighten out, and the bag is brought aboard on the drum.

The drum has other advantages: First, the set can be stopped at any point and retrieval begun. Second, because net is easy to handle, it can be let go in a straight line and retrieved to wash it; or, if repairs to the net are necessary, the vessel can hang from the net as on a sea anchor and repairs be effected.

FISHING TRIALS

Vessel modifications and equipment installation, with exception of new winch, were completed in May 1970. The first phase of field trials was a series of water hauls to uncover any unanticipated problems in performance and handling of gear. These trials were held near Los Angeles Harbor in calm water and were completed within a week. Then we proceeded with fish trials to evaluate further the effectiveness of equipment and to see if more improvements were possible.

At the outset, several minor problems were encountered, including difficulty in handling the rings when pursing from one

end of the net only. These problems were solved. At first, the existing double capstan pursing arrangement was not satisfactory. When it was necessary to "hold" the purse line on the capstan, the friction on the synthetic rope was sufficiently great to damage the purse rope. Also, it was inconvenient to tie off the purse rope during these momentary "holds". The best solution was to replace the capstan winch with a modified drum-type pursing winch. A hydraulic powered winch was installed, and the difficulties with purse line were resolved.

During the 1970-71 anchovy fishery, we obtained comparative time-in-set and manpower requirement data from other vessels in the San Pedro wetfish fleet. The combination of drum and fish pump resulted in significant decreases in time required to complete sets in nearly all catch-size categories (Table 1); often, it was possible to get an additional set in the brief time that fish were available just before dawn. We found one problem that did not occur on conventionally rigged boats. During retrieval, the net rubbed continuously against the vessel's counter and the chain leadline caused some scoring of vessel's hull. This was solved during next haul-out by installation of suitable rubbing strips on bottom and portside. Another possible solution would be to mount the drum on a rotating platform and to change location of level wind so net is retrieved off portside. This also would permit drum to be used to dry up fish completely. The modification should be studied.

Table 1 - Tons loaded per minute in set by size of catch

Size of catch (tons)	Tons/minute in set	
	SUNSET	Others in fleet
0-19	0.12	0.16
20-39	0.37	0.32
40-59	0.76	0.51
60-79	1.07	0.61
80-99	1.13	0.76
100 and over	1.18	0.98

Source: Unpublished logbook data furnished by the California Department of Fish and Game.

ECONOMICS

The purpose of the experiment was to evaluate the profitability of mechanizing small to medium purse seiners. The cost of the essential modifications to Sunset is given in Table 2. Labor performed by the vessel, crew, or National Marine Fisheries Service personnel during the installation is not included. Shipyard labor cost and contract labor costs are included since the costs cover specialized skills not readily available among average fishing crew. Table 3 illustrates possible recovery on this investment assuming investment is amortized over 5 years and financing costs run 15%. It is obvious that unless a larger share of catch is allocated to vessel, it is not profitable for owner to make this investment. However, with the illustrative distribution of vessel earnings given in the table, it can be seen that the investment can be recovered and

Table 2 - Cost of essential modifications for mechanizing M/V SUNSET

Drum, complete with level wind and stern roller	$17,000
Capsule fish pump and separator	3,500
Beaver tail	836
Modifications to net	680
Ring stripper	1,375
Dragger winch	6,039
Diesel auxiliary	2,500
Hydraulic system	4,571
Miscellaneous	1,759
Total	$38,260
Yearly cost $7,652 + (15% interest) 1,148 =	$ 8,800

Table 3. Economics of drum seining for anchovy (X1000). Annual vessel gross $138,000. Trip expenses $14,000[1]. Net proceeds $124,000

Share arrangement	Conventional seining with 10-man crew		Drum seining with 5-man crew					
	Boat 40%	Crew 60%	Boat 40%	Crew 60%	Boat 45%	Crew 55%	Boat 50%	Crew 50%
Share	49.6	74.4	49.6	74.4	55.8	68.2	62.0	62.0
Owner's costs[2]	32.2		32.2		32.2		32.2	
Drum and related costs			8.8		8.8		8.8	
Profit before taxes	17.4		8.6		14.8		21.0	
Crew share 1 man		7.4		14.9		13.6		12.4

[1]Means of 14 vessels, 1971 anchovy season.

[2]From Perrin and Noetzel (1970) increased by 40% coinciding with similar increases in annual vessel gross and trip expenses.

profitability of vessel increased. At same time, the average crewman share will increase greatly compared with his expected earnings on a conventional vessel.

During her first year of operation (1970-71) under this experiment, Sunset's earnings were compared with other boats of the fleet. Of 14 vessels that made bookkeeping records accessible, Sunset ranked seventh in gross income, fifth in boat share, and fourth in crew share. The average number of crewmen during this period was 5.4 on Sunset, and 9.9 on the other vessels. The share arrangement on Sunset was boat 50% and crew 50%. The mean share arrangement for the others was boat 40%, crew 60%.

Additional benefits that do not show in the fiscal data are the increased comfort and safety of crewmen with drum seining operation. It is no longer necessary for crew to stand in net pile with water dripping on them from above, nor to submit to the arduous and hazardous conditions of brailing. The use of ring stripper and dragger winch obviate most dangers associated with handling the rings. Since the rings never come aboard, but remain on side, the peril of working under the rings is removed. Further, the hydraulic dragger winch installation permits purse line to be handled without having loose coils of line on deck. The line can be stopped at any point during the operation. It is relieved automatically by hydraulic system if tension becomes too great.

CONCLUSIONS

1. The drum seining method of mechanizing purse seining operations is readily adaptable to the California wetfishery. The use of the drum speeds up the actual fishing time and decreases the number of men required to handle the gear.

2. Additional improvements that were tested and found to be of benefit are:

(a) The fish pump for brailing the fish into the vessel, which reduces the time and the manpower needed;

(b) the ring stripper, which simplifies handling the purse rings; and

(c) a hydraulic dragger type winch, which results in savings in manpower and a safer operation.

3. A vessel equipped with this equipment and operating with a reduced number of crewmen is capable of equalling or exceeding the performance of a power-block-equipped vessel.

4. The capital outlay for the drum seining modifications can be recovered by changing the vessel crew share arrangement of the vessel income.

5. The vessel crew earnings can be expected to increase with reduction in crew size. At the same time, they benefit from a reduction in the labor required during fishing and an improvement in safety.

LITERATURE CITED

GREEN, R. E., W. F. PERRIN, and B. P. PETRICH
In press. The American tuna purse seine fishery. Modern Fishing Gear of the World, 3:

PERRIN, W. F. and B. G. NOETZEL
1970. Economic study of the San Pedro wetfish boats. Fishery Industrial Research, 6(3): 105-138.

PETRICH, BORTI
1965. What I know about deep sea fishing. V. A. Sandoval Enterprises, Philippines. (Irregular pagination.)

PHILIPS, RICHARD H.
1971. The history of western seining. National Fisherman 52(5): IC-31C, September 1971.

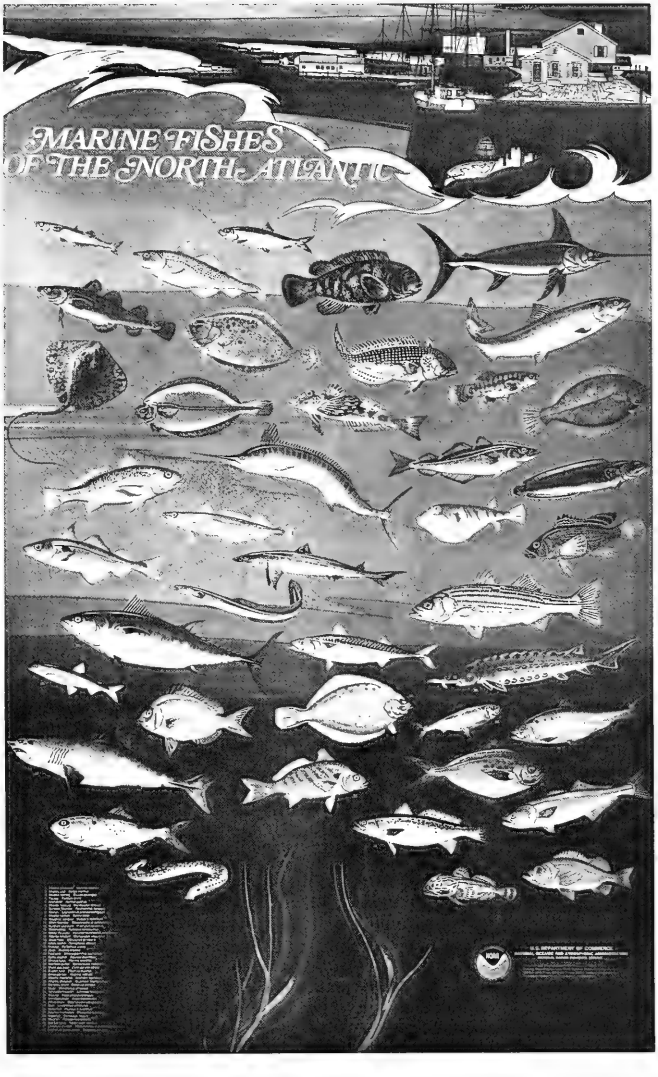
NMFS PREPARES NORTH ATLANTIC MARINE FISH CHART

NMFS has prepared a full-color chart showing 42 marine fishes of the North Atlantic from New England south to the Chesapeake Bay. It is the first in a series of 6 designed to meet a longstanding educational need. NMFS receives many requests from teachers and others for such material.

The other charts planned will show marine fish of the North Pacific, the Gulf and South Atlantic, the California-Hawaii area, and freshwater fish and shellfish.

The chart is 30 by 48 inches and can be framed for schools, libraries, restaurants, or recreation rooms. It is available for $1.50 each from the U.S. Superintendent of Documents, GPO, Washington, D.C. 20402.

The chart was developed by Bob E. Finley, Chief, NMFS National Marketing Service Office, Chicago, Illinois.



WORLD FISH CATCH ROSE 10% IN 1970

In 1970, the world fish catch rose more than 10% to a new record of 69.3 million metric tons. In 1969 it had dropped to 62.9 from 64.3 in 1968, the first decline in almost 25 years. This was reported by the UN's Food and Agriculture Organization (FAO). In 1948, the catch was 19.6 million tons.

The 69.3 million tons comprise marine, freshwater, and diadromous (fresh and salt water) fish and molluscs, crustaceans, and other marine life. Whales and seals are listed separately. The figure also contains a 5.8 million-ton estimate for China, which supplied no official figures.

THE STANDINGS

Peru remained No. 1 with 12.6 million tons (9.2 in 1969, 10.6 in 1968). Almost all of Peru's catch were anchoveta, processed into fish meal for export.

Japan followed with 9.3 million tons (8.6 in 1969). The Soviet Union was third with 7.3 million tons (6.5 in 1969); then China, 5.8 million tons (estimate); Norway, 3 million tons (2.5 in 1969); the United States, 2.7 million tons (2.5 in 1969); India, 1.7 million (1.6 in 1969).

Thailand was 8th with 1.6 million tons (1.3 million in 1969, 1.1 in 1968).

South Africa dropped to 9th with 1.5 million tons (1.8 in 1969, 2 in 1968).

OTHER NATIONS

	1970	1969
	(Metric Tons)	
Spain	1,496,600	1,496,000
Canada	1,377,500	1,504,800
Indonesia	1,249,000	1,214,400
Denmark	1,226,500	1,275,400
Chile	1,161,000	1,076,900
United Kingdom	1,099,000	1,083,000
Philippines	989,800	978,100
S. Korea	933,600	879,100
France	775,200	770,500
Iceland	733,800	689,500
Taiwan	613,000	560,900
W. Germany	612,900	651,600

CATCHES BY CONTINENTS

All the continents except Africa caught more fish in 1970 than in 1969.

AFRICA: Catch dropped to 4.2 million tons from 4.3 million tons in 1969 and 1968. This resulted mainly from catch decrease by South Africa, the largest fishing nation. Angola's catch fell from 419,200 to 368,400 tons.

Several countries increased catches: Chad from 110,000 tons to 120,000; Ghana, 162,800 tons to 187,100; Morocco, 227,200 to 256,000 tons; Nigeria, 115,700 to 155,800 tons; Senegal, 182,100 to 189,200 tons; Tanzania, 150,200 to 195,000 tons; Uganda, 125,300 to 129,000 tons; Zaire, 112,000 to 122,000 tons.

NORTH AND CENTRAL AMERICA: 4.8 million tons (4.5 in 1969, 4.6 in 1968). The U.S. and Canada accounted for most of it. The U.S. catch was its highest since 1964, but still below that of earlier years: in 1956, almost three million tons were caught.

Canada's catch was below 1968's and 1969's but above previous years'.

Cuba continued its steady catch rise: to 105,800 tons; in 1969, 79,700; 1968, 66,000 tons.

SOUTH AMERICA: The biggest increase of any continent. Catch rose to 14.8 million tons from 11.3 million tons in 1969. Peru produced most of the increase. Chile's catch also rose significantly--from 1.1 million to 1.2 million tons. Argentina's rose from 203,400 tons in 1969 to 214,800 tons. Brazil's remained level at 493,000 tons; Venezuela's dropped to 126,300 tons from 134,100 tons in 1969.

ASIA: Caught more fish than all the other continents and its highest ever--26.2 million tons; in 1969, 24.7 million tons. Japan was largely responsible. India, Thailand, and Indonesia followed, all in million-ton category. Thailand's catch increased significantly to almost 1.6 million tons from 1.3 million tons in 1969. The Philippines and S. Korea approached a million tons.

Gains were reported by S. Vietnam (577,400 tons), Burma (432,400 tons), Hong Kong (123,500 tons), and Yemen (115,000 tons).

Pakistan's catch dropped from 455,000 tons in 1969 to 420,000 tons in 1970; Malaysia's from 372,100 to 364,900 tons.

EUROPE (Excluding USSR): 12 million tons, up from 11.3 in 1969. Norway, Spain, Denmark, and the United Kingdom each exceeded a million tons. Following in order were France, Iceland, W. Germany, Poland, Portugal, Italy, E. Germany, the Netherlands, Sweden, and the Faroe Islands.

France's catch rose slightly to 775,200 from 770,500 tons in 1969. Italy had a record 403,400 tons (in 1969, 370,900 tons). W. Germany dipped slightly; E. Germany's catch increased from 309,900 to 321,800 tons. Iceland's reached 733,800 tons from 689,500 tons in 1969 and 600,600 tons in 1968, but it remained well below the 1966 peak of 1,240,300 tons.

Denmark's catch slipped from 1.3 million tons in 1969 to 1.2 million tons. Netherlands' catch fell from 323,200 to 300,700 tons.

OCEANIA: Australia, New Zealand, and South Western Pacific Islands. Harvested 190,00 tons, up 10,000. Australian catch was 102,600 tons; in 1969, 91,900 tons.

THE ECONOMIES

Developed countries increased their catches by slightly over one million tons to 26 million tons. Developing countries showed significant catch increases: from 23.6 million tons in 1969 to 28.1 million tons in 1970. This was due mainly to Peru; without Peru, the rise would have approximated the developed countries' rise.

The centrally planned economies expanded fishing from 14.3 million to 15.1 million tons. More than half of it was contributed by the USSR and Eastern Europe; China accounted for the bulk of the remainder.

CATCHES BY SPECIES AND AREAS

The greatest catch increases during 1970 were in marine fishes: from 48.3 million metric tons in 1969 to 53.5 million tons. Freshwater catches increased slightly--from 6.8 million to 7 million tons. There were small increases in crustaceans and molluscs.

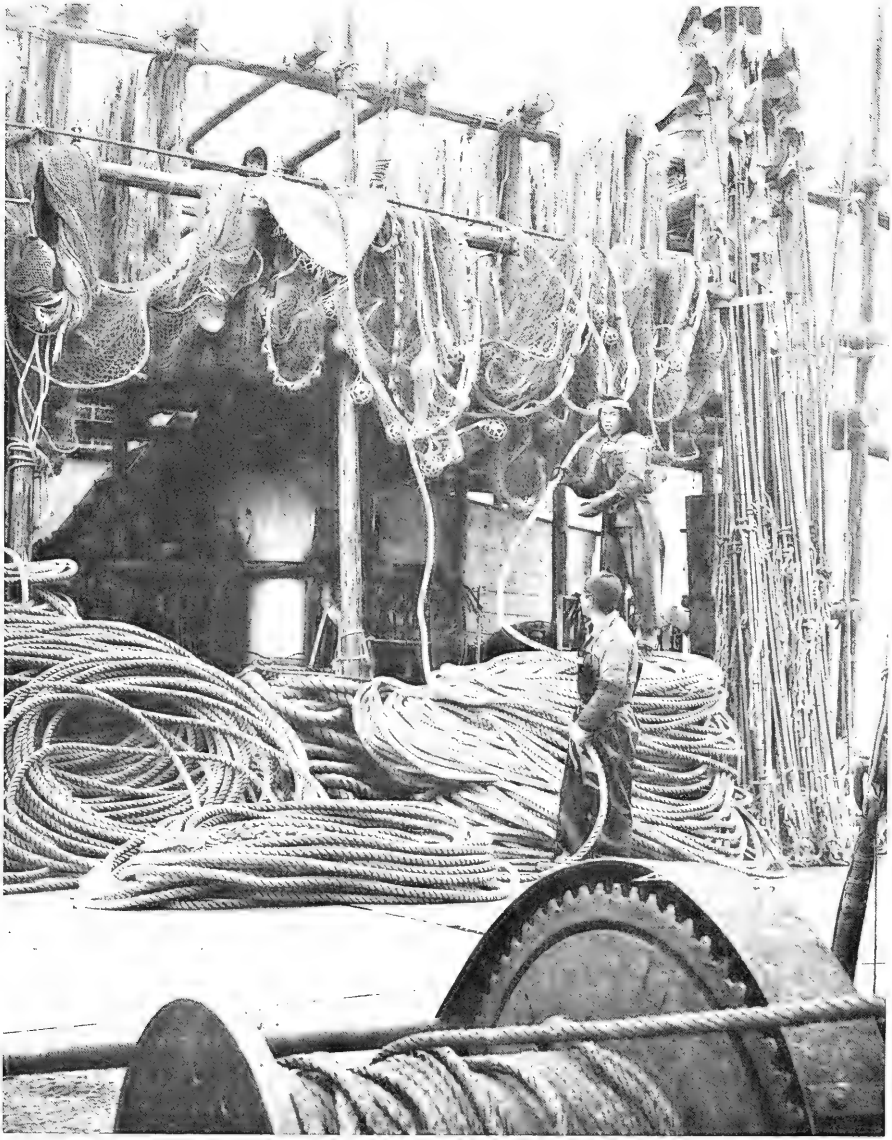
Herrings, sardines, anchovies and related species were bulk of the marine catch: 21.2 million metric tons. South African pilchards dropped significantly, from 1.4 million to 700,000 tons. Alaskan pollack, cods, hakes, haddocks, redfishes, and mackerels were higher. Tuna catches remained at about 1969 level. Shrimps rose. Carps increased considerably among the freshwater fishes, from 166,000 to 193,000 tons.

Whale catches rose from 41,735 to 42,266, mostly sperm whales, but figure was lower than in most earlier years.

The Pacific Ocean produced the largest catch: 35.3 million tons, compared to 30.1 million tons in 1969. The Atlantic Ocean yielded 23.6 million tons, up one million. Most Atlantic catches were in Northeast and Northwest Atlantic, which yielded 14.8 million tons. In Southeast Atlantic, where a new international fishery convention became operative recently, catches dropped from 3 million tons in 1969 to 2.4 million tons in 1970.

The Mediterranean and Black Seas, grouped within the Atlantic region, produced 1.1 million tons; in 1969, 970,000 tons.

The Indian Ocean, about one-fifth the earth's marine surface, was a small arena for the world marine catch: 2.7 million tons, up about 160,000 tons from 1969.



Stowing net and line aboard the 'Shinyo Maru'.

THE JAPANESE FISHING INDUSTRY: 1971 HIGHLIGHTS

William B. Folsom

The year 1971 should be another successful one for the Japanese fishing industry. As in previous years, the Japanese were extremely active--searching for new grounds, developing new techniques and products, and establishing new overseas joint ventures. Indications were that a new catch record was set, imports of marine products appeared to reach a new high, but canned-tuna exports declined sharply.

CATCH: Figures for Japan's 1971 catch are not yet available, but it would not be surprising if these exceeded its record 1970 catch of 9,272,000 metric tons (Fig. 1) worth US$3 billion. The marine catch is expected to comprise over 90% of this total, finfish nearly 80% of the marine catch, molluscs 7%, shellfish 6%, seaweeds 5%, and other species 2%.

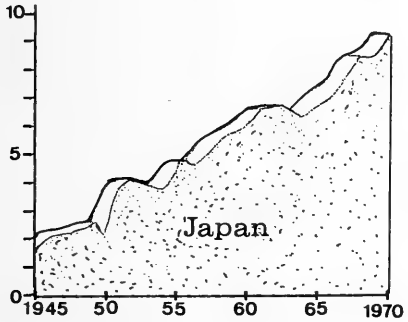


Fig 1 - Japan's fisheries catch, 1945-1970 (in million metric tons).

CONSUMPTION: The 1968 record annual per-capita consumption rate of 71.3 pounds of fishery products decreased to 67.5 pounds in 1969. Information for 1970 is not available, so a projection for 1971 can not be made. However, consumption of higher quality and more expensive fishery products (like shrimp) rose again in 1971. Total consumption of edible fishery products was expected to exceed 6 million metric tons.

With the Japanese eating more high-quality fishery products and paying more for them, the consumer price index for fresh fish and shellfish was expected to increase. During 1965-1969, the index rose 46.4%.

FISHERY COMPANIES: During the past few years, the number of smaller fishing companies has decreased; larger firms, such as Taiyo, Nichiro, Nippon Suisan, and Kyokuyo Hogei, have increased in influence, sophistication, and in development of new technology. This trend was expected to continue in 1971. The major companies appear to have had a profitable year. Taiyo has reported after-tax profits of roughly $5.5 million and declared a 6% dividend following a 2-year "recession" beginning in 1968. However, those firms dependent upon canned-tuna exports to the United States suffered reversals in 1971.

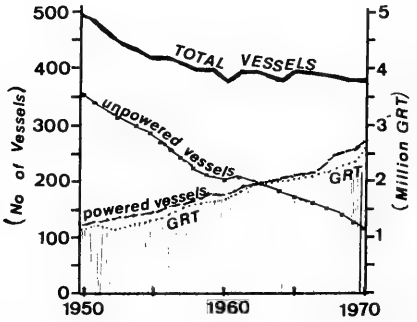


Fig. 2 - Size and number of Japanese fishing vessels, 1950-1970.

Mr. Folsom is on International Activities Staff of NMFS.

COMMERCIAL FISHERIES REVIEW
Reprint No. 927

FLEET: In the past 20 years, the fishing fleet has decreased steadily in numbers while increasing in tonnage (Fig. 2). It is believed this trend continued in 1971. In 1970, registered fishing vessels numbered 391,789 totaling 2,531,317 gross tons; unpowered fishing vessels totaled 120,600 vessels, powered vessels slightly over 271,000 vessels. One of the most significant events in 1971 was the launching of 5 giant 5,000-GRT stern trawlers for fishing off Alaska.

GEAR: To offset the high cost and shortage of labor, the industry continually seeks to improve operating efficiency, experiments with new techniques and fishing gear. One interesting development in 1971 was deployment of the "robot" automatic skipjack fishing machine (Fig. 3) that proved highly successful during sea trials. Skipjack pole-and-line fishing requires many men. The robot substantially reduces manpower requirements

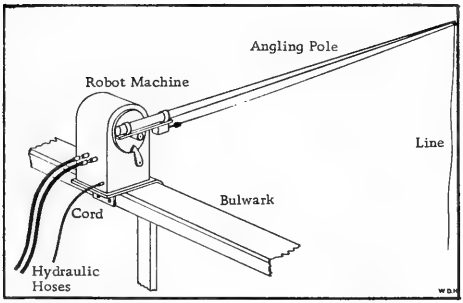


Fig. 3 - Robot skipjack tuna angler based on the drawing by the manufacturers, K. K. Suzuki Tekkojo, 7, Mikawa-cho, Ashinomaki, Miyagi Prefecture, Japan.

because one man can operate several machines. This gear can be operated easily by elderly fishermen, so it helps also to relieve the shortage of young men who prefer higher-paying, safer, onshore jobs.

FISHERMEN: The number of fishermen has declined about 20% in the past decade and a further drop was expected in 1971--to about 500,000. Wages and working conditions on the fishing vessels have improved, but the industry is still having difficulty attracting and retaining able young men.

FISHERY AGENCY: A new Fishery Agency Director, Y. Ota, was appointed in June 1971. He indicated that he planned to emphasize the development of deep-sea fishery resources. In late 1971, the Fishery Agency (JFA) announced it would add 3 new divisions (fish culture, fisheries engineering, and fisheries environment) to its 8 regional fisheries research laboratories. The JFA's FY 1971 budget (April 1971-March 1972) was a record US$139 million. Most of this money was earmarked for port construction and insurance; funding for deep-sea marine science was increased by 53% over FY 1970, to $3.4 million.

RESEARCH: As in previous years, marine research enjoyed high priority. Two new institutions, the Marine Science and Technology Center, and the Marine Fishery Resource Development Center, were formed to promote the development of marine sciences.

TYPES OF FISHERIES: Marine fisheries continued to play a major role. High-seas fishing becomes increasingly important as the spread of pollution threatens coastal and inland fishing grounds. Fish culture is important but still constitutes a small part of total production; however, it is growing rapidly. Since 1950, the Japanese have raised over 50 varieties of fish, cultivating commercially such species as yellowtail, shrimp, seabreams, and abalone. Experiments are being conducted to cultivate other species in great domestic demand, such as salmon and tuna. However, pollution of estuarine and coastal waters is a serious problem.

TRADE: Fishery imports have increased rapidly in recent years and 1971 may be the year that imports of marine products exceed exports (Fig. 4). This would be significant for a nation that traditionally has been a leading exporter. As of October 1971, imports were 53% over same period of 1970.

In 1970, Japan imported 374,569 metric tons of marine products worth US$318 million. In value, shrimp accounted for 43%, followed by tuna, 8%. Other important imports were squid, fishmeal, salmon roe, and octopus. Leading suppliers in 1970 included South Korea, China, the United States, Taiwan, and Mexico.

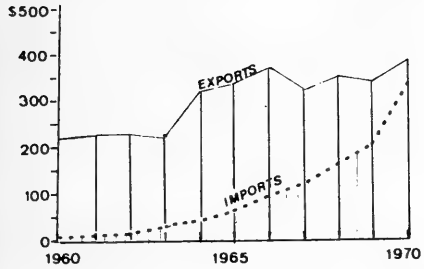


Fig. 4 - Japan's Fishery Trade, 1969-1970 (in US$1 million).

In 1970, fishery exports were valued at US$391 million. Its largest customer was the United States ($128 million, a record), followed by the United Kingdom ($46 million), West Germany ($25 million), Italy ($16 million), and the Philippines ($16 million). Principal export items were canned tuna, canned mackerel, pearls, canned salmon, and frozen tuna exports. In 1970, canned tuna exports to the United States totaled $42 million, a record, but declined sharply in 1971. (See International Affairs; United States.)

FISHING HIGHLIGHTS

Pacific Ocean: During 1971, the Japanese were especially active in exploring for new skipjack grounds and for live bait supplies in the southwestern Pacific. Joint skipjack fishing ventures were established in Indonesia and Papua-New Guinea. Efforts to do the same in the U.S. Trust Territories were not successful. In October, a voluntary ban on fishing southern bluefin tuna was adopted by Japanese tuna fishermen.

The Japanese continued their intensive trawl fisheries on the U.S. Continental Shelf in the eastern Bering Sea. Their 1971 pollock catch was expected to exceed easily 1970's catch of 1.2 million metric tons, about 85% of their total catch in that area. They met their 1971 quota of 37,500 cases (48½-lbs.) of king crab and 14 million (plus 10% allowance) of tanner crabs. Their catch of king and tanner crabs in the eastern Bering Sea is regulated by the Dec. 1970 agreement with the United States. The Japanese also initiated a new fishery for sea snail in the eastern Bering Sea.

Off the Pacific Northwest and northern California, they continued their saury fishery. In 1971, 49 vessels were reported licensed to fish off the U.S., but only 18 were sighted by U.S. surveillance officers during the peak of this fishery. Catches were reported poor: 1,300 metric tons compared to 3,278 tons in 1970.

In late 1971, the research vessel 'Ryoun Maru' scouted for squid off Cape San Lucas, south of Baja California. Initial reports indicated it was doing well, but later reports were not satisfactory.

Tuna fishing in the southeastern Pacific was marked by the arrival of the 'Nippon Maru', a 999-GRT purse-seiner, built to U.S. specification. U.S. fishermen were hired to train the crew on the vessel. If trial runs prove successful, the Japanese may build more.

Atlantic Ocean: The 'Nippon Maru' also fished off west Africa, where the Japanese operate 50-80 tuna vessels. The Japanese also extended their fishing agreement with Mauritania, where they now operate a joint fishing venture. The Japanese have a very large trawl fishery off Mauritania for squid, octopus, sea-bream, and jack mackerel. A joint squid and bottomfish fishery was established in Morocco in 1971, with plans for another venture (shrimp) there in 1972; similar ventures were planned in Nigeria and Senegal. The Japanese are anxious to establish themselves in Africa now because of the possibility that some African countries may extend their territorial/fishing limits.

Early in 1971, one large fishing company began a year-round fishery off the U.S. East Coast with 5 large stern trawlers. These vessels are joined seasonally by other larger trawlers, some based in the Canary Islands. They fished primarily for argentine, butterfish, and squid (estimated 1970 catch was 36,627 tons) but intensified their effort for herring (1970 catch 1,125 tons). There is a world supply shortage of herring. Japanese tuna longliners appeared in autumn 1971 off Cape Cod, Mass., in search of bluefin tuna. These tuna are highly prized as "sashimi" (thinly sliced raw fish). Some of these vessels reportedly purchased tuna from U.S.

fishermen. About 5 shipments (3-6 fish per shipment) of bluefin caught by U.S. fishermen were shipped by air to Japan, where they sold for $3.19/lb.

The end of 1971 was marked by reports of damage to U.S. lobster gear caught by some Japanese trawlers operating off U.S. Atlantic coast. Japanese longliners again were reported in Gulf of Mexico fishing for yellowfin tuna.

Indian Ocean: The Japanese have a sizable tuna fishery and processing/transshipment bases in or bordering the Indian Ocean. There were no significant developments in 1971.

Antarctic: The catch of baleen whales in the Antarctic is regulated by the International Whaling Commission. Japan's 1971/72 baleen whale quota is fin whale, 1,566, and sei, 3,378, equivalent to 1,346 blue whale units. The Japanese also planned to take 1,000 sperm whales and 3,000 minke whales by February 1972. They are concentrating especially on minke whales this year because this species is still relatively plentiful and not subject to quotas.

INTERNATIONAL AFFAIRS

The Japanese industry is somewhat concerned over possible extension of territorial/fishery jurisdictions by some coastal states, principally in Africa. This prompted them to try to establish themselves in some of these countries before the extensions were made. Japanese coastal fishermen pressured their government to extend Japan's 3-mile territorial sea to 12 miles to protect their offshore resources from foreign fleets, mainly Soviet.

A major development in 1971 was the Japanese decision to let the yen float following the U.S. imposition of a 10% surcharge on imports. Japanese fishery products thereby became more costly, while non-Japanese goods became cheaper. The uncertainty over exchange rates caused some confusion initially.

United States: Japan's fishery trade relations with the United States encountered problems in 1971. First came the mercury-in-tuna problem, followed by seizures of Japanese canned tuna for decomposition, then the U.S. 10% surcharge on imports, followed by the yen/dollar revaluation. Hardest hit were the packers and exporters of canned tuna-in-brine. In 1971, over 400,000 cases of tuna exported to the United States were reported rejected for decomposition by U.S. authorities. This disrupted Japan's canned-tuna trade; exports were suspended during the latter half of 1971. Large stockpiles accumulated in Japan. In December, a government/industry team was sent to the United States to discuss the tuna decomposition problem.

Soviet Union: The annual Japan/USSR fishery negotiations went badly for the Japanese in 1971. Catch quotas for salmon, crab, and herring were reduced and the fishing season delayed. The Soviets imposed a ban on herring fishing in the Okhotsk Sea, preventing Japanese access. This created difficult internal problems for Japan. Soviet seizures of Japanese vessels for illegal fishing off the USSR continued. In late 1971, large numbers of Soviet vessels (50-100 vessels) began fishing for mackerel off Japan's northern Pacific coast, further irritating Japanese fishermen.

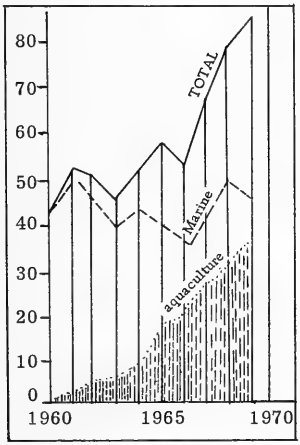
China: Japanese trade in marine products with China increased to $31 million 1970 and was expected to continue to expand in 1971. Shrimp was the single most important import ($19 million in 1970); it was anticipated that herring might become another important commodity in 1971-72. If Japan recognizes China, the private fishery agreement concluded between Japanese fishery firms and China may be changed into an official agreement later.

JAPAN

YELLOWTAIL IS NO. 1 CULTURED FISH

Yellowtail is Japan's No. 1 cultured fish. In less than a decade, it has become a multi-million dollar industry. This was reported by T. Yamamoto to a symposium in Paris, Nov. 29-Dec. 3, 1971.

Although the culture of yellowtail (Seriola quinqueradiata) had been underway for years before 1960, it was not until then that it began to grow in importance (see Fig.). By 1969, 4.3 million fingerlings produced 36,725 metric tons of yellowtail worth US$44.7 million. Cultured yellowtail accounted for 42% of yellowtail production (87,850 tons).



Yellowtail catch (1,000 metric tons).

Grows Fast

Yellowtail, "buri" in Japanese, is one of the world's fastest-growing fish. In 100-120 days, it will grow from 2 cm ($\frac{3}{4}$ inch) to over 40 cm (1'4"); it will weigh nearly 1 kilogram (2.2 lbs).

Fortunately for the culturist, the consumer prefers yellowtail 12 to 18 inches long. This allows him to grow fish when weather is warm and growth at maximum. Usually, the fish are shipped live to nearby markets; the nerve (pith) is severed just before shipment so fish remain alive but dormant. Generally, the fish are eaten raw.

Culture

Yellowtail larvae are normally caught in the early spring drifting under seaweed off Pacific coasts of Kyushu and Shikoku Islands. Then they are raised in "embanked ponds" (563,000 sq. meters in 1969), net-enclosed ponds (1,942,000 sq. meters), or in floating, net-cages (751,000 sq. meters). The fry are fed a mixture of artificial formula foods or frozen scrap fish. They seem to thrive on sand lances, anchovy, and jack mackerel. Currently, the cost of feed accounts for 60% of the total investment in cultivation. The Japanese are trying to cut these costs.

* * *

SKIPJACK FISHERY'S LIVE-BAIT PROBLEM

In 1971, the major Japanese skipjack fishery firms advanced into western equatorial Pacific to develop grounds. As 1972 began, they were preparing to move from exploration to full-scale operations.

Taiyo Gyogyo has established a base in the Solomon Islands; Nichiro at Ternate, Helmahera (Indonesia); Hoko Suisan at Kendari, Celebes; Kaigai Gyogyo, Kyokuyo, and Hokoku Suisan at Papua, New Guinea; and Sanyo Gyogyo of Okinawa at Ponape (U.S. Trust Territory). Fishing is still experimental, but progress likely will be made in 1972 to form joint ventures with local interests.

The available Pacific skipjack resource is estimated at around 800,000 to 1 million tons. The Japanese annually take about 250,000 tons, so it is possible to increase the catch. More investigation is necessary. Skipjack distribution in the Indian and Atlantic oceans is estimated at 200,000-400,000 tons each.

Live-Bait Problem

To harvest skipjack, it is necessary to solve live-bait problem. The domestic live-bait supply is mostly anchovy. Sardine, small

JAPAN (Contd.):

mackerel, and sand lance also are used to some extent. After hauling, anchovy cannot be transported immediately to fishing grounds. They must be held in receivers for at least one week. Transporting the fish from baiting ground to receiving point is a problem. So too is the heavy die-off--from 50 to 70% of catch.

In 1971, the Federation of Japan Tuna Fishery Cooperative Associations (NIKKATSUREN) transported successfully (presumably to fishing ground) the first supply of anchovy purchased from South Korea. NIKKATSUREN hopes to set up a bait-supply point at Nagasaki and plans to build a net enclosure there. It is investigating availability of baitfish in Taiwan. Bait procurement remains the bottleneck for overseas-based operations. ('Katsuo-maguro Tsushin', Jan. 3, 1972.)

* * *

HERRING FISHING IN EASTERN BERING SEA

In early January 1972, 23 Japanese stern trawlers were active in the winter herring fishery of the eastern Bering Sea north of the Pribilof Islands. Also, close to 80 Soviet trawlers were fishing there.

Japanese production from about Nov. 22, 1971, when the winter operation started, until Jan. 5, 1972, totaled approximately 15,000 metric tons of frozen product; of these, about 5,000 tons were shipped to Japan in late 1971. Compared with previous years, the herring are large but the eggs are not as good; the fish run is smaller. ('Suisan Tsushin', Jan. 6, 1972.

* * *

RED-SALMON CULTURE INCREASED TO OFFSET DWINDLING CATCHES

To offset their dwindling catch of red salmon, the Japanese have turned to the artificial propagation of native, land-locked red salmon, the "kokanee", and Alaskan red salmon.

Hokkaido Program

The Nijibetsu Hatchery on Nishibetsu River, Hokkaido Island, is an important center in Kokanee culture. It began experimenting in 1960 but money problems stopped operations. Kokanee had been raised and released during this trial period. Then fortune helped: 20 fish returned in 1965 to their breeding grounds. This excited fishermen.

In 1967, the Nijibetsu Hatchery again began rearing kokanee, more successfully this time. In 1968, red-salmon eggs from Bear Lake in Alaska were imported and hatched together with kokanee eggs; the young were released in the Nishibetsu River. ('Fishing News International', June 1970.)

The return of 56 reds (mostly 3-year olds) in 1970, and 2,609 by the end of October 1971, indicates that one phase of program to raise sea-going red salmon has been successful. Egg collections have increased satisfactorily from 4,500 in 1967 to 170,000 in 1970. The hatchery staff is now concentrating on ways to reduce hatchery mortality. ('Suisan Tsushin', Nov. 19, 1971).

Egg Collection on Honshu

The Towada Hatchery was plagued by decreasing collections between 1963, when 5 million kokanee eggs were collected, and 1970, when only 800,000 were collected. In 1971, a section of Lake Towada was closed to help increase production. This closure and the effort of scientists raised collection to 2.1 million eggs from 11,000 reds. It ended former reliance on other hatcheries for eggs. ('Suisan Keizai', Nov. 23, 1971.)

Commercial Salmon Culture

Nichiro Gyogyo, one of Japan's largest fishing firms, recently bought a large tract in northern Hokkaido to rear red salmon artificially. The company is seeking supplies of red salmon eggs. It plans to expand from freshwater to saltwater culture. If it successfully rears red salmon in salt water, it should be able to supplement its decreasing share of North Pacific red salmon catch within a few years. (U.S. Embassy, Tokyo.)

* * *

JAPAN (Contd.):

NEW GROUP COORDINATES SKIPJACK FISHERY

The 6 Japanese firms that have been conducting exploratory skipjack fishing in the tropical waters of the southwestern Pacific have formed a group to coordinate arrangements for (1) procuring bait, (2) scouting for fish, (3) buying skipjack from local fishermen, (4) resolving problems within joint ventures, and (5) training fishermen.

The 6 firms are Taiyo Gyogyo near the Solomon Islands, Nichiro and Hoko Suisan in Indonesia, and Kyokuyo, Hokoku Suisan, and Kaigai Gyogyo in Bismark Sea area.

Tetsuo Ueda, executive director of Hokoku Suisan, is director of new group. ('Suisan Tsushin', Dec. 23, 1971.)

NMFS Comment: These companies are strong competitors, but they are willing apparently to work together to develop a fishery for skipjack. This resource is attracting considerable attention in tuna fisheries. Their primary area of interest is the southwestern Pacific.

* * *

SQUID CATCH OFF U.S. WEST COAST WAS LOW

In late December 1971, the 'Ryoun Maru No. 3' (300 gross tons), surveying squid in the eastern Pacific off the U.S. since late August 1971, ended operations. It had been sent by semigovernmental Marine Fishery Resources Development Center. Production totaled 3,532 cases (26.5 metric tons) of frozen squid, 14% of original estimate.

Area Surveyed

The survey ran north to south from off Vancouver to Baja California. It failed to locate good squid concentrations, except off Cape San Lucas (south of Baja California). There, two days of excellent catch yielded 2,140 cases. The squid taken off Cape San Lucas were described as large-size American common squid ("American o-surume ika"). These measured about 23 cm (9 inches) in body length. ('Suisan Tsushin', Dec. 27, 1971.)

DOLLAR-YEN REVALUATION DISTURBS FISHERY INDUSTRY

The Japanese yen has been revalued upward in relation to U.S. dollar: 308 to one, a rise of 16.88% over previous 360 to one. This has raised fears that a long recession is ahead.

Fears are growing that sales of high-value fish and shellfish--shrimp, squid, octopus, tuna, salmon, and ark shell-will slow and export profits shrink. Fishery operators have been making sufficient profits from high-value fish to offset losses from the declining catch, prolonged fishing trips, and rising labor costs. But if market weakens and prices decline, they will be in trouble. Another factor may contribute to disruption of market prices for high-value fish: the competition among importers. This is likely to intensify because of favorable import conditions created by the yen's increase in value.

Tuna Packers Hurt

The new monetary realignment will affect fishery exports. Tuna packers will be hit hardest. Their exports to the U.S. in 1970 were 53.6% of sales. Canned-tuna sales to the U.S. were temporarily suspended at the end of 1971 because of the decomposition problem. But when the problem ends and sales resume, it is unlikely that export prices can be raised to offset the 16.88% increase in yen's value.

Prices for canned tuna in oil exported to West Germany, Great Britain, France, and other European countries will also be difficult to increase "because of the traditional resistance among Europeans to price changes."

Canned Salmon Affected

Canned-salmon exports will be affected severely. The only outlet for canned red salmon is Great Britain. The yen value has risen 7.6% more than the pound, so sales negotiations will be difficult. Canned crab export also was uncertain at the end of 1971.

Frozen Tuna

Raw tuna supply remains unchanged--demand continues to outstrip supply--so frozen tuna prices for export likely will rise to offset yen-dollar change. ('Suisan Tsushin', Dec. 21, 1971.)

JAPAN (Contd):

BUILDS 10 FISHING VESSELS FOR ICELAND

Taito Seimo, a fish-net manufacturer, has received an order to build ten 500-gross-ton trawlers for export to Iceland. This is the first time any European country has ordered Japanese fishing vessels.

Iceland invited bids from foreign countries, including Japan, France, Norway, West Germany, and Poland to build thirty 500-ton and several 1,000-1,500-ton trawlers. The Japanese firm won the contract for the ten 500-ton trawlers primarily because it promised early delivery. The vessels are scheduled for delivery by the end of March 1972. ('Suisan Keizai Shimbun', Jan. 13, 1972.)

* * *

SHRIMPING OFF GUIANAS WILL EXPAND

Seven firms shrimping off the Guianas, South America, and several others have asked the Fisheries Agency to license 70 shrimp vessels. The 7 now operate 70 shrimpers. They plan to use 35 more because of the favorable outlook. The other firms interested in entering the fishery are seeking licenses for 35 vessels.

Began in 1959

Japanese shrimp fishing off the Guianas was started in 1959 by Sakiyoshi Gyogyo. It expanded. In 1967, seven firms were authorized by the Agency to conduct "experimental" fishing with one-year renewable licenses. At first, the firms had much difficulty because they did not know the grounds and there were labor-management problems. In recent years, however, many have been operating profitably.

The firms formed the South American Northern Coast Trawlers Assoc. and began negotiating with Guianan interests to construct freezing and processing plants at Georgetown, Guyana, and Paramaribo, Surinam. In October 1971, the Association formed its plans to establish a freezing and processing plant at Paramaribo. It hopes to conclude a contract with local interests by March 31, 1972. ('Suisan Keizai Shimbun', Jan. 11, 1972.)

* * *

SCIENTIST CAUTIONS AGAINST OPTIMISM ABOUT SKIPJACK

The 3-day tuna conference at Tokai University, Shimizu, Feb. 2, 1972, heard a government scientist urge caution in developing the skipjack resource. Moriya Anraku, Tohoku Regional Fisheries Research Laboratory, said the facts do not necessarily support the optimism in some quarters. His opinion runs counter to the Fisheries Agency's administrative policy for the fishery.

Anraku's Thesis

This is the substance of Anraku's statement: Some optimistic forecasts have been made about skipjack abundance, but close examination of catch fluctuations in the pole-and-line fishery reveals facts that do not necessarily support such optimism. For example, the abundance of skipjack off Japan has trended downward since 1965. In southern waters, operations are extending over wider areas; fishing is concentrated selectively on highly dense schools. Despite the extension of fishing grounds, the catch per unit of effort remains the same.

It is hoped that application of new fishing methods and development of new grounds will produce some increase in catch. However, the question whether this increase can produce greater economic gains must be examined closely along with the structural changes in the fishery and international implications. ('Katsuo-maguro Tsushin', Feb. 7.)

* * *

GYOGO WILL REPLACE TRAWLER LOST OFF NEW YORK

Taiyo Gyogyo, whose stern trawler 'Taiyo Maru No. 77' (1,800 gross tons) caught fire and sank off New York on Feb. 9, 1972, has decided to replace it. Construction of a 5,000-ton trawler, to be named 'Tenyo Maru No. 3', will be begun soon; completion is scheduled for February 1973. Meanwhile, 'Taiyo Maru No. 82' (2,400 gross tons), operating in the Bering Sea in mid-February, will be reassigned to the southern area trawl fishery (presumably the Atlantic). ('Suisan Keizai Shimbun', Feb. 15.

日本

NORWAY'S FISHERIES PROSPERED IN 1971

Again in 1971, Norwegian fisheries had a very prosperous year. Exvessel value rose 10% to a new high of US$220 million. The catch of 2.8 million tons was the second highest (1970: 2.7) but less than 1967's record 3 million tons.

Traditionally, the bulk of the catch has come from inshore or coastal waters. But, with rapid expansion in use of purse seines since 1965, distant operations have grown and offshore catches have increased.

Capelin Half of Catch

With decline in North Sea herring and mackerel stocks, more effort was directed toward capelin, which are caught mostly off North Norway. Capelin has become the leading fish in production of fish meal and oil. In the last two years, it was half the total catch. The 1971 capelin catch was the best ever: 1.4 million tons worth US$39 million.

Fish Meal Up

Fish meal production is considerably above 1970. Output of fish oil will total about 179,000 tons. A factory fleet off West Africa also caught 200,000 metric tons of sardinella and mackerel, which were processed into fish meal.

Cod, Herring, Brisling

In 1971, the important cod fisheries yielded a record 341,000 tons worth US$78.6 million. The herring catch was 300,000 tons worth US$20.7 million. Previously, herring had formed the greater part of the catch; now they are in relatively short supply. Not many years ago, the winter herring fisheries off Norway yielded several hundred thousand tons annually. In 1971, the catch of winter herring was only 6,894 tons, fat herring 12,944 tons, and "small" herring 2,248 tons. Until recently, the main herring catch came from the North Sea; stocks there have declined drastically. The 1971 North Sea herring catch was down to 210,399 tons. The catch of brisling, mainstay of Norway's important fish-canning industry, was about 9,000 tons, down 30% from 1970.

Protecting Herring

Norway has agreed with other countries to prohibit catches of winter herring in 1972 and to reduce catch of fat and small herring to 45% of 1969 catch. A closed season for herring fishing from April 1 to June 15 has been established.

Record Exports

Exports of fish and fish products are estimated at record earnings of about $314 million.

The Industry

About one percent of Norwegians are fishermen (43,000). They operate 36,000 fishing vessels, of which 27,000 are small open motor vessels. Also, many Norwegians work in fish processing and auxiliary trades. (The Export Council of Norway, and U.S. Embassy, Oslo.)

ICELAND IS BUILDING 21 STERN TRAWLERS

The Icelandic Government is fostering a program to strengthen its fisheries. As part of this, contracts have been negotiated to build 21 stern trawlers, 500 to 1000 tons, totaling 14,000 GRT. Government and private investment will be nearly US$30 million.

Many of the new vessels are to be built in Spain; 7 in Norway, 2 in Poland, and some in Iceland. This is the first recruitment to this fleet since 1969. Delivery is slated for 1972-73.

Situation and Outlook

The failure of Iceland's herring fisheries in recent years has renewed interest in trawling. In 1970, groundfish catches were the largest since 1960; good catches are expected to continue into 1972.

Favorable prices for groundfish have strengthened the financial status of the vessel owner-operators. So they are encouraged to better equip their fleet.

The principal fishing grounds have been in Icelandic coastal waters, mainly along the south and west coasts. The newer vessels will be capable of fishing distant waters.

Government Loans

The fleet modernization, which began in 1970, is supported by government loans. Loans available from the Fisheries Fund may cover three-quarters of the vessel cost if the vessel is built at home, and two-thirds if built abroad. Interest rates are established by agreement between the Ministry of Finance and the Central Bank of Iceland. All loans are guaranteed with a first mortage on the vessel. (U.S. Embassy, Reykjavik.)

NORWAY'S FIRST PURSE SEINER TO FISH TUNA OFF AFRICA

Norway's first tuna purse seiner, the 'Sun Tuna', has been delivered to A/S Sun Tuna & Company in Aalesund. It is a former 216-foot whale catcher rebuilt in Norway.

The vessel's freezing equipment has a maximum daily capacity of 100 metric tons of fish. Total loading capacity is 900 tons. It will carry two purse seines, one among the largest ever made in Norway: 1,640 yards long, 220 yards deep, and covering 75 acres of sea.

The 'Sun Tuna' will fish off Africa and land its catch directly in Italy. (U.S. Embassy, Oslo.)

DENMARK EXEMPTS PROCESSED SHRIMP & HERRING FROM 10% IMPORT SURCHARGE

On Oct. 20, 1971, Denmark imposed a 10% import surcharge on all prepared and preserved fish products, including frozen cooked shrimp, a principal U.S. export to Denmark. On November 24, Denmark exempted prepared and preserved shrimp, among other items.

The exemption will permit continued expansion of the sale of Maine and Alaskan shrimp to Denmark. Another item exempted was prepared or preserved herring, whole or filleted. (U.S. Embassy, Copenhagen.)

FRENCH TO TEST PROTEIN FROM PETROLEUM

A plant to test a commercial process for manufacturing protein from petroleum will start operation near Marseilles. It will have a 20,000-ton annual capacity plant. If it proves successful, a 150,000-ton-capacity plant will be constructed in about 5 years. Operator is Soviete Francaise de Petroles B.P.

Present speculation is that project's protein output will compete with such proteins as fish meal. The protein from petroleum is 70% pure. Experiments have indicated no adverse effects on growth or meat quality of test animals. A uniform product is assured by adding carefully developed strains of yeast and basic chemical compounds to petroleum.

Differs from U.S. & British Work

The French process differs from U.S. and British experiments, which first separate paraffins from petroleum. Research is being conducted with the World Health Organization into possible uses for fortifying human food. (Agric. Att., U.S. Embassy, Paris.)

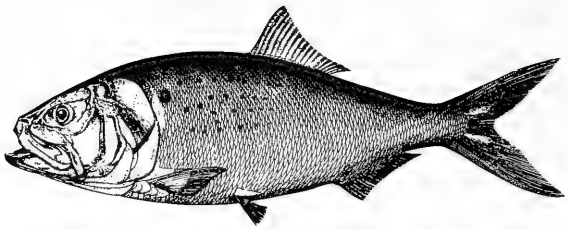
ITALY SETS STRICTER MERCURY TOLERANCE LEVEL

Italy has revised its ordinance concerning mercury in fishery products, reported the Japanese newspaper 'Suisan Tsushin' Jan. 18. Effective until Dec. 31, 1972, it establishes a new tolerance level of 0.7 part per million (ppm) of total mercury content in fish. The previous limit was 1.0 ppm; its 3-month period expired Dec. 14, 1971.

New Regulation

The new regulation allows foreign fishery products to enter Italy without sampling at the port if accompanied by a government inspection certificate of the exporting country. The certificate must state mercury content does not exceed 0.7 ppm. If there is no document, the product will be sampled by an Italian testing laboratory.

FOOD FISH FACTS



MENHADEN

Atlantic (Brevoortia tyrannus)

Gulf or largescale (Brevoortia patronus)

Menhaden, also called pogy, mossbunker, or fatback, are members of the herring family. Although seldom used for human consumption, menhaden are of great industrial importance. These fish have a tendency to school according to size and age. This habit, varying from hundreds to thousands of individuals in a school, makes netting them relatively easy for fishermen.

In calm weather menhaden in vast schools may be seen lifting their snouts up out of the water as they feed and they occasionally break through with their top fins and tails. These large groups of fish are a sight not easily forgotten as they swim together side by side, tier above tier, in perfect unison. The schools are often so dense they seem to darken the surface like great cloud shadows hovering over the waters of the Atlantic and Gulf Coast.

DESCRIPTION

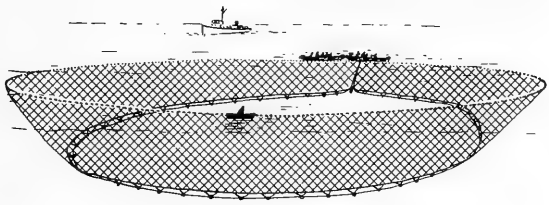
Menhaden vary in color from dark blue to green, blue gray, or blue brown above and have silvery sides, belly, and fins with a yellow or brassy luster. There is a conspicuous dusky spot on each side of the fish behind the gill openings followed by a varying number of smaller dark spots. They are somewhat flattened sidewise like other members of the herring family and the body is about three times deep as long. The scaleless head is very large in proportion to the body. The body scales are nearly vertical (not rounded) and are edged with long comblike teeth instead of being smooth. The large gaping mouth is toothless and the lower jaw projects beyond the upper. The tail is deeply forked. Menhaden feed on microscopic plants and small crustaceans which are sifted out of the water with highly specialized, sievelike gill rakers. Adults average from $\frac{1}{3}$ to 1 pound in weight and from 12 to 15 inches in length.

HABITAT

Menhaden occur in temperate waters along the coast of North America. Atlantic menhaden are found from Nova Scotia to central Florida. Gulf menhaden occur from southern Florida to Veracruz, Mexico. They are not equally abundant throughout their range but are concentrated in certain localities during certain periods of the year. They live in near-surface waters over-lying the inner half of the Continental Shelf during the warmer months. They are rarely seen in surface waters during the colder months and there is evidence that during this period they live in deeper waters over the Continental Shelf. Although they have a definite pattern of migration, menhaden are found at all times of year in Chesapeake Bay.

MENHADEN FISHING

The menhaden fishery is one of the oldest industries in the United States. History records that Indians taught early settlers to place a fish in each hill of Indian corn. It is not known whether all of the settlers followed this practice. The information, however, did lead to the utilization of menhaden for soil enrichment when crops became poor. Use of menhaden as fertilizer was the first stage in



Menhaden
Purse Seine

the development of a fishery which was to become the largest in North America.

Menhaden are caught with purse seines operated from two open seine boats. When laying the seine, the boats separate and the net is laid out as each boat completes a half-circle. When the school is surrounded, the bottom of the seine is closed or "pursed" confining the fish. The ends and bottom of the seine are hauled in and the catch is pumped into the hold of the carrier vessel standing by. Since 1946 airplanes have been used extensively in locating the schools of fish. This practice of directing the laying of the seine around a school of menhaden from the air by radio communication between the pilot and the fishing captain has been universally adopted. A smaller amount of menhaden are caught in pound nets. This catch is incidental, however, as the pound nets are usually set for other species.

CONSERVATION AND MANAGEMENT

Scientists of the United States Department of Commerce's National Marine Fisheries Service, the Virginia Institute of Marine Science, and of several other state agencies along the east coast have done extensive research on menhaden over the past years. Information concerning life history, migrations, growth, and mortality has been gathered. Studies have been made of the causes of fluctuations in abundance and techniques developed for predicting the density of populations. Increased fishing and declining catch in recent years have raised serious questions about the need for management of this valuable resource. Fishing regulations have been in effect for several years. Continuing research, tagging experiments, offshore fishing for older menhaden, and investigations into the commercial potential of two closely related species are a part of the conservation and management plans of concerned scientists.

USES OF MENHADEN

Menhaden are a valuable part of our economy. The catch is processed into fish meal, oils, and solubles and these products are used in dozens of ways. The meal, high in protein, minerals, and other essential nutrients, is excellent as an additive for the feeding of hogs, poultry, mink, and other animals. The oils and solubles are used in the manufacture of paints, putties, resins, lubricants, caulking compounds, brake blocks, soaps, cosmetics and other pharmaceuticals, and for tanning leather. This fishery provides employment for thousands of people, not only on the vessels and in the processing plants, but all through hundreds of related industries. (National Marketing Services Office, NMFS, U.S. Dept. of Commerce, 100 East Ohio Street, Room 526, Chicago, Ill. 60611.)

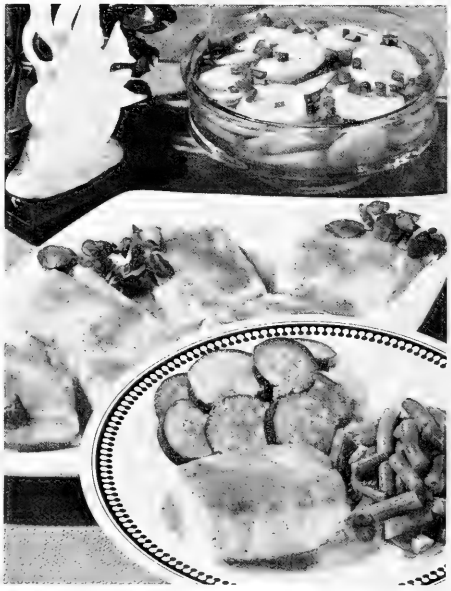
SLIM AND TRIM WITH SUCCULENT SEAFOOD

So, you've been trying to "diet in quiet" as Odgen Nash humorously advised, but you're discouraged. Those unwanted pounds aren't disappearing fast enough, and the waistline bulge is still spoiling the fit of your clothes. It has been said that "misery loves company," but you don't believe it, and you're about ready to quit. Doctors and nutritionists, aware of the difficulties of dieting, would assure you that you shouldn't give up, because there is a way to lose weight and increase vitality at the same time. Here's how--explore the wonderful world of fish and shellfish.

Eliminate your negative thoughts and set sail on a diet routine that accentuates the positive. Fishery products can slim and trim you while you enjoy every luscious bite. The reason is that seafood are high in valuable protein, vitamins, and minerals, while being low in sodium, fat, and calories. Choose recipes planned for dieters, not those loaded with butter or sauces. Give versatile seafoods a chance to prove their worth. It won't be long until you want to tell the whole world about the values of fish and shellfish in the diet.

Begin your positive diet routine with a tasty entree that offers a maximum of flavor with a minimum of calories. Spicy Seafood, a taste delight from the National Marine Fisheries Service, is a diet dandy with only 130 calories per serving. This easy-do recipe offers you a choice of thick fish fillets such as cod, pollock, or, if you prefer, choose halibut or snapper. Marinate the tender fillets for about 30 minutes in a zippy sauce made from tomato juice accented with a touch of vinegar and highlighted with old-fashioned French dressing mix. What could be simpler? Baste the fillets with the remaining sauce while they broil--just long enough to flake easily. This satisfying entree has the ultimate in flavor and taste, and you'll want to serve it again and again long after you've lost those extra pounds and no longer need to diet.

Losing weight can be a satisfying experience with Seafood Slimmers (I 49.49/2:7), Fishery Market Development Series No. 7. This full-color booklet is chock-full of tasty seafood recipes for any day of the week and any meal of the day. For your copy send 25¢ to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.



SPICY SEAFOOD

- 2 pounds cod or other thick fish fillets, fresh or frozen
- $\frac{2}{3}$ cup tomato juice
- 3 tablespoons vinegar
- 2 tablespoons salad oil
- 1 envelope ($\frac{5}{8}$ ounce) old-fashioned French dressing mix

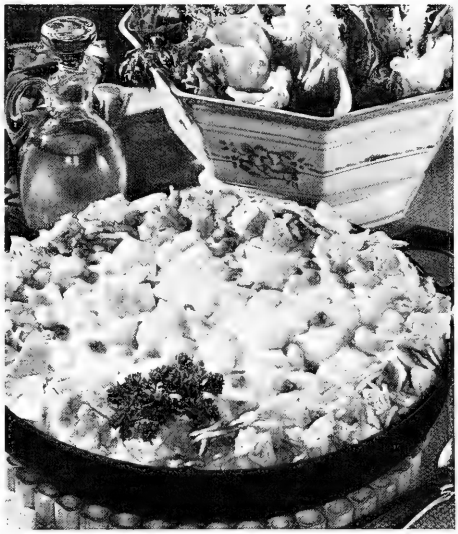
Thaw frozen fillets. Skin fillets and cut into serving-size portions. Place fish in a single layer in a shallow baking dish. Combine remaining ingredients and mix thoroughly. Pour sauce over fish and let stand for 30 minutes, turning once. Remove fish, reserving sauce for basting. Place fish on a well-greased broiler pan. Broil about 4 inches from source of heat for 4 to 5 minutes. Turn carefully and brush with sauce. Broil 4 to 5 minutes longer or until fish flakes easily when tested with a fork. Makes 6 servings.

(National Marketing Services Office, NMFS, U. S. Dept. of Commerce, 100 E. Ohio St., Rm. 526, Chicago, Ill., 60611.)

FISH FLIPS WITH CHIPS

Casting about for something tasty and new to serve? If you've been limiting your family with the same old tired menus, and your excuse is that the food money always runs out before the month does--you need a new approach. Would you like to find a food source that has infinite variety and is loaded with valuable protein and other nutrients; something tempting to eat, easy to prepare, and kind to the budget? That is a large order--but it isn't too hard to fill. The National Marine Fisheries Service says that all you need is a little imagination and a supply of fish and shellfish to spark appetites, satisfy hunger, and add variety as well as nourishment to meals. Versatile seafoods are the answer--and there is an abundant supply available at your seafood market or the frozen seafood counter at the supermarket. Fishery products come in a myriad of seafood styles to fit every taste and need ranging from budget to gourmet items. The vast majority of fishery products, however, are moderately priced. Prices are usually determined by the abundance of the species, the quantity caught, and the amount available. Wise homemakers note what is in good supply and buy accordingly.

Fish fillets, those tender pieces cut from the sides of the fish, are among the most economical of all fishery products because there is very little waste. Many varieties of fish fillets are available, and there are so many tasty ways to prepare them that one could serve this seafood style for weeks without repeating the same entree. Fish fillets may be broiled, baked, steamed, fried, poached, or combined with other foods in a satisfying entree such as a Seafood Casserole With Corn Chips. This casserole is unusual because it features succulent fish fillets combined with mushrooms, sauteed onions, peas, and--here's the something new--corn chips for crispness and body. Cream of shrimp soup blends it all together and adds a subtle flavor that will keep your eager eaters guessing and coming back for more. Try this man-pleasing recipe soon; it's so easy to do and just right when appetites are big and food funds are little.



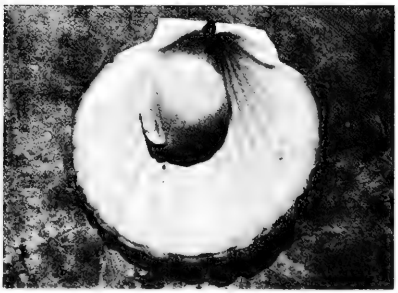
SEAFOOD CASSEROLE WITH CORN CHIPS

- 2 pounds cod or other thick fish fillets, fresh or frozen
- 1/2 cup chopped onions
- 3 tablespoons melted margarine or cooking oil
- 2 tablespoons flour
- 1 teaspoon salt
- 1 can (10 ounces) frozen condensed shrimp soup, defrosted
- 1/2 cup half-and-half (half milk, half cream)
- 1 can (4 ounces) sliced mushrooms, undrained
- 1 package (10 ounces) cooked frozen peas, drained
- 3 cups corn chips

Thaw frozen fish. Cut fish into 1-inch pieces. Cook onions in melted margarine or cooking oil in a 10-inch fry pan until tender but not brown. Add fish and cook, turning carefully until it is firm. Sprinkle with flour and salt. Add soup, half-and-half, and undrained mushrooms. Heat and stir carefully. Fold in peas. Spread 2 cups corn chips in even layers over the bottom of a shallow, 2-quart round casserole or a 12 by 8 by 2 inch rectangular baking dish. Add fish mixture. Sprinkle remaining corn chips around edge of dish. Bake in a moderate oven, 350°F., 25 to 30 minutes or until mixture is hot and bubbles around edge. Makes 6 servings.

(National Marketing Service Office, NMFS, U.S. Dept. of Commerce, 100 East Ohio Street, Room 526, Chicago, Ill. 60611.)

FOOD FISH FACTS



SCALLOP MEAT AND SHELL

Throughout the centuries many romantic and historical events have evolved with the beautiful scallop shell as a symbol. Buildings in ancient Pompeii were ornamented with scallop shell designs. During the Crusades scallop shells were the symbol of the holy pilgrimages and one European variety is still referred to as "the pilgrim" or "St. James' shell." Poets have written about their beauty and artists so admired their symmetry and grace that they were often used in paintings of Venus and the name "Venus-cocle" came into common usage in Old English.

Early American Indians of the Pacific Northwest used scallop shells in their ceremonial dances and some tribes used them as ornaments. Today the shells are eagerly sought by collectors. The larger shells are frequently used as practical, individual containers for cooking and serving fish mixtures.

Inside the scallop shell is another work of art that is also a source of eating pleasure to all people who love good food from the sea.

DESCRIPTION

The name "scallop" aptly describes the fluted edges of the fan-shaped scallop shell. The shells of young scallops, in particular, are beautiful; the outside is delicately colored, sometimes having pink and white or other darker color variations. The inside of the shells is pearly-white and has a satiny luster.

Scallops, like clams and oysters, are mollusks having two shells. They differ, however, from those shellfish in that they are active swimmers. The scallop swims freely through the waters and over the ocean floor by snapping its shells together. This action results in the development of an oversized muscle called the "eye" and this sweet-flavored muscle is the only part of the scallop eaten by Americans. Europeans, in contrast, eat the entire scallop meat.

The New England sea scallop (Placepecten magellanicus) is the most commercially important scallop in the United States. It has a saucer-shaped shell and grows as large as 8 inches in diameter with the muscle or "eye" sometimes reaching up to 2 inches across.

The bay scallop is much less plentiful but greatly desired by scallop fanciers. It reaches a maximum size of about 4 inches in diameter with the muscle or "eye" about $\frac{1}{2}$ inch across. The bay scallop shell is similar to that of the sea scallop except that it is smaller, more grooved, and the edges are more serrated or scalloped.

DESCRIPTION (Contd.)

A number of important new scallop beds have been found recently through National Marine Fisheries explorations. The calico scallop, located off Florida and in the Gulf of Mexico, is closely related to the bay scallop although slightly larger. It gets the name "calico" from the mottled or calico appearance of the shells.

Particularly exciting has been the discovery of a new and potentially important source of sea scallops in the cold waters surrounding Alaska. This species, found as far south as Oregon, is a different variety of sea scallop than that found in New England waters.

HABITAT

Sea scallops from the east coast are taken from the deep waters of the Northern and Middle Atlantic States, with the old whaling port of New Bedford, Massachusetts claiming most of the catch. This is still the largest source of supply.

Bay scallops live in bays and estuaries from New England to the Gulf of Mexico.

SCALLOP FISHING

Sea scallops are harvested with dredges on gravel, sand, or sand-mud bottoms. Some trawl fishermen harvest scallops on a part-time basis. This necessitates removing the otter trawl nets and bringing aboard the equipment needed for scallop dredging.

Bay scallops are taken with small dredges operated from small boats or scows in deeper bay waters. In shallow water bay scallops are usually taken with dip nets, rakes, or by hand.

Scallops cannot close their shells tightly and die soon after being taken from the water. Because of their perishability scallops are shucked aboard ship as soon as they are caught, and the meats are iced.

CONSERVATION AND MANAGEMENT

The supply of scallops has decreased in some areas in recent years. Many factors affect their abundance, some of which are beyond man's control. Studies are being made to correct this problem through grant-in-aid legislation passed by Congress, the Commercial Fisheries Research and Development Act of 1964. Through research and explorations it is hoped that a continuing and abundant supply of scallops can be provided for an ever-growing population.

USES OF SCALLOPS

The tender, succulent meats from either bay or sea scallops have no waste and can be used interchangeably. All scallop meats are excellent sources of protein, have many of the vitamins and minerals valuable in good nutrition, and are low in fat. The delicately-flavored nuggets of meat are available throughout the year either fresh or frozen. (National Marketing Services Office, NMFS, U.S. Dept. of Commerce, 100 East Ohio Street, Room 526, Chicago, Ill. 60611.)

INDEX

BACK COVER: Madagascan child unloads Pirogue. Fish are taken home, strung out in long lines to dry in the open, and then sold. (FAO: P. Pittet)

UN
GOVERNMENT PRINTING OFFICE
PUBLIC DOCUMENTS DEPARTMENT
WASHINGTON, D.C. 20402

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
U.S. GOVERNMENT PRINTING OFFICE

U.S.MAIL

Commercial Fisheries REVIEW

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

-APR. 1972
VOLUME 34
NUMBERS 3-4

Commercial Fisheries REVIEW

A comprehensive view of United States and foreign fishing industries — including catch, processing, marketing, research, and legislation — prepared by the National Marine Fisheries Service.

CONTENTS

COVER: Many Ceylonese fishermen shoot drift nets in the evening, then sleep on the beach until next morning. FAO is working with Ceylon to increase fish supply by more efficient methods.

(FAO Photo)

FISHERMEN'S MEMORIAL—GLOUCESTER, MASS.

U.S. DEPARTMENT OF COMMERCE
Peter G. Peterson, Secretary

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Robert M. White, Administrator

National Marine Fisheries Service
Philip M. Roedel, Director

Address correspondence and requests to: Commercial Fisheries Review, 1801 North Moore Street, Room 200, Arlington, Va. 22209. Telephone: Area Code 703-557-9066.

Use of funds for printing this publication was approved by the Director, Bureau of the Budget, April 18, 1968.

Editor: Edward Edelsberg

Production: Alma Greene

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price 60 cents (single copy). Subscription price: $7:00 a year; $2 additional for foreign mailing.

NOAA HEAD VOWS TO PROTECT MARINE RESOURCES

"Our marine resources--poorly understood, managed hardly at all, threatened on all sides--are among our most priceless assets. We intend that what has happened to the whale shall not be repeated with other species if it lies within our power to prevent it." So ended a speech by Dr. Robert M. White, NOAA Administrator, at the inauguration of an auditorium of the New Bedford Whaling Museum in Massachusetts on April 23.

His inaugural lecture, titled "Whales and Men," limned the rise and fall of the whaling industry and the threat today to depleted species. Its latter part dealt with major problems facing men, marine resources, and the Nation. The lesson of the whale is relevant to the solution of these problems.

The following is excerpted from Dr. White's speech.

We must, in fact, conserve or suffer the consequences. Although it is not a popular thing to say, conservation must begin at home. The concept is not an easy one to accept in the face of the difficulties which today beset New England's fisheries and with the spectacle of foreign fleets gobbling up valuable--and perishable--stocks almost under our noses.

For more than 300 years, men from New England have fished the rich banks off New England for their livelihoods. During these centuries the fishing grounds, although located in international waters, were used almost exclusively by American fishermen. In the early 1960's, huge fleets from the USSR and other nations moved in, bringing modern technology, mass fishing, depletion and hardship. Haddock, cod, herring, the hakes, mackerel and other species have been, and continue to be, heavily exploited. This audience knows the impact better than all others. You suffer double jeopardy. You bear the brunt of the economic hardship that accompanies both bad conservation practices as well as the remedies of drastic quotas necessary to give hope of restoration of resources on which you depend. I speak of the yellowtail flounder, one of the mainstays of New Bedford's fleet today. In recent years this species has declined alarmingly, with the hardships more than evident.

You are faced with a Hobson's choice--some of you think unfairly--to suffer the immediate hardship of quota regulations and to work with us to restore the resource on which the community depends, or suffer in the long run the catastrophe which will result from unregulated take and permanent destruction of the resource. You have a right to expect the support of your Government to assist you in these difficult times. You have the right to expect your Government to represent you and your interests forcefully in international negotiations, and you have the right to expect your Government to insist upon enforcement by all, of such agreements as are arrived at. I will be the first to admit that we have not always been successful. But it is not because we have not tried. And I pledge that we will not cease to exert our every effort.

We face a dilemma. It is a fact that fisheries on the high seas beyond 12 miles, are in international waters. Under present law, they are common property and are subject to exploitation by anybody and everybody. The only mechanism we now have to regulate the take is through the International Commission for the Northwest Atlantic Fisheries. It has not served our national interests adequately, but it is all we have. We are striving in that forum to push for adequate regulations. We seek to move toward national quotas as a means, at the present time, of insuring adequate fish for our fishermen. We have made a start with herring. More species must be brought under quotas soon.

This kind of regulation may save the stocks but not necessarily American fishermen, for those nations whose recent efforts have depleted the stocks still will be able to take a major share. In our view, the problem will not approach solution until the coastal nation has a much greater degree of control over coastal fishery stocks, and a preferential share of the yield of those stocks. We have expressed our views vigorously in support of coastal Nation control of coastal stocks at the most recent preparatory meeting for the United Nations Law of the Sea Conference to be held in Geneva in 1973. NOAA and its National Marine Fisheries Service are deeply involved in planning for the conference, and we are determined to seek a U.S. position which will bring an end to the systematic overexploitation of resources on which our people depend.

We are also deeply concerned about environmental deterioration and its effects upon the living things of the sea. The practice of dumping polluted materials in the ocean has had serious consequences. Clams, bay scallops, and oysters, limited essentially to coastal waters, are especially vulnerable and deserve the best protection we can offer them. Even more important is the continuing decline of water quality in our estuarine and coastal environments, and its effect upon their capacity to produce the things we need. Man has physically damaged these environments through thoughtless dredging, filling and bulkheading, thus removing vital nursery areas. I wish very developer along the United States coastline could be made somehow to realize that two-thirds of all our coastal species spend at least part of their lives in our bays and estuaries.

Nevertheless, there are hopeful signs. Officialdom, at least, is becoming painfully aware of the fact that the coastal zone has a multiplicity of use, and one of the most important is as a habitat for valuable commercial fisheries and a source of recreation. It is becoming quite clear that coastal zone management mechanisms must be found and put into practice to properly balance the uses to which we put this vital area.

When NOAA was created in October, 1970, President Nixon charged us with a major environmental mission. Chief among our tasks are the exploration and description of the oceans, their basins, and their life forms and resources, achieving a better understanding of their processes, and supporting the technological advances necessary to effective and protective use of the seas.

Our marine resources--poorly understood, managed hardly at all, threatened on all sides--are among our most priceless assets. We intend that what has happened to the whale shall not be repeated with other species if it lies within our power to prevent it.

FOOD PRICES MAY RISE 4½% IN 1972

"Food prices in 1972 may average 4½% higher than in 1971, up from the 3% increase last year," predicts the U.S. Department of Agriculture. Contributing most of this increase will be the continued large increases in disposable income and a leveling of food supplies.

The prices of food for the home "will rise close to 4% compared with the 2½% boost in 1971."

Fishery Products Situation

Supplies of fishery products generally have been tight at the markets during the past few years. The situation continued in 1971. The dock strikes in late 1971 made things worse. They disorganized normal distribution and discouraged exports by foreign suppliers. Revaluation of foreign currencies favors shipment of available world supplies to overseas markets. This may cut even more the availability of seafoods in the U.S. So, per-capita consumption, down in 1971, "may do well to hold steady in 1972."

Because prices soared to records in 1971, the value of per-capita sales continued strong. This was true especially for shellfish, particularly shrimp, lobster, lobster tails, crab, and scallops. Scallops remained popular at retail and institutional levels. The only major weakness was in retail sales of such basic fish commodities as fillets, steaks, and breaded fish sticks and portions.

Demand Strong

Another large rise in prices is indicated in 1972 because the continued strength in demand will keep ahead of supplies. However, due partly to Phase II of the government's economic policy, "the increase probably will be smaller than in 1971."

The institutional market, too, remains strong. Fast growth is expected in fish sandwiches, fish and chips, and similar items used mainly by food-service operations.

Supplies Tight

Supplies will remain tight. At the start of 1972, inventories of frozen fishery products were below a year earlier. In the early months of the year, domestic production is seasonally low; imports are expected to run below a year ago.

FDA PROPOSES NUTRITIONAL VALUES BE PUT ON PACKAGED FOOD LABELS

U.S. consumers will be able to determine from packaged-food labels the nutritional values of the contents, including vitamins, minerals, proteins, and calories, under a proposal made March 29, 1972, by the Food and Drug Administration (FDA). It appeared in the Federal Register the next day.

The FDA Commissioner said that if industry adopted and carried out the new program, it "could provide one of the most fundamental changes in the history of food labeling in this country. . .In the past, labeling emphasis has been on identifying the product and its ingredients. The new program encourages labeling emphasis on the identity of nutrient values." The FDA program is voluntary.

Type of Information

The proposal outlines the format and type of nutrient information manufacturers must make available (and position on the label) if they want to join the labeling program. Tests showed that consumers want and will use better information on nutrients.

Recommended Daily Allowance

The Recommended Daily Allowance (RDA) will serve as the standard for nutrient values on the labels. The RDAs are amounts of nutrients recommended by the Food and Nutrition Board of the National Research Council. They are considered adequate to maintain good nutrition in healthy persons in the U.S. The allowances are revised as newer knowledge of nutritional needs accumulates.

The declaration on the label must include this information according to the stated serving or portion:

1. Caloric content to the nearest 5 calorie increment;

2. Number of grams of protein, fat, and available carbohydrates to the nearest gram;

3. Vitamins and minerals expressed in 10% increments of the RDA (5% increments may be used up to 20%). The statement, "Contains no significant quantities of vitamins and minerals," may be used

if product contains less than 5% of any vitamins or minerals required to be listed; and

4. The listing must include Vitamin A, Vitamin C, Thiamin, Riboflavin, Niacin, Calcium, and Iron. Mention of other vitamins and minerals is optional.

NMFS NAMES CHIEF OF STATE-FEDERAL RELATIONS

NMFS has appointed Takashi Miyahara, 46, of Seattle, Wash., Chief of its Office of State-Federal Relationships (OSFR). He will plan and administer State-Federal cooperative efforts to develop and implement new concepts in managing commercial and recreational fisheries. He will direct the NMFS $6.5 million grant-in-aid program.

NMFS Director Philip M. Roedel noted the long-established need for more rational systems to manage U.S. fishery resources. The new State-Federal Fisheries Management Program is intended to create and encourage such systems.

To develop programs and policies for solving management problems of mutal concern, Miyahara will represent NMFS in contacts with Congress; State and Federal officials, including State legislative bodies; officials of scientific organizations, and commercial and recreational fishing groups.

Background

Miyahara worked for the Bureau of Commercial Fisheries (now NMFS) from 1953 to 1962. He resigned to join Wakefield Fisheries of Alaska as general superintendent for about nine years. Wakefield was the pioneer and largest king-crab processor in the U.S. until its merger with Hunt-Wesson Foods. Frequently, he testified at fishery regulation hearings and participated in international negotiations.

After leaving Federal Service, he was asked to continue his association with scientists on the U.S. Section of the King Crab and Tanner Crab subcommittee of the International North Pacific Fisheries Commission. On several occasions he served as chairman and spokesman for the subcommittee. Also, he worked with the Alaska Department of Fish and Game and the Alaska Legislature on the State's king-crab program.

Miyahara holds a B.S. degree in fisheries from the University of Washington, Seattle. He is a member of the American Institute of Fisheries Research Biologists.

U.S. AND CANADIAN LOBSTER RESEARCHERS MEET

U.S. and Canadian lobster researchers met at the NMFS Biological Laboratory in Woods Hole, Mass., March 28-29, to review both current research and progress since their last meeting in St. Andrews, New Brunswick, in 1970.

Researchers know that seawater temperature and available food are the primary factors affecting the growth rate of juveniles and young adults. They are seeking the information necessary to induce a greater ratio of internal growth with more frequent moulting. Also, they would like to increase the size increment resulting from each moulting. These aspects of lobster culture have direct application to the commercial rearing of lobsters.

Distinct Stocks of Lobsters

The study of lobster growth patterns is especially important in estimating productivity rates of lobster populations. The separation of the lobster resource into distinct stocks, each with a different growth rate, will help to clarify some aspects of the total productive capability of natural lobster populations. Understanding this capability is important in maintaining profitable commercial fishing operations.

The meeting was held at the NMFS Northeast Fisheries Center in Woods Hole, although the Center's lobster research is conducted at Boothbay Harbor, Maine. Boothbay Harbor scientists reported on the results of their lobster-tagging program. This program is important in "determining the extent,

seasons, and areas of mixing between New England offshore and coastal lobster populations."

The coordinator of the workshop was Ernest D. McRae Jr.

GRAY-WHALE CENSUS SHOWS 15% DECLINE

The annual count of the southward-migrating gray whales, Dec. 18, 1971-Feb. 8, 1972, was conducted at Yankee Point near Monterey, Calif. Richard Fletcher and Ella Mae Zeman counted 2,740 whales passing between 7 am and 5 pm daily. Forty more whales were seen that already had passed the point by 7 am or had not reached it by 5 pm. Total population--including whales that passed at night or were missed by the observers during poor visibility--is estimated at about 9,000.

Possible Reasons for Decline

This year's count was about 15% below the previous 4 years, 1967-68 to 1970-71. The reasons are unknown. NMFS La Jolla suggests that these possibilities be investigated: 1) increased boat traffic in Monterey Bay area may be causing a larger proportion of the whales to migrate farther offshore; 2) Eskimos in Siberia and Alaska may be killing more whales; and 3) increased tour-boat traffic in Scammon's Lagoon, one of the whale's major Mexican calving grounds, may be reducing the survival rate of calves. The lagoon is south of the Bay of Sebastian Vizcaino on the west coast of Baja California.

Mexico Establishes Sanctuary

By presidential decree, effective in early January 1972, Mexico established a refuge for whales in Scammon's Lagoon.

SAN PEDRO NO. 1 IN LANDINGS VALUE, CAMERON, LA., IN VOLUME

San Pedro, California, retained its position as No. 1 fishing port during 1971 in value of landings--but Cameron, La., replaced it in volume.

Many of the same seaports remained among the top 10 in value of catch to fishermen and in pounds landed. None of the 10 occupies the same position on both lists.

The leading ports by value of landings were San Pedro, Calif.; Brownsville-Port Isabel, Tex.; Kodiak, Alaska; New Bedford, Mass.; Aransas Pass-Rockport, Tex.; Dulac-Chavin, La.; San Diego, Calif.; Freeport, Tex.; Cameron, La.; and Morgan City, La.

Tuna is the primary species landed at San Pedro; menhaden accounts for most landings at Cameron.

The port rankings by volume in 1971 were Cameron, La.; San Pedro, Calif.; Pascagoula-Moss Point, Miss.; Dulac-Chavin, La.; Morgan City, La; Empire, La.; Kodiak, Alaska; Gloucester, Mass.; New Bedford, Mass.; and San Diego, Calif.

WASHINGTON-OREGON SALMON PACK ROSE SHARPLY

Preliminary estimates of the 1971 Washington-Oregon canned salmon pack indicate 615,550 standard cases (48 one-pound cans per case). This is an increase of 357,900 cases (139%) over 1970. Dominating the 1971 pack was Puget Sound sockeye salmon: 251,483 cases, 41% of total.

The canned pack of sockeye salmon in Puget Sound was up to 50% above the cycle year 1967 pack.

The 1971 Puget Sound pink-salmon pack of 146,800 cases was slightly less than double the 1969 cycle year pack of 75,857 cases.

In Puget Sound, pink salmon are 2-year-olds when they return from the ocean to spawn; sockeye salmon are 4-year-olds when they return. Puget Sound pink-salmon runs occur only in odd-numbered years.

1971 GULF MENHADEN CATCH SETS RECORD

The menhaden catch in the Gulf of Mexico broke all records in 1971--over $1\frac{1}{2}$ billion pounds were landed in Mississippi, Louisiana, and Texas. It was the largest catch of a single species in U.S. history. Menhaden, primarily, is an additive in meal fed to poultry and cattle.

MORATORIUM ON NORTHERN STOCK OF PACIFIC SARDINE RECOMMENDED

The "catastrophic decline" in California sardines in the late 1940s motivated establishment of the California Marine Research Committee (MRC). MRC coordinated U.S. and state research on sardines.

On Feb. 8, 1972, MRC recommended a moratorium on the northern stock of Pacific sardine. Although this stock is very important to commercial and sport fish industries of California, MRC said, data from CalCOFI indicated it was at extremely low level. Drs. W. Lenarz and P. Smith of NMFS La Jolla Laboratory provided some of the data.

MRC Recommends Legislation

MRC asked the Director, California Department of Fish and Game, to initiate appropriate legislation in the 1972 regular session of the California Legislature. It asked the U.S. State Department to join with Mexico to enact a moratorium on northern stocks of Pacific sardines off west coast of northern Baja California, Mexico.

REVIEW PACIFIC NORTHWEST COASTAL-POLLUTION STUDIES

Six Oregon State University scientists have compiled a review of all oceanographic literature on the coastal zone from Cape Flattery, Wash.; to Cape Mendocino, Calif. It is entitled, "Oceanography of the Nearshore Coastal Waters of the Pacific Northwest Relating to Possible Pollution." The first volume contains a bibliography and 21 chapters on the physical, biological, and chemical characteristics of the northeastern Pacific. The second volume contains charts and tables. The report excludes studies on bays and estuaries.

Available From GPO

The report was prepared with a grant from the Water Quality Office of the Environmental Protection Agency. It is part of the water-pollution-control research series sponsored by the Water Quality Office. Copies are available through the U.S. Government Printing Office for $11.25.

NMFS ALASKA HOLDS POT FISHING WORKSHOPS

Nearly 200 fishermen, businessmen, and students came to a series of informal workships designed by NMFS Alaska Region to demonstrate assembling and fishing techniques of pots for sablefish and other bottomfish. The workshops were held in Homer, Seward, Sitka, Petersburg, and Ketchikan in January. Components of the pots, preshipped to the workshops, were assembled with audience participation. The completed pots, ready to fish, were left with fishermen at each location. The fishermen will experiment with them on various species. Results of the test fishing will be made available to other interested fishermen.

Extension Program

The workshops were part of the NMFS Alaska fisheries extension program. Fred Hipkins, fishing-gear research specialist, from Seattle, Wash., demonstrated and supervised pot-assembly methods. He discussed experiments, evaluation, and fishing experience with the pots on black cod in Washington and Oregon waters.

The purpose of the workshop was to expose fishing communities to relatively inexpensive gear that, potentially, can be used by independent fishermen to catch underutilized bottomfish resources. This purpose was explained by NMFS Alaska coordinator, Walter Jones, who arranged the workshops.

A step-by-step description of pot construction (6 and 8 foot), with a materials list, will be written by Fred Hipkins for distribution to workshop participants. Information on NMFS experimental fishing with pots off Alaska during sablefish tagging in February will be provided fishermen.

Can Catch Other Bottomfish

NMFS staff emphasized that the pots would fish bottomfish other than sablefish, such as cod, lingcod, rockfishes, and soles. Many southeast Alaska fishermen are so oriented to salmon, king crab, and halibut fishing that they doubt they can fish for much less than 20 cents per pound. There are markets in all workshop areas offering 8-12 cents per pound (depending on dressed condition) for rockfishes and around 17 cents a pound for true cod (for bait). The market now for sablefish is strong--around 30 cents per pound.

ALASKA FORECASTS 1972 SALMON CATCH

The 1972 catch forecast for Bristol Bay red salmon is grim, that of pink salmon bright, according to the Alaska Department of Fish and Game.

The catch of red salmon in Bristol Bay is predicted at about 5,375,000 fish. This will produce a case pack of about 375,000 standard cases--down 45% from 1971 pack, but slightly above cycle year pack of 335,000 cases.

1972 Alaskan Salmon Catch Forecast
(In Numbers of Fish)

Region	King	Red	Coho	Pink	Chum	Total
			(1,000 Fish)			
So. Eastern	300	800	750	16,500	1,000	19,350
Central	30	2,990	670	12,350	3,080	19,120
Western	280	5,370	170	1,140	1,290	8,250
Total	610	9,160	1,590	29,990	5,370	46,720

An Alaskan pink salmon pack of 1,420,000 cases is predicted, 39% above 1971's 1,017,653 cases. This would be up slightly from the 1970 cycle year pack of 1,329,000 cases.

ALASKA'S SALMON-FISHERY LICENSING SOARS

Alaska requires licenses for fishermen, vessels, and gear. Between 1962 and 1971, only the numbers of purse seines licensed annually remained relatively constant. Those of troll, drift net, and set-net licenses reached record levels in 1970 and 1971. More than 4,000 fishermen entered Alaska's fisheries during the decade.

	1962	1971
Vessels	8,157	10,710
Gear:		
Troll	1,440	2,353
Purse seine	1,402	1,323
Drift gill net	2,895	4,779
Set gill net	2,294	3,062
Fishermen:		
Resident	10,333	14,176
Nonresident	6,072	6,388
Total fishermen	16,405	20,564

Nonresident fishermen make up about 30% of all fishermen. The home state of nonresident fishermen has not been tallied, but the Alaska State Department of Revenue reports that over half of the nonresidents were from Washington State, and one-fourth from Oregon. An estimated 600-700 Californians register to fish in Bristol Bay.

In 1971, only 14 Alaska vessels fished in Washington State waters.

BLOODWORM MAY BE MOST VALUABLE MARINE ANIMAL

On the basis of weight, the bloodworm used as bait by sport fishermen may be the most valuable regularly harvested marine animal.

In 1971, about 845,000 pounds were harvested in Maine. They were worth about $1,250,000 to the diggers, who took the worms from mud flats exposed by receding tides. In recent years, the bloodworms have averaged about 140 to the pound and cost

anglers about $1 a dozen. This is almost $12 a pound if sold by weight.

Because bloodworms are valuable, scientists of Maine's Department of Sea and Shore Fisheries, supported financially by NMFS, are studying causes of mortality in harvesting, handling, and shipping.

TAGGED BLUE SHARK RECAPTURED 2000 MILES AWAY

A 6-foot blue shark, tagged off Cape Cod, Mass., October 1970, was recaptured by a Taiwanese longliner in April 1971. The site was latitude 19°29' N. longitude 43°23' W.--over 2000 miles southeast of tagging site, about half way between the West Indies and Africa. This is the farthest east a tagged shark has moved.

Earlier, a blue shark was recovered from this same area. It had traveled 1800 miles westward from the Canary Islands.

Both sharks were free for nearly 6 months. Their rates of travel were 10.5 and 11.8 miles per day.

U.S. FIRM FLIES EELS TO BRITAIN

A Philadelphia, Pa., firm last fall delivered 70 tons of live eels by air freight to London in less than 12 hours. The mortality rate for such shipments rarely exceed two percent.

The size of the British market was estimated at around 800 tons a year. Most imports are made from December to March, when live eels, mainly from Ireland, are out of season. Frozen eels are imported only when adequate live supplies are not available. American yellow (known in London as brown) and silver-bellied eels are sold in Britain. (Fish Industry Board, New Zealand.)

BASKET COCKLE IS EXPOSED BY OREGON RESEARCHERS

A bay clam common to Oregon, the basket cockle, is having its life history told. It is the result of a 3-year study, begun in 1969, by Oregon State University's Department of Fisheries and Wildlife to learn more about this important invertebrate's biology.

"Harvest regulations are based on a very limited knowledge of the basic biology of this animal. We sought to gain information which would provide a basis for alterations in management practices, where needed, to regulate harvest," said Robert Scott, a research assistant.

"As a near-surface dweller, the basket cockle is easy to harvest with sport gear and in the study area, the sport harvest of clams has been tremendous. As a result, it is not uncommon to find cockles in limited supply in once heavily populated areas in Netarts Bay."

It Is Long Lived

The basket cockle is long lived. It may live as long as 10 to 15 years in Oregon estuaries. Age of cockles up to 2-3 years can be determined on the basis of size. "Older individuals become increasingly difficult to age, because growth patterns become more irregular. Counts of shell 'growth rings' provide no useful indication of age on animals from the study area," Scott notes.

The spawning season is long. Free-swimming larval stages are found in the Bay from early spring to late fall.

Oregon shellfish harvest regulations set daily limit of the first 36 cockles dug, regardless of size.

GULF AND SOUTH ATLANTIC FISHERIES

John P. Wise

In the early 1930s, the Gulf and South Atlantic section of the U.S. coast (North Carolina to Texas) produced only about 10% of the volume and value of the U.S. commercial fishery catch. In recent years, the region has become the most important in terms of total commercial landings--almost two billion pounds a year. This compares with one and a third billion for the northeast coast (Maine to Virginia) and one and a half billion for the west coast and Alaska. Much of the change has been recent--as late as 1950 the Gulf and South Atlantic region produced less than a billion pounds annually (Figure 1).

The dramatic increase in volume of commercial landings has been matched by an increase in value. Nearly 200 million dollars were paid to fishermen for their products in 1970; the figure was well under 100 million in 1950.

Important Salt-Water Angling

The Gulf and South Atlantic states are also important in salt-water sport angling. The population has been growing faster than in most other sections of the country, tourism is increasing, and the good-weather season is long--year round in southern Florida. The result is that over half of the U.S. salt-water sportsmen's catch now is taken in the Gulf and South Atlantic.

Post-1950 Developments

What has happened to commercial fisheries is shown in Figure 2. The traditional mainstays have been menhaden, mullet, crabs, and shrimp. Menhaden landings have tripled since 1950, crabs have more than doubled, and shrimp are up a third. Only mullet have stayed at the same level. Also, a new element has entered the picture--industrial fisheries for reduction and pet food, insignificant in 1950, now take about 100 million pounds a year.

None of these figures include the catch of U.S. shrimpers, mostly from the Gulf coast, who fish far from home waters and land their catches principally in South America. This fishery, brand new since 1960, now produces about 80 million pounds of shrimp a year, almost all exported to the U.S.

The Future

What is the future of the Gulf and South Atlantic fisheries? Biologists of the National Marine Fisheries Service point out that the record menhaden catches in recent years may be close to the maximum the stocks can produce. On the other hand, blue crabs, the most important crab, could almost certainly support increased landings. (Processing and distribution problems are the industry's main headache.) There is evidence that the yield of shrimp in the Gulf of Mexico could be increased by increasing the average size of the shrimp caught. Spiny lobster fisheries are growing rapidly, now at least 10 million pounds a year worth 10 million dollars or more to the fishermen. Snapper fisheries may have a large potential. Even the mullet stocks could probably support a larger fishery; the market has been the limiting factor.

Almost-Untouched Resources

There are two major resources in the region as yet almost untouched. The calico scallop is probably capable of producing some 80 million pounds of high-value meats a year, and herringlike fishes in the Gulf might yield 600 million pounds of fish for reduction each year. Thus it seems likely that the Gulf and South Atlantic region could easily produce something closer to three billion pounds a year than to the two billion pounds presently taken.

Production Can Increase

There is no doubt that fishery production in the Gulf and South Atlantic can and probably will increase--particularly because of the aggressive nature of the fishing industry there. Foreign competition is minor: Mexico takes about 40 million pounds of shrimp a year in

The author is a fishery biologist with the National Marine Fisheries Service, Southeast Fisheries Center, Miami Laboratory, Miami, Florida 33149. Contribution No. 209.

COMMERCIAL FISHERIES REVIEW
Reprint No. 929

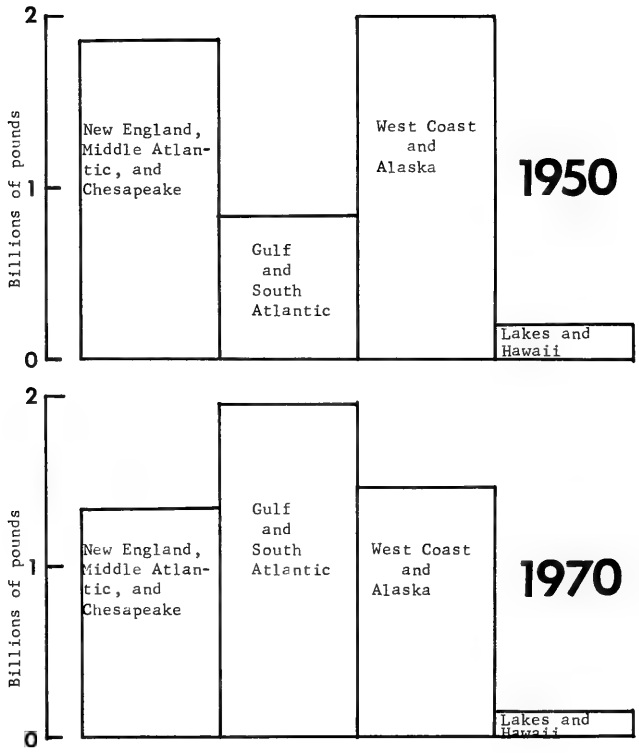


Fig. 1 - U. S. total fishery landings, 1950 and 1970.

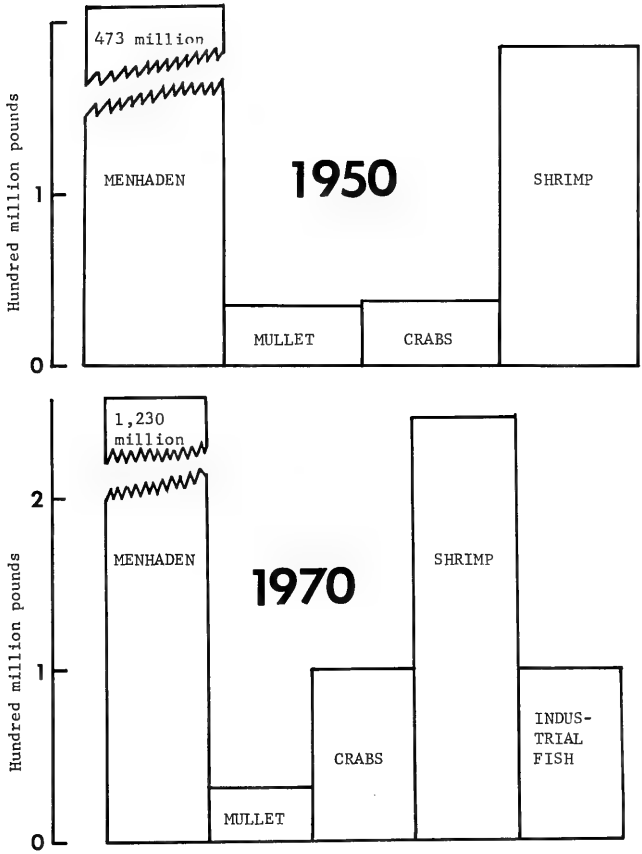


Fig. 2 - Principal Gulf and South Atlantic landings, 1950 and 1970.

the Gulf of Mexico. With the Mexican government's emphasis on fishery development, this fishery probably will increase. (A large part of the Mexican shrimp catch is exported to the U.S.)

Cuba's total catch is now over 170 million pounds a year, more than doubled since 1960. But, to judge from its composition, nearly 60% snappers, groupers, and spiny lobsters, most of Cuba's fishing is in home waters.

Except for a few longliners, mostly Asian, that take relatively small amounts of tunas and billfishes, there are only very minor fisheries in Caribbean, Central, and South American countries, in all the waters from North Carolina to northern Brazil.

In summary, commercial fish catches in the Gulf and South Atlantic region have increased tenfold in the last forty years, and more than doubled in the last twenty. Prospects for even further increases are likely--to a level approaching three billion pounds a year.

Shrimp trawling in Gulf of Mexico off New Orleans. Trawl and otter boards, suspended from outrigger boom, are being lowered back to fish again. Part of last mixed catch of fish and shrimp is on deck. (C.H.B.)

ALBATROSS IV CONDUCTS GROUNDFISH SURVEY OFF EASTERN UNITED STATES

During the fall of 1971, the NMFS research vessel 'Albatross IV' completed surveys of 5 major areas: the continental shelf off western Nova Scotia, the Gulf of Maine, Georges Bank, and shelf areas off southern New England, and the middle Atlantic States.

The groundfish surveys have been an important part of the research program of the NMFS Northeast Fisheries Center at Woods Hole, Massachusetts, for over 20 years. The timing and techniques of the survey have varied considerably. In 1963, when the Albatross IV become available, a fairly standardized approach was adopted. From 1963-1965, three times a year, surveys were conducted from western Nova Scotia to Long Island, New York. Since 1967, the survey area has included the continental shelf southward from Long Island to Cape Hatteras, North Carolina. Current surveys are carried out twice a year, in spring and autumn.

The primary goal of the survey series is to measure changes in the composition of species and the abundance of the fish populations of the continental shelf off the U.S. northeastern coast. The results supplement other information available to develop management policy for conservation under The International Commission for the Northwest Atlantic Fisheries (ICNAF). Recent surveys by Canadian and USSR fishery research agencies have followed NMFS guidelines. The results of these cooperative surveys increase "the precision of interpretation."

How Survey Is Conducted

The evaluation of survey results relies heavily on statistical techniques aided by automatic data processing. The sampling stations are chosen to reflect an accurate measure of the entire area. Primary sampling is done by trawling at stations

Crew of NMFS research vessel 'Albatross IV' retrieves fishery gear off Georges Banks during experimental fishing operations. Vessel has stern trawling ramp, bow thruster to help control it on station, variable pitch propeller, active rudder and closed circuit television. TV shows operations on vessel and trawl and other gear.

selected randomly with a standard #36 Yankee trawl. Measurements of the trawl net during presurvey testing show an average wingspread of 36.5 feet and average headrope height of 8.5 feet. The nets used were equipped routinely with a $\frac{1}{2}$" stretched-mesh liner in the cod-end to retain smaller organisms. Operations are continuous on a 24-hour day basis; trawl hauls are 30 minutes.

Preliminary evaluation of data from the 1971 survey for southern New England and Georges Bank is compared in Table 1 with data from earlier surveys (1965-1970) for several important species.

In Fall 1971, the relative abundance indices (mean catch per haul in pounds) for Georges Bank area was only 52% of average fall survey figure for the 6-year period, 1965 to 1970. Haddock catches dropped most precipitously: The 1971 figure was only 14% of 1965-70 average (down 86%).

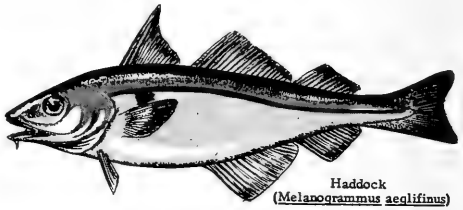
Overall catch rates for southern New England also showed a decline. However, these were off only 17% in 1971 from earlier (1969-1970) data. The catch index for yellowtail flounder was off about 25% for the period.

1971 Results

Some observations on key species include:

HADDOCK

Recruitment to this fishery will remain at a low level until at least 1974. The 1969 and 1971 year-classes appear better than the very



Haddock
(Melanogrammus aeglifinus)

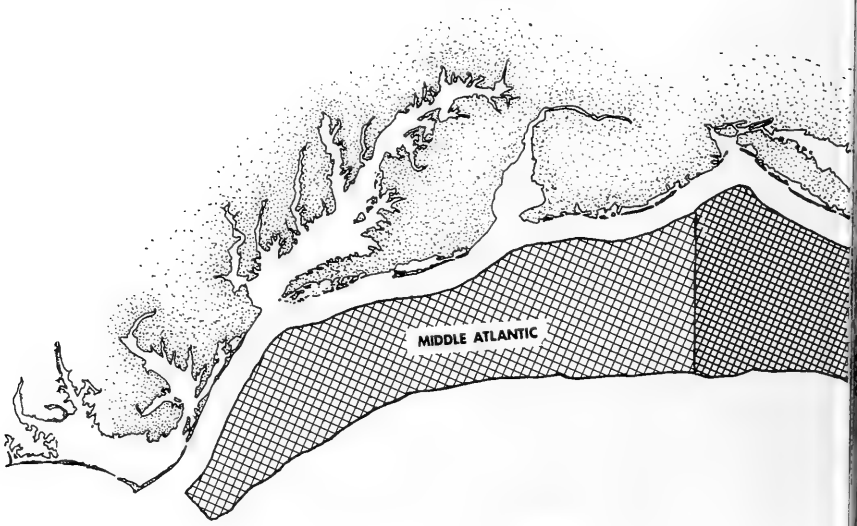


Fig. 1 - Sampling areas in groundfish survey.

poor year-classes spawned since about 1965. But it must be remembered that they are small relative to the average year-classes that supported a much larger fishery in the 1950s. Even though the present level of fishing for it is low, it is very doubtful that the haddock population will be able to do much more than hold its own. The recruitment will not produce any significant build-up of the stock under current quota levels, the NMFS scientists predict.

YELLOWTAIL FLOUNDER

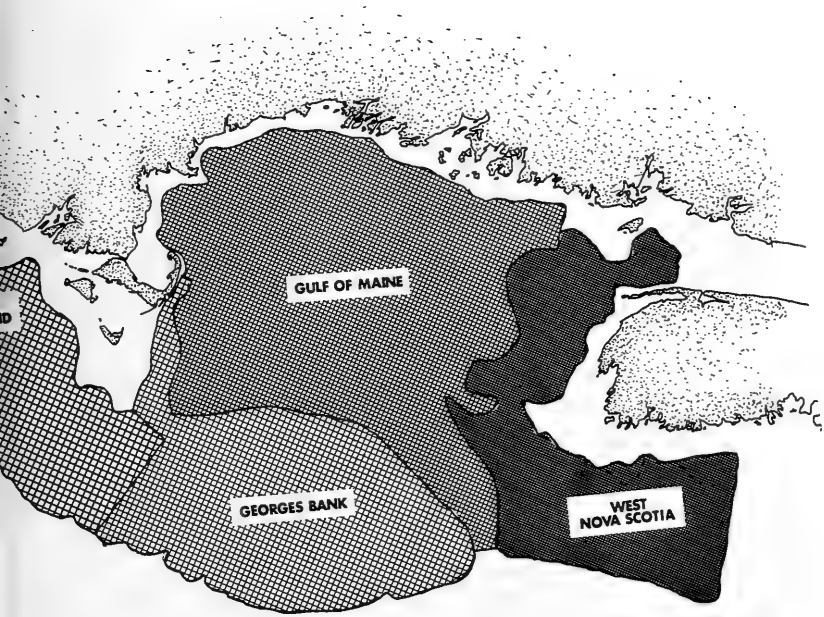
Recruitment of the southern New England yellowtail flounder stock is low. The reduction in quota from 13,000 to 10,000 metric tons in 1972 is essential to maintain the stock. No major increase will be possible until recruitment improves. In 1972, recruitment will remain low.

The Georges Bank yellowtail flounder indices for total stock and recruitment also have shown a decrease. Although the relationship between recruitment and fishable stocks is not yet established for this area, the decline is cause for concern, say MMFS scientists.

Table 1 - Yellowtail Flounder Fall Index of Recruitment

Year	Relative Recruitment *Index So. New England	Georges Bank
1963	16.3	12.7
1964	18.5	2.2
1965	11.7	1.3
1966	34.4	9.9
1967	19.9	7.7
1968	9.0	9.7
1969	7.0	6.0
1970	9.2	5.7
1971	7.7	3.5

*Addition of fish one-year-or-more old to the exploited stock.



selected randomly with a standard #36 Yankee trawl. Measurements of the trawl net during presurvey testing show an average wingspread of 36.5 feet and average headrope height of 8.5 feet. The nets used were equipped routinely with a $\frac{1}{2}$" stretched-mesh liner in the cod-end to retain smaller organisms. Operations are continuous on a 24-hour day basis; trawl hauls are 30 minutes.

Preliminary evaluation of data from the 1971 survey for southern New England and Georges Bank is compared in Table 1 with data from earlier surveys (1965-1970) for several important species.

In Fall 1971, the relative abundance indices (mean catch per haul in pounds) for Georges Bank area was only 52% of average fall survey figure for the 6-year period, 1965 to 1970. Haddock catches dropped most precipitously: The 1971 figure was only 14% of 1965-70 average (down 86%).

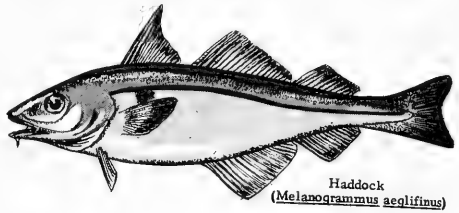
Overall catch rates for southern New England also showed a decline. However, these were off only 17% in 1971 from earlier (1969-1970) data. The catch index for yellowtail flounder was off about 25% for the period.

1971 Results

Some observations on key species include:

HADDOCK

Recruitment to this fishery will remain at a low level until at least 1974. The 1969 and 1971 year-classes appear better than the very poor year-classes spawned since about 1965. But it must be remembered that they are small relative to the average year-classes that supported a much larger fishery in the 1950s. Even though the present level of fishing for it is low, it is very doubtful that the haddock population will be able to do much more than hold its own. The recruitment will not produce any significant build-up of the stock under current quota levels, the NMFS scientists predict.



Haddock
(Melanogrammus aeglifinus)

YELLOWTAIL FLOUNDER

Recruitment of the southern New England yellowtail flounder stock is low. The reduction in quota from 13,000 to 10,000 metric tons in 1972 is essential to maintain the stock. No major increase will be possible until recruitment improves. In 1972, recruitment will remain low.

The Georges Bank yellowtail flounder indices for total stock and recruitment also have shown a decrease. Although the relationship between recruitment and fishable stocks is not yet established for this area, the decline is cause for concern, say MMFS scientists.

Table 1 - Yellowtail Flounder Fall Index of Recruitment

Year	Relative Recruitment *Index	
	So. New England	Georges Bank
1963	16.3	12.7
1964	18.5	2.2
1965	11.7	1.3
1966	34.4	9.9
1967	19.9	7.7
1968	9.0	9.7
1969	7.0	6.0
1970	9.2	5.7
1971	7.7	3.5

*Addition of fish one-year-or-more old to the exploited stock.

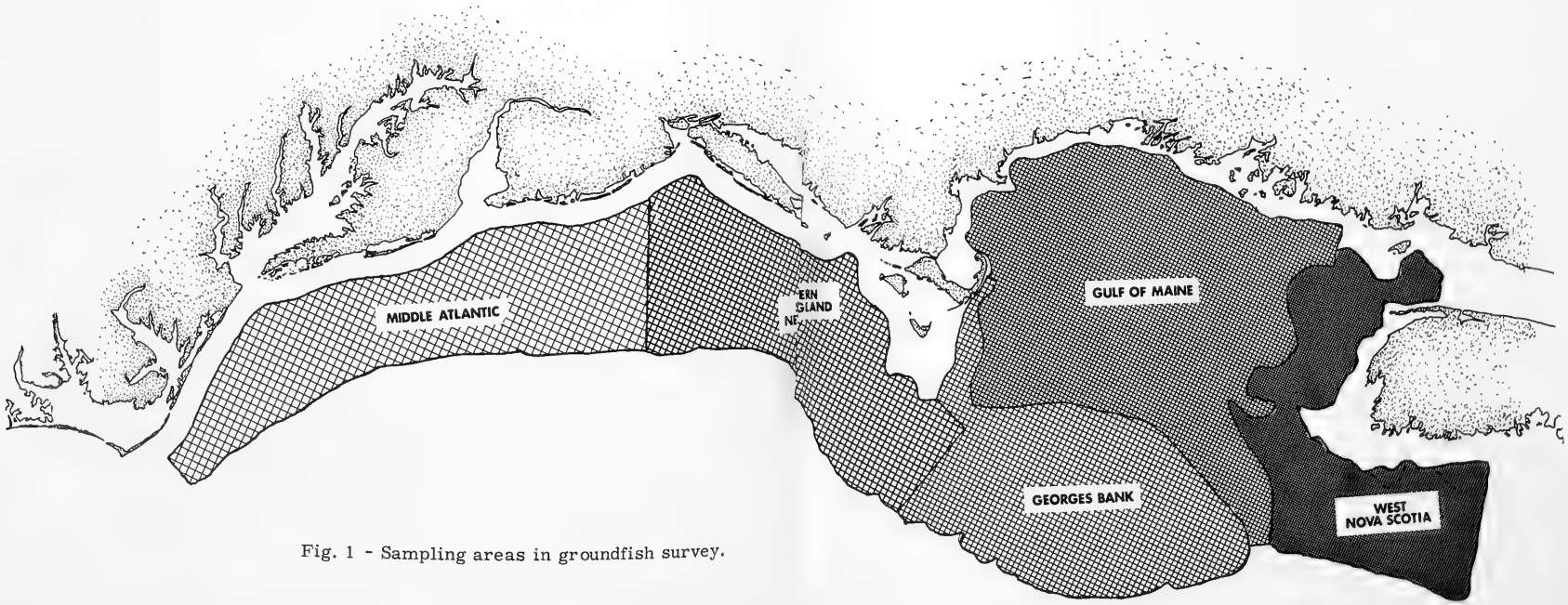


Fig. 1 - Sampling areas in groundfish survey.

SILVER HAKE

Survival of the 1971 year-class was very good: Albatross IV caught hake 10 cm. or less. The greatest improvement was in the Gulf of Maine and on Georges Bank. Abundance of young fish in the Gulf increased about 44-fold from the 1967-70 average; on the Bank, about 7-fold. Catches of young fish in the southern New England-Middle Atlantic area were the highest since 1968--1.7 times greater than the 1967-70 average. This year-class will begin recruiting to the fishery in late 1972. It should become more evident in 1973 and 1974.

Total abundance of the fishable stock of silver hake increased in the Gulf of Maine and southern New England-Middle Atlantic area. It decreased on Georges Bank.

RED HAKE

Survival of the 1971 year-class was better than average. Catches of red hake 10 cm. or less were greater in all areas than in 1970 and most other years. These young-of-the-year on Georges Bank was only slightly less abundant than in 1969, the previous high; 1969 was far superior to any other 1963-70 catches by Albatross IV.

Total abundance of red hake in all areas increased from 1970. Catches in the Gulf of Maine were 5 times greater than the 1967-70 average. The increase was not as great in other areas.

OTHER

Fair catches of redfish were made in the Gulf of Maine. Incidence of copepod parasite infections was low; some redfish catches appeared free of copepods.

Other Collections and Observations

Large series of samples were collected to support detailed studies of age, growth, and food habits of principal species. Observations of maturity indicated pollock were approaching spawning, cod were just starting to develop, and haddock generally were still in resting stage. This order of development is as expected for the fall season.

FIGURE 2

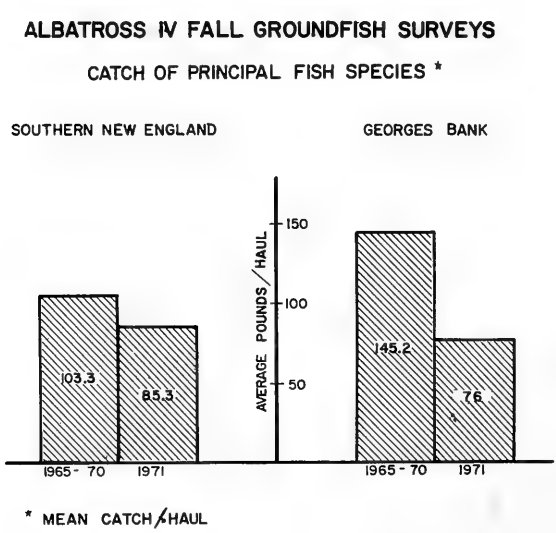


Table 2 - Relative Abundance Indices (Mean Catch Per Haul in Pounds) of Groundfish in Southern New England and on Georges Bank During Albatross IV Fall Surveys

Species	So. New England			Georges Bank		
	65-70	"71"	1971 Catch in Percent of 65-70 Average	65-70	"71"	1971 Catch in Percent of 65-70 Average
Haddock	0.9	0.2	22	45.4	6.4	14
Cod	3.0	0.3	10	11.3	8.3	73
Silver Hake	9.4	10.0	106	3.5	2.3	66
Red Hake	8.9	8.0	90	3.0	4.4	147
Yellowtail	24.1	17.7	73	12.2	10.4	85
Winter Flounder	4.2	1.9	45	6.4	2.6	41
Other Flounders	5.6	2.9	52	4.4	3.0	68
Butterfish	7.4	12.8	173	1.1	2.4	218
Scup	1.5	0.5	33	-	-	-
Goosefish	7.3	3.2	44	6.0	1.6	27
Skates	12.1	14.6	121	32.7	18.6	57
Miscellaneous (all other sp.)	18.9	13.2	70	19.2	16.0	83
Total (all sp.)*	103.3	85.3	83	145.2	76.0	52

* Exclusive of invertebrates and spiny dogfish.

PLANKTON

Routine and special plankton collections were completed using a standard MARMAP "bongo-net" array. The array consists of two 60 cm. diameter nets of .333 mm. and .505 mm. mesh, and two 20 cm. diameter nets of .253 mm. and .366 mm. mesh. An oblique plankton tow from 50 meters depth to the surface was made at each trawl station. These collections support studies in three principal categories:

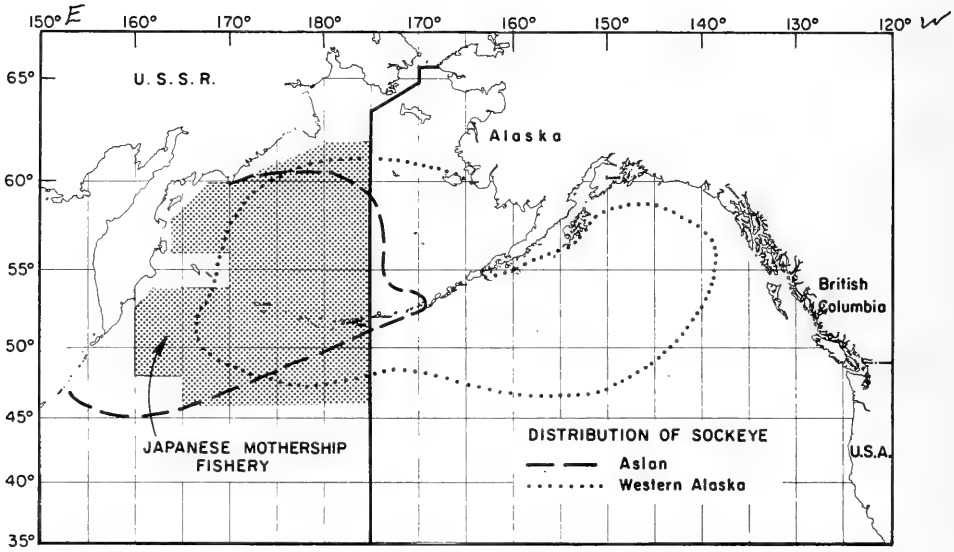
1. Monitoring of fish egg and larval abundance from Cape Hatteras to Nova Scotia.

2. Preoperational evaluation of specialized techniques being developed for MARMAP Survey I. This will be a comprehensive survey in waters contiguous to North America. It is designed to monitor on a continuing basis the abundance and distribution of marine resources.

3. Supplemental information for the International Herring Larval Dispersal Study completed cooperatively by French, Soviet, West German, and U.S. research vessels and scientists during Fall 1971.

AUTOMATIC DATA LOGGER TRIALS

A portable Data Acquisition System (PODAS) supplied by NASA Mississippi Test Facility (MTF) was used for the entire groundfish survey on Albatross IV to record automatically 22 hydrographic, meteorological, and ship-operating factors.



An example of research findings on the ocean distribution and intermingling of Pacific salmon is shown on the map. Here is a generalized summary of the distribution and intermingling of Asian and western Alaskan sockeye salmon. It is based on data from tagging and racial studies, catch statistics of commercial fisheries, and fishing surveys of research vessels. Most findings were made by scientists of the Fisheries Agency of Japan, NMFS, and the Fisheries Research Institute, University of Washington, under NMFS contract.

The shaded portion of map indicates fishing areas of Japanese mothership fleet. The heavy line along eastern border of shaded area is provisional abstention line established by International North Pacific Fisheries Convention.

JAPANESE MOTHERSHIP SALMON FISHERY MEANS RESEARCH FOR NMFS

A mothership fleet that has sailed each spring for nearly 20 years from Hakodate, Japan, to fish Pacific salmon has affected significantly the research program of the NMFS Northwest Fisheries Center, Seattle, Wash. So, too, has the International North Pacific Fisheries Convention. Scientists at the Center and from other groups have worked with their Canadian and Japanese counterparts to conduct research related to salmon stocks in the vast mothership fishing area and to important convention provisions. Convention members are Japan, Canada, and the U.S.

During the 1930s and early 1940s, a fleet of up to 19 motherships and 305 catcher-boats fished salmon just outside territorial waters off Kamchatka's east and west coasts. Maximum annual catches were near 12 million salmon--mostly sockeye (39%), chums (32%), and pinks (27%).

In 1936 and 1937, Japanese vessels sought and caught salmon off Alaska in the eastern Bering Sea, not far from the mouth of Bristol Bay. This Bay is the major producer of North American sockeye salmon. The U.S. protested strongly and the Japanese ended those exploratory operations. When World War II began, Japan suspended all high-seas salmon fishing; it resumed in 1952.

Fishing Areas

For a few years, fishing was limited to the western North Pacific Ocean, between 155° E and 175° E. Then it expanded westward to the Okhotsk Sea, 1955-58, and, in 1956, eastward in the North Pacific Ocean and Bering Sea to 175°W. Since 1959, the fleet has fished this area: 160° E on the west, 46° N on the south, 60° to 62° N on the north, and 175° W on the east.

Size, Fishing Gear, & Operation

Since 1962, the mothership fleet has remained 11 motherships and 369 catcher-boats; in 1952, it was 3 motherships and 57 catcher-boats; the peak was in 1956-59: 16 motherships and 460 to 500 catcher-boats.

The motherships are owned by large companies. The vessels range from 7,000 to 12,000 tons, are capable of canning 100 to 200 tons of salmon a day, and freezing another 40 to 160 tons. (Freezing capacity varies inversely with canning capability.) They carry about 400 persons, including 2 inspectors from the Fisheries Agency of Japan, a company biologist, and a Russian-speaking interpreter. Each mothership is accompanied by 30 to 35 catcher-boats. The latter, generally owned independently, are in the 80-ton class, usually of steel, and carry crews of about 20. Motherships and catcher-boats also fish other species when not catching salmon.

3,000-3,800 Miles of Gillnet

West of 170° E in the mothership fishing area, each catcher-boat may fish 264 tans (8.2 miles) of gillnet each day. East of 170° E, the maximum gillnet length is 330 tans (10.2 miles). So, when it is desired, the fleet of 369 catcher-boats can fish 3,000 to 3,800 miles of gillnet. "Two sizes of mesh are used in the gillnets: 121 mm (4.8 inches) and 130 mm (5.2 inches), stretched measure. Up to 40% of a string of net can be of the smaller mesh west of 170° E, and up to 60% east of 170° E."

Fishing Season

The fishing season usually begins around May 20 and ends between July 15 and August 10. The closing date depends on when the fleet has caught the quota agreed upon during annual meetings of the Japanese-Soviet Commission for Fisheries of the Northwestern Pacific Ocean. On any one day during the season, only 1 mothership with its 30 to 35 catcher-boats (or equivalent) can fish in any one of 169 subareas designated by the Japanese Fisheries Agency for controlling fishing. Average size of subareas is about 5,600 square miles (70 miles north to south by 80 miles east to west).

INPFC-RELATED RESEARCH

The eastern boundary of the fishing area is the provisional line established by the Protocol to the International North Pacific Fisheries Convention (INPFC). This implements the Convention's abstention provisions concerning salmon. The salmon-abstention

provisions have been in effect since the Convention was implemented in 1953. Under them, Japan abstains from fishing salmon east of 175° W in the North Pacific Ocean and Bering Sea; Canada abstains east of 175° W in the Bering Sea. And Canada and the U.S. must provide evidence that their salmon stocks are being fully utilized, scientifically managed, and under extensive research to determine the conditions necessary to achieve and maintain maximum sustained productivity.

Also, the Convention Protocol requires the three members to conduct research to determine areas and extent of Intermingling of Asian and North American salmon. Such information is needed to decide whether a longitudinal line or lines other than the provisional line at 175° W would divide salmon of the two continents more equitably.

Large-Scale Research

In the mid-1950s, Canada, Japan, and the U.S. began large-scale research related to the Protocol problem. The prevailing hypothesis in the U.S. prior to the early 1950s was that salmon in their marine life were confined essentially to continental shelf areas. Research by the NMFS Northwest Center and its contractors has proved that the 5 principal species of North American salmon typically inhabit the high-seas waters of the subarctic North Pacific Ocean. Now it is common knowledge that salmon originating in Asian streams migrate as far eastward as western Gulf of Alaska; also, that North American salmon migrate as far west as Attu or the Komandorskie Islands.

The studies have provided a reasonably complete picture of the intermingling of most major stocks of Asian and North American salmon. The scientists now are able to make fairly accurate estimates of the numbers of North American salmon caught by the mothership fishery.

Salmon-Stock Abstention

Also, U.S. scientists have collected and analyzed much data on the qualification of U.S. salmon stocks for abstention. Demonstrating the qualifications of U.S. salmon stocks for abstention is important. Removing a stock from the Convention's abstention list would remove the protection given it by the abstention line at 175° W. Even with the abstention line, many salmon of western Alaska origin--mostly Bristol Bay sockeye--are caught by the Japanese. However, the abstention line generally provides much protection for North American salmon--practically 100% for all stocks other than those originating in western Alaska. During 1954-70, 1,337 billion North American salmon were caught; the estimated Japanese catch was about 44 million fish, 3% of total.

Bristol Bay Sockeye

Research on the Protocol problem was completed in the early 1960s. Then research of the Center and its contractor, the Fisheries Research Institute, focused on forecasting the strength of Bristol Bay sockeye salmon runs through high-seas research. The scientists also examined the relation between Bristol Bay sockeye salmon abundance and the dynamics of the ocean current systems in the subarctic region. The latter yielded a detailed description of seasonal changes in transport and flow between North Pacific Ocean and Bering Sea. And this information has provided provisional hypotheses about the spawning migration patterns of Bristol Bay sockeye.

Center Researchers

Dr. Francis Fukuhara is scientific coordinator of U.S. Section of INPFC and director of Center's Division of Marine Fish and Shellfish. His division has three major teams that conduct salmon research for U.S. Section:

1. Dr. Felix Favorite heads an oceanography group. It surveys North Pacific Ocean and Bering Sea.

2. Robert French heads a team that surveys distribution of salmon on high seas. The two teams collaborate to study influence of oceanic features on distribution and migration of salmon at sea.

3. The third team is a scale unit headed by Richard Major. It uses scales from the fish body to study age, and it uses scales to determine the natal origins of salmon taken on the high seas.

Personnel of the Division of Fisheries Data and Management Systems, directed by R. A. Fredin, study catch statistics of the Japanese catch of U.S. salmon.

GRAVEL SYSTEM HOLDS PROMISE FOR SALMON FRY INCUBATION

Robert M. Burnett

Fishery biologists think the female salmon may know what she's doing when she buries her eggs in gravel, so they're experimenting with the same method at the Auke Creek hatchery near Juneau, Alaska.

Designed to find ways of improving hatchery production, both in quantity and quality, the experiments at Auke Creek utilize a "back to nature" concept which departs considerably from traditional methods of rearing fish from eggs to fry. Instead of incubating eggs in flat trays in the usual manner, scientists at Auke Creek have mixed the eggs in gravel up to three feet deep. This provides a more natural environment and produces fry which are stronger than those reared in trays.

The Auke Creek hatchery was built and is being operated under a cooperative agreement involving the National Marine Fisheries Services (NMFS), the Alaska Department of Fish and Game and the Territorial Sportsmen.

"Cooperative agreements such as this can play an important role in the development of the fisheries of Alaska," said Robert Roys, director of the Division of Fisheries Rehabilitation, Enhancement and Development of the Department of Fish and Game. "By sharing funding and personnel, the agencies involved can achieve their common objectives at less cost and without duplication of efforts."

At Auke Creek, for example, the Territorial Sportsmen provided the land, the Department of Fish and Game purchased the equipment and provided technical assistance and the National Marine Fisheries Service renovated the building and is supplying the senior biological talent to operate the project.

The Auke Creek hatchery will be capable of producing at least one million fry annually when completed. Initial work is with pink salmon because the two-year cycle of this species permits quick evaluation of results.

"Basically, we're trying to find a way to produce the most quality fry in the least space and with the minimum amount of water," says Jack E. Bailey, NMFS project leader at the hatchery.

"We have found that the tray-reared fry are not as strong as wild fry because they use large amounts of energy in movement and in efforts to remain upright. By burying the eggs in gravel, we duplicate as nearly as possible the natural egg nest and this produces stronger fry," Bailey notes.

He explains that the fry hatch in the small spaces between the pieces of gravel and remain there until fully incubated. The gravel supports them and they are thus less inclined to spend energy in movement. More of the yolk is utilized for growth and the result is a healthier, stronger fish which is better able to withstand the rigors of ocean life.

The concept of incubating salmon eggs in a carefully controlled gravel environment has been under study for several years by the National Marine Fisheries Service and the Fisheries Research Board of Canada. NMFS tests have shown that the gravel boxes can produce five to 10 times as many fry as could be expected from the same number of eggs in natural spawning beds.

Similar incubators developed by R. A. Bams in British Columbia have yielded a six-fold advantage over natural production of pink salmon.

The Auke Creek experiments is utilizing both NMFS boxes and Bams boxes, plus the normal hatchery tray method. Fish hatched in the three incubation systems will be compared with natural pink salmon fry from Auke Creek to determine which gives the best production.

The author is Chief Information Officer, Alaska Department of Fish and Game. Article appeared in Department's 'Alaska Fish Tales and Game Trails'.

Evaluation of the incubator test results in the spring of 1972 will be on the basis of survival from eyed eggs to emergent fry, fork length of preserved fry, wet weight of preserved fry, timing of emergence, state of development at time of emergence and energy reserve of emergent fry.

While studies of fry quality and quantity are important, the final test will be the number of adults which return from eggs incubated at the hatchery. Such a study of adult returns will require the release of at least one million fry, but the natural run of pink salmon in Auke Creek will not provide enough eggs for such a study now. For this reason, present plans call for evaluation of the systems on the basis of fry quality only while the Auke Creek pink salmon run is being built up to the point that it will support a full-scale test.

"Our experiments began last fall when eggs were taken from 170 pink salmon which had entered Auke Creek to spawn. These eggs were fertilized with sperm from an equal number of males; and then incubated to the eyed stage in trays and baskets," Bailey said.

The eyed eggs were then placed in the incubation boxes between layers of gravel.

"The 170 females which supplied the eggs accounted for about one-sixth of the potential natural egg deposition in Auke Creek," Bailey said. "But if the gravel incubators function satisfactorily, the eggs from those 170 females could return as many fish to Auke Creek as will return from the other 926 females which spawned naturally in the stream."

The current test is utilizing two NMFS boxes and two Bams boxes, plus the standard hatchery incubator.

Both types of gravel incubators are four feet by four feet by three feet deep. The Bams boxes utilize a system of perforated pipes and layers of gravel to distribute the water while the NMFS box uses a space-saving perforated false bottom and a different configuration of gravel.

One Bams box is loaded with 112,163 eggs, the other with 53,650 eggs. The NMFS boxes contain 112,147 eggs and 56,074 eggs, respectively. Water flow to the high density boxes is 14.8 gallons per minute, while the low density boxes receive 7.4 gallons per minute.

Plans for the Auke Creek hatchery call for installation of 16 four by four by four foot incubators which will receive a total flow of 150 gallons per minute of filtered and sterilized water. This will enable the hatchery to produce up to one million fry per year for continued tests of the incubation system.

"If this system proves itself, it could be a valuable management tool for the production of fry for stocking Alaska's streams and rivers," says Roys.

"The system is simple, relatively inexpensive to construct and operate and can produce large numbers of high quality fry in limited space. We think it has a tremendous potential for a variety of projects," Roys said.

Although the initial tests at Auke Creek will be with pink salmon, the gravel box system could be used to build up runs of other salmon species elsewhere in the state.

So They Built A Better Trap--for Lobsters

The lobster fishery has experienced radical changes in the past decade, but one factor has remained constant: the fisherman's search for a trap that will "fish" better than any other. A trap fishes well when it attracts and holds as many lobsters as it possibly can. First, the lobster samples the bait in trap's kitchen. Then it moves leisurely into the "parlor," the trap's storage section. It is assumed in the fishery that the lobster cannot make its way out.

From its beginnings over 200 years ago, to the early 1960s, New England commercial lobstering remained unchanged. Generally, the lone lobsterman went to sea in his small boat. Each morning, in water close to shore, he set wooden pots in 6 to 120 feet of water; at night, he hauled them--hoping to see $\frac{1}{2}$ to $2\frac{1}{2}$ pounds in each trap.

Offshore Lobsters

The inshore supply of lobsters kept falling behind, and the lobsterman went farther looking for more. He found a large popula- 100 to 250 miles offshore, down to 2,000 feet. Lobstering became a new venture: large boats, 7-8-man crews, expensive equipment. The lobsterman tried trawling at first, but it did not work. Lobsters often were damaged, and the trawling gear was damaged on rough bottoms.

NMFS Research

NMFS undertook to produce a practical trap for the offshore fishery. First, its researchers tried steel. Most inshore lobstermen already had replaced their traps' wooden slats with polyvinyl-coated wire mesh because it resisted water less and therefore lasted longer. This concept was carried over to an all-metal polyvinyl or aluminum-coated trap. This was heavier and less buoyant in deep water, and much lighter and easier to handle out of water; it weighs about half the water-logged wooden pot.

Price was the problem. Big traps were designed first--up to 138 pounds costing $100 each. This was too much for the average offshore lobsterman fishing over 500 pots. Also, many lobstermen believed that metal did not fish as well as wood; to them, wood takes on an attractive mossy exterior and fishy smell.

As design was modified and price lowered considerably, all-metal traps won over some fishermen. The 48 x 28 x 18 inch size is popular. It costs about $24; a wood-framed trap, same size and design, costs around $18. When a lobsterman handles hundreds of pots, the $6 difference becomes great.

The Double-Parlor Model

The 48 x 28 x 18 inch size, called the double-parlor model, is the best-selling offshore trap of several New England manufacturers. It represents a major change from two other pots: the standard inshore trap, with one parlor, and the unsuccessful large-size pots developed for offshore fishing. The double-parlor trap, supporters say, has 2 advantages: it offers more holding space for lobsters (important when traps are hauled only every 4-5 days), and it offers the lobster two exits from the kitchen--and so eases the congestion around the bait there. Fishermen generally are pleased with this model.

Which Material for Ideal Trap?

No material is ideal for the lobster pot, according to the New England Marine Resources Information Program. Besides considering which material fishes best, the lobsterman has to consider price, weight, and durability. Neither wood, steel, nor plastic meets all requirements.

Shipworms

Many fishermen believe that wood-framed traps catch 25-30% more lobster than all-metal traps. However, wood is susceptible to attack by shipworms when not dried periodically, as are inshore traps. After 4 or 5 months, it is not uncommon for a fisherman to lose a third or more of his traps to shipworms.

Many fishermen doubt the value of dips that are applied to wooden traps and are supposed to keep shipworms--but not lobsters--away.

It is safe to say that fishermen will continue to debate the economics and longevity of wood vs. metal traps for many a lobster season.

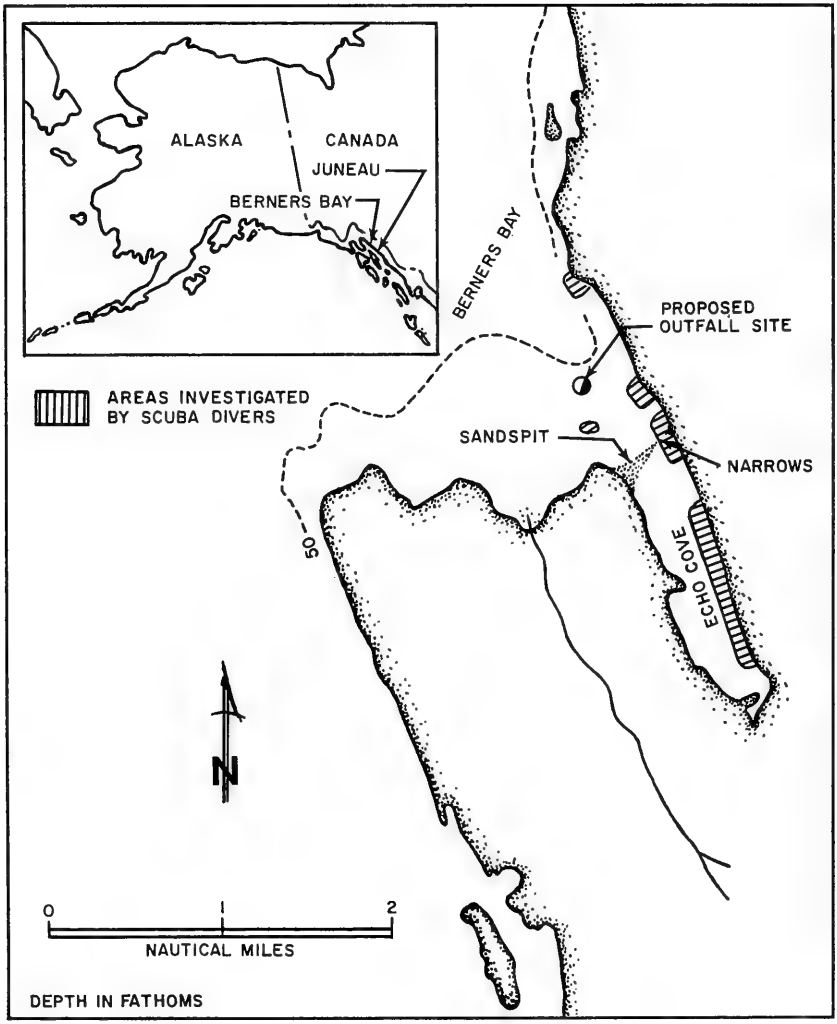


Fig. 1 - Location map of study.

MARINE LIFE ABUNDANT NEAR SITE OF PROPOSED ALASKAN MILL

Richard T. Myren

Numerous marine organisms--many of commercial importance--were observed by biologists of the National Marine Fisheries Service Auke Bay Fisheries Laboratory on a recent survey near Juneau at Echo Cove, the site of a proposed large pulp-and-lumber mill (Fig. 1). The biologists worked from the research vessel 'Murre II' and used three techniques to sample marine life: underwater time-lapse photography, observations by divers, and fishing with a bottom grab sampler. Scientists from the State of Alaska Department of Environmental Conservation also participated in the survey. They collected geological information on bottom sediments.

A series of photographs was taken over an 18-hour period with a stationary underwater camera-strobe system in 210 ft. of water at the site of the proposed location of the mill effluent outfall. The camera system was mounted on a quadrupod (described in Commercial Fisheries Review, Vol. 29, No. 1). The photographic target area was a sheet of plywood baited at the center with herring. Yellowfin sole; king, Dungeness, and tanner crabs; and pink shrimp were attracted to the bait. In addition to documenting the presence of these species, the serial photos, taken at half-hour intervals, disclosed differential behavior among the species attracted to the bait in the camera's view.

Yellowfin sole appeared first, shortly after the camera was in position at 1:30 p.m. (Fig. 2A). Dungeness crabs appeared between 3:30 and 4 p.m. (Fig. 2B). By 8 p.m., most of the sole had left the area (possibly displaced by the Dungeness crabs) and a few pink shrimp began to appear (Fig. 2C). Tanner crabs were abundant at 10 p.m. (Fig. 2D), and shrimp became more abundant during the night--from 10:30 p.m. until 7:30 a.m. (Fig. 2E), when the experiment was completed. King crabs such as the one photographed at 2:30 a.m. (Fig. 2F) appeared occasionally.

Behavioral Differences

The sequence of photographs demonstrated behavioral differences between species of larger mobile benthic animals. The shrimp may have been inhibited from approaching the bait while the sole were present because of the threat of predation by the fish--or because of effects of daylight and darkness on general activity. The sole were displaced by the crabs, but the shrimp were not inhibited by the presence of crabs. Perhaps the shrimp temporarily benefited from the presence of the crabs by receiving protection from the fish and, thereby, access to the food.

Mr. Myren is a Fishery Biologist with the National Marine Fisheries Service, Auke Bay Fisheries Laboratory, Auke Bay, Alaska 99821.

COMMERCIAL FISHERIES REVIEW
Reprint No. 930

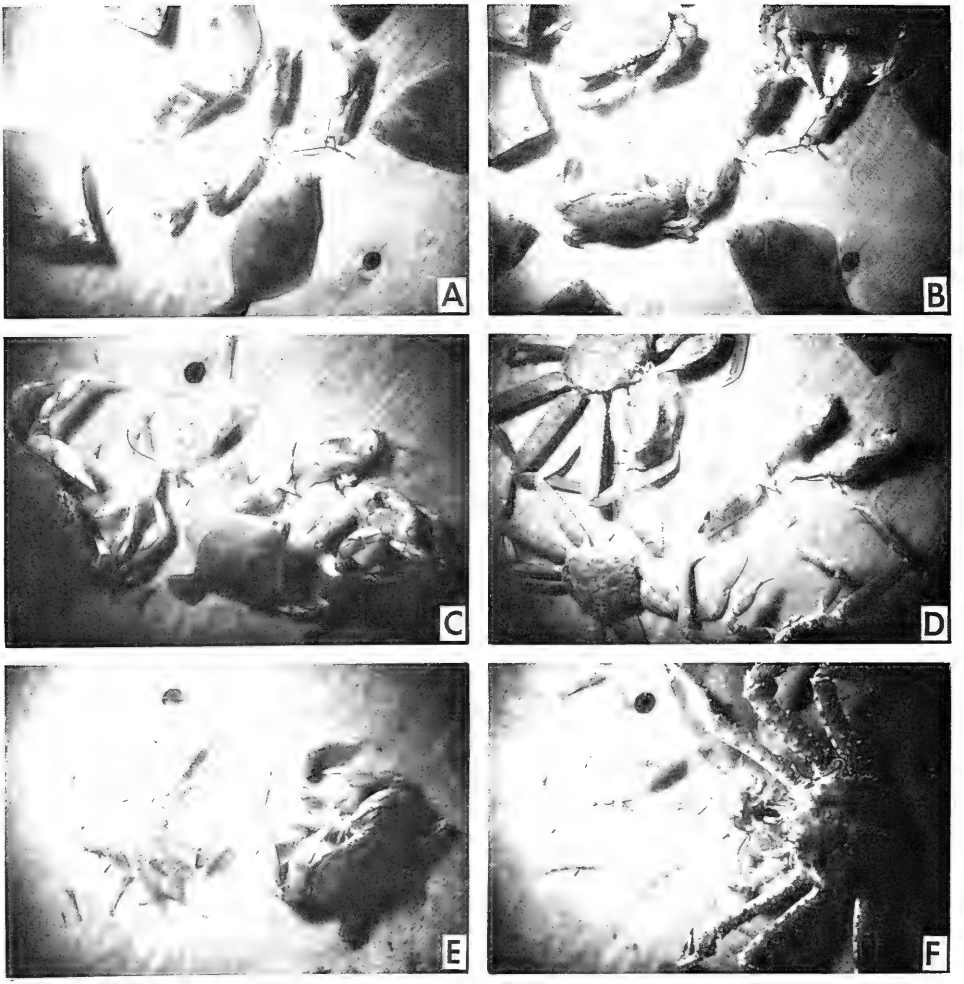


Fig. 2 - Selected photographs from series taken over an 18-hour period with a camera-strobe system.

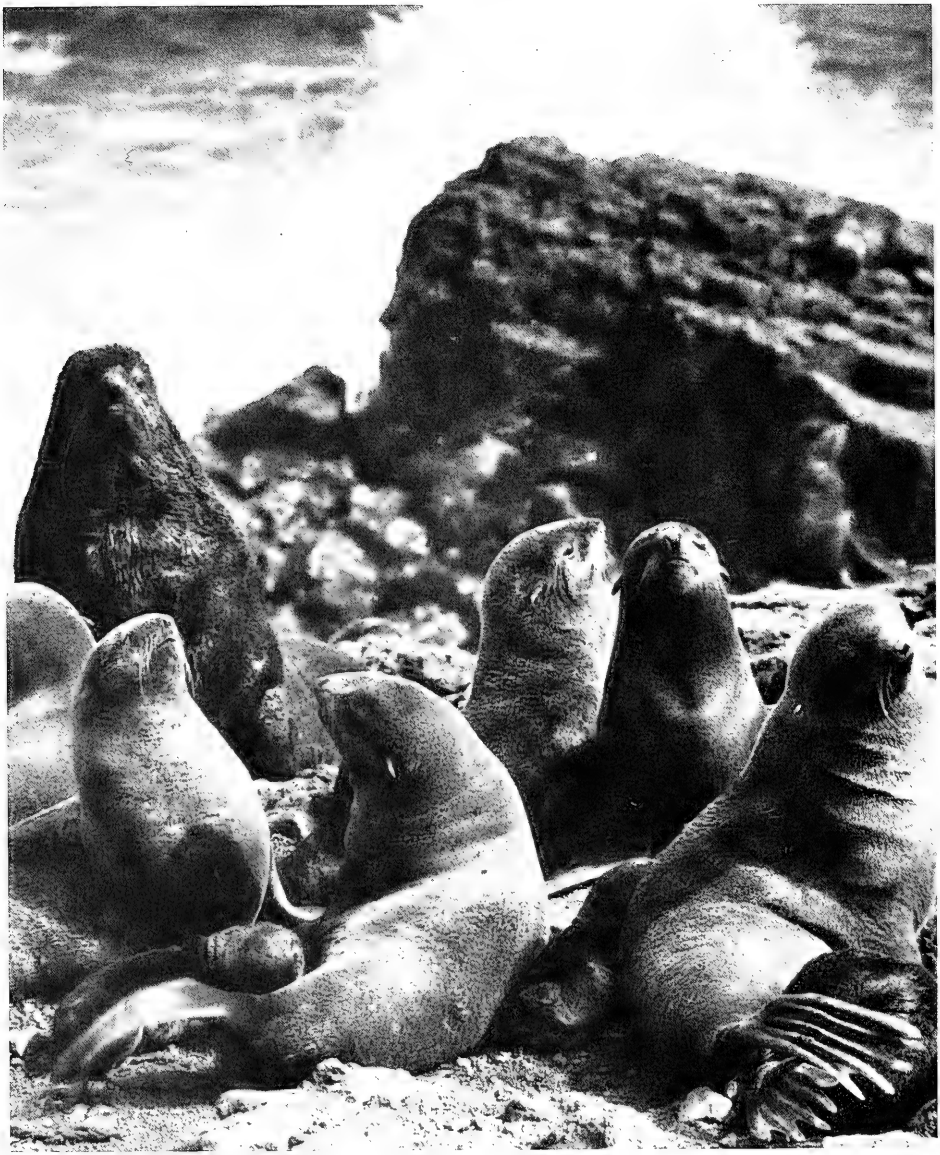
Biologists-Divers

A four-man team of biologists-divers also made 13 dives in the Echo Cove vicinity (shaded areas of Fig. 1) in depths to 100 ft. They found abundant populations of invertebrates. Molting and mating tanner crabs were common throughout the area. Several hundred maturing female king crabs were concentrated just outside Echo Cove--an indication that the area may serve as a mating area for this species later in the season as adult males migrate shoreward from deep water. Adult male Dungeness crabs were found just inside the narrows at the entrance to Echo Cove. Juvenile pink and humpy shrimps were very abundant in several areas. Sea urchins, anemones, clams, and many other invertebrates were especially abundant at the entrance to Echo Cove. The strong currents through the narrows probably contribute to the high biological productivity of this area.

Bottom Samples Collected

Bottom samples were collected by a grab sampler at several locations in 90 to 630 ft. of water. Burrowing animals were abundant, particularly in Echo Cove and the adjacent areas of Berners Bay. Surprising and significant was the capture of several adult sand lances in two of the bottom samples near the sandspit where Echo Cove joins Berner Bay. The grab sampler is not designed to capture fish and only a few square inches of bottom surface area are collected in each sample; therefore, the sand lances may be very abundant. A high abundance of these small forage fish would help explain why large numbers of salmon, trout, halibut, seals, sea lions, whales, eagles, gulls, and diving birds are often observed in the Echo Cove area.

Periodic surveys of the marine environment at Echo Cove will be continued to predict the environmental impact of the mill on the marine environment, especially the commercial species of fish and shellfish, and to provide baseline data for comparisons after the mill is built.



A fur seal family on St. Paul Island, Pribilof Group, Alaska. (Photo: V. B. Scheffer)

MEASURING MORTALITY OF FUR-SEAL PUPS IS IMPORTANT TO MANAGEMENT OF HERDS

About a million northern fur seals (Callorhinus ursinus) return to the Pribilof Islands in the Bering Sea each year. In rookeries on these five small islands, mostly on St. Paul and St. George, the pups are born and the adults breed. Forty to 50 thousand fur seals are harvested annually for their furs. By agreement, these are divided among Canada, Japan, and the U.S.

NMFS is responsible for management and conservation of these herds. Research seeks to determine the most favorable level at which to hold the breeding population in order to produce a maximum sustained yield.

Management is made more difficult by appreciable fluctuations in survival of pups from birth through their early years. So an important research aspect is to detect and measure these fluctuations and to analyze the importance of several survival or mortality factors. Then, independent and collective effects of these factors as related to deliberate population manipulations can be investigated to make possible more effective management of the herds.

Estimating Breeding Population

NMFS wildlife biologists have developed reasonably accurate methods of estimating adult females and males required to produce certain numbers of pups. With a pregnancy rate of 0.6, five adult females are needed to produce three pups. About 500,000 females produced the 300,000 pups (200,000 females were nonpregnant for various reasons) estimated to have been born in 1969-70. The fur seal is a polygamous breeder. So with one male to a harem of many females, about 7,000 "harem" bulls counted on the rookeries in 1969-70 sired the 300,000 pups born in those years.

Causes of Mortality

Pups die on land and in sea. Causes of death on land vary and may or may not be factors in deaths at sea. To meet the need for a continuous systematic approach to research on mortality of newborn seals, Dr. Mark C. Keyes, DVM, joined the Marine Mammal Division of the Northwest Fisheries Center in 1962.

As Research Veterinarian, he has concentrated on mortality factors, especially of newborn. Most deaths occur during first 4 weeks after birth, so field work on mortality is conducted primarily from about June 25 to August 15.

Dead pups are retrieved with a long gaff from catwalks constructed over three rookery study areas. The rookeries cannot be entered at ground level during height of breeding season because the ferocious $\frac{1}{4}$-ton bulls will attack a man without hesitation. The females and young males also are dangerous; even live pups must be handled carefully. Causes of death are determined by necropsies, postmortem detailed laboratory examination of pup bodies.

10 Summers of Mortality Research

During the last 10 summers, 1962-71, on St. Paul Island, Dr. Keyes and his assistants retrieved nearly 2,000 dead pups for examination. About 7% of the examinations yielded no diagnosis; 10% of the bodies could not be examined because of advanced postmortem degeneration. Causes of death are grouped into six major categories with most prevalent first: apparent malnutrition, hookworm disease, microbial infection, multiple hemorrhage--liver damage--perinatal complex, trauma, and miscellaneous. In 1971, hookworm disease and malnutrition together accounted for 73.5% of the deaths.

The causes of death are complex. Although the researchers have accumulated considerable data, they do not know the interactions of various factors. Apparent nutrition cannot be explained on the basis of simple starvation due to separation of mother and pup. The mother could have had agalactia, a condition that prevented her production of milk. Also, the pup could have been carrying several diseases leading to loss of appetite, and so emaciation occurred. Investigation of microbial infection would be facilitated if trained virologists were present to develop seal tissue culture cell lines. Where liver damage was the primary lesion, the organ was found to be extremely fragile; it often leaked blood into the body cavity. Trauma was caused by bites from other mothers (protective attitude) or from other seals on the crowded rookeries.

The Hookworm

The hookworm (Ucinaria lucasi) long has been known as a major cause of death of pups. In early investigations, infected pups of one-years class were believed to pass the eggs of this parasite into the rookery soil. There they hatched, wintered as larvae, and infected following year-class by penetrating flippers and migrating to intestines to cause anemia by feeding on their hosts' blood. At the same time, biologists were puzzled because hookworms were never found in seals older than pups. The study area was saturated with powerful chemicals to control or eliminate the source of infection by killing overwintering larvae in the soil. Control efforts failed: pups born a few weeks later had mortality equal to pups born on untreated areas.

Ten seasons (between 1951 and 1962) of contract research revealed the hookworm's unique life history. The work was done by Dr. O. Wilfred Olsen--parasitologist with Colorado State University--and his graduate student assistant, Dr. Eugene Lyons. As expected, the larvae were found to penetrate the flippers of seals of both sexes and all ages. Instead of moving to the intestines, however, the larvae migrated to the belly blubber. There they lay dormant in all seals except some females. Carried by the pregnant female, the larvae moved into mammary glands to infect her pup at its first, and only the first, nursing. This discovery emphasized the futility of early control methods of chemical saturation of the ground.

A diagnosis is made on the basis of lesions--alteration of normal structure or function of a part--that are characteristic of a particular cause. It is designated primary, secondary, tertiary, etc., according to relative severity of lesions or order of occurrence.

Mortality Rates

To get estimate of death rate, or percentage of year-class that died, the number of pups born must first be estimated. Several thousands pups are marked temporarily in early August by shearing a patch of fur from top of head. Later counts of several hundred samples of 25 pups each (after sheared and unsheared pups have throughly mixed) yield a marked-to-unmarked ratio from which an estimate of total number born is made. Estimates made with this method (or another method of marking pups with permanent tags) are tested by actual counts on small rookeries. By October, the pups have molted. Those sheared have lost their marks.

Survival of each year-class to ages 2-5 (or reciprocal-mortality rate) is measured by comparing number of pups born against (1) number of young males from year-class harvested and allowed to escape, and (2) an equal number of females from year-class--assuming 1 to 1 sex ratio of survivors. Counts of dead pups on land are made on rookeries each August. Although counts are made carefully, they are not completely accurate because some pups have been eaten by scavengers, others have been washed away by the sea, and some have decomposed.

The Seal as Experimental Animal

For disease and other research, a system of maintaining fur-seal pups in captivity was necessary. To incriminate one organism as causative agent of an infectious disease, it must be isolated from the subject; on exposure of a susceptible subject, it must produce the disease. Then the same organism must be isolated from the experimental subject. For such reasons, fur seals as experimental animals could answer many questions.

The first problems were development of artificial fur-seal milk and establishment of appropriate husbandry practices to rear newborn fur seals. After 3 years of trials, Dr. Keyes was successful. Since then, fur-seal pups have been used in cryogenic (very low temperatures) marking experiments, studies of echo-sounding capabilities of fur seals, and research on experimental transmission of seal diseases.

Nutrition Experiments

Nutrition experiments and knowledge obtained about pups' nutritional requirements led to research and analysis of feeding problems with captive marine mammals in general. Through these efforts, it became apparent that the difficulties in preserving nutritional value of fresh fish fed to seals and porpoises could be solved with a processed food. Such a product was developed at the NMFS Pacific Fishery Products Technology Center, Seattle, by Max Patashnik, Paul Kangas, and Dr. Keyes. It is made mainly

from whole fish and kelp. The food is compact, pasteurized, and stable in storage. It is produced and marketed by a private company under the name "Sea Ration".

Anesthesia and Restraint

While obtaining milk samples from seals so artificial milk could be formulated, Dr. Keyes developed methods of anesthesia and restraint that could be used to implant instruments in fur seals to study their cardiovascular adjustments during diving and various methods of slaughter. During these experiments, conducted by Virginia Mason Research Center, Seattle, an instrument was developed by Dr. M. P. Spencer of VMRC. It detects bubbles in the blood stream of human divers before any signs of decompression sickness were apparent to the divers themselves.

During necropsies of pups in 1962, Dr. Keyes observed the large size of the pineal gland (a brain appendage) of a pup that displayed convulsions before death. It necessitated examination of the central nervous system. This discovery has led to cooperative work on the endocrinology of the pineal gland of fur seals with the Massachusetts Institute of Technology. It has established the fur seal as a model for studying the probable function of the mammalian pineal gland.

Objectives of Future Research

Research on mortality will continue along the lines of animal physiology. The entire process of how disease begins, develops, and causes death or disability of the seal will be investigated. The researchers will emphasize that part of the process that takes place at sea. It will include rearing seals from birth and subjecting them to environmental features similar to those in the ocean.

Massed seals on St. Paul Island. (Photo: V. B. Scheffer)

OREGON FISHERMEN PROFILED

The men behind the gear in the nearly $70 million Oregon fishing industry are caught in a study by Oregon State University (OSU) as part of the NOAA Sea Grant Program.

Who are they? Frederick J. Smith, Extension Specialist in Marine Economics, writes: "The typical Oregon fisherman is clearly not the old, weatherbeaten, long-time waterfront dweller that many imagine him to be. If the typical fisherman of 1968 and 1969 could be assembled from the nearly 6,000 fishermen he represents, he would be 41 years old, live about 45 miles from the coast, have a 51% ownership in a vessel for less than three years, earn 66% of his income from fishing and would have fished for less than six years."

Mr. Smith emphasizes the importance of knowing these men: "An appreciation of these characteristics will contribute to more relevant, effective and efficient research and educational efforts directed towards Oregon's fishing industry."

Data Sources

The researchers used data from the files of the Fish Commission of Oregon and from surveys conducted in 1970 by OSU Marine Advisory Program.

The Commission issues commercial fishing licenses to persons who catch or help to catch food fish for commercial purposes in Oregon waters; to those who land food fish for commercial purposes; and to persons who operate (or assist) commercial fishing vessel or gear. Also, the Commission licenses every commercial fishing vessel. Name, age, mailing address, and numbers are on these licenses.

Number of Fishermen

In 1968, the Commission issued 5,923 commercial licenses; in 1969, 5,663. During 1968 and 1969, 8,085 different persons held Oregon commercial fishing licenses. Up to 53% of these license holders are crew, not captains. Nearly all licensees are fishermen because there are very few vessels with crew members who do not handle fish or gear.

Average Age Is 41

Licensed fishermen are relatively young. Nearly 12% were college age (17 to 21). There were more 20-year-olds than any other single age; many in 30 to 36 group; more than half in 42 to 50 range. The average age was 41, "and there is no reason to believe that this is rising." Nearly 45% of all licensees were under 41, and nearly 65% under 50.

21% Non-Residents

All licensees do not live on Oregon coast or in state. Over 21% were non-residents. Resident license holders lived an average 45 miles from Pacific. Nearly as many commercial fishermen lived inland as in major ports. The majority of non-residents lived in California or Washington.

Many fishermen lived inland during most of year and on coast during fishing season.

Do They Own Vessels?

More than half the licensees obtained a vessel license; over 95% of licensed vessels were licensed by persons who also held fishing licenses. Absentee vessel ownership is minor. About 3% of vessel license holders licensed more than one vessel in 1968 and 1969. The person who licensed the vessel may have been running it under lease or share arrangement. The true owner's name, often the mortgager's, may never have appeared in records.

The number of owners-operators probably was a little under 90% of 3,000 vessel licenses issued--but over 50% of all commercially licensed fishermen. "This is a significantly large percentage compared to other states," writes Mr. Smith.

Vessel Owners Average 45

Of all 44-year-old fishing licensees, 75% also held vessel licenses. Of all 26- or 67-year-old fishing license holders, only 25% also held vessel licenses.

During 1968 and 1969, the average age of all vessel licensees was 45. This was a little above the average age of 41 for all fishing licensees. Of all vessels, 52% were licensed by persons 45 or younger; 66% of vessels by those 50 or younger. Vessels were licensed by 16-, 17-, and 18-year-olds as well as 71-, 72-, and 73-year-olds.

Where Owners Live

Of all vessel licensees, 1,000 lived on the coast and over 700 in the Willamette Valley. The average distance was 34 miles, although some lived up to 200 miles from Pacific. Resident fishing licensees lived an average 45 miles from coast. "In general, the geographic distribution of vessel license holders is surprisingly close to that of all commercial fishing licenses."

The Part-Timers

A commercial fishermen is a part-timer if he holds a second job while fishing or fishes one year and lays off the next. In 1970, nearly 38% of Oregon licensed fishermen received less than half their annual income from fishing; 46% received all from fishing.

Nearly 43% of licensees had fished 5 or fewer years. The fishing industry sees many persons enter one year and drop out the next.

In 1968, of 5,923 persons who obtained licenses, only 3,501 renewed their licenses. They were joined by 2,162 new licensees in 1969. The turnover for 1968 and 1969 was over 25%.

Vessel license holders change vessels at a faster rate. In 1968, of 3,048 licenses issued, 68% renewed with same vessel or vessels; 32% either changed vessels, did not renew, or were new licensees.

"In general," states Mr. Smith, "there are many part-time fishermen in Oregon and even the full-time fishermen change vessels frequently."

HADDOCK SPAWN IN CAPTIVITY

For the first time in the U.S., haddock are spawning in captivity--at the Narragansett (R.I.) Laboratory of the NMFS Northeast Fisheries Center.

Haddock, "scrod" on the restaurant menu, is a traditional and valued foodfish. Once king of the New England groundfish industry, the haddock has been reduced by heavy fishing and poor spawning success in recent years.

Haddock spawn during March or April in the bottom waters off New England. The first time haddock spawned in an aquarium was in 1967; it was an accident. The water-cooling unit in a marine laboratory in Aberdeen, Scotland, broke down and the water temperature in a tank began to rise. A night watchman was the first person in marine research to observe the courtship and spawning act of haddock.

The Narragansett Project

The Narragansett Laboratory obtained 12 sexually mature haddock from Bob Nickerson, a Chatham, Mass., longline fisherman. The fish were placed in experimental tanks on February 17, 1972, and held at a temperature of 40 degrees (fahrenheit) for two weeks. After that, the temperature was increased slowly a fraction of a degree each day.

Dr. Geoffrey C. Laurence, who directed the experiment, reported: "As the temperature increased, the females enlarged noticeably. On the afternoon of March 3, there were no eggs in the water. When we came to work the next morning, there were eggs in the water; so we knew the fish had spawned." Spawning had begun only two days after the increase in temperature began and continued nightly from March 7 to March 17.

Fig. 1 - These haddock, photographed during day, spawned several nights in succession. It was first time in U.S. that haddock spawned in captivity.

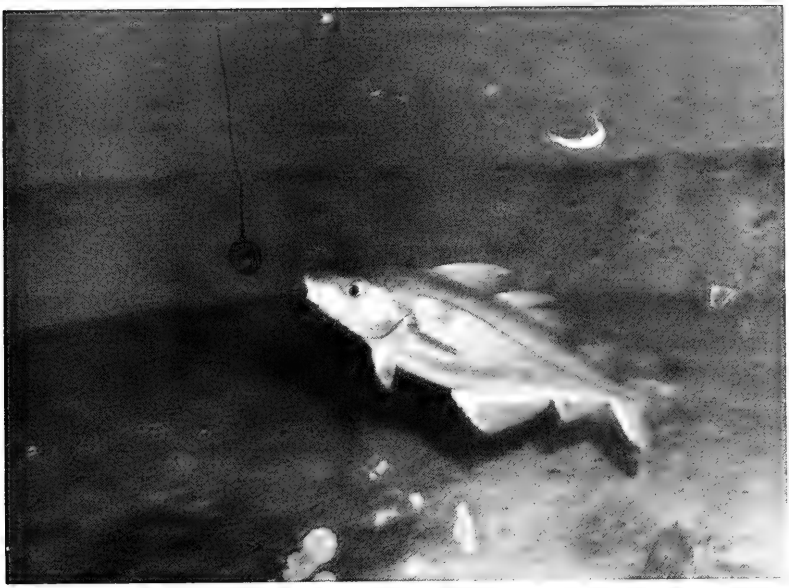


Fig. 2 - Haddock approaches microphone used by scientists to record "clicking" sound made by male during the spawning season. (R. K. Brigham)

At first, only 10% of the eggs were found to be fertilized. When the temperature reached 42 degrees, fertilization improved to 90%.

The amount of eggs also increased. On March 16, observers watched Dr. Laurence draw a fine mesh net twice around the circumference of the 15,000-gallon tank. The operation brought in over a quart of eggs.

Hydrophones and amplifiers were placed in the tank so scientists could listen to the "clicking" sound made by the male haddock during the time of spawning. This sound is produced by special muscles highly developed in sexually mature fish. During courtship activities preceding the spawning act, the sounds intensify. The repetition frequency increases to give a "humming" sound.

Significance of Successful Spawning

The successful spawning of haddock at the Narragansett Laboratory means it will be possible to supply experimental biologists at the Northeast Fisheries Center with large numbers of fertilized haddock eggs of known age. These eggs will be used to study the fish's early life stages.

A single haddock female can produce up to one million eggs. But when the fertilized eggs rise and float near the ocean surface, mortality is high. It is very difficult to detect the actual causes of larval mortality and even to measure this mortality rate in the open ocean.

Research Vessel Surveys

The NMFS research vessel 'Albatross IV' samples throughout the spawning season to learn the distribution and abundance of haddock eggs and larvae on Georges Bank. Biologists at Northeast Fisheries Center headquarters in Woods Hole, Mass., are confident that sufficient sampling at sea will yield valuable clues to factors in the environment that are most important to the survival of eggs and larvae. Then these clues can be used to set up tests under experimental conditions that should reveal even more about cause and effect in larval mortality.

To assess and manage this valuable resource, NMFS scientists say, it is essential to understand the growth process that culminates in the entry of the fish into the "fishable" population.

SEA URCHIN FISHERY STARTS

Sus Kato of the NMFS Tiburon Fisheries Laboratory traveled to Avila Beach to help initiate the sea-urchin fishery. The first shipment of sea-urchin gonads, destined for the domestic market, was delivered from Avila Beach to Los Angeles on February 24. These gonads are considered a delicacy in some gourmet establishments, especially Japanese seafood restaurants. The fishery was expected to start several months earlier, but the absence of suitable packing material forced the long postponement.

Mr. Kato provided on-site indoctrination and instructions to the divers, "shuckers", cleaners, and packers. As a result of his visit, the yield rose from 25 pounds of gonads per day to 100 pounds. This yield is based on 800 to 1200 urchins collected daily by two divers in about four hours. Up to 11 other part-time workers have been employed in a single day's operation.

The immediate goal is to produce 200 pounds of gonads daily for U.S. consumption with about 15 full-time workers. Initial reaction of the wholesale and retail buyers was mixed. A meeting was held to discuss product quality. The problems appear minor. The fishery promises to be viable. It will aid in the economy of the little port town of Avila Beach.

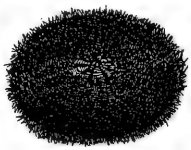
The San Diego Fishery

Several months ago, NMFS helped start a sea-urchin fishery in San Diego, Calif. On February 23, two tons of whole red urchins and 150 pounds of processed urchins were delivered frozen to Los Angeles for shipment to Yokohama and Kobe, Japan. Delivery was delayed because of the extended dock workers' strike.

The San Diego fishery is small, although up to six people have been employed by the processor. The potential for becoming a large export trade with Japan is uncertain. This is due primarily to the extremely large size of the gonads and because frozen urchin gonads are new to Japan.

Fishery Helps Environment

Besides economic benefits, many persons believe that the removal of sea urchins will lead to a better environment for fish and shellfish. For example, sea urchins are reported to compete directly with abalone for space and probably for food as well. Also, experiments have indicated that removal of urchins enhances the growth of kelp beds which, in turn, provides suitable habitats for many species of fish.

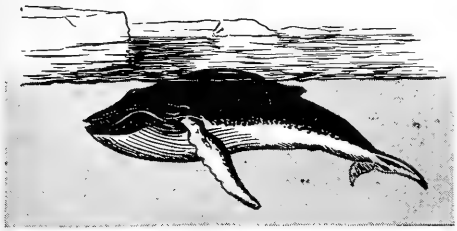


Sea urchin

JAPANESE PREPARE FOR U.N. CONFERENCE ON WHALES

How to conserve whale species will be considered at the UN Conference on the Human Environment at Stockholm, Sweden, in June 1972. According to the Japanese press, Japan and the USSR will bear the brunt of attacks by other nations.

The Japanese believe that materials being prepared for the conference will show a sharp decline in blue whales over the past 40 years, and that the humpback whale is seriously threatened. They expect a decline in marine mammals to be attributed to Japan and USSR.



A Different View

Tatsuzo Oyama, the Japan Fishery Agency, states that most of the arguments are "groundless" and "emotional" rather than scientific. He believes there are about 17,000 blue whales in the Antarctic, and another 1,400 in the North Pacific. "These figures show that the species do not face extinction."

Kinji Fukuda, a whaling company official, notes that foreign fleets used to hunt whales for their oil and meat to be used as dog and cat food. However, in Japan, it is an important source of human food--about 10% of all meat consumed, or roughly half the beef consumed.

Whaling Restrictions

Dr. Hideo Omura, director of Tokyo's Whale Research Institute, states that whaling for humpback and blue whales was completely forbidden in 1963 and 1964. At present, only fin, sei, and sperm whales can be caught within quotas established by the International Whaling Commission. More than 70,000 catchable whales, excluding calves, are believed to exist in the Antarctic. Taking 3,000 to 4,000 a year will not deplete resources, Omura believes. Japan and the USSR are allowed 2,300 blue whale units (1 blue whale unit equals 1 blue, 2 fin, or 2.5 humpback whales.) An international agreement between Japan and the USSR on observers for the whaling fleets would help protect stocks.

Observers Stranded

Dr. Seiji Kaya, who set up a "Society to Protect Whales," notes that the Soviet fleet sailed before observers could board the vessels. This was a major setback. He would like to see the blue-whale-unit system abolished and a catch limit for each species substituted. ('Japan Times', March 6.)

12 EUROPEAN COUNTRIES SIGN ANTIPOLLUTION PACT

Twelve European countries signed a convention, in Oslo, Norway, on February 15 designed to stop the dumping of poisonous waste by ships and planes in the northeast Atlantic.

The convention prohibits totally the dumping of durable plastics and dangerous substances, such as mercury and cadmium, that find their way into the food chain. Less harmful substances and materials--arsenic, lead, pesticides, scrap metal, and tar--can be discharged only with special permits.

British Government officials, who began negotiations in London in June 1971 that led to the convention, described it as "the biggest single step yet taken to fight sea pollution."

The Signers

In addition to Britain and Norway, the signers were Belgium, France, Denmark, West Germany, Finland, Iceland, The Netherlands, Portugal, Spain, and Sweden. The Soviet Union and Poland were invited to join the convention but said no.

British officials stressed that the agreement was a large accomplishment--but that ships and planes caused only a small part of marine pollution.

Industrial and Domestic Discharges

Ninety percent of this pollution is caused by industrial and domestic discharges through rivers, estuaries, outfalls, and pipelines that are under national jurisdiction. No international action has been taken on this problem.

However, the convention preamble expresses the hope that the 12 signers will coordinate policies to control pollution of their own waterways.

Preventive Steps Asked

Article 1 of the 27-article convention calls upon the countries to "pledge themselves to take all possible steps to prevent the pollution of the sea by substances that are liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea."

The Convention area covers the high seas and territorial waters in the northeast Atlantic, including the North Sea and part of the Arctic Ocean. The area extends westward to Greenland, and southward to the Strait of Gibraltar. It excludes the Baltic Sea.

Parliamentary Approval Needed

The convention "for the prevention of marine pollution by dumping from ships and aircraft" becomes effective when ratified by the Parliaments of seven of the 12 countries. A commission representing all 12 countries will meet regularly to supervise implementation of the convention.

Banned Substances Listed

Besides mercury and cadmium compounds, other banned substances are poisonous halogen or silcon compounds that do not convert rapidly into biologically harmless substances. Also banned are carcinogenic, or cancer-producing, substances and "persistent synthetic materials" that float.

Specific Permits

Among the other substances that can be dumped with specific permits from national authorities are copper, zinc, cyanides, fluorides, and containers.

The convention states that when it is considered necessary to deposit waste in deep water, it should be done only when two conditions are fulfilled: (1) The depth is not less than 2,000 meters (about 6,500 feet); (2) The distance from the nearest land is not less than 150 nautical miles.

British officials said penalties for violation of the convention would be legislated initially by the parliaments of the member nations. But there will be an attempt to coordinate them after the convention becomes effective.

U.S. & DENMARK AGREE ON CURTAILING ATLANTIC SALMON FISHERY

The U.S. and Denmark have agreed on curtailing the salmon fishery off West Greenland, the U.S. Department of State reported Feb. 22, 1972. U.S. and Danish officials met in Washington, Feb. 3-5.

The high-seas fishery conducted off Greenland by Danish flag vessels will be phased out gradually over a 4-year period, 1972 through 1975. The inshore salmon catch by local Greenland fishermen will be stabilized.

The agreement is equitable to all parties, the U.S. believes: to the countries where the Atlantic salmon originates, such as the U.S., which spend much money to protect salmon in the streams of origin; and to Denmark in the local Greenland fishery, which has special importance to Greenland's economy.

The Agreement

Denmark will limit its high-seas catch to about 800 tons (round weight) in 1972. In the three following years, it will reduce the catch to about 600, 550, and 500 tons. After that, Denmark will end the fishery.

Salmon fishing by local Greenlanders within the 12-mile fishing zone will be limited to about 1,000 tons a year.

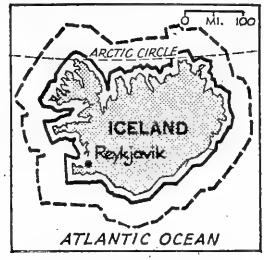
Denmark and the U.S. will seek to have the essentials of their agreement incorporated into the conservation regulations of the International Commission for the Northwest Atlantic Fisheries (ICNAF) at its annual meeting in May. They have been consulting other governments directly concerned--Canada, the United Kingdom, and Norway. Already, ICNAF has banned high-seas salmon fishing effective for 12 member nations.

Status of Salmon Stocks

Denmark or the U.S. can request a meeting to review the status of salmon stocks. In a joint statement on Atlantic salmon, Dec. 24, 1971, the U.S. and Canada pledged to cooperate closely on conserving Atlantic salmon. The U.S. also will seek to ensure that other conservation measures are undertaken within North American inshore waters.

BRITAIN TO REFER DISPUTE WITH ICELAND TO WORLD COURT

Britain has decide to take to the International Court of Justice in The Hague her dispute with Iceland over fishery limits. Iceland plans to extend her limits from the present 12 nautical miles to 50 on September 1. The British move was announced on March 6 in the House of Commons by Anthony Royle, Parliamentary Under Secretary at the Foreign Office.



Dispute is over Iceland's plan to extend its fishing limits from 12 to 50 nautical miles.

A week earlier, the House of Lords was informed that Iceland's proposed extension would deprive Britain of 20 to 25% of haddock, cod, and plaice.

Hope For Interim Arrangement

British officials have informed Iceland about the Hague move. They hope to reach agreement with Iceland on interim arrangements for British fishing in the waters affected while the case is before the World Court.

'Cod War'

There was a long "cod war" between Iceland and Britain in which clashes at sea occurred. In 1961, the 2 parties reached agreement. Iceland's fishing limits were set at 12 nautical miles. Britain maintains these limits cannot be ended by Iceland alone.

ICELANDERS EAT THE MOST FISH

Iceland leads all countries in annual per-capita consumption of edible fishery products: 86.1 pounds. Japan is second with 67.6. U.S. per-capita consumption in 1971 is estimated at 11.2 pounds.

NORWAY BUILDS FLOATING FISH MEAL & OIL FACTORY

A floating fish meal and oil factory, the 'Protangue', "the first plant in the world specially designed as a movable unit," is ready for delivery. It was built by Stord Bartz Industri A/S, Bergen, Norway, for the Portuguese firm Proteinas de Angola, Luanda.

The Protangue can process about 500 tons of raw material in 24 hours. This corresponds to about 100 tons of fish meal and 50-100 tons of oil--depending on type of fish.

The factory barge is 64.6 meters long overall, its breadth 17 meters, and dead weight 3500 tons.

The top deck is continuous from fore to aft. There is ample space for net repair and a helicopter deck.

The Protangue

It is constructed as a compact factory ship, without its own propulsion engine. When in operation, it will lie at anchor in port or alongside quay and operate as a self-supporting shore factory. It also can be towed to other ports or areas.

The manufacturer states: "The floating factory is fully equipped with processing plant for meal and oil; unloading, loading, conveying facilities; diesel electric power station, main steam power plant, fresh water generators, and storage tanks for raw material, fish meal, fish oil, fuel oil, diesel oil, and fresh water." There are air-conditioned cabins and lounges, gallery, and complete service for 20 men in production staff and management; office, and production control laboratory.

The purposes of this floating factory are: to be able to move to another area if fish supplies fail, if industry in the area becomes oversized; or quotas reduce raw material quantities available; or other circumstances make removal desirable.

Plant's Special Advantage

A special advantage of a "mobile factory plant" is that local conditions may not offer favorable conditions to build industrial plants in areas where fish supplies are abundant.

This applies to the underdeveloped countries. Where new fish stocks are to be exploited, the application of mobile factories of this type will mean an excellent solution: they can be put into service quickly and moved easily.

This type of factory is considerably less expensive to build and operate than the big factory ships of orthodox type for pelagic operation.

Raw Material Handling

The fish are unloaded from fishing boats by 12" Karmoy-type submersible pumps at a rate of 1500 tons fish per hour. The pumping water is removed in a stationary screen and wire-belt conveyor that brings the fish to an automatic measuring device. The fish are distributed by screw conveyors to 4 storage tanks, each with 120-ton holding capacity. The tanks are made for automatic discharge and built specially for easy cleaning. Bloodwater is strained off thoroughly during transport of fish from holding tanks to factory. The bloodwater is treated separately and used in the fish meal and oil process.

Process and Plant

The plant is a single Atlas-Stord process line for 100% utilization of the raw material. The raw material is supplied from an automatic feeder to a continuous indirect cooker type SS-75/12 with special device for level control and automatic heat control. The cooked material is treated in a special pre-dewatering arrangement--a combination of strainer conveyor and vibrating dewaterer type SVS-30. After pre-dewatering, the material is passed over a stationary magnet and then supplied to a twin-screw, press-type BS-56 F, in which oil and water are separated.

The "dry phase", the presscake, is distributed by screw conveyors to two Rotadisc Driers type TST 80 R operated in parallel.

After grinding in a horizontal Hammer Mill type M-44, the fish meal is treated automatically with antioxydant. It is passed through an automatic scale and finally pressed into pellets in a CPM pellet plant. The pellets are distributed to the meal stores under deck by conveyors. This ensures good use of the holds and good trimming conditions.

"The meal holds have a network of thermoelements for remote control of storage temperatures. Transshipment of pellets from factoryship to carrier is made by two pneumatic conveying systems with a capacity of 60 tons per hour."

The liquid phase from prestrainers and press is pumped via preheating tanks to a horizontal centrifuge-type Sharpless P-3400. The dry phase is mixed with the presscake; the liquid, consisting of oil and water, is treated in two automatic separators type Titan CNS 150. The separated fish oil is pumped to storage tanks. The remaining water, the stickwater, is processed to fish solubles in a stickwater-evaporating plant, type SAC 15 HLV, with stainless-steel tubes and automatic control.

The oil contents of the fish solubles are reduced to a minimum through separation in a solubles separator type Titan CNS 70. The soluble are mixed with the presscake and dried into whole meal.

Automatic controls are widely used. The complete plant can be operated at full production by 2-3 men.

ARSENAL OF OCEAN FISHERIES

Sergei Snegov

The Central Institute for Fishery Information and Technico-Economic Research (CIFITER) is only three years old. But within this short time, scientists at CIFITER gave the commercial fisheries numerous valuable recommendations--and set for designers problems the solution of which is bound to result in higher fish catch.

This article deals with the work of the commercial fishery laboratory headed by Ksenofont Pavlov, M.Sc. (Tech.).

What Kind of "Disposition" Does A Fish Have?

A fisherman will not find this question strange at all. He will probably suggest too that the quotation marks be crossed out. The point is that without knowing the fishes' disposition and behavior--differing not only in winter and summer, but even by day and at night--one cannot hope for a good catch. But, the system of "off-chance" and the concept of "fisherman's luck" are hopelessly outdated. Today, the successes of commercial fisheries must become constant and lend themselves to forecasting and exact calculation.

There is not room enough for all the vessels in traditional catch areas in shallow waters. Hundreds of trawlers and seiners sometimes crowd on small parts of the water area. Moreover, the stocks of valuable fish species in shelf waters require natural replenishment. So, the fishing flotillas sail ever farther and farther off the coast. Their catch of fishes and pelagic animals inhabiting the depths of the World Ocean is steadily growing. In our diet we now have mackerel and scad, capelin and tuna, anchovies and sardinelles, calmars and shrimps, as well as shark's "meat".

It is useless to try to catch the ocean's quick and timid inhabitants by old methods and tackle. New models of fishing equipment are being developed at institutes and designing bureaus with due account of the life and behavior of fish. But before speaking about them, we must answer the question: Where should pelagic fish be looked for? Does it have any favorite depths and location under the ocean surface that adds up to a hundred million square kilometers? (Scientists consider the areas where pelagic catch objects are to be found so immense.) Yes, it does. And they may be located through the simple taste of the oceanic population. Four fifths of all sea fishes and animals feed on plankton. And the development of phyto- and zoo-plankton proceeds in waters that are rich in nutrients: phosphorus, nitrogen, and potassium, in approximately a 45-meter layer which the sun rays necessary for photosynthesis penetrate. Plankton "clouds" stretch to approximately two kilometers down, and scientists consider that

Mr. Snegov is a correspondent with the Soviet Novosti Press Agency.

below that the ocean depths are almost uninhabited. Moreover, there are "dead" zones on the surface too. They account for 69% of the total area. These zones are reigned by circular currents, the water evaporates intensively, and its salinity increases. Heavy salt water ousts, as it were, the nutrients from the central areas of the World Ocean. There is nothing for a fisherman to do in these sea "deserts."

THE SACK THAT HAS BEEN TURNED INTO A STRUCTURE

The trawl, which used to be hauled over the bottom by a small vessel that used all the 600-650 h.p. of her steam engine, cannot qualify as anything but a sack. Fifteen or 20 years ago, such a sack, about 50 meters long and opened vertically but to a meter or two, was the main fishing tackle. It was attached to the trawler by two cables--wires. Its inlet--the mouth--was opened in the vertical plane by floats and sinkers, and in the horizontal by spacers on wires, flung open at a certain angle towards the direction of movement. Sluggish cods and haddocks and, less frequently, bass and flounder were the usual catch in those days.

It was considered that the catch could be increased by enlarging the trawl. And this meant greater resistance to be overcome by the tackle during travel, when water seeps through the small meshes of the net. Only a vessel with a powerful engine (several thousand h.p.) was capable of pulling it--and at a speed that would prevent the fishes from "escaping" from the trawl. There was another reason for the renovation of the trawling fleet: fisheries were becoming the expedition type. Vessels started sailing thousands of miles to fishing grounds and were away from home long months. A large-tonnage trawler, possessing a high degree of autonomy, was provided with a freezing plant. And then, too, an actual fish-processing shop appeared on such vessels.

The changeover to pelagic fishing, which began several years ago, proved much less simple than it might seem to the layman. At first sight, there is nothing difficult here: just pick the trawl off the ground, pull it closer to the vessel, and the pelagic fish will get into the net. Moreover, commercial fishermen have echo-sounders and fish locators. The trawl master has to only to look at the screen of the hydroacoustic receiver and to aim the mouth of the trawl at the shoal. At first, trawling often used to end in failure. The main reason was established when the trawl operation was observed directly under water. Skin-divers and then researchers of the Kaliningrad Special Experimental Designing Bureau (SEDB) for commercial fishery saw the complex behavior of various fish species near fishing tackle. The scientists went down in the "Atlanti-1" aquaplane. The fishes showed no "intention" of breaking through the netted walls of the trawl. They stayed three or four meters away from them. This meant that there was no need for small meshes. The very first tests of large-mesh trawls showed their advantages. The reduction of the hydrodynamic resistance of the net helped to enlarge considerably the dimensions of pelagic fishing tackle. The nets now used are so great that their "mouth"--the inlet--is capable of swallowing a multistoried building. Smaller resistance resulted in

much greater trawling speeds. Commercial fishing vessels pull whole shoals of quick mackerel and scad on board.

The mesh pitch already exceeds a meter for some experimental trawls. What is the optimum mesh size? How does the complex 3-dimensional structure, which ought to be called a "submarine plant," behave at various travel speeds? How is such a 100-meter-long "sack" to be controlled and aimed precisely at fish shoals? These are a few of the numerous questions to be answered. A large testing pool is being constructed in Kaliningrad. It will contain a thousand tons of water circulating at the velocity of 3-4 meters per second. It will help to experiment with models of trawls, propulsion screws, and turbines. The test pool will save much money now spent on marine testing the hydrodynamic characteristics of new trawling systems.

ELECTRIFIED TRAWL

Specialists from Poland, the German Democratic Republic (GDR), and the Soviet Union have tested it in the North Sea. The catch capacity of a trawl with netted electrodes attached to it is increased by two-thirds. The principle underlying the operation of this tackle is rather simple. The fish that gets into the zone of the electrodes effects is periodically hit by current and deprived of the possibility of escaping from the trawl forward.

The pulse electric device made in the GDR may operate in six different cycles. The most suitable is chosen for the definite fish species. Work with the electric trawl is quite safe. An automatic device limits the tensioning of the high-voltage cable, protecting it against overloads. The pulse generator is switched on only after 200 meters of cable are overboard. When the last 100 meters run out, a warning signal sounds.

An experimental specimen of an electric trawl for shrimp catch has been developed and constructed at the Kaliningrad SEDB. It produces a 40-50% higher effect than conventional shrimp trawls. Electric current is doing a fine job in the fishermen's trade.

THERE IS A NET, BUT NO VESSEL

Or, to be exact, there is no seiner that can cope with the most efficient pelagic catch tackle--the purse net.

What is a purse net like today and how is it used? It is a net of high-strength synthetic material, 1,000-1,200 meters long and 200-280 meters high. It is cast to trap a shoal located by search instrument or from a helicopter. After the ends of the net are drawn together (the gate is shut, as fishermen say), the cable running through rings on the lower edge of the net is tightened. The net turns into a giant purse stuffed with fish.

The very principle of purse-net catch demands that both seiner and her equipment possess special properties. The main ones are high speed and maneuverability of the

vessel and efficient operation of the net-drawing machine. Specimens of high speed and reliable deck mechanisms have already been tested and are being prepared for serial output. Now it is time to develop a seiner equipped with steering devices and active rudders meeting all requirements.

Meanwhile, fishermen have to resort to all possible devices to prevent the fish from escaping from nets.

FISHING "COMBINE" PUT OUT TO SEA

She carries various fishing tackle on board. A modernized bed trawl does good service in shallow waters. Its spacers are adjusted to raise directional mud clouds, leaving for the fish a single clean passage--into the trawl. The pelagic giant controlled from a desk in the steering room will report on all movements via an ultrasonic "channel" or via cable. The trawl may even become autonomous: it will be provided with its own submarine tugs.

Before the ocean "combine" starts a purse-net catch, an automatic steering system based on electronic computers will be switched on. Analyzing instruments will quickly appraise the catch conditions and suggest the most rational decision to the captain.

Bright lights will flare up at night over the surface and in the depth, and a fish pump will start delivering "live silver" into the ship's holds.

An acoustic device that reproduces the sounds of a feeding shoal will gather tuna fishes into a flock. An aromatic bait will attract the fish species into traps.

This looks like a fantastic picture. But each of the above ideas is already being worked on. Some, like the netless catch of Caspian sprats with the aid of light, are already practiced. So fantasy does not play so great a role in the description of future all-purpose fishing vessels.

THE GREEK FISHING FLEET AND MARKET

In mid-1971, Greece's distant-water fleet totaled 49 freezer trawlers with freezing capacity of 16,300 tons. Seven fished shrimp only. Six transport vessels serviced the fleet.

In 1970, the production of this fleet had increased 3% over 1969 due to three basic factors: 1) cancellation of certain price ceilings that enabled fishermen to earn more (this freed 15 vessels withdrawn from service in 1969); 2) increase in fishing time through development of a transhipment system; and 3) extension of hake fishing to South American waters.

Medium-Distance Fleet

The medium-distance fleet totaled 700 vessels: 388 trawlers (15,400 GRT), and 312 purse seiners (4,900 GRT). Forty to 50 vessels operated off Northern Africa; results have been discouraging. Production was down 8% from 1969. The decline has been attributed to poor fishing off Mauritania, the ban on fishing off Libya, and generally declining yields off northwest Africa. Fishing conditions in Greek territorial waters also were unfavorable.

Early 1972 Situation

At the end of 1971, the market for frozen fish weakened and wholesale prices declined. A decision was reached to restrict imports, except those under commercial agreements. Yields on fishing grounds off Northwest Africa were moderate. Because of increased fishing-license cost in Mauritania, and many foreign fleets off that country, Greek vessels are exploring more productive fisheries.

Fishermen Received More in 1970

In 1970, landings by the Greek fishing fleet for all sectors were 122,500 metric tons worth US$78.9 million. This compared with 122,900 tons in 1969. Prices at landing points rose an average 36% above 1969. The Atlantic fleet accounted for 27% (33,268 tons); the Mediteranean and coastal fleet took 43% (52,000 tons) and 21% (33,500 tons). ('Alieia', Dec. 1971; OECD, 1970.)

Greek fishing vessel returning to its home port near Pireus, landing point for vessels supplying Athens. (FAO: H. Henjaud)

JAPAN'S FROZEN-SHRIMP IMPORTS SOAR 2,000% IN 10 YEARS

William B. Folsom

Japan's 1971 shrimp-import season ended with a record spurt in volume and value at year's end. Beginning in October (See Fig. 1), the Japanese increased their imports to 6,808 metric tons worth US$18.9 million; in November, 8,471 tons ($28.2 million) and, in December, 11,429 tons ($41.3 million). Total 1971 imports reached 78,874 tons valued at $214.0 million, an increase of 38% in quantity and 48.7% in value over 1970 imports (57,146 tons worth $137 million). All of Japan's shrimp imports are frozen.

Many American shrimp importers felt at the time that the Japanese "buying spree" was touched off by devaluation of the U.S. dollar and that resulted in large-scale speculation in shrimp by Japanese firms trying to exchange dollars for shrimp. They were correct in that some nonfishery firms (textile,

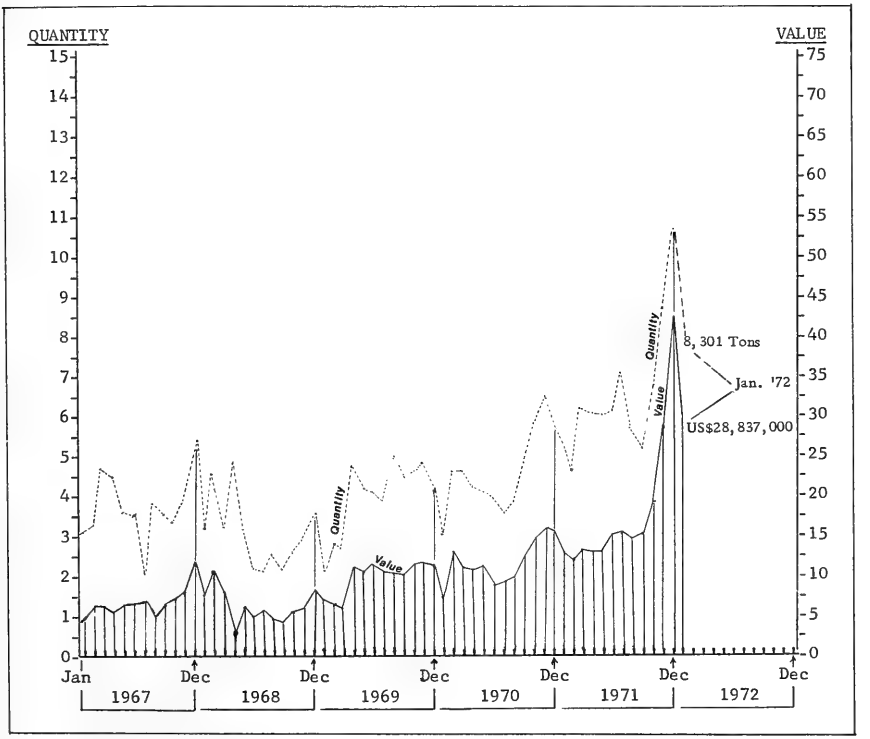


Fig. 1 - Japan. Frozen shrimp imports, value and quantity, by month, 1967-1972 (in 1,000 metric tons and US$1 million).

Mr. Folsom is on International Activities Staff of NMFS.

COMMERCIAL FISHERIES REVIEW
Reprint No. 931

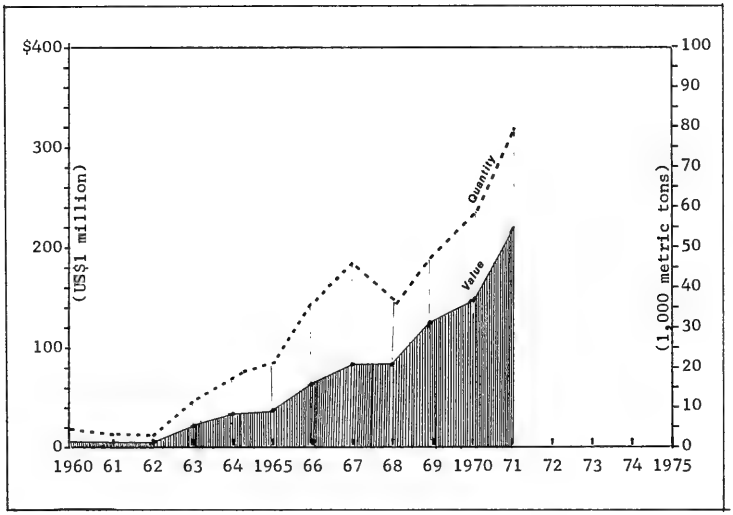


Fig. 2 - Japan. Value and quantity of frozen shrimp imports, 1960-1975 (in US$1 million and 1,000 metric tons).

JAPAN. Value and quantity of frozen shrimp imports, 1960-1975

YEAR	VALUE (US$1 million)	QUANTITY (1,000 metric tons)	PRICE PER METRIC TON (US Dollars)
1975			
74			
73			
72			
71	214.0	78.8	2,715
1970	137.0	57.1	2,399
69	121.7	48,8	2,493
68	78.0	35.2	2,215
67	79.7	44.4	1,795
66	60.0	36.1	1,662
1965	35.9	21.0	1,709
64	31.4	17.0	1,847
63	23.5	11.7	2,008
62	6.2	3.6	1,722
61	6.9	4.1	1,682
1960	6.6	-	

Note: Quantity is expressed in heads-off weight.

cement, and fruit importers) apparently did engage in buying shrimp on the world market. As a result, the Japanese market was reported glutted with certain-size shrimp, and some firms were compelled to sell shrimp below cost.

Trend Began After 1962

Japan's late 1971 shrimp buying was indeed striking, but the increase in imports, accentuated in 1971, is part of a long-term trend that began after 1962 (See Fig. 2). Imports totaled 3,600 metric tons in 1962, rose sharply to 11,700 tons in 1963 and, in 1971, totaled 78,800 tons. This was an increase of over 2,000% in 10 years.

Many reasons account for Japan's growing shrimp imports. Some can be summarized as follows:

1. Traditionally, the Japanese have considered shrimp a great delicacy above all other seafoods. There is no finer way of treating a guest, a client, or a family than with a shrimp dinner. The Japanese have many ways of preparing outstanding shrimp meals.

2. The Japanese worker has more money. In Gross National Product (GNP), Japan is the world's third most prosperous country. Average income of workers has risen steadily to the point where more of them now can afford to eat shrimp--and are willing to pay prevailing prices for the best seafood.

3. Because they have more money, many Japanese housewives are purchasing home freezers, refrigerators, stoves, etc. These purchases have increased sharply in the past 5 years. The housewife now can store frozen shrimp. Along with this development, the frozen-food industry has expanded rapidly. Frozen foods are becoming a big business. The industry has responded vigorously. Supermarkets are being constructed throughout the country.

4. The domestic catch of shrimp (generally sold live or fresh) has been static. It has averaged 60,000 to 70,000 metric tons per year and shows signs of a gradual decline. In the early 1960s, production was as high as 80,000 tons. To meet increased domestic demand, Japan has looked abroad.

5. The Japanese have been investing steadily in joint shrimp ventures overseas. Currently, they have about 25 scattered throughout the world. As more are established, the Japanese can be expected to increase their imports of shrimp.

The Outlook

Barring an economic recession, the outlook is that the Japanese public will continue to demand shrimp and pay high prices. Continued affluence and expansion of the frozen-food industry (including sales of home freezing units) will result in a growing domestic market. To meet this demand, the Japanese can be expected to increase their imports and to compete actively with U.S. importers for supplies. Japanese trade sources say that by 1980 total shrimp consumption may reach 150,000 tons, with imports supplying most of this demand.

JAPAN

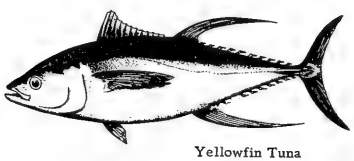
CULTURE OF YELLOWFIN AND BLUEFIN TUNA IS SUCCESSFUL

A tuna-culture experiment of the Pelagic Fisheries Research Laboratory, Japan Fishery Agency, has achieved marked success in raising yellowfin and bluefin tuna.

The research centered on (1) collection of spawn from mature yellowfin tuna, fertilization and hatching of eggs, and raising the young; and (2) raising immature bluefin tuna, whose stocks have decreased sharply in recent years.

Yellowfin Experiment

In the yellowfin-tuna experiment, about 1.2 million ripe eggs were collected from two mature yellowfin tuna and fertilized artificially. Hatching required 24 to 30 hours in water temperature of about 79° F (26° C); about 10,000 larvae were produced. One of these larvae lived 20 days--the longest survival in the experiment. Data on food and conditions of the water tank were collected. The experiment likely can be extended to cover the whole process from fertilization to raising of mature yellowfin tuna.



Yellowfin Tuna

Bluefin Experiment

In the bluefin-tuna experiment, young fish were captured by set nets and reared at culturing centers. Some were kept alive through the following winter. When caught in August 1971, the fish weighed 7 to 10 ounces (200 to 300 grams); in January 1972, about 3 kilograms (6.6 lbs).

Bluefin Tuna

Catching Young Fish Difficult

Although the artificial raising of young tuna from eggs collected from cultured, mature fish has succeeded experimentally, the method of catching young fish, such as bluefin tuna, at sea, has defects:

1. Systematic production of fish through culturing is difficult because young fish must be caught and the catch varies greatly from year to year.

2. It is becoming more difficult to adjust the catch for culture in competition with conventional fisheries. Fish culture and commercial fishing interests will have to determine how many young fish can be taken safely without upsetting the resources. This is not easy.

3. Seaweed beds in coastal waters, indispensable for the growth of immature fish, are becoming polluted; as a result, the catch of young fish is decreasing sharply.

So, it has become necessary to rely on artificial propagation--from raising mature fish to spawn collection, fertilization, hatching, and to rearing larvae and young fish.

The success of the latest yellowfin-tuna propagation experiment is an advance in fish culture because yellowfin is considered difficult to raise. ('Asahi Evening News', Feb. 17.)

JAPAN (Contd.):

SKIPJACK VESSELS SWITCHING TO CARP AS NEW BAIT

The Japan Tuna Association (NIKKATSUREN) plans to use grass (or silver) carp, Hypophthalmichtys moritrix, as live bait during the 1972 fishing season. This decision stems from successful experiments in 1971, in which grass carp were transported to the tuna fishery in tropical waters. Grass carp is abundant in Japan. ('Suisan Keizai', Feb. 4.)

NMFS Comment: Live bait is essential to Japan's skipjack (pole-and-line) tuna fishery, which long has had supply problems. The lack of live bait was an important reason for the slow expansion of the skipjack fishery in southwestern Pacific.

The live-bait problem can be summarized as follows:

(1) Anchovy is especially important in the skipjack fishery. However, anchovy is subject to high mortality due to handling. It must be caught, transferred to holding pens, kept for a week, transferred to holding pens aboard tuna vessels, and transported to distant-fishing grounds. Bait mortality normally runs as high as 50-70%. In 1970, anchovy marketed as live bait totaled 24,027 tons, or 10.7% of total anchovy catch. This accounted for only 27% of the skipjack fishery's bait requirements.

(2) The uncertain supply of commercial quantities of live bait in distant foreign ports. This uncertainty inspired bait-research cruises by the government and by industry. Bait-supply depots may be established in certain southwestern Pacific islands in 1972.

The Japan Tuna Association began experiments with grass carp in 1971. The tuna longliner 'Sakura Maru No. 18' fished with about 15,000 grass carp and reported success. In mid-September, the Japanese sent a survey team to Taiwan, where they found the Taiwanese using carp widely in their tuna fishery.

The Japanese now are studying the use of young "nishiki koi," a species of carp, as baitfish. Results have not yet been announced.

The successful experiments with grass carp mean that the pole-and-line fishery should be able to expand into new areas.

* * *

FIRM WILL FISH SKIPJACK FROM PONAPE, U.S. TRUST TERRITORY

The trading firm Marubeni Iida plans to form a skipjack venture with the Ponape District Fishery Corporation, U.S. Trust Territory of the Pacific Islands. On Feb. 10, 1972, Iida sent a 5-man team to that island on a one-month baitfish survey trip.

Fishing plan for the first year involves four 20-40 gross-ton skipjack poling vessels and one refrigerated mothership (500 to 1,000 gross tons) to be chartered from Hoko Suisan. The catch will be brought back to Japan. Plans under consideration include construction of a cold storage and processing plant at Ponape.

Other Venture Suspended

In 1971, trading firm Mitsui Bussan and the Okinawan Sanyo Fishing Co. established a joint skipjack fishing venture at Ponape. However, they have suspended fishing temporarily because of poor fishing conditions. ('Katsuo-maguro Tsushin', Feb. 23.)

* * *

GYOGYO TO FISH SKIPJACK IN INDIAN OCEAN

Kaigai Gyogyo (Overseas Fisheries Co.), one of several fishing skipjack off New Guinea and Indonesia, has decided to extend operations to the Indian Ocean. This decision followed a feasibility study at Seychelles Island in the Indian Ocean. Details are not available, but reports indicate one or two Gyogyo skipjack vessels have been fishing experimentally off Madagascar since Feb. 9, 1972. Gyogyo's advance into the Indian Ocean indicates increasing industry interest. ('Katsuo-maguro Tsushin', Feb. 22.)

* * *

JAPAN (Contd.):

COMPETITION FOR SHRIMP SHARPENS IN AFRICA

Intense competition looms among major Japanese trading firms for African shrimp, 'Mainichi' reported on March 3. Marubeni, C. Itoh, Sumitomo Shoji, Nissho-Iwai, and Mitsui are all interested.

Marubeni and Kyokuyo Hogei (large fishing company) set up a joint shrimp venture in Madagascar. Itoh plans joint ventures in Nigeria and Madagascar. Sumitomo Shoji plans to send fishing experts to Africa to survey resources. Nissho-Iwai and Mitsui are interested in a survey.

A First Step

The trading firms hope to "use their fishing ventures as footholds for their full-scale entry into the African markets and for the development of rich African mineral resources."

NMFS COMMENT: The Japanese are anxious to establish themselves in Africa. Shrimp resources there remain relatively untapped and the Japanese want to be first.

* * *

3 VESSELS EXPLORE OFF PERU

Three Japanese vessels began exploratory fishing in November 1971 off Peru for marine resources not now consumed there. Peru has an annual catch of over 10 million metric tons, nearly all anchovy. The anchovy are reduced to fishmeal for export.

Japanese participation in this research resulted from an agreement involving Nihon Hogei (a whaling firm), Mitsubishi Corp. (a trading firm), and EPSEP, Peru's food-fish promotion agency. Three 350-GRT vessels are exploring.

The 'Challwa Japid' is concerned mainly with pelagic and demersal fish species. The 'Koyo Maru' and one other vessel are searching for shrimp. The vessels operate with mixed Japanese-Peruvian crews.

For Peruvian Consumers

The fish caught by the Challwa Japid are destined solely for the Peruvian market. The Peruvians hope to develop a larger market for fish to meet local protein needs. The total catch will meet Peruvian demands first; the remainder will be exported to Japan. ('Pesca', Jan. 1972.)

* * *

OCEAN DUMPING RECOMMENDATIONS SUBMITTED

The Japanese fishing industry is reported generally pleased with recommendations on disposal of wastes in the sea submitted on March 16 by the Central Pollution Advisory Council to the Director General of the Environment Agency. These specify:

(1) the disposal of non-hazardous wastes (coli, mud) should be 50 miles or more from shore; (2) disposal of non-hazardous wastes (cinder, scrap-metal) should be confined to 5 places where water is deeper than 1,500 meters (3 in Pacific, 2 in Japan Sea); and (3) disposal of hazardous wastes (mercury, cadmium, lead) should be in the same 5 areas after being placed in concrete or sealed in suitable containers.

Pollock fishermen operating their own boats are being urged by processors, shallow-sea culturists, and administrators to process their catch aboard ship before returning to port in order to minimize pollution along Japan's coast. ('Suisan Keizai', Mar. 21-22.

* * *

FROZEN-TUNA EXPORTS ROSE IN 1971

In 1971, Japan exported 73,460 metric tons of fresh, chilled, or frozen tuna valued at US$38 million. This is an increase over 1970's 62,414 tons worth $32 million. It reverses the slump that began in 1967 (see Figures 1 and 2).

Fig 1. JAPAN. Exports of frozen skipjack, albacore, yellowfin and bluefin tunas, by quantity; 1960-1971.

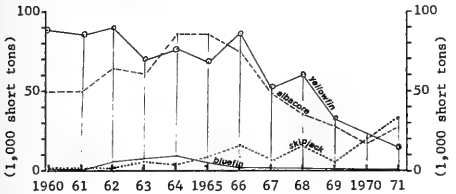
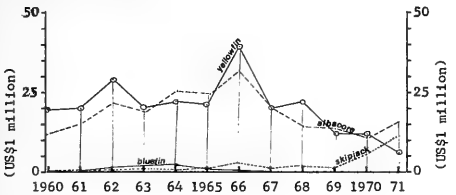


Fig 2. JAPAN. Exports of frozen skipjack, albacore, yellowfin and bluefin tunas, by value; 1960-1971.



Skipjack tuna became the leading export item: 32,342 tons in 1971, 20,564 tons in 1970. The Japanese have increased their fishing effort for it in the southern Pacific.

Albacore exports also increased in 1971: 25,116 tons; 17,280 tons in 1970. This reversed a long, steady decline that began in 1964-65.

Yellowfin exports decreased in 1971: 13,961 tons; 21,756 tons in 1970. It continued the decline begun in 1967-68.

Bluefin exports (0.2 ton versus 22 tons in 1970) remained small. This was due primarily to high domestic demand for it as "sashimi" (thinly sliced fish served raw). Japanese importers flew bluefin to Japan from the U.S., Taiwan, and Australia to meet demand.

Where Exports Went

The U.S., Japan's best customer, imported 77,563 short tons of frozen tuna and tuna loins worth US$41 million. (Includes direct exports and transshipments.) This was a 36% increase in quantity and 42% in value over 1970. It resulted partly from the 10% U.S. surcharge on canned tuna goods imposed in fall 1971. Frozen tuna was not subject to the surcharge. So it helped fill the gap left by slumping canned tuna sales due to surcharge and decontamination problem.

Also, the Japanese exported sizable quantities of tuna to Puerto Rico, American Samoa, and Fiji for processing and/or transshipment to the U.S.

Italy was another important market. It is normally supplied by Japanese tuna fleets in the Atlantic, mainly off West Africa. Ghana was one of Japan's principal African buyers. Most of the remainder went to Western Europe.

JAPAN (Contd.):

TWO FIRMS CEASE SAURY FISHING OFF U.S. WEST COAST

Taiyo Gyogyo and Nippon Suisan have announced they will not fish for saury off the U.S. Pacific coast in 1972 due to financial losses during the past three years. The other firms, Nichiro, Hoko Suisan, and Hokuyo Suisan, still plan to continue their exploratory fishery. ('Suisan Keizai', Feb. 10.)

NMFS Comment: The Japanese began exploring for saury off the U.S. West Coast in 1969 when their fishery off Japan reached a low--52,290 tons taken by 1,200 vessels. In 1970, the Japanese coastal saury catch increased to to 87,000 tons; by Nov. 1971, to 176,000 tons. This increase means that Japan needs to rely less on distant-water production. Exploratory fishing for saury off the U.S. has been unprofitable: in 1969, 500 tons; in 1970, 3,278 tons taken by 15 vessels; and 1,300 tons by 10 vessels in 1971.

* * *

SAURY FISHING OFF U.S. TO BE REDUCED SHARPLY

Japanese distant-water saury fishing will be cut sharply this year. For the past 3 years, the Japanese have been fishing experimentally in the central Pacific and off the U.S. northwest coast. They sustained heavy losses because of poor fishing. Only a very few saury vessels are likely to operate this year in that region. Most firms that had sent vessels have cancelled fishing plans for 1972 because price improvement in Japan seemed uncertain; in contrast, the coastal fishery seems headed for a good season.

Begun In 1969

Saury fishing off the U.S. West Coast was first undertaken in 1969 by 7 government-licensed vessels. On that trip, they caught many off Vancouver, B.C., in September, but their total catch was only about 470 tons. In 1970, 36 vessels were licensed, but only about 20 fished; these processed about 3,000 tons of frozen fish. In 1971, the number of licensed vessels was increased to 48; of these, 12 or 13 participated and processed about 1,000 tons of fish.

Problems Facing Japanese

The problems facing the Japanese are: 1) long distance to the fishing grounds; 2) unstable fishing conditions; 3) absence of large fish (even a good-sized saury measured only 9-10 inches and weighed about 2.9 ounces; and the count of 120-130 fish per 22-pound box obtained from the catch is not a very good size, even for tuna bait); and 4) heavy occurrence of parasites--making the fish unsuitable for humans. ('Suisan Tsushin', Mar. 28.)

* * *

RESUME CANNED-TUNA SALES TO U.S.

On Feb. 24, 1972, the Tokyo Canned Tuna Sales Co., which represents tuna packers, resumed canned-tuna-in-brine sales to the U.S. for the first time in seven months. Exports were halted in August 1971 because of heavy losses from U.S. detention of decomposed canned-tuna shipments. The Sales Company offered about 300,000 cases--about 250,000 cases of canned white-meat tuna and 50,000 cases of light-meat tuna. By March 3, the entire quantity was sold to trading firms. The company planned to offer another 300,000 cases around the end of March.

New Export Prices

The sales were transacted in accordance with new export prices based on revaluation of the yen in relation to the U.S. dollar. The new quotations show an average price reduction (in yen) of 5.6% for canned white-meat tuna and 2.9% for light-meat tuna. The range was unexpectedly small, particularly for the institutional pack, compared with the 16.88% upward revaluation of the yen (new official exchange rate is 308 yen = US one dollar). ('Suisan Tsushin', Feb. 26; 'Kanzume Joho', Mar. 6.)

Refunds for Recalled Canned Tuna

The Sales Company has informed trading firms that their canned tuna rejected by the U.S. will be repurchased in quantities up to 4,000 cases per firm at 5,600 yen (US$15.55) a case. Payment will be made upon presentation of a warehouse receipt, provided labels have been removed from all cans before they are returned.

JAPAN (Contd.):

	Price Per Case (Exwharehouse, Shimizo)							
	White Meat Tuna				Light Meat Tuna			
	New Price		Old Price		New Price		Old Price	
	Yen	US$	Yen	US$	Yen	US$*	Yen	US$
Solid								
7-oz. 48s	5,180	17.27	5,600	15.55	3,950	13.17	4,150	15.53
13-oz. 24s	5,080	16.93	5,550	15.42	3,870	12.90	4,110	11.42
66½-oz. 6s	6,250	20.83	6,450	17.92	4,850	16.17	4,900	13.61
Chunk								
66½-oz. 6s	-	-	-	-	4,630	15.43	4,680	13.00

*Dollar price represents conversion from yen at going exchange rate of 300 to one U.S. dollar. Previous rate: 360 yen to one.

As of late February 1972, an estimated 160-170,000 cases were shipped back to Japan. When these are tested and approved by the Health and Welfare Ministry, the Sales Company will resell them to mass-feeding institutions, such as the defense forces and school lunch program. ('Kanzume Joho', Feb. 21.)

* * *

1971 FISHERY IMPORTS ROSE SHARPLY

Japanese fishery imports during Jan.-Dec. 1971 were about US$424,178,000, based on 360 yen equal one US dollar. This was increase of more than $105 million over the 1971 imports worth about $318,900,000. The yen was revalued upward following implementation of new U.S. economic policy in August 1971. So imports of fishery products rose sharply during second-half 1971. By December, the new official exchange rate was 308 yen to the dollar.

Frozen Shrimp 50% of Imports

Frozen shrimp imports rose spectacularly from 1970's 57,146 tons worth $137 million to 78,874 metric tons valued at $203 million. These imports represented close to 50% of total fishery imports.

Among other fresh and frozen products scoring substantial gains were skipjack tuna, 17,587 tons (5,399 tons in 1970), and octopus, 64,455 tons (35,000 tons). ('Suisan Shuho', Mar. 5.)

* * *

MINKE WHALE FLEET ATTAINS GOAL OF 3,000 WHALES

On Feb. 18, 1972, Taiyo-operated Antarctic minke whale fleet reached its goal of 3,000 whales. The fleet is formed by the factoryship 'Jinyo Maru' (9,113 gross tons) and 4 killer boats. The fleet operated near 64° S. and 121° E. The average kill per day was 37 whales, higher than the planned 30/day. Body length of whales averaged 8.5 meters (previously believed 7-8 meters). The catch was processed into 7,500 tons of frozen meat and 1,000 tons of whale oil. This was the first time in Japanese whaling history that a mothership-type minke whaling expedition was sent to the Antarctic. ('Suisan Tsushin', Feb. 24.)

* * *

CRAB FLEETS DEPART FOR BRISTOL BAY

Two crab fleets departed Hokkaido, Japan, for Bristol Bay on March 1, 1972. The factoryship 'Keiko Maru' (7,536 gross tons) with 16 catcher boats and two 'Kawasaki' deck-loaded boats will fish from March 13 to September 24 and return to Japan October 5. Its 1972 quota is 19,148 cases of king crabs and 7,460,000 tanner crabs.

The factoryship 'Kyo Maru' (7,480 gross tons) with 14 catcher boats and two 'Kawasaki' boats will fish from March 11 to September 25 and return to Japan October 30. Its quota is 18,325 cases of king crabs and 7,140,000 tanner crabs.

JAPAN (Contd.):

Both factoryships will freeze their king crab catch instead of canning them aboard. The king-crab quota for the frozen production is 440,000 crabs for 'Keiko Maru' and 425,000 crabs for Koyo Maru. ('Suisan Tsushin', Mar. 31.)

* * *

ROUNDNOSE FLOUNDER HATCHED EXPERIMENTALLY

The roundnose flounder--Eopsetta species, called "mushi-garei" in Japan, where it is very expensive flatfish--has been hatched at the Shimane Prefectural Fishery Research Station.

The experiments were conducted by Yojiro Imazeki, chief of Utilization and Research Station. They began in a tank on Jan. 31, 1971. Imazeki injected sex-stimulating hormones into the fish on Feb. 10 and 16. One female hatched 40,000 to 50,000 eggs on Feb. 20. The water temperature was kept at about 14°C (50°F) and salinity increased. Roundnose flounders live at depth of 130 meters (426 ft.).

Exvessel prices for "mushi-garei" range from US$0.73 to $1.10/lb., and retail at about $0.48 apiece. ('Mainichi,' Feb. 28.)

* * *

SPECIAL SHIPBOARD SCALE DEVELOPED

Scales to measure weights aboard ship can err around 10%, even more in heavy seas. This is troublesome because proper scales are needed on factoryships for canning operations. Now a special scale has been developed to weigh objects correctly even in pounding seas.

Very Accurate

The scale was developed by Takubo Kogyo Co. of Osaka with Professors Ryuichi Masuo and Chikayoshi Maeda of the Osaka Institute of Technology.

Its error is less than 1/400th. The scale is designed so it will not be affected by a rolling ship. Tests were conducted for 6 months aboard a Japanese trawler in the Bering Sea.

Commercial sales of the scales have begun. ('Japan Economic Journal', March 1.)

* * *

THERMAL EFFLUENT USED FOR FISH CULTURE

A fish-culture pond believed to be the world's largest is being built at the Tokai atomic power station northeast of Tokyo. The budget is $550,000 over 5-year period. The project is to breed fish through the use of heated water discharged by the nuclear power plant.

Under present plans, 20,000-square-foot pond will be built first. A larger breeding pond of 70,000 square feet was scheduled to be completed by March 1972. Breeding will begin 3 months later. Sea bream, prawn, abalone, and eels are being considered for breeding and cultivation. Sponsors of the project are the Japan Fishery Resources Conservation Association, Science and Technology Agency, and the Fisheries Agency. The electric power industry will grant $490,000 in subsidies. ('Japan Report', Jan. 1.)

* * *

FISHERY AID MISSION TO VISIT 'THIRD WORLD'

The Japanese will send a "Fishing Ground and Marine Resources Development Cooperation Mission" to Latin America, Africa, and Southeast Asia later this year. The mission is being planned by officials of the Japanese Foreign Ministry, Fishery Agency, and the Japan Fisheries Association. The goal will be to explore ways Japan can help in development of marine resources.

The Agenda

The mission will consist of three 5-man groups. The first two teams will leave in September 1972 for Latin America (Argentina and Brazil) and Africa (Senegal and Rwanda). The African team also will visit Spain and Portugal. The last group will depart in November and visit Thailand, Burma, Malaysia, and Singapore. The teams will spend two weeks in each country. ('Japan Economic Journal', Feb. 11.)

* * *

NEW NICHIRO HEAD STRESSES 'SYSTEMATIZATION'

"The secret for success in business operation lies, in the final analysis, in how top executives get hold of correct information and data and pass them along the company grapevines in the shortest possible period of time." That is what Takeshi Hirano, new president of Nichiro Fisheries Co., told the Japan Economic Journal, Feb. 22, 1972.

"For this purpose," Hirano added, "rank-and-file employees, who form the base of a 'company triangle' should be in front, while top executives, who occupy the pinnacle of the 'triangle,' should hold up the rear. If top executives elbow their way to the front and personally urge their employees to greater efforts, the tactic is liable to backfire. Under such circumstances, employees are most likely to pay greater attention to currying favor with top executives than to their own business roles."

Troubled Fishing Industry

The fishing industry is plagued by knotty problems, including tightening international controls on fishing and the serious business slump caused by the "dollar shock."

"I will try my damnedest," Hirano states, "to turn our company into an all-embracing foodstuff manufacturer from a mere fishery firm.

"Fishery is very much a seasonal industry, so to speak. If we continue to depend on fishery alone, we shall not be able to cope with the rapid fluctuations of the world's economy. We have to process fish and other marine products and turn them into commodities equipped with high added value."

Nichiro Is Diversified

Already, Nichiro Fisheries is more than a fishery company with its subsidiaries engaged in a wide variety of business, including bakery and production of cola, feedstuffs, frozen foods, etc. It has about 6,000 employees.

Chukyo Coca-Cola Bottling Co., one of the subsidiaries, has become Nichiro's biggest profit earner. "We will go into any fields related either with fishery or foodstuffs in general," Hirano says.

He emphasizes frozen foods: "The living standards of the Japanese people have been greatly elevated in recent years. The tendency to use fish 'clean'--without guts, bones and heads etc.--will grow in the future. This year will prove a year of preparations for the serious debut of frozen foods."

The problem, he noted, is that the systematization of the nation's distribution channels is still far from completed.

"If there is no rail," Hirano says, "there will be no transportation. We will put everything into building and consolidating frozen-food distribution chains this year."

Role in World Arena

Hirano will advance into the international arena. Nichiro is now engaged in

consignment production for Nichiro Heinz Co. This is a joint foodstuff sales venture with J. H. Heinz Co. of the U.S.

Nichiro is emphasizing too the development and import of marine resources in foreign countries, especially African and Latin America.

"Self-restraints are indispensable in fishing operations," Hirano explains. "If we sail mighty 'black ships' in the seas off developing nations whose only assets are deserts and the seas and start catching fish and prawns at random, such nations are certain to believe that we are marauding on their own natural resources. Fishing is one industry in which international cooperation and restraints are of maximum importance."

[Note: Hirano and 4 top aides plan to discuss fisheries, processing, and feed with Chinese officials after the 1972 Spring Canton Trade Fair.--'Suisan Tsushin,' March 2.]

His Management Philosophy

In Hirano's management philosophy, front-line workers get top priority. "Success of business operations heavily depends on front-line workers. Our company will enjoy success only when the three different armies of our employees--men working on fishing boats, men engaged in factory works and men selling our products--are working truly hand in hand."

To attain this, he advocates systematization of distribution channels and management structures.

"If men get used to working as part of systems, the spirit of cooperation--or esprit de corp, if you like to call it--is naturally born and men will stop having 'scoop mentality.'"

TAIWAN'S FISHERY PRODUCTION ROSE 6% IN 1971

Taiwan's total fishery production in 1971 reached 650,096 metric tons, up 6% over 1970's 613,044 metric tons, but below the set target of 665,000 metric tons.

	1972	1971	Increase
	M.T.	M.T.	%
Deep-sea fisheries	293,780	277,955	5.7
Inshore fisheries	250,679	234,704	6.8
Coastal fisheries	27,876	27,690	0.7
Fish culture	77,761	72,695	7.0

The 7% increase in fish-culture production was due mainly to the conversion of rice fields into fish ponds. It is estimated that about 3,000 hectares of low-yielding rice fields were converted for rice production in 1971.

Mullet Propagation

Continuing the work started 8 years ago, the Tungkang Marine Laboratory in South Taiwan produced about 60,000 fingerlings of grey mullet by induced spawning. This was made possible by the completion of the weather-proof nursery ponds at the laboratory.

Shortage of Seed Eels

The acreage of eel ponds in Taiwan increased to about 1,000 hectares by the end of 1971. It was estimated that about 30 tons of seed eels would be required to stock these ponds. The catch of elvers from the coastal waters, however, was only about 15 tons as of the end of February. Due to the shortage, the price has soared from about NT$1 (US$0.025) at the beginning of November to NT$7 (US$0.175) for each elver in February. In face of this situation, the government has prohibited export of elvers and permitted their import from Japan.

--T. P. Chen
Chief, Fisheries Division

S. KOREA WILL INCREASE DEEP-SEA FLEET TO 800 BY 1976

South Korea will enlarge its deep-sea fishing fleet from the present 335 to 800 vessels by 1976, according to Director Dong-soo Kim, Office of Fisheries. The expansion will require US$200 million in foreign exchange. Kim plans to conclude a fishery cooperation accord with Spain and Ivory Coast this year to facilitate Korean fishing in the Atlantic.

To Increase Fisherman Income

S. Korea also plans to boost per-capita fisherman income from the present 53,000 won (approx. US$140) to 80,000 wons ($210) a year by 1976. There are 1,160,000 fishermen in Korea. Their annual income is $10 less than farmers'. ('The Korean Herald', Feb. 8.)

SOUTH PACIFIC

AUSTRALIAN ROCK-LOBSTER SEASON LOOKS PROMISING

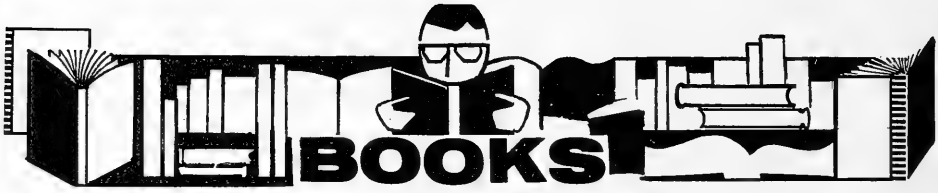
The 1971-72 rock-lobster fishing season in Western Australia and southern States looks fairly good, reports 'Australian Fisheries', Feb. 1972. The State catch will be about 17.9 million pounds, about the previous season level--but up from the 15.5 million pounds in 1969-70.

Catches in the central area of Victoria have been poor. In western and eastern areas, catches have been good.

On the West and East Coast of Tasmania, catches are reported better than average. Catches in the South Australian season have been poor.

Prices paid to fishermen run from A$1 to A$1.20 per pound. (A$1 equals US$1.15.)

The 1970-71 record production was up 13% from 25.2 to 28.5 million lbs. Western Australia, main producing State, took 17.8 million pounds.



OUR CHANGING FISHERIES - Sidney Shapiro, Editor, available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, $9 a copy.

This book was produced by specialists of the National Marine Fisheries Service. Its editor, Dr. Sidney Shapiro, has retired from NMFS after many years of noteworthy service in the U.S. and abroad.

Its story line ties the background of U.S. fisheries to today's complex, often-troubled industry--and points the direction these fisheries are likely to take in the future. Those who believe that the world's No. 1 problem is the population explosion will find special interest in the discussion of the ocean's food potential.

Dr. Shapiro writes:

"The fisheries are complex. Our experts are concerned with a multitude of technical subjects, as diverse, for example, as the classification of species, life history studies, exploratory fishing, gear and vessel development, chemical and physical analysis of the environment, and management of the resources. Other experts are concerned with utilization, that is, the combined effort in processing and marketing that puts the aquatic resources before you as savory seafood. Fish is even an important element in growing the chicken and eggs that you eat."

A "fishery" is many things: it is fishing; it is the place to catch fish or other marine resources; it is fishermen and the establishment they constitute; it is the technology involved; it is the legal right to catch fish at a certain place or in certain waters.

Sharing their knowledge of our commercial fishery resources in this book are biologists, chemists, bacteriologists, economists, administrators, trade specialists, and others.

The book is as attractive as it is informative. It contains many colorful maps, drawings, and graphics prepared by Bob Hines, artist-illustrator for the Bureau of Sport Fisheries and Wildlife, and George Lampathakis, Art Director for Creative Arts Studio.

The breadth and depth of the enterprise captained by Dr. Shapiro reflect the experience of a century-old organization.

COASTAL ZONES

"Coastal Zone Management: Multiple Use With Conservation," edited by J. F. Peel Brahtz, 352 pages, $19.50. John Wiley & Sons, Inc., Publishers, 605 Third Avenue, New York, N.Y. 10016.

There are demands on the coastal zone by diverse groups. To develop good policies and viable objectives, regional planners must combine the opinions and advice of scientists, engineers, economists, public officials, and the public. The book is aimed at persons who contribute to, or benefit from, the management function.

Part I examines the "multiple use of Coastal Zone resources in terms of the structure and conflict of goals." Part II discusses technological requirements and resources. It suggests how technology can be applied to the problem of goal conflict.

The book is a useful reference for: public planners, who must "formulate concepts of land use" that comply with public policy while getting the most use out of it; land developers; conservation groups; students and specialists.

CONTENTS

Part 1: GOALS AND MULTIPLE-USE

- National Goals, State's Interests, and Jurisdictional Factors
- Conservation of Biological Resources of the Coastal Zone
- Social Needs and the Urban-Marine Environment
- Traffic and Transport Needs at the Land-Sea Interface
- Conservation of Mineral Resources of the Coastal Zone

Part 2: SYSTEMS PLANNING AND ENGINEERING

- Systems Planning and Control: Coastal Regions
- Information Systems and Data Requirements: Coastal Development Planning
- Ocean Installations: State of Technology
- Marine Waste Disposal Systems: Alternatives and Consequences
- Marine Transport Systems: State of Technology

LAMPREYS

"The Biology of Lampreys," edited by M. W. Hardisty and I. C. Potter, Vol. 1, 423 pages, $22.50. Available from Academic Press Inc. (London) Ltd., 24-28 Oval Road, London NW1, and Academic Press Inc., 111 Fifth Avenue, New York, N.Y. 10003.

Lampreys are very important to biologists for two reasons: in their study of developmental biology and evolution--and as laboratory animals for physiological and biochemical research. In recent years, biologists have made significant progress in studies of lampreys during their larval life as microphagous feeders and as parasites in their adult stage.

The editors say no attempt had been made to "collate and review" recent developments. The 2-volume work tries to do this.

Students of vertebrate zoology will find detailed background information on the "systematics, life histories, ecology and behaviour of lampreys."

The destructive role of lampreys in the U.S. Great Lakes is discussed.

CONTENTS OF VOL. 1

- Distribution, Phylogeny and Taxonomy
- Lampreys in the Fossil Record
- The Behaviour, Ecology and Growth of Larval Lampreys
- The General Biology of Adult Lampreys
- Sea Lampreys in the Great Lakes of North America
- Paired Species
- The Chromosomes
- Gonadogenesis, Sex Differentiation and Gametogenesis
- Embryology

SALT-WATER FISHING

"Salt-Water Fishing From Boats," by Milt Rosko, paperback, $2.45, Collier Books, 866 Third Avenue, New York 10022.

The book aims to give the fisherman the information he needs to fish successfully in the Atlantic, Pacific, and in the Gulf of Mexico. It describes each coastline separately. The author tells how to get the most out of a fishing trip. He explains chumming, trolling,

rigging, baiting, casting, fighting and landing the catch.

The book describes tackle for many fishing situations. Boats suitable for fishing--from party packet to private skiff--are discussed.

Included is a detailed list of the fish the boatman is likely to encounter--from African pompano and winter flounder to California yellowtail.

There are more than 100 illustrations.

UNITED KINGDOM

"FISHING NEWS Directory and Equipment Guide 1972," editor John E. Webb. Published by Arthur J. Heighway Publications Ltd., Ludgate House, 110 Fleet Street, London EC4A 2JL, $7.20.

The contents of this latest reference are:

Official List of UK Fishing Vessels 25 Tons and Over
Owners, Managers and Vessels of Individual Fleets
Number of Vessels in Fishing Ports of the United Kingdom
Builders and Their Facilities
Vessels Recently Completed, Under Construction or on Order
Suppliers and Manufacturers
Wholesale Merchants at Main Ports
Authorities, Association and Organizations
General Information
Alphabetical Index
Advertisers' Index

SALMON AND TROUT

"SALMON and TROUT--A Resource, Its Ecology, Conservation and Management," by Derek Mills, 351 pp., March 1971, $14.95. St. Martin's Press, 175 Fifth Ave., N.Y. 10010.

The Atlantic salmon (Salmo salar), the trout (S. trutta), and other salmon family members are distributed widely in temperate regions. The conditions affecting their future as an important fishery resource are extremely varied. "To produce sound plans for their future conservation and management," writes Mr. Mills, "it is necessary to review their history, value and method of exploitation and consider the ecology of the individuals forming the resource."

The author has fashioned the book to aid students in ecology, fishery management and regional planning. He also had in mind "fishing proprietors, river authorities, district fishery boards, estate managers, and engineers, and angling associations."

The book is a useful summary of information about the study, conservation, and management of game fish. Their future depends heavily on enlightened management efforts.

Part I focuses on man's exploitation of the resource. It deals with history, catching methods, and value of the salmon and trout fisheries. To understand the impact of exploitation on a renewable or biological resource, its ecology must be known.

So Part II provides a comprehensive account of the ecology of salmon, trout, and other salmon family members. Exploitation is not the sole factor affecting them and their environment. Part III describes these factors. Much space is devoted to pollution and hydroelectric development. Part IV details conservation and management of the resource.

Finally, the future of the salmon and trout fisheries is discussed. The main subjects are the development of the high-seas salmon fishery and the methods of regulating stocks in home waters. The future of trout fisheries for commerce and recreation and fish cultivation is considered.

Mr. Mills warns about the effects of insecticide residues.

TRY A TUNA TEMPTER TODAY

Wake up taste buds with Tuna Tempters--a new creation from the National Marine Fisheries Service. This recipe was designed to arouse and satisfy appetites while assuring Mom that her hungry eaters are getting hot, wholesome nourishment. Little kids, big kids, and kids of all ages love tuna, and it's easy to see why. This satisfying seafood is power-packed with a generous supply of protein as well as other valuable nutrients--and it tastes so good! Tuna's versatility is well known, too; homemakers everywhere rely on this tasty fish for snacks, dips, cocktails, salads, casseroles, loaves, patties, chowders, burgers, and sandwiches. Tuna is also delightful eating just as it comes from the can.

Tuna was rather a latecomer to the canning industry, having started in the early part of the 20th century. The growth of the California-based tuna industry, however, has been phenomenal and now equals or exceeds most other canned fishery products in volume and sales. The reason, of course, lies in the quality and excellence of the fish as well as in the modern techniques and up-to-date, sanitary equipment and plants where the canning is accomplished. The tuna industry had the homemaker in mind when it planned the size of the cans. Tuna is canned in four sizes for consumer use: $3\frac{1}{4}$ to $3\frac{1}{2}$ ounces for individual servings; $6\frac{1}{2}$ to 7 ounces for salads for two or combination dishes; $9\frac{1}{4}$ ounces for medium-sized families; and $12\frac{1}{2}$ to 13 ounces for larger families. Tuna is easily digested, low in calories, and economical because there is no waste in the compactly packed and compressed cans.

Tuna Tempters blends the goodness of tuna with a medley of other foods such as onion and celery for crunch and texture interest, cheese and hard-cooked eggs for smoothness and added nourishment, and sweet pickle relish and stuffed olives for flavor interest. The succulent mixture is placed between bun halves and securely wrapped in foil. This unusual recipe is adaptable, too; the Tuna Tempters may be heated in the oven for immediate enjoyment or they may be stored in the freezer and used at the convenience of the homemaker. What a tempting way to satisfy kids of all ages! Be sure to try Tuna Tempters soon!

TUNA TEMPTERS

1 can ($6\frac{1}{2}$ or 7 ounces) tuna drained and flaked	2 tablespoons finely chopped onion
$\frac{1}{2}$ cup shredded cheddar or American cheese	2 tablespoons drained sweet pickle relish
$\frac{1}{2}$ cup thinly sliced celery	2 hard-cooked eggs, chopped
$\frac{1}{3}$ cup sliced stuffed olives	$\frac{1}{4}$ teaspoon salt
$\frac{1}{4}$ cup salad dressing	6 hamburger buns, split and buttered

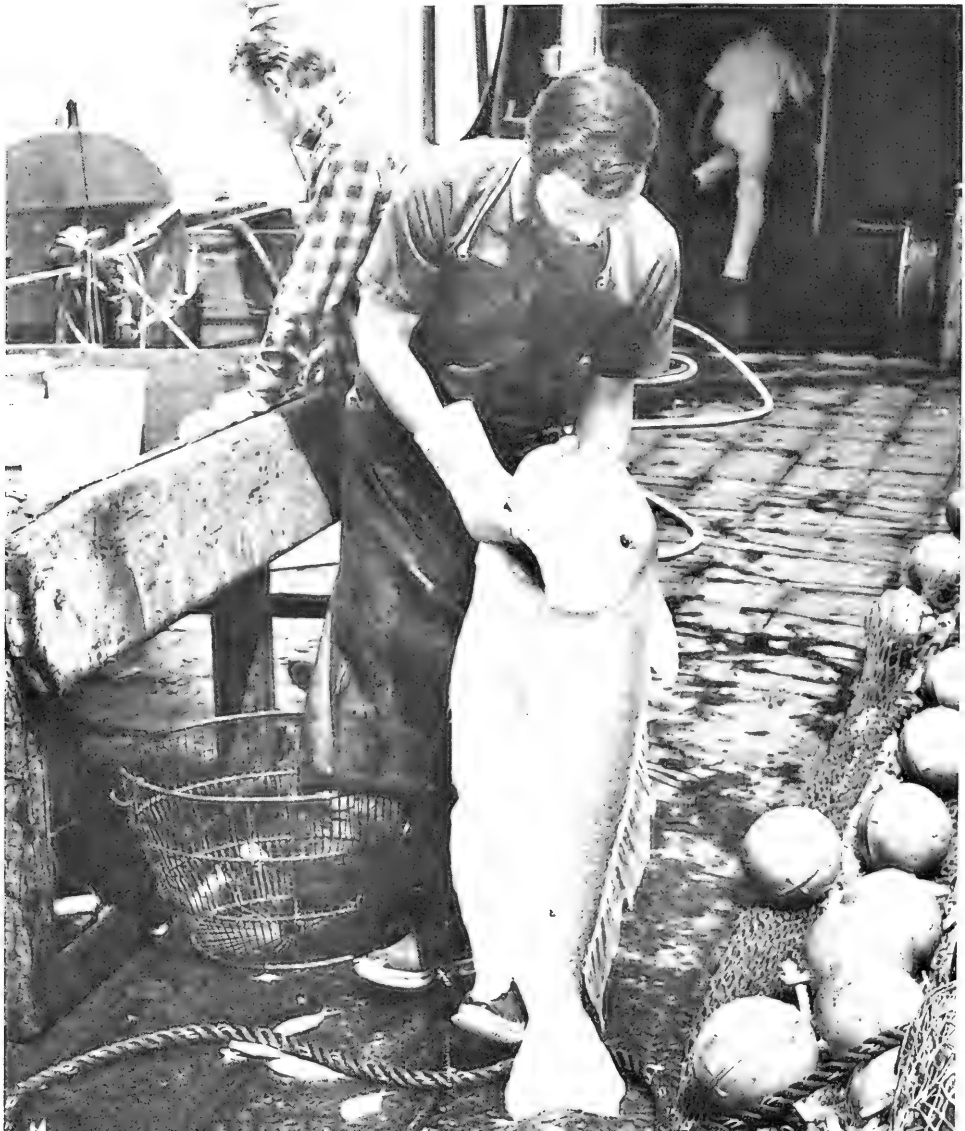
Combine ingredients, except buns; mix well. Spread an equal amount of tuna mixture over bottom halves of buns; cover with bun tops. Wrap each Tuna Tempter securely in aluminum foil. Place on baking sheet. Heat in a moderate oven, 350° F., about 25 minutes or until sandwich filling is hot. If desired, these may be made ahead of time and stored in the freezer. Heat frozen Tuna Tempters in moderate oven, 350° F., about 40 minutes or until filling is hot. Makes 6 servings.

(Source: NMFS, NOAA, U. S. Department of Commerce, 100 East Ohio St., Room 526, Chicago, Ill. 60611.)

INDEX

BACK COVER: Tile fish aboard NMFS Research Vessel 'Albatross IV'.

(Robert K. Brigham)



A UNITED STATES DEPARTMENT OF COMMERCE PUBLICATION

Commercial Fisheries

REVIEW

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

AY-JUNE 1972
VOLUME 34
NUMBERS 5-6

Commercial Fisheries REVIEW

A comprehensive view of United States and foreign fishing industries — including catch, processing, marketing, research, and legislation — prepared by the National Marine Fisheries Service.

CONTENTS

COVER: Fishermen strapping in purse seine aboard vessel in San Diego wetfish fleet. See article page 11.

FISHERMEN'S MEMORIAL · GLOUCESTER MASS.

U.S. DEPARTMENT OF COMMERCE
Peter G. Peterson, Secretary

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Robert M. White, Administrator

National Marine Fisheries Service
Philip M. Roedel, Director

Address correspondence and requests to: Commercial Fisheries Review, 1801 North Moore Street, Room 200, Arlington, Va. 22209. Telephone: Area Code 703-557-9066.

Use of funds for printing this publication was approved by the Director, Bureau of the Budget, April 18, 1968.

Editor: Edward Edelsberg

Production: Alma Greene

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price 60 cents (single copy). Subscription price: $7:00 a year; $2 additional for foreign mailing.

OUR OCEAN PRIORITIES ARE CHANGING, NOAA HEAD SAYS

In the 7 fiscal years 1967-1973, total Federal investment in marine-science activities has increased 53%--from $438 million to $672 million--Dr. Robert M. White, NOAA Administrator, told the Marine Technology Society in Washington, D.C., on May 15. During these years, the total Federal Research and Development budget rose only 16%--from 16 billion to 18.6 billion.

Significant, too, Dr. White noted, was the trend since 1967 in the investment of Federal money. In the first half of the period, there was an increase of $75 million; in the second, $159 million. "The growth rate appears to be accelerating," he said.

Priority and Importance

As a percent of annual ocean expenditures, national security programs "suffered the greatest loss in relative priority." In 7 years, these dropped from 37% of total effort to only 14%.

Dr. White stated: "Our National expenditures for both living and nonliving resources, ocean monitoring and prediction, mapping and charting, general purpose engineering, and education, were relatively constant as percentages of the total."

The big gainers were 3 major program areas: coastal zone, from 5% to 14% of total, marine transportation, from 3% to 10%, and general-purpose ocean research, from 14% to 19%. "These numbers reveal a very clear reordering of our national ocean priorities," Dr. White asserted.

Greater emphasis on the Coastal Zone reflects the growing national demand to protect the environment. It conforms to the purposes of the Environmental Policy Act of 1969, the clean Water Act of 1969, pending legislation on Ocean Dumping, Coastal Zone Management, etc.

In 6 years, the budget for coastal-zone activities increased from $21 million to $94 million.

MARINE TRANSPORTATION

Greater emphasis on transportation reflects 3 factors: increasing U.S. concern with its economic position in the world; U.S. attempts through research and technology to create again a merchant marine fleet equal to its growing needs; expansion of Coast Guard enforcement of marine law.

The budget for marine transportation rose from $12 million to $70 million.

GENERAL-PURPOSE OCEAN RESEARCH

Ocean research mirrors the policy of the Resources and Engineering Act of 1966. It represents U.S. determination "to seek the understanding of the oceans which underpins all else that we seek to do."

Ocean research increased 100% from $62 million to about $126 million. In fiscal year 1973, this research--19% of the total--is the largest slice of the ocean-budget pie.

Several ocean activities that increased at a much faster rate than the average included

those involving living and nonliving ocean resources. Fishery activity rose from $38 million to $62 million, a gain of 62%. Nonliving-resource activities gained 181% from $7 million to $20 million.

Dr. White singled out two programs as "candidates for greater emphasis in the future. . .Our National programs directed at the exploration, development and conservation of our nonliving and living resources." He believes their growth in recent years reflects "the growing realization that the oceans offer substantial hope for meeting some of our pressing National resource needs."

At the same time, there is growing realization that our living resources have to be protected. This will push us towards a comprehensive living-resource management system. We need new technologies of fish-stock assessment, new understanding of pollution's effects on marine ecosystems, and national systems of fishery resource management through new institutions. This development will underscore the need for greater investments to protect and manage our invaluable resources.

And the NOAA Administrator saw this prospect:

"We in the marine field have a new climate and a new opportunity for innovation in marine industry. The oceans offer excellent opportunities of substantial potential--aquaculture, marine mining technology, and environmental preservation, to name a few. And I see encouraging opportunities arising for collaborative work between the Government and industry. I believe that these kinds of opportunities will be among the principal determinants of the nature of the National ocean program over the next six-year period."

NMFS PREDICTS GOOD ALBACORE FISHING SOUTH OF SAN FRANCISCO

The best location for catching albacore tuna this year will be south of San Francisco, according to Dr. R. Michael Laurs of the NMFS Laboratory in La Jolla, California. Dr. Laurs is in charge of fishery prediction investigations.

He bases his forecast on environmental conditions and the trend over the years in distribution of the commercial albacore catch. He estimates that 70 to 80% of the 1972 catch will be south of San Francisco, with most of it off central California; 20 to 30% is expected to come from waters north of San Francisco, which is below the long-term catch average of 36%.

Catch Predictions

Commercial boats fishing south of San Francisco can expect to catch 30 to 45 million pounds of the valuable white-meat tuna; boats north of San Francisco may catch 10 to 15 million pounds. Dr. Laurs cautions, however, that these estimates could be low if many more boats enter the fishery.

Weekend fishermen and sport boats in southern California waters should have very good albacore fishing this season, although the development of warm water conditions in late summer could limit fishing success.

Role of Environmental Conditions

The prediction of the fishery's general distribution was developed by Dr. Laurs and his staff of meteorologists, oceanographers, and biologists. It is based partly on an experimental index that relates the north-south coastal distribution of the fishery with environmental conditions in certain offshore waters during spring. This assumes that midocean environmental conditions encountered by incoming migrant albacore affect their distribution when they enter North American waters. In past years, the albacore prediction was based solely on analysis of sea-surface temperature conditions in spring in near-shore waters; the summer albacore fishery traditionally takes place there. Biologists assumed that trends in environmental conditions observed in spring persisted and indicated the probable distribution of sea-surface temperature in midsummer. However, later research has shown that dynamic air-sea interactions during summer can alter considerably the sea-surface temperatures seen in spring prior to the fishing season--and alter albacore distribution.

"In the near future, Dr. Laurs stated, "our current population dynamics research should enable us to make more accurate forecasts of tonnage and general size of albacore that will enter the fishery."

NMFS INSPECTS AREA AFFECTED BY CANNIKIN NUCLEAR TEST

Four biologists-divers of the NMFS Auke Bay Fisheries Laboratory in Alaska made a series of reconnaissance dives at Amchitka Island in late April 1972 to determine the extent of underwater biological and geological effects of the detonation in November 1971 of a 5-megaton nuclear device. The divers were Louis Barr, Roy Martin, John Karinen, and Robert Budke. They were accompanied by Theodore R. Merrell Jr., environmental research coordinator for the Auke Bay Laboratory.

Ten locations off the Bering Sea coast within 3 km of Cannikin ground zero were inspected. Six of the locations showed shock-caused bottom disturbances in the form of broken bedrock outcrops. At some sites, damage was slight but, at others, extensive severe damage occurred.

Greatest Damage

The area of greatest damage was along the margin of a large offshore reef about 1.7 km from ground zero. The reef consists of a rock pinnacle that rises precipitously from a depth of about 10 to 15 meters to the sea surface. The basal margin of the reef was littered with freshly broken large rocks, some more than 3 meters in diameter, which apparently were broken from the reef by the shock of the Cannikin explosion. The newly exposed surfaces of broken rock were readily apparent because they were uneroded and unencrusted by marine organisms.

Biological Changes

Biological changes occurring in the disrupted areas are of two types: disappearance of organisms from previously exposed rock

Fig. 1 - Diver inspecting a small underwater rock fall caused by the shock of Cannikin, a 5-megaton nuclear test at Amchitka Island, Alaska. Rock falls of this size and larger were common in an area off the Bering Sea coast of Amchitka adjacent to the test site.

Fig. 2 - Diver at base of a precipitous underwater cliff in an area off Amchitka Island undamaged by the Cannikin test. Closer to the test site, cliffs such as this suffered extensive breakage.

surfaces, and colonization by plants and animals of newly exposed substrate. Some kelps and other algae growing on exposed surfaces of rocks which have been displaced are now in shaded positions where insufficient light penetrates to support plant life. These algae are dying and will eventually disappear. Likewise, some sessile filter-feeding invertebrates (such as sponges and tunicates) may be eliminated on surfaces where water circulation and food availability have been reduced by displacement.

Because of the extensive fracturing of rock, much new substrate has been exposed. These newly exposed surfaces are already being colonized by mobile invertebrate animals, such as urchins and gastropods and, especially at the shallower locations, by Alaria sp., a common alga. Within several years, these new surfaces probably will be encrusted by organisms and will be indistinguishable from undisturbed areas.

More Surveys

The Auke Bay Laboratory of the National Marine Fisheries Service will make additional underwater surveys at Amchitka in 1972 and 1973 to map the full extent of the disturbed areas and to monitor the reestablishment of marine plants and animals in disturbed areas.

1972 FISH STOCKING IN GREAT LAKES TOTALS 18.5 MILLION

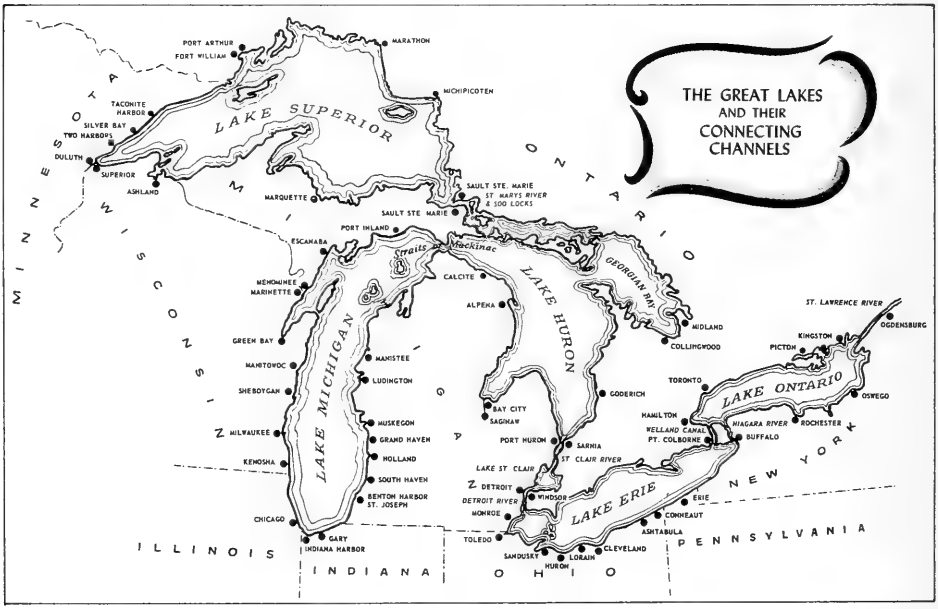
About 18.5 million hatchery-reared fish will be placed into the Great Lakes and their tributary streams in 1972. This will be about a million fewer than the 1970 high, but offers a better balance of species. Atlantic salmon are being introduced; and, for the first time, the release of chinook salmon will surpass coho plantings. This information is provided by the Great Lakes Fishery Commission.

Salmon

Salmon will be released in all Great Lakes and in the waters of all bordering jurisdictions. The 9.7 million smolts or young salmon will include nearly 4.3 million chinook, about 4.1 million coho, over 1.3 million kokanee, and about 39,000 Atlantic salmon. The Atlantics were transported in tank trucks by Michigan and Wisconsin department of natural resources personnel from a hatchery in the Gaspé section of Quebec. Release locations are the Boyne and Au Sable rivers in Michigan, and Pikes Creek at Bayfield, Wisconsin.

Lake Trout

Nearly 5 million lake trout were being planted in lakes Superior and Michigan this spring, the most since 1968. Planting of this species began in 1958 in Superior along with the lampricide treatment of streams where the predator sea lamprey spawn. With 1972's



addition, the 15-year total for Superior will exceed 32 million. Rehabilitation of the lake-trout fishery in Lake Michigan started in 1965, and plantings to date total more than 16 million. The Great Lakes Fishery Commission coordinates this stocking program, which is largely supplied with yearling lake trout from U.S. hatcheries.

Also being planted this spring were 3.8 million other trout--brown, brook, rainbow, steelhead, and splake. Splake is a lake trout-brook trout hybrid; steelhead is the lake-run rainbow trout, which is larger than the stream-dwelling variety.

Lake Michigan

Lake Michigan waters will receive nearly 10.3 million young fish this year--more than half the amount scheduled for release in the Great Lakes. Some 2.9 million lake trout will be put into the waters of the four bordering states by the U.S. Bureau of Sport Fisheries and Wildlife. Michigan's plans to release nearly 5.3 million game fish in Lake Michigan represents about two-thirds the state's 1972 total of about 7.9 million. For Wisconsin, another major contributor, about 1.8 million fish out of this year's $2\frac{1}{2}$-million total release will go into Lake Michigan.

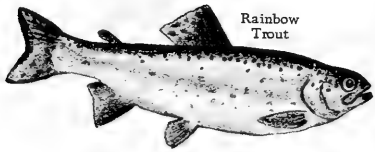
Lake Superior and Huron

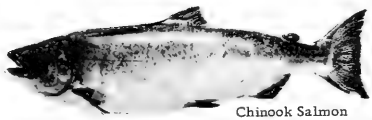
Fish stocking for Lake Superior will total 3.3 million; for Huron, 3.4 million. Lake trout is the principal fish going into Superior. The selectively bred splake and splake-lake trout backcross are being used extensively in Lake Huron.

In the eastern Great Lakes, coho and chinook plantings in Lake Erie will total about 300,000, a decline from 1971. However, the Lake Ontario stocking programs of New York and Ontario indicate a two-species total of just over a million, or about double the 1970 figure for that lake.

Huron's Saginaw Bay

About 50 million walleye or yellow pickerel fry were released into the Saginaw Bay section of Lake Huron by Michigan's Department of Natural Resources. The young, quarter-inch fish were provided by New York State's Oneida Lake fish hatchery as part of a reciprocal arrangement under which Michigan has supplied New York with salmon and steelhead eggs. Walleyes are slow growers. It is expected that the legal catch size (13 inches) generally will not be attained in the once-prime Saginaw Bay fishery before 1976.


Rainbow Trout


Chinook Salmon

SCIENTISTS CONTROL REPRODUCTION OF MULLET

The controlled reproduction of mullet, including their spawning out of season, has been achieved by scientists of Hawaii's Oceanic Institute at Waimanalo. These results bring closer the commercial breeding and farming of this widely used oceanic fish. Sea Grant funds supported the research.

The researchers succeeded in spawning the fish in September 1971, five months earlier than their natural spawning season of January or February. They used temperature and photoperiod (light) control. With this, conditions in the holding tank simulated the midwinter season. Also, the females were injected with hormones. Both males and females responded to cool water and short light exposure. Three females were successfully spawned in September. The process was repeated with three other females in October and early November.

Critical Accomplishment

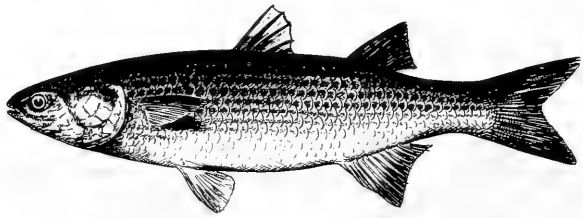
Another important achievement was finding ways to enable the tiny mullet to survive the critical three days after hatching. Immediately after hatching, larvae are nourished by their attached yolk sac. At the end of this stage, about three days, their mouths break through; shortly thereafter, they begin feeding. They sink to bottom of tank. (In the ocean, thermal layers in the water keep them afloat.) Their tender skins break or are bruised by the bottom of the tank, and the injuries lead to infection and mass mortality.

The researchers used an upwelling system in the tanks to prevent larval settling. They achieved survival rates ranging up to 70% instead of the previous 0.5 to 5.0%.

Applicable to Other Fish?

The researchers are refining their techniques. They are examining the possibility of transferring these techniques to other commercially important fish.

They have taken the first steps toward trying to spawn the mahimahi--Hawaiian name for the dolphin or the dorado, an important food fish and luxury item on dinner menus across the Pacific.



FDA SEEKS TO IMPROVE FOOD-PLANT SANITATION

The Food and Drug Administration (FDA) will intensify its regulatory program designed to end insanitary conditions in U.S. food plants. Dr. Charles C. Edwards, Commissioner of Food and Drugs, stated that FDA has devoted most of its inspection resources in recent years to microbiological contamination problems. "It has become apparent, however, that there has been a general decline in the food industries sanitation practices. This has been shown by recent FDA inspections and confirmed by a report of the General Accounting Office which concluded that serious insanitary conditions exist in the food industry."

300 More Inspectors

The proposed 1973 budget for FDA will provide for 300 more food-plant inspectors. They will be able to carry out the sanitation-inspection program without reducing microbiological-contamination inspection.

The Commissioner added: "While we must continue to give high priority attention to microbiological problems such as salmonella and botulism which can present a serious hazard to health, we cannot tolerate a decline in general sanitation practices. We, therefore, intend to take prompt, vigorous action to assure good housekeeping operations, including cleanliness of personnel, equipment, and premises and elimination of all conditions that attract vermin and rodents."

FDA Push Begins

FDA is notifying the food industry through more than 100 trade associations that it is increasing inspection and enforcement actions against sanitary violations. Inspection priority will be given those establishments with a record of deviating from good manufacturing practices.

Inspection Procedure

FDA inspectors will report violations to management and request a written response within 10 days detailing steps taken to correct conditions. The plant will be reinspected within 30 days. Regulatory action will be taken if uncorrected violations are found. Action could include seizure of products, injunction against the plant, or civil or criminal prosecution.

FDA will work closely with State and local officials in all parts of the new program.

Dr. Edwards emphasized that this is not a short-term program but a policy action. Priority will be given to the inspection of conditions under which foods are processed, packed, shipped, and stored. At the same time, the level of inspection of the finished food products will be continued.

Anchovies being emptied into hold of a purse-seine vessel.

SAN PEDRO WETFISH FLEET:
Major Purse-Seine Gear Changes, 1952-1972

Eric H. Knaggs

In 1952, the San Pedro purse-seine fleet consisted of 161 vessels. It dwindled to 42 by 1972. Very few new vessels have been constructed; all but 4 are 23 years old or older.

Although the fleet has decreased, definite improvements have been made in purse-seine gear and techniques.

The two most important changes are the use of nylon netting (replacing cotton netting) and the Puretic power block.

Twenty-eight other changes in equipment represent successful original developments, improvements, or modifications of existing gear.

The first purse-seine vessel to operate at San Pedro, California, was the 'Alpha', which began fishing in 1894. Purse seining proved a very successful way to capture fish. By 1920, the fleet consisted of about 125 purse seiners (Scofield, 1951). The fleet size always fluctuated with economic conditions and availability of wetfish*.

With the collapse of the sardine fishery in the Northwest in the late 1940s, many boats moved into California waters. The later decline in the early 1950s of the California sardine fishery left a sizable fleet of purse seiners (161 vessels in 1952) seeking other wetfish. Some of these vessels turned to salmon or tropical tuna seining, some converted to trawling, while many left the west coast to become property of foreign fishing companies (Perrin and Noetzel, 1969). By 1972, there were only 42 vessels in the wetfish fleet.

Many gear changes have occurred that increased vessel efficiency during this latest period of fleet decline. Some gear adaptations are from the purse-seine revolution that took place in the west coast tuna fishery (McNeely, 1961). Government programs have helped to stimulate fishermen to use new equipment; other gear changes are typical of the ingenuity of individual fishermen.

This article documents major gear changes during the 21 years prior to March 1, 1972. Information on gear improvements is based on personal observations in the San Pedro area and discussions with many fishermen.

PURSE SEINERS IN THE WETFISH FLEET

Thirty-eight of the 42 purse seiners based in the San Pedro area are 23 or more years old. The other seiners are of wood plank construction and range from 44 to 86 feet. Individual load capacities run from 27 to 160 tons. Construction is along the lines of the west coast sardine purse seiner, figure 1

The author is a Marine Biologist, Marine Resources Region, California Department of Fish and Game, 350 Golden Shore, Long Beach, California 90802.

This study was conducted in cooperation with the Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, under Public Law 88-309, Project 6-3-R.

*Wetfish are species that, when canned, are placed uncooked in the container before being preserved through sterilization by heat. The species canned as such in California are: northern anchovey, Engraulis mordax Girard; Pacific sardine, Sardinops caeruleus (Girard); Pacific mackerel, Scomber japonicus Houttuyn; jack mackerel, Trachurus symmetricus (Ayres); and squid, Loligo opalescens Berry.

Trade names mentioned in this article do not imply endorsement of commercial products.

COMMERCIAL FISHERIES REVIEW
Reprint No. 933

Fig. 1 - Typical west coast "sardine" purse seiner. (J. D. Spratt)

(described by Scofield in 1951 and Daugherty 1952). These vessels have certain common features: a low, flat stern for net storage; one main engine turning a single propeller; a crow's nest on top of a central mast used for fish scouting; a single, large storage area located below ship's deck; and a pursing winch just in front of the hatch.

The 4 newest vessels were built in 1966, 1967, 1969, and 1971. Three of these are steel hulled, while the fourth's hull is fiberglass over plywood.

The 'Veteran' and 'Erm Too' have built-in live-bait wells. These boats have been used very successfully by alternating between live-bait fishing in summer months and mackerel-anchovy fishing in fall and winter months.

The 'Bumble Bee' is the first new boat built since 1949 solely for seining wetfish. It has many features that depart from the typical sardine purse seiner. It has two main engines, the hull is constructed of fiberglass over plywood, refrigeration facilities consist of a spray system and brine tanks, and much equipment is hydraulically run. The vessel has a registered length of 51 feet and carrying capacity of 40 tons. It cruises at 13 to 13.5 knots (3 knots faster than the others) and has a top speed of 18 knots. Bumble Bee has been fished very successfully since its first trip in July 1969.

The 'Teresa T' is a steel-hulled, 50.8-foot (Alaska limit) purse seiner built in 1971. It has a carrying capacity of about 60 tons. The main engine is a Detroit Diesel 12V-71.

The daily load capacity of the San Pedro-based wetfish purse-seine fleet, including old and new vessels, approximates 3,655 tons.

GEAR CHANGES

SYNTHETIC NETTING

DuPont 66 Nylon was first tested experimentally for gill nets in 1939; however, military demand for Nylon during World War II delayed further work in the fishing industry.

The first synthetic fibers to be used by the San Pedro wetfish purse-seine fleet were ropes of Nylon and Dacron. Some difficulty was experienced at first in hanging nets on these ropes. Fishermen learned that synthetic fiber ropes stretch somewhat more than manila ropes, but do not shrink when wet. They modified their hanging techniques to compensate for these differences.

Synthetic polymer netting was first introduced in the 1950s with Marlon in sardine-mackerel seines. Eventually, Nylon replaced all others. In January 1956, the 'Anthony M' carried the first all-Nylon tuna seine (McNeely, 1961); by spring 1959, some boats had tuna or sardine-mackerel purse seines made partly or entirely of Nylon. By 1961, almost all purse seines were made largely or entirely of this fiber. No other type of webbing was being used for repairing nets.

Nylon's Advantages

The advantages of Nylon are: (1) high tensile strength, (2) good elasticity and relatively good recovery, and (3) high resistance to rot and mildew. Formerly, it was necessary to replace half the webbing in a cotton net each year. By comparison, Nylon nets are usually good for 4 or 5 years. In those parts of the net where wear is negligible, Nylon webbing may last 7 or 8 years.

Nylon nets are considerably lighter than cotton nets, and much lighter when compared to wet cotton nets of the same size (approximately half the weight).

To achieve optimum handling characteristics, fishermen dip Nylon purse seines into a stiffening agent, such as an asphalt base tar. It also has been found that a slightly heavier chain lead line must be used to provide desired sinking qualities in the net (National Fisherman, 1957a).

Netting

Standard mesh size for Nylon netting is $1\frac{3}{8}$ inches (stretched mesh) in sardine-mackerel nets, and $\frac{11}{16}$ inch for anchovy nets; some $\frac{5}{8}$- and $\frac{3}{4}$-inch anchovy netting has been used. The larger mesh tuna seine ($4\frac{1}{4}$ inch) has been replaced by sardine-mackerel nets, which also are suitable for taking large pelagic fish. In some cases, boats sew extra pieces of webbing (tuna extensions) on their sardine-mackerel nets for the summer tuna season. This provides the additional length sometimes needed for catching fast-swimming tuna.

Knot slippage or loosening in knotted mesh (Figure 2) was a problem in the early days of synthetic netting. This problem was overcome by using special resin-treated twines and special knots, heat-treating finished nets, and using knotless webbing (Figure 3). Knotless webbing is formed by cords woven together. It is easy to handle, easy to patch, and less likely to chafe. However, knotted webbing is still used in most nets today (1972).

NET AND NET DESIGN

Purse seines, lampara, and ringnets are all classified under the general term of roundhaul net. These nets are all large, encircling nets supported by floats at the water's surface, and weighted by chain or lead at the bottom. The two ends of the net are brought together, the opening at the bottom is at least partially closed to impound a school of fish, and then the net is pulled aboard a boat (Scofield, 1951).

The lampara's essential features are: (1) a large central bag (bunt), (2) wings pulled together, (3) graduated mesh sizes, and (4) no purse line or rings.

The purse seine is characterized by: (1) no bunt, (2) one wing pulled, (3) uniform mesh, and (4) use of the purse line with rings.

The ringnet is a hybrid that started as a modified lampara: (1) the two wings are pulled together, (2) it has purse rings, and (3) little or no bunt.

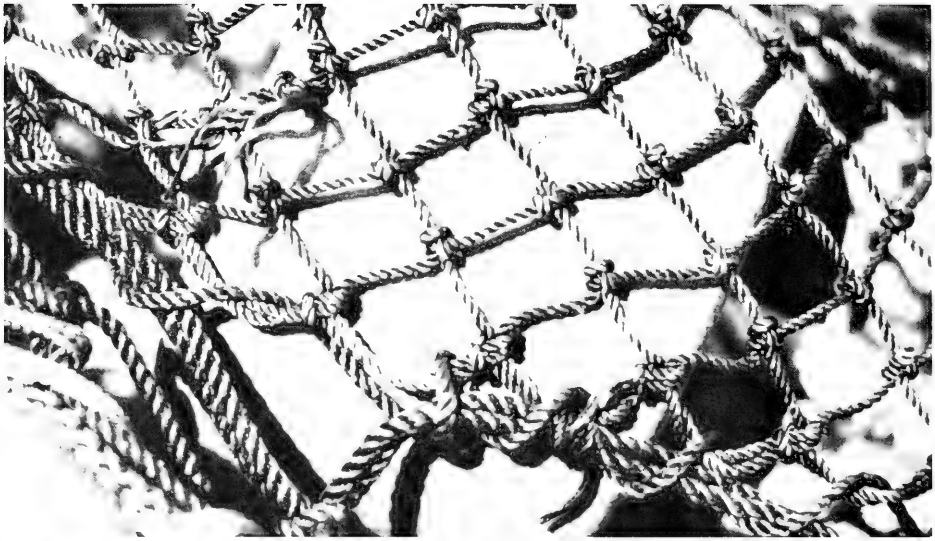


Fig. 2 - Knotted nylon netting.

Fig. 3 - Knotless nylon netting. (Photos 2 & 3: Dave Hoopaugh)

Lampara Net Advantages

Each net has been popular with fishermen during various periods of the fishery. Before acceptance of Nylon netting and power block, the lampara net had the advantage of being faster, easier to use, and more efficient than a purse seine; however, with the adoption of these new pieces of equipment, the situation was reversed.

In either the late 1940s or early 1950s, a new-style lampara net, the Porter seine, was developed to catch fish more efficiently under the guidance of an aerial spotter. This adaptation must not have become too popular because it was never mentioned after 1954.

There were still many lampara nets (15) used to fish anchovies in 1966. By early 1967, only four were left; from June 1967 to 1969, only one was used with any regularity. Although lampara nets are no longer used by the wetfish fleet, they still are used by various boats fishing for live bait.

There were never many ringnets used by the wetfish fleet. The last ringnet vanished in 1954 from the San Pedro area.

Each purse-seine net constructed by San Pedro area fishermen has its characteristic design; nevertheless, all are long rectangular walls of webbing. Fishermen are always changing the lengths and depths of their nets. In the early years of the anchovy reduction fishery (1965 and 1966), the average anchovy net was 243 fathoms long by 31 fathoms deep. An average anchovy net in 1972 was 260 fathoms long (range is 190 to 300 fathoms) by 36 fathoms deep (range is 28 to 41 fathoms). An average sardine-mackerel net was 273 fathoms long by 36 fathoms deep.

A modified purse seine, similar to one designed by Ben Yami and Green (1968), was built and used on 'Southern Monarch' by Nick Jurlin in 1969. Basic innovations in this net are longer chain lead line and tapering the net from the center towards the ends. This gives the net a faster sinking rate, and available webbing is used in a more efficient way. This 235 by 31 fathom anchovy net worked very successfully.

PURETIC POWER BLOCK

The first prototype power block was used by Andrew Kuljis on 'Courageous' while fishing for tuna off Mexico in early 1954. Mostly, it was used for small tuna hauls of 10 to 15 tons. The power block kept the net moving and enabled the crew to put the net on the boat faster, thus preventing shark attacks on the catch. By Fall 1960, at least 27 of the 58 large seiners (60 feet or over) fishing for sardines had installed a power block. All purse seiners in the present wetfish fleet are so equipped (Figure 4).

The Puretic power block is an aluminum block with a power-driven sheave. The block is mounted on the boom's tip on most purse seiners.

The first power blocks were powered by the pursing winch. A circular piece of rope, running between a small V sheave on the side of a block and pursing winch, was used as a power belt. Later, a circular piece of $\frac{1}{2}$-inch steel cable was used. After several unsuccessful attempts to mechanize the power block, an integrated hydraulic system was finally perfected. It is the system now in general use. Nevertheless, one boat continues to use the steel cable and pursing winch to rotate the block.

Power Block's Desirable Features

The power block's desirable features are: (1) it reduces manpower requirements; (2) it relieves crew of considerable physical exertion; (3) block can be opened and net placed on the sheave (handy if only half the net is set); and (4) it increases the hauling speed or speed at which a net is put aboard. Vessels utilizing a power block average 25 to 35 minutes in stacking a net; it took 90 minutes with the old method of using a sling and boom hoist.

SPRAY REFRIGERATION SYSTEMS

In recent years (1955-1971), the fleet has seined various pelagic fishes with more regularity and for longer periods. These include jack mackerel, Trachurus symmetricus (Ayres); Pacific bonito, Sarda chiliensis (Cuvier); albacore, Thunnus alalunga (Bonnaterre); bluefin tuna, Thunnus thynnus (Linnaeus); yellowfin tuna, Thunnus albacares

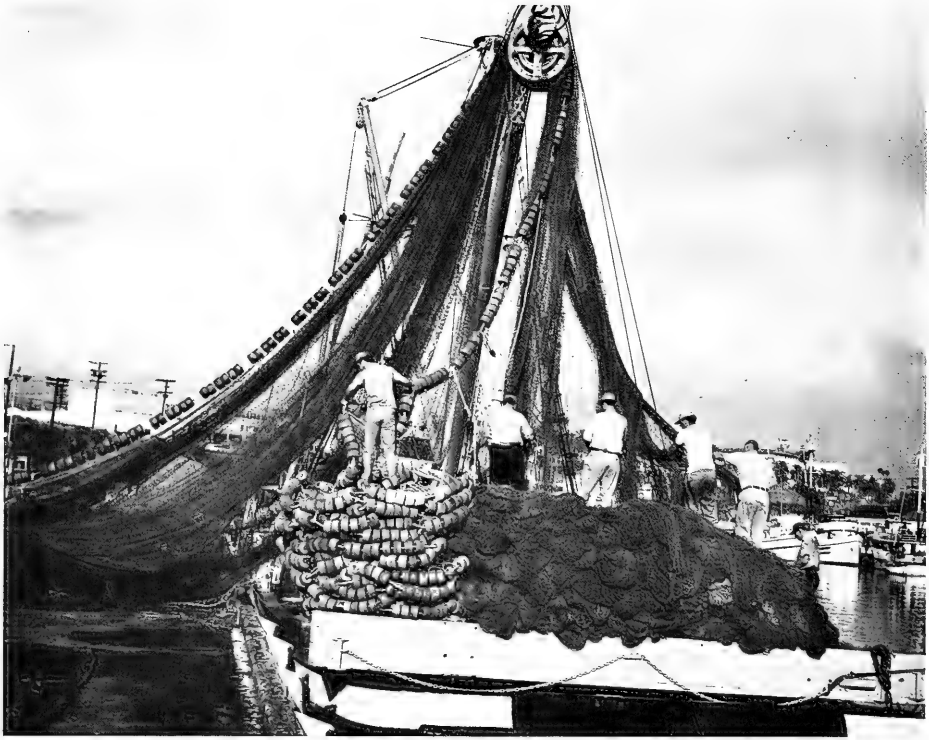


Fig. 4 - Puretic power block being used to stack a net.

(Bonnaterre); and skipjack tuna, Euthynnus pelamis (Linnaeus). It is not unusual for a boat to spend up to 10 days at sea. So spray refrigeration systems have been added to boats' gear.

When purse seiners started making long trips for fish, the boats would be filled with ice. When fish were caught, they were brailed on deck. Then a large part of the crew would go below and break loose the ice carried by the vessel. Then the fish were passed down to the crew. Generally, a layer of fish was stowed and a layer of ice shoveled in on top of them. The process continued until the bin or hold was filled (National Fisherman, 1958a).

Permanent installation of freezing coils in larger tuna purse seiners began about 1945 or before. During 1946, many larger seiners were equipped with refrigeration (Scofield, 1951). This refrigeration coil system did not have the capacity to freeze large amounts of fish without auxiliary ice.

The first spray brine system was used on the 'Jo Ann' in 1957. This system consisted of an ice machine and coils in the ship's hold. Water was circulated and sprayed on refrigeration coils, gradually building up a large mass of ice on them as much as a foot in diameter.

Fish were placed in the hold and brine water released into the compartment. Ice that had built up on the coils would melt, thus cooling the brine water. Then, the brine water was circulated to freeze the fish. Also, more water was sprayed on the coils. This cold

brine dripped on the fish and continued to chill them (National Fisherman, 1958a).

In the early 1960s, Capt. Anthony DiLeva saw a new type of refrigeration system on some visiting Canadian fishing vessels. Aided by Quality Refrigeration Company, Wilmington, California, he modified this new form of spray system and installed it on 'San Antonio IV'. This spray system consists of a refrigeration compressor, an evaporator mounted on deck, and a chiller mounted overhead in the fish hold. The compressor is a Carrier 5H40, driven by a 3-71 GM diesel engine.

The fish hold is lined with fiberglass. Overhead polyvinyl chloride plastic (PVC) spray lines begin at 3 inches in diameter and are gradually reduced to 1 inch to maintain uniform pressure. The actual spray system consists of 13 spray heads and a spray pipe that runs diagonally across the hatch cover. Brine temperature is normally kept at 28 degrees Fahreheit, and the system uses between 1000 and 1200 gallons of sea water.

The spray system operates automatically by means of a control valve built into the compressor. The automatic valve increases or decreases capacity of the system by cutting out one or more cylinders of the 4-cylinder compressor when the desired temperature is reached. Conversely, the valve permits all cylinders to operate when fish are put in the ship's hold (Pacific Fisherman, 1964).

The advantages of this system are: (1) refrigeration of fish is accomplished more efficiently, (2) cooling coils on the bottom of the hold can be eliminated, (3) with the system in operation, the boat can remain at sea until a full load of fish is caught, and (4) this system makes it possible to discharge partial loads when a daily limit is imposed on the vessel.

This newer type of spray system is easily adapted to vessels in the San Pedro wetfish fleet; 11 boats are now so equipped.

FISH PUMP

As early as 1932, attempts were made to use a suction hose to empty the net at sea (Scofield, 1951). In 1955, a suction pump was used on the purse seiner 'Golden West' by John Stanovich (National Fisherman, 1955). The suction pump was 32 inches in diameter, stood 4 feet high, and weighed 700 pounds. This pump sucked 2 tons of water and sardines from the net every minute, rushing the mixture through an 8-inch hose. All these early attempts were impractical or unsuccessful.

In 1968, a commercially built fish pump (Figure 5) and dewatering screen (Figure 6) were installed by John Zankich aboard 'St. Christina' and used successfully in transferring anchovies from net to vessel. This pump was an 8-inch "Capsul-pump" built by Marco of Seattle, Washington. About this same time, the National Marine Fisheries Service (formerly U.S. Bureau of Commercial Fisheries) placed a fish pump aboard 'S.G. Giuseppe' as part of a gear-development program.

The "Capsul-pump" is readily adaptable to purse seiners since it uses hydraulic power that exists already on most boats. Advantages of this lightweight compact pump include: (1) fish transfer from net to boat can begin sooner, (2) "drying up" time is reduced, (3) strain on nets and gear are reduced, and (4) there is less labor involved in handling the catch.

The older method of transferring fish from net to boat is the "stocking" brail (Figure 7). This cumbersome method involves 5 or 6 men who can transfer 1 to 3 tons of fish at a time. In comparison, the fish pump requires only 2 or 3 men and is faster.

Lack of acceptance of the "Capsul-pump" by most fishermen is due to three factors: (1) to most fishermen, the "stocking" brail has proved successful in transferring all types of pelagic fish, (2) transfer of fish can be accomplished in reasonable time by the "stocking" brail even though it is slower, and (3) the pump hasn't been used successfully in transferring pelagic fishes larger than anchovies and mackerel.

At the present time, there are 7 fish pumps on the purse seiners. There is only one 8-inch model, while the rest are 10- or 12-inch models.

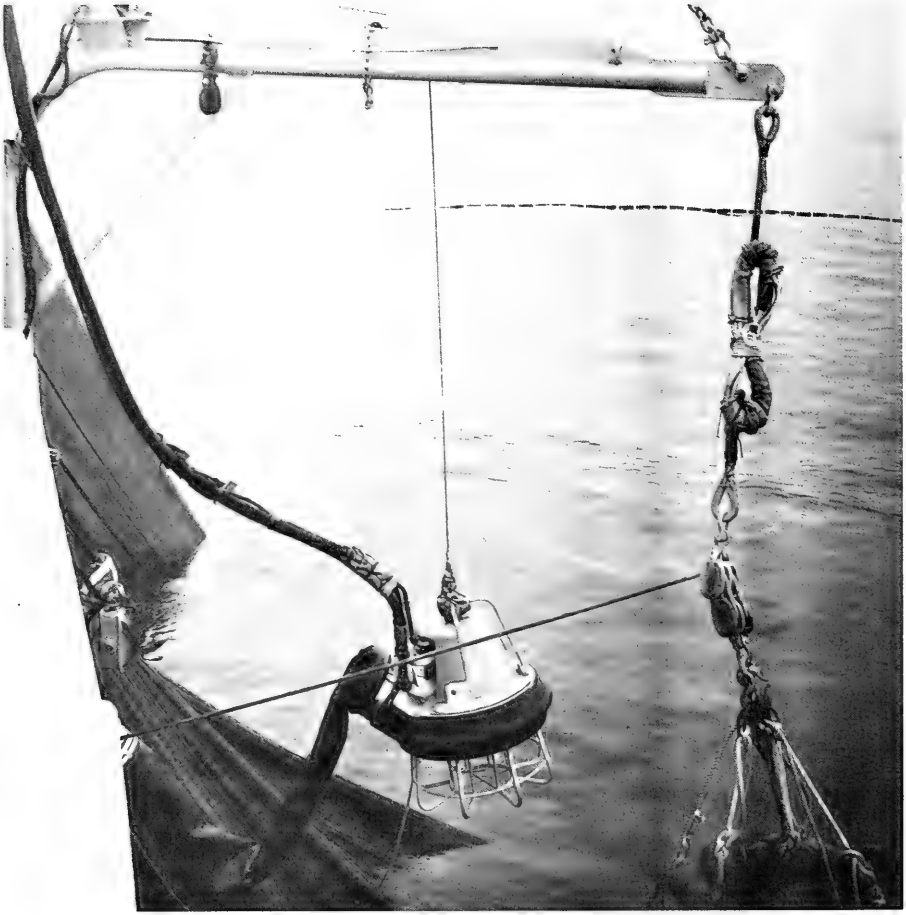


Fig. 5 - Capsul-pump attached to "Morgan" boom.

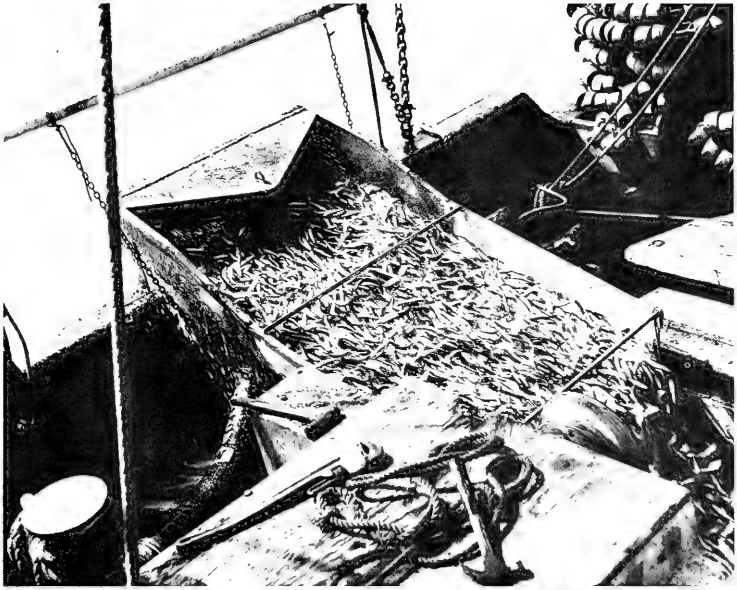


Fig. 6 - Dewatering screen being used on a catch of anchovies. (J. D. Spratt)

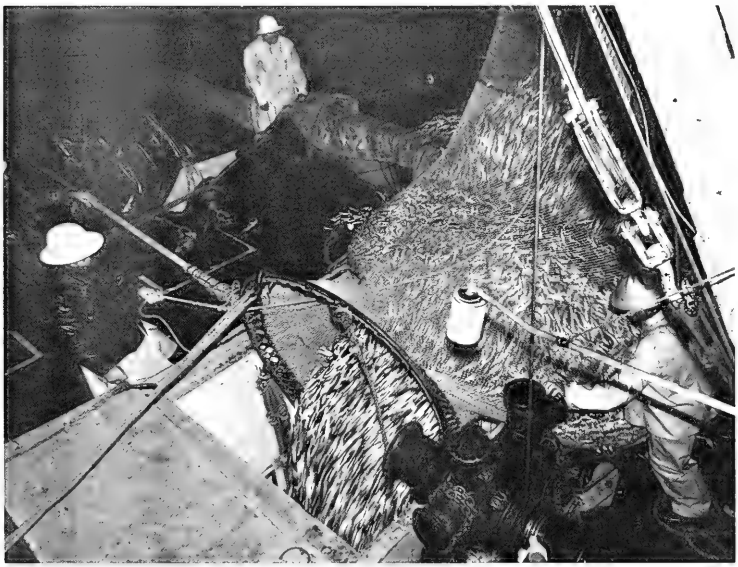


Fig. 7 - The stocking brail being used to transfer anchovies from the net to the boat.

SONAR

In 1944, the United States Navy cooperated with the Fish and Wildlife Service in conducting experiments to determine the feasibility of using sonar to locate sardine schools off San Francisco.

The tests demonstrated that fish schools could be located with sonar. However, when all aspects of sonar scouting were considered, it was concluded that the efficiency of the sardine fleet was not increased. The work was discontinued (Smith, 1947).

Sonar was installed aboard 'Sea Pride' and 'West Point' in 1961 (Pacific Fisherman, 1961a); however, it did not prove satisfactory and eventually was removed. In 1969, sonar was installed aboard 'Diana' by Mike Trama; by March 1970, 6 other boats had installed sonar. By March 1972, 15 boats were operating with a sonar. Fourteen of these units were Wesmar SS 150's, built by Western Marine Electronics of Seattle, Washington, while the other was a Honeywell Scanar-11F, Seattle, Washington.

The equipment used is simplified sonar: it is only a scope presentation. The two types of sonar used basically are constructed of two units: a 10-inch display unit, and a transducer. The sonars normally operate on 12, 24, or 32V dc.

The Honeywell Scanar-11F sonar has manual control through 300 degrees, but has automatic sweep through the 180 degrees ahead of the vessel. Also, it can be put on automatic sweep for a selected arc from 30 degrees to 180 degrees. The transducer can be tilted from 10 degrees above horizontal down to 90 degrees. This sonar has a range of 1200 yards and the ranges are marked off on the screen to as close as 40 yards.

The Wesmar SS 150 has a full sweep through 360 degrees. Manual control is available for the whole sweep, or there are a number of programmed search patterns available for varying sectors of the sweep. The transducer can be tilted from 4 degrees above horizontal down to 90 degrees. The range selection is from 100 to 1600 feet.

Fishermen are using sonar very successfully in finding anchovy schools in deep open water. But, in shallow-water areas (under 30 fathoms), the success of finding fish is limited due to bottom interference.

During the 1970-71 southern California anchovy season, over 25,000 tons of anchovies were taken in catches where sonar was used as an aid to detect and help capture these fish.

DEPTH RECORDERS AND INDICATORS

Depth recorders and indicators have been improved in many ways since the early days of finding fish with electronic gear. The earliest depth indicators consisted of a neon-tube display with a rotating neon light that showed the depth on any fish schools between boat and ocean floor. This enabled fishermen to locate schools that did not show on the surface.

The first installations on California seiners were made in late 1944. Within 2 or 3 years of its introduction into the fleet, almost every seiner had some kind of depth indicator (Daugherty, 1952). These earlier indicators were replaced with recording paper sounders, where a moving stylus passed over moving sensitized paper. Electrical impulses from echoes produced traces to form permanent records.

Later, more sophisticated sounders with "white line" presentation for detecting fish within a few feet of the seabed were installed. This new concept was developed because of color tones that can be produced on recording paper are limited and fish images may merge with that of the bottom. To correct this, a gating circuit used for a fraction of a second produces a white line that divides the bottom contour from fish echoes (Haines, 1959). For the San Pedro wetfish fleet, the white-line depth recorder is very useful when fish are deep, over rough irregular bottom, or next to kelp, Macrocystis.

The boats have been equipped with many types of depth recorders and indicators. Some of these depth indicators are still the neon-tube type.

RADIO TELEPHONES

The first reported California trial of a radiotelephone on a fishing boat was in February 1935 on a Monterey purse seiner (Scofield, 1951). The radio telephone was standard equipment in the purse seine fleet by 1940. The two-way communications equipment enabled skippers to inform each other

about fishing conditions and areas of fishing, contact canneries to inform them of arrival time, and talk with aerial spotters.

The first marine radios were double side-band (DSB) or commonly referred to as AM (Amplification Modulated) radio. These radios are still being used on purse seiners; however, in recent years, fishermen also have been using more frequently citizens band (CB) radios. Since citizens band radios are for short distances and generally limited to line of sight, fishermen are able to talk with an aerial spotter or other fishermen close to fishing areas.

The Federal Communications Commission has changed some rules and regulations covering marine communications. A double side-band radio could not be licensed after Jan. 1, 1972, and may not be used at all after Jan. 1, 1977. In its place a very high frequency-modulated (VHF-FM) radio will be used for short-range communications, and single side band (SSB) radios will be used for long-distance transmissions. Citizens band radios may still be used; however, the U.S. Coast Guard does not monitor CB channels, while VHF-FM Channel 16 is monitored.

The radio is indispensable every day to wetfish-fleet fishermen.

NET SKIFF

The net skiff was first used on one end of the net and served as initial drag in pulling the net off the purse seiner when a set was made around a school of fish (Figure 8). The net skiff also was used in pursing the corks and to hold up the net's outer edge (cork line) when fish were brailed onto the vessel (Figure 9). The skiff developed into a heavy and wide "pumpkin seed" craft (Scofield, 1951); the early models had no motors.

The first seiners to have skiffs with motors were 'Ronnie M' and 'Delores M' in 1944. By winter 1950-51, motorized skiffs were observed on at least 46 of the 232 seiners delivering sardines to the Port Hueneme or Los Angeles regions. At present, all purse seiners have motorized skiffs.

Fig. 8 - Net skiff being used at the start of a set.

Fig. 9 - Net skiff holding up outer edge of net.

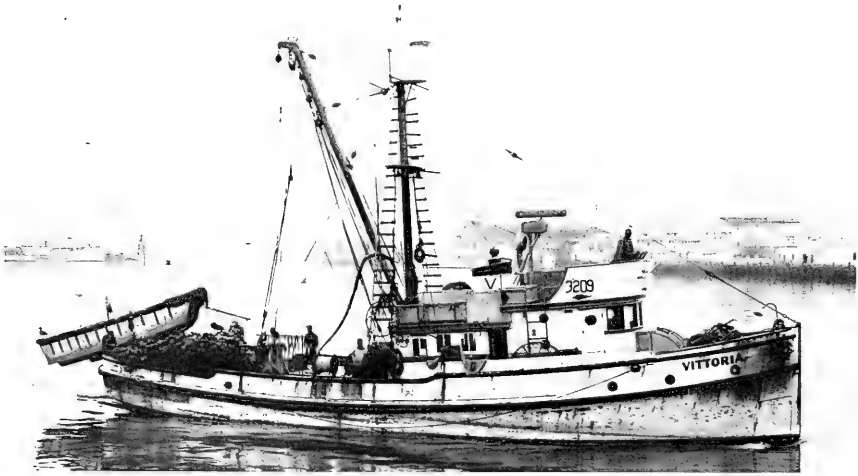


Fig. 10 - Skiff being carried piggyback.

There are two types of skiff engines. The first is a gasoline or diesel inboard engine. A good example is Detroit Diesel Model 2-71 or 3-71. The other type is an outboard motor. Outboards generally range from 35 to 50 horsepower and propel the skiffs on smaller purse seiners.

PIGGYBACKING

A recent development is piggybacking the net skiff. This feature was first used on the west coast tuna seiner 'American Beauty' in 1961 (Pacific Fisherman, 1961b).

Before piggybacking, the skiff was carried atop the net when the vessel was cruising and towed astern when scouting for fish. When the skiff was being towed, it slowed the vessel when speed was essential.

In piggybacking, the skiff is carried on the stern of the purse seiner at such an angle (Figure 10) that if falls directly into the water when a set is made. When the vessel is cruising or scouting for fish, the skiff is held by a cable attached to the pursing winch. The cable is held by a pelican hook, and when a set is made a hammer is used to strike the retaining ring, the pelican hook opens, and the skiff drops into the water.

Since its introduction, piggybacking the net skiff has been widely accepted. There are only two boats that do not have their skiffs riding piggyback.

BALLAST BARRELS

Ballast barrels are 55-gallon oil drums carried in the net skiff. When a large school of fish is netted, the drums are hung outside the skiff and immediately filled with water to stabilize it. This keeps the skiff from tipping over when large amounts of fish sink in the net. Most seiners use one or two ballast barrels in their net skiff.

RADAR

In 1951, only 3 seiners were equipped with radar; the rest did not have great interest in it (Daugherty, 1952). In 1972, only 5 boats are not equipped with radar. Fishermen have purchased radars, not for navigation purposes, but for determining fishing zones open to them during the anchovy reduction season.

CORKS

The first corks were Spanish or Portuguese corks. A later invention was "black cork," which was a cork, tar, and carbon mixture. In the 1950s, synthetic corks first appeared on nets. Spongex corks made by B. F. Goodrich became standard on purse seines. These corks are lightweight, tough, resist crumbling, and absorb little or no water. The plastic reinforcing grommet in the middle of the cork was a later development. This prevents the rope from wearing through the cork.

STEEL CABLE PURSE LINE

Jack Berntsen on the 'Mabel' was first to use steel cable as a purse line in 1927 (Scofield, 1951, Daugherty, 1952). Today, all purse seiners, except one, have steel-cable purse lines.

Most purse cables are spliced together in 3 sections; the center section is constructed of heavier wire. The purse line is commonly $\frac{9}{16}$-inch wire with a $\frac{5}{8}$-inch center piece. The purse cable is $\frac{7}{16}$-inch on smaller seines.

The pursing gypsies on the seine winch had to be enlarged when steel cable was used (Figure 11). The gypsies were surfaced with hardened steel and water cooled to retard wear caused by the steel cable (Philips, 1971).

Steel-cable purse lines couldn't be coiled, so a hand-cranked spool was added to the gear. The purse line was stored on this spool as it was wound off the gypsy.

AERIAL SCOUTING

The first aerial-scouting trials were conducted at San Diego in about 1918. Extensive trials were made in Washington, Oregon, and California from 1930 to 1938, but results were discouraging.

In 1946, aerial spotters were scouting for fish during daylight hours in the Port Hueneme-Santa Barbara area. There were 8

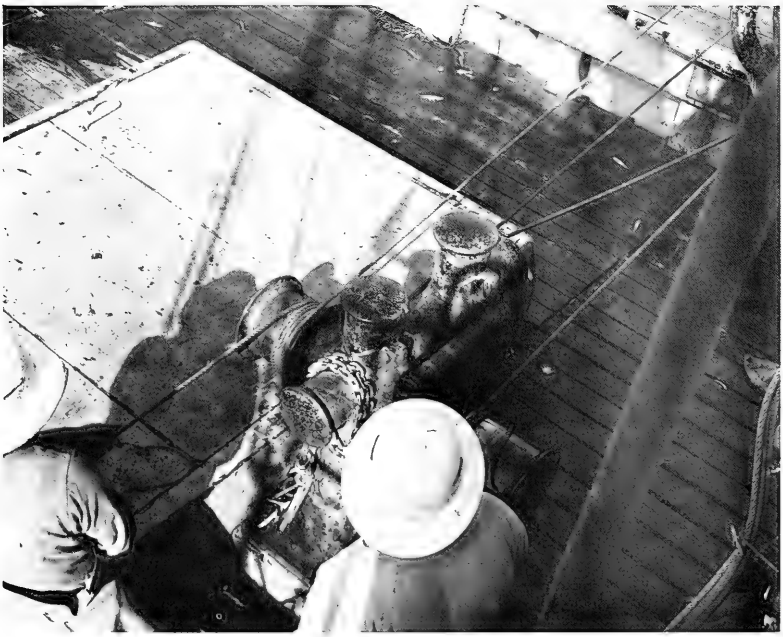


Fig. 11 - Steel-cable purse line wound around the gypsy while the net is being pursed.

aerial observers operating in southern California by 1954 (National Fisherman, 1957b). Aerial spotters were not only locating schools of fish, but guiding boats in a set. Sardine schools were visible from altitudes of 500 to 1000 feet. In 1956, 3 planes were operating out of San Pedro. Pilots worked on a share basis of 5% of the gross catch. These aerial spotters worked day and night hours.

Plane spotters were independent contractors hired by the vessels (National Fisherman, 1958b). They received 7.5% of the gross from catches the vessel made as a direct result of the spotter setting them on fish; otherwise, they received 5% of the gross of all fish taken by the boat, whether or not the aerial spotter was responsible for the catch.

In 1958, there were 8 pilots operating out of San Pedro; during the sardine season, as many as 15 spotters flew. The planes were Pipers or Cessnas equipped with 2-way radio. Aerial spotters operated day or night, up to 16 hours a day. Plane operations generally ranged from Point Conception to San Diego, and covered all islands and fishing banks as far as 90 miles offshore.

Now 6 airplane spotters scout for the San Pedro wetfish fleet. All planes are land based and have a single engine and flying time of over 15 hours. The only modification of the planes is the addition of "crop-dusting tanks" for extra fuel capacity. The aerial spotter receives 5% of the gross from catches the vessel makes as a result of his setting the vessel on the fish, or if he just finds an area of fish and the fishermen catch the fish themselves.

Airplanes are a great advantage in scouting for fish. They cover a greater ocean area and have a much better vantage point in locating fish schools and guiding the direction of a set.

During the 1970-71 anchovy season, aerial spotters helped detect and guide fishermen aboard 13 boats in capturing over 30,000 tons of anchovies.

HYDRAULIC CHOKER WINCH

The hydraulic choker winch is another piece of equipment first used by tuna purse seiners in the late 1950s. Before its invention, the net had to be strapped aboard--using the boat's boom and pursing winch--after the power block had been used to pull in most of the net. Then the net was raised out of the water and on to the boat's deck in sections. This process was repeated until fish in the net were concentrated enough to be brailed. If the catch was large, this process was repeated several times until all fish were brailed aboard.

Choker winches make it easier and faster to bring the net aboard. The most noticeable difference is during brailing. Instead of everybody stopping work to strap net aboard, the choker winch is engaged, which pulls more of the net aboard, and brailing continues.

The winch consists of a drive motor, worm gear, and line spool. While several commercial models are available, some boat owners either have made their own or have had them made locally.

SNAP RINGS

Pietro Maiorana first used snap rings on the 'Diana' in the Monterey area. The snap ring (Figures 12 and 13) is a purse ring with a snap fastener. It is made from hard steel, which is galvanized, and has a safe working load of 2,000 pounds. The working parts are stainless steel to prevent corrosion (Pacific Fisherman, 1959).

The old-type purse rings had to be hoisted on deck after net was pursed and before they could be taken off purse line (Figure 14). This could be extremely dangerous in rough weather.

The newer snap rings are left at the side of the boat after the net is pursed, and the lead line stays in the water. A fisherman then unsnaps the rings from the purse line as

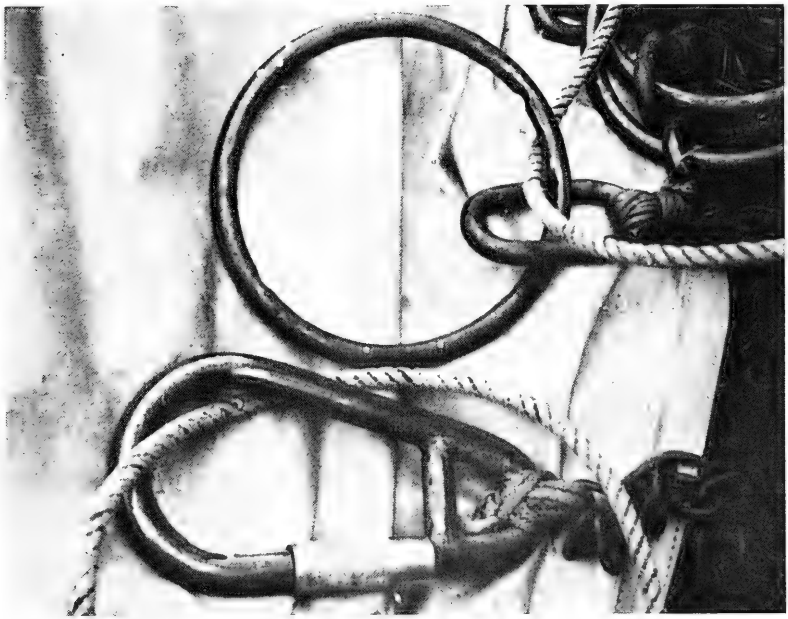


Fig. 12 - Older type purse ring (top) and snap ring (bottom).

Fig. 13 - Snap ring in open position.

Fig. 14 - Purse rings being hoisted on deck.

the net is being put on board. The snap ring not only makes handling the net safer, it cuts handling time by about 30% (Pacific Fisherman, 1959).

AUTOMATIC DIRECTION FINDER

An automatic direction finder (ADF) is a radio-receiving device for determining direction of incoming radio waves. It was first used in the wetfish fleet around 1958. ADF is used for taking bearings on spotter aircraft or on other vessels. Although receivers can be set for several broadcasting bands, purse-seine fishermen generally use citizens band radios during fishing. Because of the limited broadcast range of these radios, ADF has been less effective in finding other boats.

There are presently two models of automatic direction finders used on the boats. One is Bendix ADF 100, the other is Raytheon 358A.

AUTOMATIC PILOT

Automatic pilots are self-regulating mechanisms used in steering the boat. It keeps the purse seiner on a predetermined course in most sea conditions--and saves the man on watch from having to tend the ship's wheel constantly. Most boats are equipped with models of automatic pilots made by Wood Freeman.

RING STACKER

The ring stacker is a horizontal bar used to carry purse rings on small seiners. It is built on the port rail opposite the net.

Larger seiners hang their purse rings over the port rail. If the purse rings were carried in a similar manner on smaller seiners, the rings would either hang in the water or near it. The boat's roll and motion would cause water to sweep and tangle the purse rings. To prevent this, purse rings are stowed on the ring stacker.

KINGPOST

The kingpost is a power-block-carrying davit placed several feet astern the mast and near the starboard side of a purse seiner. The first kingpost was used aboard 'Diana' by Pietro Maiorana (Pacific Fisherman, 1959). With this davit, the power block stays at the top of the boom and doesn't have to be raised and lowered during or after a set has been made. It is a safety factor and eliminates hazards of a wide-swinging boom. The net is a little more difficult to stack when using a kingpost. Six boats have used the kingpost, but fishermen have converted 5 of these back to using a boom to carry the power block. The one exception is 'Erm Too', which still uses a kingpost; this has been moved to the center of the deck behind the hatches. This modification makes the net extremely easy to handle.

DRUM SEINE

Nick Kelly developed the drum seine right after World War II. A large part of handling previously done by crewmen is done automatically with the reel. The net can be set and retrieved more quickly than a regular purse seine. These two advantages make the drum seine ideal for "scratch" fishing where many sets are required to produce a profitable catch (Philips, 1971).

The system consists of a hydraulically driven drum that extends across the vessel's stern. The drum rotates in both forward or reverse for setting or retrieving the net.

The net is retrieved over the stern through a level wind which moves back and forth across the deck on a track. The level wind consists of two parallel upright rollers that are tipped down when the net is set. A free-wheeling mechanism allows the drum to run free when the net is being set, and a brake is used to control the drum to prevent backlashes.

A ring stripper is an accessory piece of equipment used with the drum seine (Figure 15). This steel rod holds all purse rings. It allows the purse line to run freely through them while feeding off one ring at a time as net is retrieved (Hester, Aasted, and Green, 1972).

The 'Sunset', captained by Nick Jurlin and David Masura, was equipped with a drum seine in 1970 (Figure 16). The drum is 14 feet wide with an 8-foot diameter. The drum costs about $17,000, complete with motor and hydraulic equipment (Bunker, 1971; Hester, and Green, 1972).

A purse seine used with a net drum is similar to a regular purse seine, except the cork line and lead line are of equal length so the net will wind up evenly on the reel. The net used on 'Sunset' is 290 fathoms long by 42 fathoms deep.

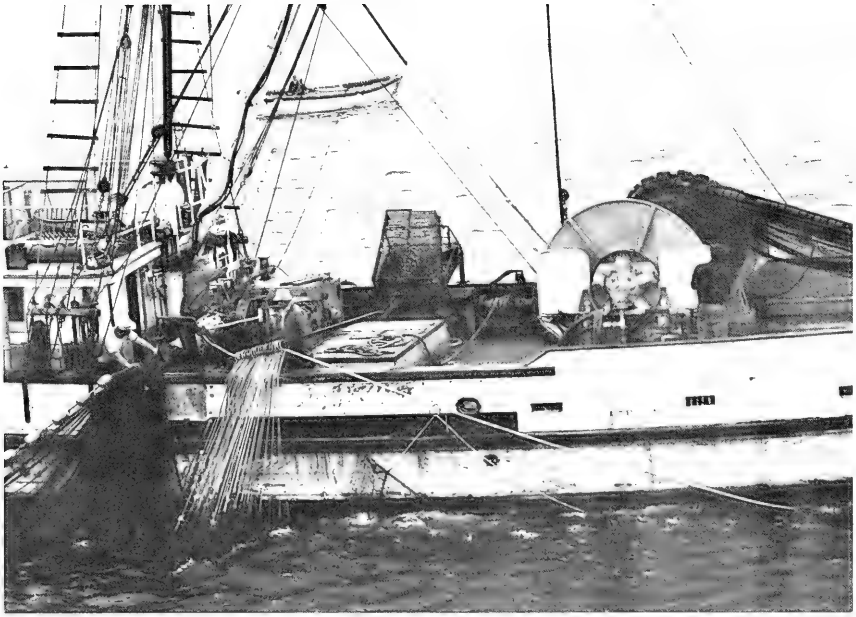


Fig. 15 - Purse rings on ring stripper while net is being retrieved on the drum.

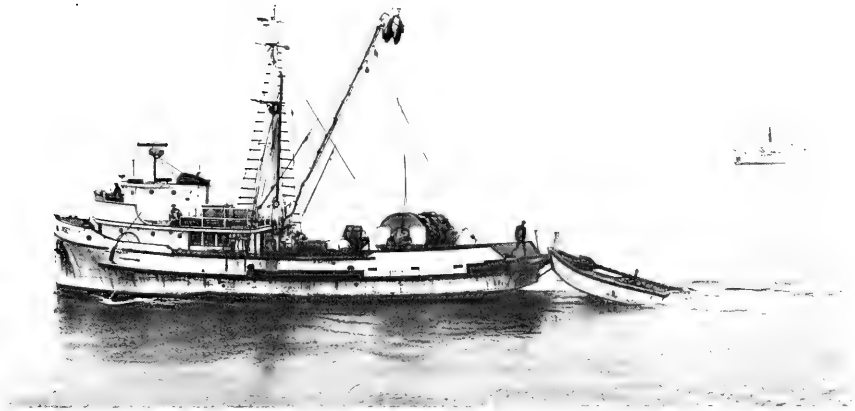


Fig. 16 - The 'Sunset' with a drum seine. (Photos 15 & 16: Roger Green, NMFS)

Drum seining may be one of the least exploited of modern seining techniques. It was obscured before it reached its full development by the Puretic power block. Most wetfish fishermen are impressed by the drum seine's operation, but cost, agreements with local unions, and the impracticability of setting the net with rope suspenders are some present disadvantages.

TURNTABLE

The turntable is a platform on the vessel's stern upon which the net is stacked. The table can be rotated, which permits easier net stacking (Scofield, 1951). In recent years, the turntable has been removed from all but 3 boats; only on one is the turntable operational.

This was a very practical piece of equipment when nets were being strapped aboard before the invention of the Peurtic power block. There was less need for a turntable when fishermen adopted the power block to retrieve their nets.

A net stacked on a boat without a turntable is twisted a half turn as it is rolled through the power block. This twist makes stacking the net a little more difficult; nevertheless, stacking is safer because fish caught in the net more often fall directly to the deck rather than on crew members.

OUTRIGGER POLE

The outrigger pole or "stick" is used when large concentrations of fish are caught. Its main function is to give fish in the net more room to swim by keeping the net away form the boat. This reduces the chance of the cork line being pulled under by fish sounding--and ripping the net or escaping over the sunken cork line. The stick is used rarely today because the power block has reduced the time needed to complete a set. The time fish are crowded at the brailing strip of a purse seine is shortened. Nylon netting also plays a role since it is stronger than cotton netting and less likely to rip if fish sound.

BOOMS

A new concept of the "stick" is the cargo boom and the "Morgan" boom. These are accessory booms in addition to the main boom. These booms, especially the "Morgan", are becoming popular with fishermen using fish pumps. These two booms are used when the catch is "dried up." The cork line of the brailing strip is attached to the boom, which frees the skiff from the "drying up" process and brailing function. This permits the skiff to continue to keep the net free from the purse seiner.

The "Morgan" boom (Figure 5) is a right-angle steel boom mounted on the port rail. It is equipped with a hydraulic ram to keep it in place or pull it in out of the way. Frank Iacono first thought of and installed the "Morgan" boom aboard 'Frankie Boy II'. It works extremely well and many of the vessels with fish pumps are installing it.

CORK PURSE LINE

The cork purse line is a rope strung through a series of small rings along the cork line (Figure 17). It is used to group the corks so there is more support in those areas where a large catch is apt to sink part of the net. The cork purse line has been modified: reduced in length to about 20 to 40 fathoms, compared to old cork purse lines that practically encompassed the entire net. Although there is little need for a cork purse line when catching Pacific mackerel, there is a definite need for it when catching larger pelagic fishes, such as tuna and bonito.

NEW ZIPPER

The zipper is a rope running through a vertical series of rings extending the depth of a purse seine net (Daugherty, 1952). It is used to divide ("cut") the net into smaller parts when a large school of fish has been captured. This division reduces the strain placed on the net by a large catch.

Japanese seine fishermen, working out of San Pedro, developed the net zipper concept in the early 1930s (Scofield, 1951); by 1950, many nets were equipped with zippers. At present, either the zipper has been completely removed or, in a few cases, a narrow strip of large webbing is sewn into a net. This large webbing not only stops tears, but provides a handy marker if the net is divided by hand. Experienced fishermen can divide a wetfish net by hand merely by following the mesh vertically in a straight line.

Fig. 17 - Cork purse line.

ROPE SUSPENDERS

The first rope suspenders were used by Tony Mihovilovic on 'Marauder' in November 1956 off Santa Barbara Island.

A rope suspender is a rope run from the cork line in a vertical direction down to the chain lead line. This keeps the net from sinking to its normal fishing depth, and keeps it from snagging on a rough rocky bottom. Several areas where rope suspenders are used are Cortes Bank, when fishing for jack mackerel, and Clarion Island for tuna.

A typical suspender is 17 to 20 fathoms long and can be adjusted to a shorter length. The lines are spaced 15 to 20 fathoms apart along the net. The purse seine tends to sag between suspenders; therefore, 2 to 7 fathoms are allowed for clearance to keep the net off the bottom.

Rope suspenders work very well in combination with a dragger winch. When the net is set, tension is kept on the purse cable and the net can be fished in very shallow water (6-7 fathoms). Rope suspenders have been used for a number of years, but it wasn't until recently that they have been used with any regularity. Most of sardine-mackerel nets are equipped with rope suspenders, while suspenders are not used on anchovy nets.

FLOATING LIGHTS

In 1948 and 1949, high skiffs were used by small boats fishing off San Pedro to attract sardines and live bait (Young, 1950). Small quantities of fish are still caught using this method at various times of the year, but only live-bait lampara fishermen use light skiffs with any regularity at present.

Fig. 18 - Modified dragger winch being used to purse the net.

TRAWL WINCHES

Trawl winches or dragger winches have been modified for seining by being fitted with three drums: two for the purse line and one for the tow line. The 'Fisher Lassie' was equipped with this type of winch in 1944 (Daugherty, 1952). The dragger winch (Figure 18) winds up and holds the purse cable, thereby eliminating hand cranked deck drums. The dragger winch has the advantage, over the standard seine winch, of being able to handle a purse cable with a heavier center piece and there is less tendency for the purse cable to kink. Only nine boats are equipped with modified dragger winches.

SUMMARY

Boats in the San Pedro wetfish fleet range from less than 1 year to 42 years old, with all but four 23 year old or older. All boats have certain common features: a crow's nest on top of a central mast for fish scouting, some form of pursing winch, a low flat stern for net storage, and a relatively large storage area for the catch.

The 'Bumble Bee' is the only boat with many features that depart from the typical sardine purse seiner. This new boat has two engines instead of the usual one. It cruises at 13 to 13.5 knots, 3 knots faster than the others, and has a top speed of 18 knots.

Certainly the two most important gear changes have been adoption of Nylon netting and the Puretic power block. These, along with the other gear changes, have enabled fishermen to remain in business and adjust to the varying availability of several pelagic fishes being sought and taken by the fleet.

ACKNOWLEDGMENTS

The fishermen were extremely helpful and patient when I was collecting data, and I am deeply grateful to them. I thank Herbert W. Frey for his editorial assistance, and Micaela Wolfe and Gayle Jones for their patience in typing my many and various versions of this paper.

LITERATURE CITED

BEN YAMI, M'NAKHEM, and R. E. GREEN
1968. Designing an improved California tuna purse seine. U.S. Fish Wild. Serv., Fish Ind. Res., 4:183-207.

BUNKER, JOHN
1971. Drum seiner excites Calif. wetfish fleet. National Fisherman, 51(4):14A.

DAUGHERTY, ANITA E.
1952. Recent changes in purse seine gear in California. Calif. Fish and Game, 38(1):125-131.

HAINES, R. G.
1959. The development of echo sounding and echo ranging. :493-498. In Modern Fishing Gear of the World, Fishing News (Books) Ltd., London. p. 607.

HESTER, F. J., D. A. Aasted, and R. E. GREEN
1972. Experimental drum seining for wetfish in California. Commercial Fisheries Review, 34(1-2):23-32.

McNEELY, RICHARD L.
1961. Purse seine revolution in tuna fishing. Pacific Fisherman, 59(7):27-58.

NATIONAL FISHERMAN
1955. New pump sucks sardines from California purse seines without damaging fish. National Fisherman, 36(10):16.

1956. California sardine schools being spotted by planes. National Fisherman, 32(10):33.

1957a. Synthetic fibers for nets and ropes in the fisheries. National Fisherman, 38(11):17, 32.

1957b. California anchovies increase in abundance. National Fisherman, 38(4):15-17.

1958a. New freezing method for tuna purse seiners. National Fisherman, 39(6):9-10.

1958b. California planes spot fish. National Fisherman, 39(6):34.

PACIFIC FISHERMAN
1959. Pete Maiorana pioneers with purse rings and power block davit. Pacific Fisherman, 57(3):20, 23.

1961a. Sea Pride pioneers fish-finder in California tuna fishing fleet. Pacific Fisherman, 59(4):25.

1961b. How American Beauty carries her papoose. Pacific Fisherman, 59(8):19-20.

1964. Brine-spray refrigeration system developed for small tuna seiners. Pacific Fisherman, 62(5):15-16.

PERRIN, WILLIAM F. and B. G. NOETZEL
1969. Economic study of San Pedro wetfish boats. Bureau of Commercial Fisheries, Division of Economic Research. Working Paper 32. 1-81.

PHILIPS, RICHARD H.
1971. The history of western seining. National Fisherman, 52(5):1C-30C.

SCOFIELD, WILLIAM L.
1951. Purse seines and other roundhaul nets in California. Calif. Dept. Fish and Game, Fish Bull., (81):1-83.

SMITH, OSGOOD R.
1947. The location of sardine schools by super-sonic echo ranging. Commercial Fisheries Review, 9(1):1-6.

YOUNG, PARKE H.
1950. Netting bait and cannery fish with the aid of lights. Calif. Fish and Game, 36(4):380-381.

SEASONAL AND GEOGRAPHIC CHARACTERISTICS OF FISHERY RESOURCES

California Current Region--VIII. Zooplankton

David Kramer and Paul E. Smith

Plankton is defined in most dictionaries simply as the passively floating or weakly swimming animal and plant life of a body of water (zooplankton and phytoplankton, respectively). Such an uninteresting definition in no way acknowledges the important roles of such organisms in the food chains in bodies of water and their tremendous variety in species and morphology.

In the California Current region alone, it has been estimated that, for zooplankton only, there are at least 546 invertebrate species (Isaacs, Fleminger and Miller, 1971) and approximately 1,000 vertebrate species, that is, as fish larvae. Such larvae and, in some instances, their eggs were the bases of the first seven reports in this series (Kramer and Smith, 1970a, b, c, d, 1971a, b, c). The variety of species in this region, just for a part off central Baja California, was shown by Ahlstrom and Thrailkill (1963, Table 5). They listed about 145 invertebrates and 36 vertebrates in only 12 plankton samples. Another example of variety of species found near our survey pattern was reported by McGowan and Fraundorf (1966, Table 7) for a small area southeast of Cabo San Lucas near the northern limits of the zooplankton fauna of the equatorial water mass. This report on zooplankton diversity listed 69 species of invertebrates and 81 species of fish larvae collected in 24 plankton samples.

Zooplankton's Essential Role

Zooplankton is not reported here as a fishery, but in recognition of the essential part its vast community plays in relation to the fish resources. In worldwide fisheries, its supply forms the entire diets of plankton feeders such as anchovies, herrings, pilchards, and menhaden. Certain of its constituents, possibly including some phytoplankton, are essential foods for most stages of larval fish development. One of the greatest phenomena of marine-animal development is that of the growth of baleen whales, which feed exclusively on plankton, sometimes only on the shrimplike plankter "krill", a large euphausiid. One example in particular is the blue whale's growth. At birth, this whale is about 7 m long and 2,000 kg in weight (21-23 ft, 2+ tons). Seven months after birth, it is about 16 m long and weighs 23,000 kg (48-52 ft, 25 tons)--feeding only on krill! (Rice, 1972.)

This report deals with the seasonal and geographic characteristics and variations of zooplankton biomass in the California Current region. Organizations, area of investigation, and treatment of data were presented in the first report of this series (Kramer and Smith, 1970a). In addition, we will discuss the annual cycles (variation) for different parts of the survey area north to south and inshore-offshore.

Data Processing

Our previous descriptions of processing data did not include discussion of the methods used to collect and process plankton. Detailed descriptions of the methods for collecting and processing data in the California Current region were described by Kramer, et al. (in press) and in some detail by Smith (1971).

For the data 1951-60, the following methods were used to collect plankton. Each sample was taken with the standard CalCOFI net constructed of silk mesh (bolting cloth), mouth diameter 1 m, and mesh size approximately 0.55 mm. Occasionally a nylon net of the same mouth opening and mesh size was used. A flow meter in the mouth of the net

The authors are Fishery Biologists, NMFS Fishery-Oceanography Center, 8604 La Jolla Shores Drive, P.O. Box 271, La Jolla, California 92037.

COMMERCIAL FISHERIES REVEIW
Reprint No. 934

permitted calculation of the amount of water strained. Each tow was made by sinking the net at 50 m per minute to a depth of about 140 m (200 m of wire out, depth permitting) and retrieving it at 20 m per minute while maintaining a wire angle of 45 degrees. The ship's speed during a tow was about 2 knots.

Each sample was preserved in 5% formalin and buffered with sodium borate. The samples were brought back to the laboratory and measured by the displacement method described by Ahlstrom and Thrailkill (1963), or by a method developed by Thrailkill, described by Kramer, et al. (in press). Both methods are accurate to $\pm$ 1 ml. Smith (1971) discussed the variations due to shrinkage and interstitial liquid as previously reported by Ahlstrom and Thrailkill (1963). Two volumes, reported as ml/1,000 m^3 water strained, were determined for each sample: first, the total volume and, second, the total volume less large organisms--5 ml or greater--usually jellies or jellylike organisms. (Juvenile and small adult fishes captured by the net are not considered planktonic.) Each sample was than sorted for all fish eggs and larvae. The sorted sample was studied further for selected invertebrates (e.g., Isaacs, et al., 1969, 1971). Also see their Table 1 in each volume, which cites investigators, their publications, and interests.

Our treatment of the data is for zooplankton only in terms of total volumes of all organisms with no separation by constitutents or groups. Isaacs, et al. (1969) reported on the seasonal and annual variability among 17 functional groups of zooplankton for the spring (April cruises) and fall (October cruises) for 1955 through 1959. In 1971, they reported on winter variability for January in 1955 through 1959.

Seasonal and Geographic Distribution

The variations in seasonal and geographic distributions for 1951-60, shown in Figures 1 and 2, are similar even though the diagrams are from two sets of data and are presented in somewhat different ways. Figure 1 shows summaries of plankton volumes only for organisms less than 5 ml, expressed as medians of volumes per 1,000 m^3 of water strained--the medians represent the central values of suites of samples. Figure 2 summarizes plankton volumes only for organisms greater than 5 ml, expressed as percentages of occurrences in plankton hauls. Smith (1971, Figure 2) presented the same data in a figure of relative abundances in an atlas of plankton volumes for every survey conducted by the CalCOFI from 1951 through 1960. The basic data for all surveys, 1951 through 1966, were reported by the Staff, South Pacific Fisheries Investigations (1952, 1953, 1954, 1955, 1956) and Thrailkill (1957, 1959, 1961, 1963, 1969, MS).

Each figure indicates the trends to be expected during a year's production of plankton, wherein peaks of abundance occur from spring to summer and decreases occur in fall and winter. (Data were insufficient for summaries to be made for August, September, and November.)

Temperature and Zooplankton

Temperatures at 10 m, summarized for the 10 years in the same pooled areas (Figure 3)--see Kramer and Smith, 1970a, Figure 2--indicate the trends of centers of greatest plankton abundance within a particular range of low temperatures, 12°-15° C. (The 10-m depth is regarded as mid-depth or average of stratum between surface and thermocline. Ten-meter temperatures have been published in atlases for 1949 through 1969 for all CalCOFI surveys (Anonymous, 1963; Wyllie and Lynn, 1971).)

Zooplankton production in "warm" and "cold" years bear out the trends to be expected from the data depicted in Figures 1, 2, and 3. Reid (1962, Figure 5) showed that for each year, 1949 through 1960, plankton volumes were high with low temperatures and low with high temperatures. He also depicted two figures from Thrailkill (1959, 1961) showing averages of high volumes in 1956, a cold year, and low volumes in 1958, a warm year. Ahlstrom and Thrailkill (1963) cited the warm year 1959 and the fact that plankton volumes then were the lowest in a decade.

Annual Cycles

Another illustration of seasonal and geographic changes is in the summarization of data to show annual cycles by region and pooled area (Figure 4). Here, monthly median volumes are presented for six regions, north to south, at 40-mile intervals onshore-offshore. Each curve is an annual cycle beginning in each January (J), summarized over the 10 years, 1951-60. Each

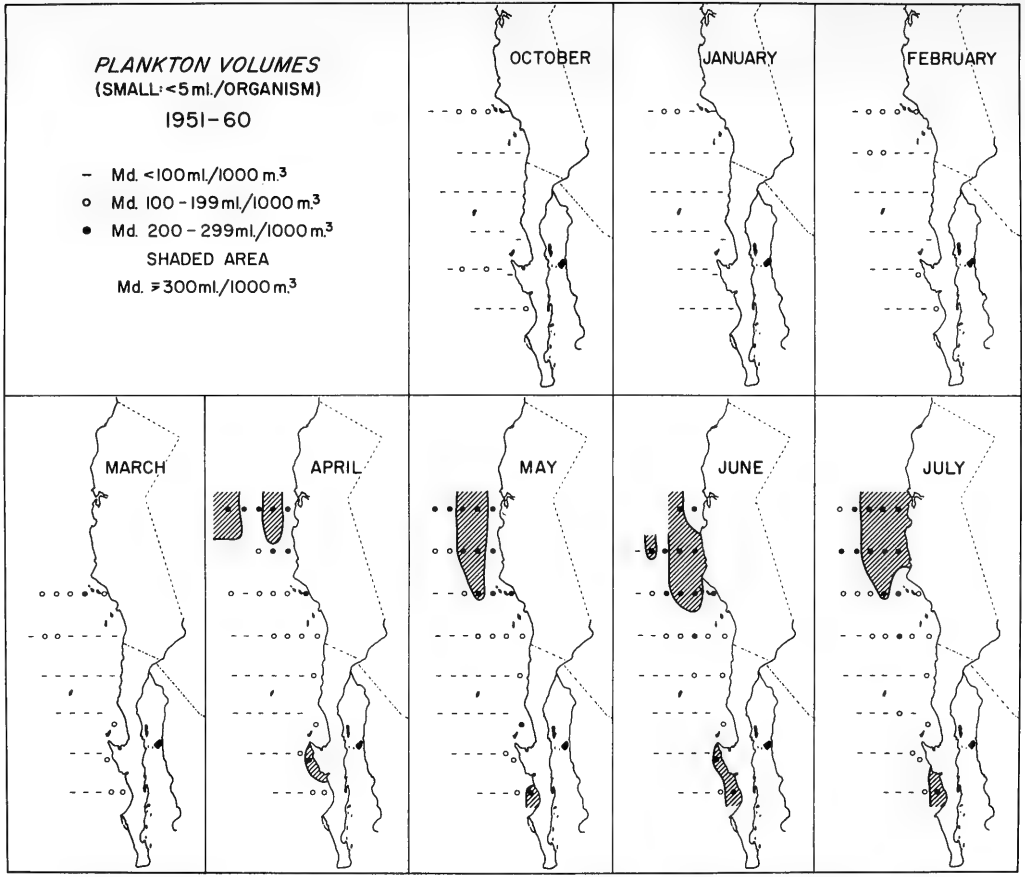


Fig. 1 - Medians of plankton volumes consisting of organisms less than 5 ml collected on survey pattern of California Cooperative Oceanic Fisheries Investigations (CalCOFI), 1951-60. Each circle, line, or dot represents a pooled statistical area (see Kramer and Smith, 1970a).

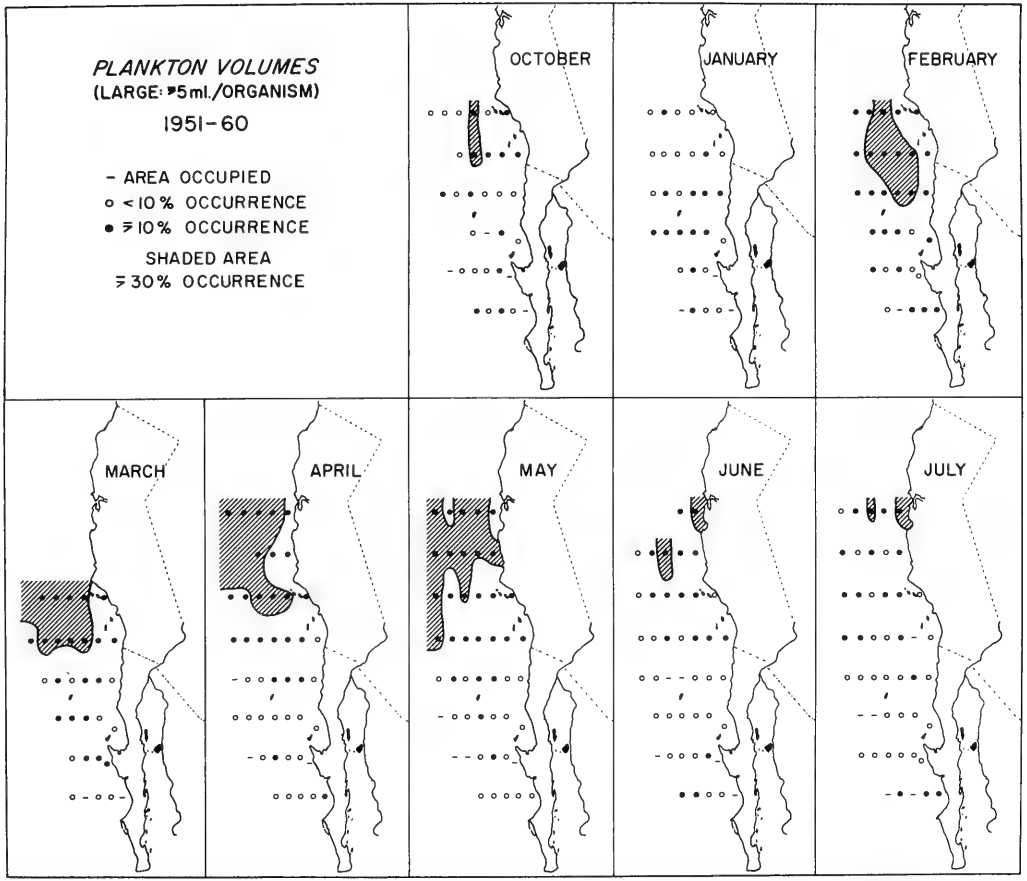


Fig. 2 - Percent occurrence of plankton volumes, consisting of organisms equal to or greater than 5 ml, collected on survey pattern of California Cooperative Oceanic Fisheries Investigations (CalCOFI), 1951-60. Each circle, line, or dot represents a pooled statistical area (see Kramer and Smith, 1950a).

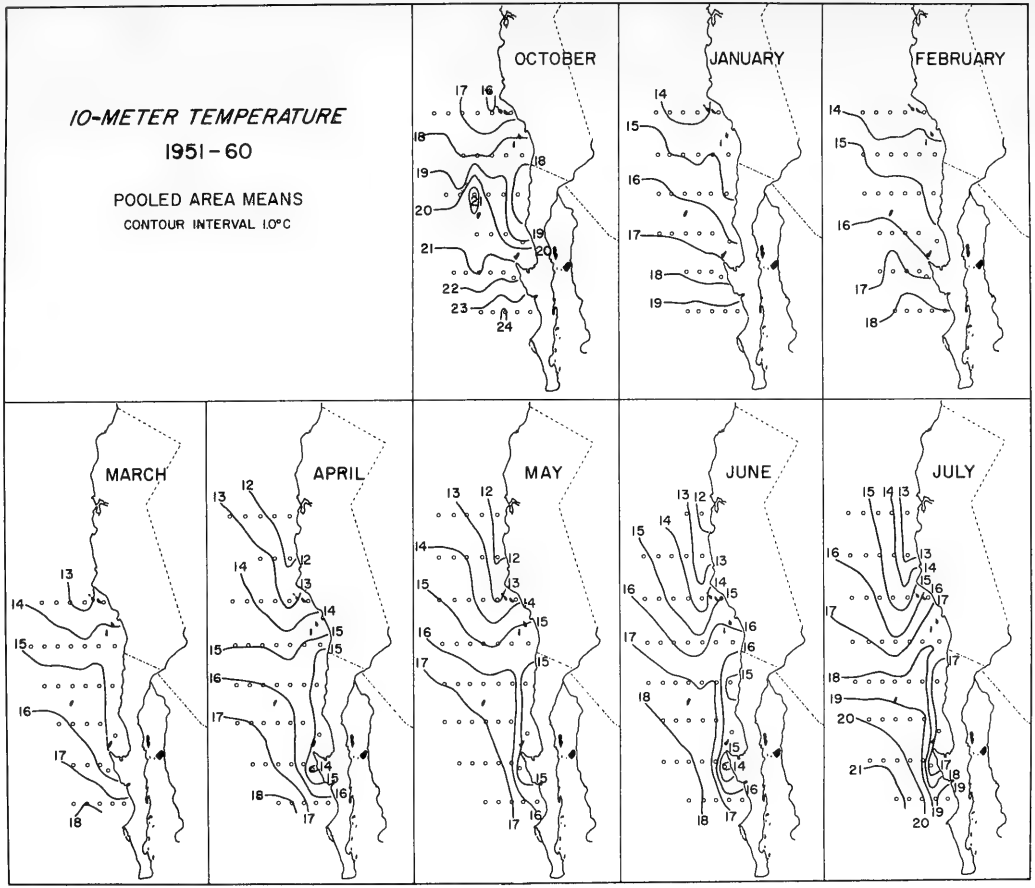


Fig. 3 - Pooled area means of 10-m temperatures in survey pattern of California Cooperative Oceanic Fisheries Investigations (CalCOFI), 1951-60. Each circle, line, or dot represents a pooled statistical area (see Kramer and Smith, 1970a).

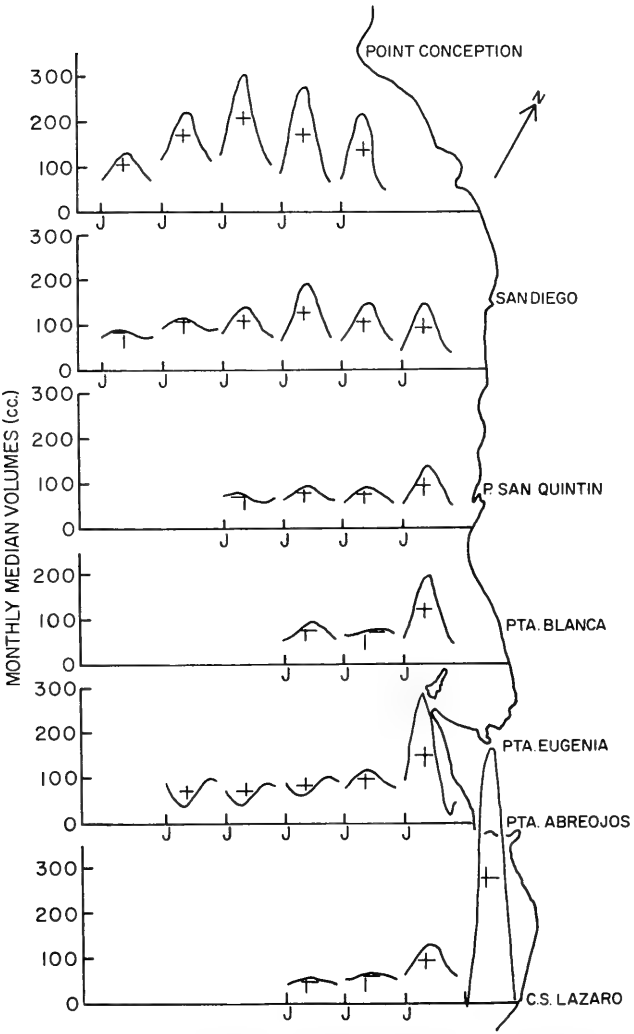


Fig. 4 - Annual cycles of plankton volumes (monthly medians) collected in survey area of California Cooperative Oceanic Fisheries Investigations (CalCOFI), 1951-60. (See text.) There are no curves shown for offshore areas, Punta San Quintin, and south because there were no significant annual cycles in monthly median volumes in those regions.

vertical line in each curve represents June and each horizontal line is the annual average. Here, as in Figures 1 and 2, high abundance occurs in mid-year when day length is longest and temperatures are low, as shown in Figure 3.

Determinants of Zooplankton Concentrations

Zooplankton concentrations are established by the rates of production of their components, their growth rates, their natural mortality, and predation on their populations. Very little is known about any of these since our data are based only on that proportion retained by our rather coarse-mesh net. A large part of the plankton escapes through this net--those immature stages that are smaller than our primary targets, fish eggs and larvae. It is highly probable that a very large part of the escaping plankton is the food in sizes needed by the fish larvae we collect--for example, as listed for anchovy larvae by Kramer and Zweifel (1970, Table 2).

It has been hypothesized that high plankton concentrations are the result of (1) high nutrient content, and (2) transport of plankton during certain seasons. Reid, Roden and Wyllie (1958) observed that dense plankton in summer months and high phosphate-phosphorous (PO_4-P) content coincide with low temperatures in the California Current region. Reid reported in 1962 that dense zooplankton might be the result of its transport into the region by the west wind drift from dense subarctic populations. Our major problem in this study is that estimates and predictions of rates of water movement, and life histories of plankton that are not well known, are inadequate to show what parts in their different stages of development drift in and out of, or stay in, the region.

LITERATURE CITED

AHLSTROM, ELBERT H. and JAMES R. THRAILKILL
1963. Plankton volume loss with time of perservation. Calif. Coop. Oceanic Fish. Invest. Rep., IX:57-73.

ANONYMOUS
1963. CalCOFI atlas of 10-meter temperatures and salinities 1949 through 1959. Calif. Coop. Oceanic Fish. Invest. Atlas, 1.

ISAACS, J.D., A. FLEMINGER and J. K. MILLER
1969. Distributional atlas of zooplankton biomass in the California Current region: spring and fall 1955-1959. Calif. Coop. Oceanic Fish. Invest. Atlas, 10, xxv + 252 p.

1971. Distributional atlas of zooplankton biomass in the California Current region: winter 1955-1959. Calif. Coop. Oceanic Fish. Invest. Atlas, 14, xxiii + 122 p.

KRAMER, DAVID, MARY J. KALIN, ELIZABETH G. STEVENS, JAMES R. THRAILKILL, and JAMES R. ZWEIFEL
In press. Collecting and processing data on fish eggs and larvae in the California Current region. NOAA Tech. Rep., Natl. Mar. Fish. Serv. Circ., 370.

KRAMER, DAVID and PAUL E. SMITH
1970a. Seasonal and geographic characteristics of fishery resources, California Current region--I. Jack mackerel. Commer. Fish. Rev. 32(5): 27-31. Also Reprint No. 871.

1970b. Seasonal and geographic characteristics of fishery resources, California Current region--II. Pacific saury. Commer. Fish. Rev. 32(6): 46-51. Also Reprint No. 876.

1970c. Seasonal and geographic characteristics of fishery resources, California Current region--III. Pacific hake. Commer. Fish. Rev. 32(7): 41-44. Also Reprint No. 880.

1970d. Seasonal and geographic characteristics of fishery resources, California Current region--IV. Pacific mackerel. Commer. Fish. Rev. 32(10): 47-49. Also Reprint No. 891.

1971a. Seasonal and geographic characteristics of fishery resources, California Current region--V. Northern anchovy. Commer. Fish. Rev. 33(3): 33-38. Also Reprint No. 907.

1971b. Seasonal and geographic characteristics of fishery resources, California Current region--VI. Rockfish. Commer. Fish. Rev. 33(7 & 8): 40-43. Also Reprint No. 915.

1971c. Seasonal and geographic characteristics of fishery resources, California Current region--VII. Pacific sardine. Commer. Fish. Rev. 33(10): 7-11. Also Reprint No. 922.

KRAMER, DAVID and JAMES R. ZWEIFEL
1970. Growth of anchovy larvae (Engraulis mordax Girard) in the laboratory as influenced by temperature. Calif. Coop. Oceanic Fish. Invest. Rep., 14: 84-87.

McGOWAN, JOHN A. and VERNIE J. FRAUNDORF
1966. The relationship between size of net used and estimates of zooplankton diversity. Limnol. Oceanogr., 11(4): 456-469.

REID, Jr., JOSEPH L.
1962. On circulation, phosphate-phosphorus content, and zooplankton volumes in the upper part of the Pacific Ocean. Limnol. Oceanogr., 7(3): 287-306.

_____, GUNNAR I. RODEN, and JOHN G. WYLLIE
1958. Studies of the California Current system. Calif. Coop. Oceanic Fish. Invest. Rep., 26-56.

RICE, DALE W.
1972. The great blue whale. Pac. Search, 6(6): 8-10.

SMITH, PAUL E.
1971. Distributional atlas of zooplankton volume in the California Current region, 1951 through 1966. Calif. Coop Oceanic Fish. Invest. Atlas, 13, xvi + 144 p.

STAFF, SOUTH PACIFIC FISHERY INVESTIGATIONS
1952. Zooplankton volumes off the Pacific coast, 1951. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish 73, 37 p.

LITERATURE CITED (Contd.)

STAFF, SOUTH PACIFIC FISHERY INVESTIGATIONS (Contd.)

1953. Zooplankton volumes off the Pacific coast, 1952. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 100, 41 p.

1954. Zooplankton volumes off the Pacific coast, 1953. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 132, 38 p.

1955. Zooplankton volumes off the Pacific coast, 1954. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 161, 35 p.

1956. Zooplankton volumes off the Pacific coast, 1955. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 177, 31. p.

THRAILKILL, JAMES R.

1957. Zooplankton volumes off the Pacific coast, 1956. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 232, 50 p.

1959. Zooplankton volumes off the Pacific coast, 1957. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 326, 57 p.

1961. Zooplankton volumes off the Pacific coast, 1958. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 374, 70 p.

1963. Zooplankton volumes off the Pacific coast, 1959. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 414, 77 p.

1969. Zooplankton volumes off the Pacific coast, 1960. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 581, 50 p.

MS. Zooplankton volumes off the Pacific coast, 1961-1966.

WYLLIE, JOHN G. and RONALD J. LYNN

1971. Distribution of temperature and salinity at 10 meters, 1960-1969, and mean temperature, salinity and oxygen at 150 meters, 1950-1968, in the California Current. Calif. Coop. Oceanic Fish. Invest. Atlas, 15, xi + 188 p.

OYSTERS: Reattachment As Method of Rearing Cultchless Hatchery Oysters

John G. Riley, Richard J. Rowe, Herbert Hidu

Cultchless European oysters, Ostrea edulis, were artificially reattached to asbestos-cement boards. After 4 months' submersion, the oysters showed growth rates and morphology superior to those of nearby tray-grown stocks; they demonstrated natural reattachment to the panels. Experiments were conducted to identify a suitable gluing technique to take advantage of this phenomenon and to investigate the potential for reattachment as a field-rearing technique.

The most significant development in oyster hatchery economics in recent years has been cultchless setting (Pacific Mariculture 1967, Long Island Oyster Farms 1970, Anon. 1969). Great efficiency is achieved in the juvenile phase by eliminating bulky cultch and oyster mortality due to crowding loss on cultch. However, the rearing of a free juvenile oyster to harvest has presented the industry with new problems. It may not be practical to place small free oysters directly on the bottom because of high loss due to siltation, movement by currents (MacKenzie 1970), and bottom-dwelling predators, especially blue crabs in the Chesapeake area (Edwin Powell). The traying of cultchless oysters to harvest may present economic problems due to the handling necessary to alleviate crowding and to control fouling organisms.

Rear Cultchless Oysters

An alternate approach is to rear cultchless oysters under controlled conditions to a size allowing efficient growth in the hatchery (approximately $\frac{1}{4}$") and then reattach the oysters to a substrate for placement in the field to harvest. Such a method would permit the efficiency of the hatchery cultchless operation; at the same time, it would allow optimal spatial distribution of oysters later in the field. This may provide conditions for maximum growth and desirable shell dimensions. A rearing system incorporating small flat panels as the substrate for reattachment offers potential for the mechanization of all necessary handling operations.

INITIAL EVALUATION

Experiments were begun in June 1971 to determine the biological response of oysters to reattachment and to identify a suitable artificial substrate and glue. Experimental work in developing and evaluating artificial cultch materials has identified asbestos-cement board as the most widely successful (Marshall 1970). Plastics coated with various materials have been tried as natural set collectors but, as yet, with no marked success. To evaluate asbestos board as a substrate for reattachment, 2' x 1' panels of $\frac{1}{4}$" material were cut. Six-month-old European oysters, Ostrea edulis, were attached at 3" spacings on both sides. Two types of glue were used, a 2-part epoxy compound (Polypoxy Underwater Patching) and a polysulfide-based calking material (Boatlife--Life Calk).

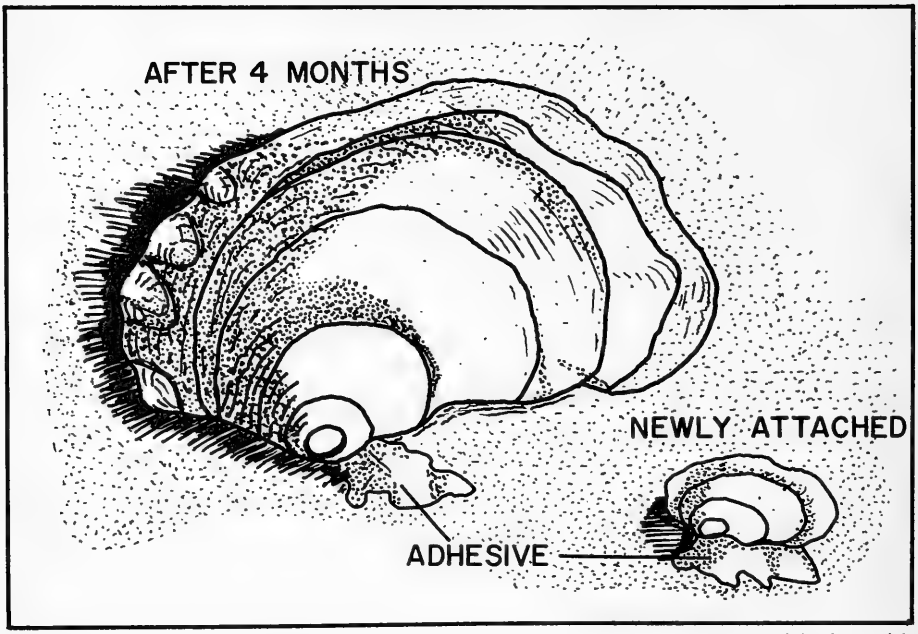
4 Months In Water

The panels were suspended vertically from a raft in a sheltered cove in Maine's Damariscotta River in June 1971. After 4 months in the water, they were removed for examination. A large proportion of the reattached oysters had fallen off. This indicated that the method of attachment was as yet unsatisfactory. The fault probably lay in insufficient drying time allowed for the glues before submersion. However, those that remained attached showed a very favorable response in several aspects. The reattached oysters responded to the substrate by depositing the new shell of the left valve in close

The authors are with Department of Agricultural Engineering, University of Maine, Orono, and the Ira Darling Center for Research, Teaching and Service, University of Maine, Walpole.

This study was made possible through Sea Grant Coherent Project SG1-36099.

COMMERCIAL FISHERIES REVIEW
Reprint No. 935



Growth response of the European oyster when attached to asbestos cement-board panel. New shell growth of the left value is tightly adhered to the flat surface around most of its margin.

proximity to the substrate. The result was that a very permanent new adhesive was formed that probably would be able to support the oyster in position to a harvestable size (Figure).

The oysters' growth rate exceeded rate of oysters in the laboratory or in nearby screened cages. Moreover, the attached oysters maintained a more symmetrical shell morphology. This has bearing on the ultimate sale price.

DEVELOPMENT OF GLUING TECHNIQUE

Despite the high losses due to falling off in the initial tests, the results were encouring. A second pilot experiment was performed to find a suitable adhesive and method of applying it. In addition to the original two glues, we used a fiberglas resin (Valspar Super Iso-Resin) and a portland-cement-based waterproof patcher (Quick Plug, Reardon Co., Toms River, N.J. 08753). The adhesives were made up according to directions. The juvenile oysters were attached simply by putting spots of glue at 4" centers on each panel, and pressing the shell into the glue.

Variables other than different glues were investigated: (1) attachment by upper (right) valve or lower (left) valve, (2) drying oysters before gluing versus gluing wet, and (3) curing time for glue before submersion. After appropriate drying times, the panels were hung from raft as in first experiment.

Comparative Values of Glues

After two months in the water, the panels were removed and examined for loss through falling off and mortality of the reattached oysters. The fiberglas resin formed the strongest bond. However, it required that the oysters be dry before gluing; also, it necessitated several hours' curing time before submersion. A further fault lay in the

fact that it was simple, using this low-viscocity resin, to glue together inadvertently the two valves of the oyster--thereby preventing opening. The Polypoxy Resin and the Life Calk gave a high incidence of falling off and proved messy to apply. The portland-cement Quick Plug yielded the best overall results. Besides giving zero mortality and zero loss due to falling off, it was nontoxic and took minimal drying time.

Using Portland Cement

Using the portland cement, juvenile oysters may be taken out of the water, glued in place on a panel, and the panel submerged immediately. It was not the strongest glue tested, but it is doubtful that any artificial glue used on the small oysters could maintain support for the 2 to 3 years necessary to harvest. All that is required is positioning of the juvenile until natural reattachment occurs--1 to 2 weeks under favorable growing conditions. Concerning orientation, during the few months of submersion, it appeared that growth rate and gluing success were equally good, whichever valve was attached; permanent natural reattachment was most apparent where the right valve was uppermost, as in Figure, but further investigation is required into this aspect.

CONCLUSIONS

The initial experiments indicated that reattachment is a technically feasible method, using asbestos-cement board as an artificial substrate, and a quick-drying portland cement as the gluing agent. Reattachment has potential as a means of rearing cultchless hatchery oysters. More extensive work is now in progress to evaluate the system quantitatively on a long-term basis, to determine the optimum spatial arrangement of the oysters on the panels and of the panels themselves, and to compare growth rate and survival to those of conventional rearing methods.

We thank Dwight Worcester and Brian Holmes for their efforts in setting up the initial experiments, and Phyllis Coggins for the illustration.

LITERATURE CITED

ANON.
1969. New hatchery technique produces cultchless seed oysters. Comm. Fish. Rev. 31 (5) :2-3.

LONG ISLAND OYSTER FARMS, INC.
1970. Artificial rearing of oysters. U.S. Patent 3,495,573.

MACKENZIE, C. L.
1970. Oyster culture in Long Island Sound. 1966-1969. Comm. Fish. Rev. 32(1) :27-40.

MARSHALL, H. L.
1970. Development and evaluation of new cultch materials and techniques for three-dimensional oyster culture. Marine Tech. Soc. Journ. 4(1) :7-20.

PACIFIC MARICULTURE, INC.
1967. Method and apparatus for growing free oyster spat. U.S. Patent 3,526,209.

SHIPBOARD PROCEDURES TO DECREASE LOBSTER MORTALITY

Ronald Joel Smolowitz

The development of the offshore lobster fishery has created a need to decrease lobster mortality during long periods of storage onboard ship. This paper discusses aspects of the shipboard-storage problem and presents one successful method now in operation.

Reduction in lobster mortality means more lobsters to meet increasing demand. A 1971 market analysis by NMFS economists indicated that industry revenue should increase as production increases, although a temporary decline in prices might occur. Revenue would increase because the increase in quantity would more than offset decrease in price.

The major causes of lobster mortality after capture are:

a) suffocation
b) thermal shock
c) rough handling
d) disease

A review of the cause-and-effect relationships will introduce possible engineering solutions to the problem.

Suffocation Major Death Cause

Suffocation seems to be the major cause of lobster deaths in storage. If water circulation and aeration are not provided, or are not adequate, oxygen deficiency will result. The oxygen problem can be a localized one, such as in tank corners where lobsters tend to congregate. Lobsters require a continuous supply of oxygen to live. Their oxygen demand increases at higher water temperatures and during feeding. For this reason, feeding lobsters in storage is not recommended. Feeding lobsters also results in increased waste products, which make the environment unhealthy and consume the precious oxygen. Cold water not only lowers the lobsters' oxygen demand but increases the oxygen-holding capacity of the tank water.

The most common method of replenishing the supply of oxygen to lobsters in holding tanks is to pump new sea water continually through the tanks. The disadvantages are the need for special equipment to move large amounts of water, and the lack of control over the water temperature.

Water temperature should be held between 45° and 50° F. to minimize thermal shock. Thermal shock can result if lobsters are brought up from the colder bottom depths and stored at much higher water temperatures, or if a sea-water circulation system is used, when passing through warm surface water. The key here is rate of acclimatization. Lobsters can survive in warm water provided it warms gradually. However, cold water is desirable because you can store more lobsters per gallon due to the increased oxygen-holding capacity. Colder water also has the advantage of delaying moulting. Many vessels refrigerate and recirculate sea water in their tanks. Over longer storage periods, though, the oxygen must be replenished.

Successful Storage Method

Massachusetts Marine Biologist John Hughes has developed a successful storage method in cooperation with lobstermen Jack Baker and Jack Marley. Mr. Baker is the owner of two stern trawlers, the 'Shanty Queen' and the 'Shanty Girl', and two seafood restaurants, Baker's Lobster Shanty at Point Pleasant Beach, New Jersey, and Lobster Shanty North, P.E.I., Canada. Mr. Marley manages the operations. Baker's vessels have refrigerated holds containing plywood tanks. The same seawater is used for the entire trip and is aerated continuously by an air-pump system.

The author is a Lieutenant (j.g.), NOAA Corps, National Marine Fisheries Service, Woods Hole, Massachusetts 02543.

COMMERCIAL FISHERIES REVIEW
Reprint No. 936

The Hold

It is desirable to refrigerate the hold, which contains the lobster tanks, to maintain air temperatures between 40° and 45° F. Due to the wide variety of vessel and hold configurations, local refrigeration people will have to provide the necessary assistance in choosing the right equipment. A standard freezer-evaporator system, using refrigerator plates or coils, has been found adequate. The hold should be insulated and, possibly, a fan provided to improve air circulation. One refrigeration company familiar with lobster-refrigeration systems suggests foam in-placed urethane as a good insulator. The lobsters should not be permitted to come in direct contact with the urethane because they will tear it.

In some installations, of a more permanent nature, it may be desirable to refrigerate the tank water directly. If this is the case, the cooling coils have to be made of, or coated with, a material that is not toxic to lobsters. The lobsters should not be allowed to come in direct contact with the coils. To avoid mass mortality due to a leak in a coil, a secondary coolant might be considered, such as brine, that can be detected by a salinometer before deaths occur. A common system is a separate cooling tank with a circulating water system to the lobster-holding tanks.

If a vessel has a small hold, it might possibly be cheaper to use ice outside the tanks. When using this method, care should be taken to keep ice from entering the tanks because decrease in salinity of tank water could harm the lobsters.

The Tank

Ordinary Marine Grade plywood is good material for tank construction. However, the better exterior grade plywoods can be used with excellent results, especially when coated. Rubber or plastic-based paint should be used on the interior surfaces. The seams of the tanks can be bonded with brushable epoxy glue. Be sure that no copper, lead, or zinc materials are used on the sea-water side of the tanks. Stainless steel or plastic fittings are best because they are nontoxic to lobsters and hold up well in the sea-water environment.

The sizes of the tanks depend on the size and shape of the hold. Too large a tank can cause stability problems in rough weather.

HOLDING TANK

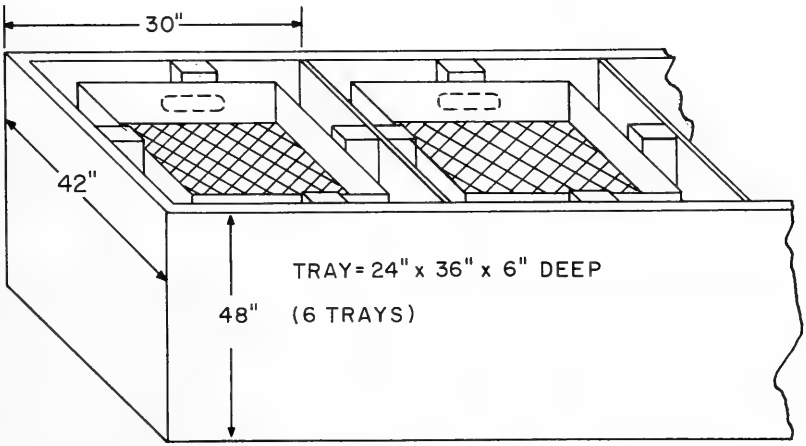


Fig. 1 - Concept for a lobster-holding tank using tray storage. The trays are designed to have positive bouyancy when full, and to sink when the next tray is placed on top.

Surge effects in the tanks can harm lobsters. On Baker's boats, the holds are 18' x 16' x 8' high and contain ten tanks 48" x 32" x 34" deep. Each tank holds 600 pounds of lobsters.

It may be desirable for fast turn-around operations to build smaller tanks that can be hoisted out of the hold. A variation on this might be permanent tanks containing removable trays. This also has the benefit of decreasing the handling of lobsters, which will improve the quality of the landed product. Handling weakens and often injures the lobsters, which are already under stress. Handling also increases the possibility of death from loss of blood, infection, and the effects of overcrowding.

A drain should be located near the bottom of the tank so the tank can be emptied easily in case of emergency or before docking. The drain, like all the sea-water piping, should be either plastic or stainless steel.

The tank should have a removable splash cover. On Baker's vessels, the covers can be hooked onto the overhead and out of the way while work is in progress.

The Air System

Baker's system uses a Conde air pump to supply air to the tanks. This pump is a milking machine pump adapted for continuous commercial aquarium usage. It supplies a large voulume of air at low pressure (18 cu. ft./min. at 8 psi). The power supply for this pump can be either 110 or 32 volts.

The air pump discharges into an air main constructed of $1\frac{1}{2}$" plastic piping (PVC) running the length of the hold. At points along the air main, small brass air valves are screwed in, to which $\frac{1}{4}$" flexible plastic tubing can be attached. The tubing is connected to an air gang valve for each.

The air gang valve is a small brass manifold that can contain any number of valves. It provides a means of controlling the air division to the air stones.

If the tanks are to remain in the hold, it does not matter where the air gang valve is located. However, if the tanks are to be removed often--as for bulk offloading, or removal for cleaning, drying, or repair--the gang valve should be mounted on the tank. In this way, only one air hose has to be disconnected to remove the tank.

Quarter-inch plastic tubing is run from the gang valve outlets to air stones located in three of the tank corners and in the center of each side, all on the tank bottom.

Air Stones Break Air Flow

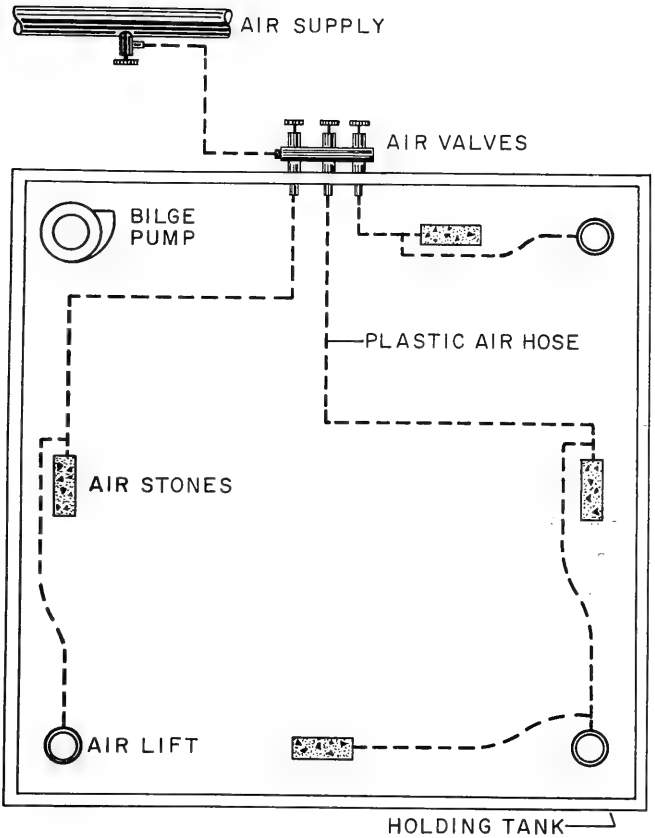
Air stones are devices commonly found in home tropical aquariums that are used to break the air flow into many tiny bubbles. The air stones for the tank corners can be the small round type, those for the sides can be the 12-inch variety. The corner-located air stones should be enclosed in $1\frac{1}{2}$" PVC pipe mounted vertically. This pipe should be located about an inch off the bottom and extend up to within several inches of the water surface. The flow out of the air stone provides an air lift creating an upward flow of water, thus circulating and enriching the water.

Filtration and additional circulation are provided by a small all-plastic bilge pump in the fourth corner of the tank. The pump discharges via a plastic hose to a quarter-bushel basket that contains filter material. The water is filtered and circulates back into the tank. Fiberglass should not be used as the filter material because it has been found that the strands of glass injure the lobsters. Instead, cotton waste or polyester wool can be used. If the tanks are made small, an air lift filtration system can be used instead of a bilge pump.

When the lobsters are taken aboard, they should be banded as soon as possible. Wooden pegs should not be used because they invite diseases such as Gaffkemia, which can cause high mortalities in storage areas.

Lobsters taken by otter trawls require several hours in a deck holding tank to clean themselves of sand. This is important because sand in their gill areas causes hardship in breathing, further weakening them. The deck tank also allows culling out weakened lobsters that should be placed in special storage.

When installing pumps that supply sea water to lobster-storage tanks, be very



HOLDING TANK AIR SYSTEM

Fig. 2 - Layout of the air system on the tank bottom. All fittings exposed to the sea water should be free of toxic materials.

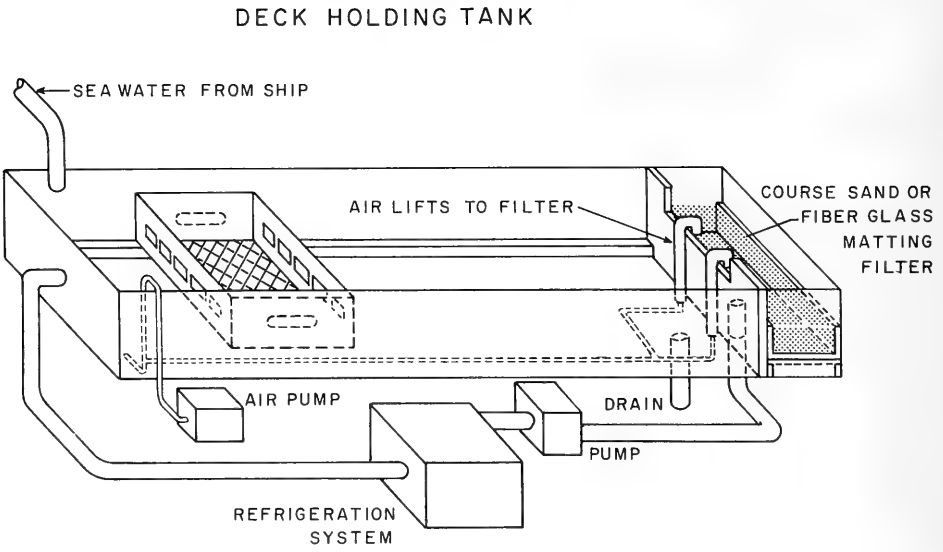


Fig. 13 - Concept for a deck lobster-holding tank using tray storage. The filter section is removable.

careful that there are no air leaks on the pump inlet side. This can supersaturate the tank water and cause Gas Disease fatal to lobsters.

The tanks should be flushed regularly. Usually fresh tap water is sufficient, but if there is any suspicion of disease-causing organisms present, a chlorine solution should be used. The tanks must be flushed well with fresh water after cleaning with chlorine solution.

This system and handling procedures are effective. On Baker's vessels, losses have been cut from an average 20% to less than $2\frac{1}{2}$%. During one summer trip, when surface-water temperatures were in the 70's, they lost only 165 lbs. of 7,300 lbs. landed; 90% of the fatalities were newly shed lobsters.

CONCLUSION

The practical application of scientific principles has contributed to the rapid growth of American technology. The development of effective but low-cost systems for shipboard storage of live lobsters is an example of a happy union of theory and practice. Many variations in similar systems are possible; however, the most successful will be those that adequately meet the basic biological requirements of the lobsters. The success of the system described above reflects its capacity either to compensate for the lobster's needs or to adjust them to fall within the system's capabilities. Either way, the result has been successful.

REFERENCES

HUGHES, JOHN and JACK MARLEY
1971. "Biologist and Lobsterman Devise System to Bring Haul Back Alive," 'National Fisherman', Vol. 52, N. 7, November, page 12-A.

McLEESE, D. W. and D. G. WILDER
1964. "Lobster Storage and Shipment," Bulletin No. 147, Fisheries Board of Canada, Ottawa.

STEWART, JAMES E. and H. E. POWER
1965. "A Unit Suitable for Holding and Displaying Live Lobsters," New Series Circular No. 21, Fisheries Research Board of Canada, Halifax Laboratory, April 26.

STUDIES OF SALMONELLAE POTENTIAL IN CATFISH FEEDS

Travis D. Love and Brenda H. Minkler

Eighteen samples of catfish feeds used in U.S. Southeast, which included 14 brand names, have been analyzed by standard bacteriological methods for the presence of salmonellae.

Each of 18 samples taken from 50-pound bags was divided into six 50-gm portions for inoculation into tetrathionate broth. After 24 hours, the broth was streaked on Bismuth Sulfite agar and Salmonella-Shigella agar. A considerable number of large mucoid swarming colonies were noted on the Salmonella-Shigella agar, but scanty growth was noted on the Bismuth Sulfite agar. Most of the large mucoid colonies appeared to be Proteus on further culture.

Not true salmonellae could be confirmed on further selective media culture and by serological methods.

Although a limited number of samples were examined, it appears that catfish feeds are relatively free from salmonellae.

Farm-raised channel catfish (Ictalurus punctatus) are fed a pelletized feed composed in part of meat meal and fish meal to supply the necessary animal protein. In the past, meat meal and fish meal have been implicated in the epidemiology of outbreaks of Salmonella dysentery. Much progress has been made in the sanitation and processing techniques of these meals. The potential, however, exists for further outbreaks.

We decided it would be valuable to the commercial pond-raised catfish industry to determine the potential for Salmonellae in the dressed fish from pelletized feeds. Eighteen samples, composed of six 50-gm portions, were obtained from 14 different brand names. The samples were obtained by aseptic techniques from 50-pound bags. Two bags were infested with small beetles, and these insects caused the samples to be contaminated from an outside source.

METHODS

The six 50 gm portions were added to 500 ml flasks containing 300 ml of tetrathionate enrichment broth and incubated overnight. Cultures from the tetrathionate were streaked on Salmonella-Shigella agar and on Bismuth Sulphite plates. These plates were incubated 24 hours and any suspicious colonies were inoculated on Triple Sugar Iron slants. Slants showing typical Salmonellae reactions were transferred to Urea broth and Salmonella-Shigella plates. The few positive results from these media were tested by serological methods.

The authors are with Fishery Extension Service, National Marine Fisheries Service, Pascagoula, Miss. 39567.

COMMERCIAL FISHERIES REVIEW
Reprint No. 937

RESULTS

From the 108 50-gm portions, no positive serological tests were found for Salmonellae. It was noted, however, that considerable "spreading colonies" occurred on the Salmonella-Shigella plates. This was especially notable in those samples containing insects when the entire plate was covered by the "spreader." These "spreaders" gave the typical presumptive tests for Proteus in Urea broth and on the Triple Sugar Iron slants.

CONCLUSIONS

It is not known at this time what effect large numbers of Proteus might have on the keeping quality of fresh dressed iced catfish. Proteus is a hydrogen-sulphide former in most situations. The pond-raised catfish industry is troubled with "off" odors in the live fish, and these odors are carried over to the dressed fish even in the most sanitary conditions.

It has been learned that pelletized catfish feed is often formed by a hot extrusion method in order to obtain the necessary dryness for slow sinking or floating feeds. It appears from this brief study that Salmonellae from commercial catfish feeds will not be a problem in that industry. Further studies already are underway on the musty odor problem at other laboratories.

WHALING OBSERVER PACTS SIGNED

1. JAPAN AND USSR

Japan and the Soviet Union signed an agreement in Moscow on April 18 providing for the placement of observers aboard their whaling vessels. The agreement, first of its kind between whaling nations, resulted from a decision reached at the June 1971 annual meeting of the International Whaling Commission (IWC).

The Agreement

The agreement will be in force until Feb. 28, 1973. Under it, Soviet observers will be assigned to each of the three Japanese whaling fleets that will operate in the North Pacific between mid-May and mid-June. Japanese observers will be assigned to the two Soviet whale fleets that will operate later in the summer. The observers will help determine whether whaling operations are being conducted under the rules of the international convention for the regulation of whaling. They will report their findings to the IWC. ('Tokyo Kyodo', Apr. 19.)

2. JAPAN AND U.S.

On April 26, Japanese Foreign Minister Fukuda and U.S. Ambassador Ingersoll signed an Agreement on the International Observer Scheme for Whaling Operations from Land Stations in the North Pacific. The agreement will remain in effect until Feb. 28, 1973.

Under the agreement, U.S. observers may be stationed at the six Japanese land stations: Wakkanai of Nippon Hogei, Kiritappu and Osawa of Nitto Hogei, Onagawa of Nippon Suisan, Ayukawa of Taiyo Gyogyo, and Ayukawa of Nitto Hogei.

The 1972 North Pacific Coastal Whaling season is from May 1 to October 31 for baleen whales, and from May 1 to December 31 for sperm whales ('Suisan Tsushin', Apr. 27.)

The Japanese quota for 1972 coastal whaling was reduced 20% from 1971 quota.

The Japanese quota for the 21st North Pacific Whaling Season was reduced 20% to 554 BWU.

3. NORTH ATLANTIC

On April 7, 1972, representatives of Norway, Canada, and Iceland signed an agreement to implement an international observer system for North Atlantic coastal (land based) whaling stations. The agreement entered into force on April 14. The three countries were expected to exchange observers during this year's whaling season beginning in May. (U.S. Embassy, Oslo, Apr. 24.)

JAPAN & USSR AGREE ON 1972 SALMON QUOTAS

The 16th annual meeting of the Japan-USSR Fisheries Commission, Moscow, March 1-April 20, culminated in an agreement signed April 21. The high-seas salmon quotas for 1972 are 87,000 metric tons for Japan and 3,000 tons for the Soviet Union.

This year, besides closing designated zones in Area A (north of 45° N. latitude) to Japanese fishing during specified periods, closures were established for the first time in several places in Area B (south of 45° N. latitude). Japan finally accepted this measure only for 1972, a year of poor pink-salmon run.

In the 1972 high-seas salmon fishery, the Soviets are likely to use mothership-type operations for the first time. ('Suisan Tsushin', May 2, 'Nihon Suisan Shimbun', Apr. 24.)

U.S.-BRAZIL AGREE ON SHRIMP FISHING

On May 9, 1972, the U.S. and Brazil signed an agreement establishing a shrimp-conservation zone off Brazil. Within the zone, the activities of shrimp vessels of the two countries will be regulated.

The agreement was signed by U.S. Ambassador William Rountree and Brazil's

Foreign Minister, Mario Gibson Barbosa. It will be submitted to the senate for ratification. A ratified agreement would remain in effect at least until January 1973.

Reserve Juridical Positions

The agreement reflects mutual concern for shrimp conservation. The two parties reserve their juridical positions on territorial seas and fishery jurisdiction under international law.

FAO FERRO-CEMENT FISHING VESSEL SEMINAR IN NEW ZEALAND

A 5-day seminar on the design and construction of ferro-cement fishing vessels will be held by FAO in Wellington, New Zealand, beginning Oct. 9, 1972.

The seminar, hosted by New Zealand, is being held in response to growing interest in developed and developing countries in the use of these vessels. Participants will be from FAO's Indo-Pacific Fisheries Council (IPFC)--largely the developing countries along the Indian and Pacific Oceans--and from the Netherlands, United Kingdom, U.S., and others.

Main Purpose

The seminar's main purpose is to collect all data on existing ferro-cement boats, especially on construction methods, costs, and operational experience. The properties of ferro-cement as a boatbuilding material will be discussed and compared with other materials, modern and traditional.

FAO provided technical aid in building a 16-meter trawler in Thailand, an 11-meter gillnetter/handliner in Dahomey, and two open boats (7.5 and 10 meters) in Italy for Egypt. Also, three ferro-cement trawlers are being constructed for use in FAO projects in Uganda, Dahomey, and Madagascar.

Address questions about seminar to: Secretary, Seminar on the Design and Construction of Ferro-Cement Fishing Vessels, Department of Fisheries, FAO, Rome 00100, Italy.

NORWEGIAN FISHERIES FAIR, AUGUST 14-20

The Fourth Norwegian Fisheries Fair will take place in Trondheim, August 14-20.

The first day's program will deal with the use of acoustical instruments in fishery research and be of interest primarily to researchers. On the second day, the use of acoustical instruments in fishing will be discussed.

Preparations are underway for a study conference on the "transport of fish from pier to consumer". The fair's planners hope to organize visits to foreign factory vessels and large trawlers, and study trips to the fishing grounds aboard one of the Marine Research Institute's research vessels.

NORTH SEA IS CLEANER

The North Sea off West Norway shows no signs of oil pollution and the volume of chlorinated aliphatic hydrocarbons is much less than in 1970, reports the Ocean Research Institute, Bergen, Norway.

A Norwegian-Swedish team has made a systematic collection of water samples in the area between Feie and Shetlands. It also has collected fish, which will be measured for hydrocarbons, DDT, lead, and other heavy metals.

The researchers believe that the improvement is due partly to the halt in 1971 of the dumping of industrial chemical waste.

CANADA

CANADA CURTAILS ATLANTIC SALMON FISHING

On April 24, Canada's Minister of Fisheries, Jack Davis, announced in the House of Commons a partial ban on commercial fishing for Atlantic salmon. It is expected to last at least 6 years and to close most of Canada's Atlantic salmon fishing grounds.

The action was brought on by excessive high-seas fishing by foreign countries, heavy fishing by Canadian commercial fishermen, and pollution in some main salmon rivers. The closure will affect commercial fisheries in several producing rivers in the Maritime Provinces and Port Aux Basques in Newfoundland. It will not apply to salmon returning to streams in Newfoundland, Labrador, or Nova Scotia. Davis reported a serious decline in salmon returning to the St. John, Miramachi, and Restigouche rivers.

The Plan

The cost of the program for the current fiscal year was estimated at $2 million. The ban will affect over 900 commercial fishermen. The plan anticipates buying out the commercial salmon fishermen--vessels, gear, and all. The move, reportedly, is designed to encourage Denmark to take similar action. Davis said the Danes have agreed with the U.S. to stop salmon fishing by 1975, but he contended that this will be too late to save the species.

Denmark & Norway

External Affairs Minister Mitchell Sharp said Canada had made vigorous representations to Denmark about its high-seas salmon catches. Canada was not satisfied with the Danish response and "wants exclusive rights to harvest salmon from our streams."

In a similar action, Norway has announced its intention to urge a total ban on salmon fishing outside national fishery limits. This hinges on other members of ICNAF and NEAFC engaged in the fishery undertaking the same obligation, with stricter catch limitations in any phase-out period. (U.S. Embassy, Ottawa, April 24.)

* * *

CANADA'S ATLANTIC PROVINCES MADE RECORD EARNINGS IN 1971

In 1971, landings of Canada's Atlantic Coast provinces totaled 2.2 billion pounds, slightly below 1970 landings. They were worth C$128.9 million, surpassing the record set in 1970.

Groundfish, lobster, herring, and scallops were 95% of landings and 85% of value.

During 1965-70, landings of groundfish (mainly cod, flounders, ocean perch, and haddock) fluctuated between 1.10 and 1.24 billion pounds; in 1971, they totaled 1.13 billion pounds. Their value has been increasing steadily in recent years and reached nearly C$60 million, 11% above 1970's record.

Catch Composition Changes

Groundfish landings have changed in recent years. Cod were 10% less than in 1970. Still, they accounted for 39% of groundfish landings, compared to 52% in 1965. In 1971, the haddock catch increased but was still substantially below level of earlier years. In recent years, ocean perch and flounder have accounted for a larger share of the total groundfish landings. In 1971, ocean perch were 22% (12% in 1965), flounder 25% (18% in 1965). However, 1971 flounder landings declined 6% from 1970 record of 299 million pounds.

Herring Fishery Expands

The herring fishery has expanded appreciably since 1965. From 405 million pounds in 1965, landings increased to 1.16 billion pounds in 1968. They have declined annually since then: in 1969, by 7% and, in 1970, by 2%. In 1971, herring catches declined again, by about 12%. They were 41% of all fishery landings but only 10% of total value.

Lobster landings, which have been ranging between 35 and 40 million pounds, rose only slightly in 1971. Their increased value reflected higher market prices.

The low abundance of sea scallops on traditional fishing grounds has contributed to

CANADA (Contd.):

decreased catches in recent years. Landings decreased 14% in 1971, but prices reached records. The Atlantic salmon catch of 4 million pounds was about 1 million pounds less than in 1970. ('Canadian Fishermen' and 'Canadian Fisheries Statistics').

* * *

NEWFOUNDLAND LANDINGS FELL 13% IN 1971 BUT VALUE ROSE

In 1971, landings in Newfoundland declined 13% from 1970, but their value to fishermen set a record. The catch totaled 388,600 metric tons worth US$35.3 million. Of the total catch, groundfish registered 242,200 tons, down 13% from 1970. Cod declined 10% from 127,700 tons in 1970. Flounder slipped 13%, ocean perch 37%, and Greenland turbot 4%. Herring landings also fell: 134,500 tons, compared to 159,100 in 1970.

The salmon catch decreased almost 16% to 1,500 tons. Salmon anglers landed 12% fewer fish. In 1970 and 1971, there was full-scale tagging of smolt and adult salmon in Labrador. This project is part of an international study to determine the origins of salmon stocks exploited in Greenland area.

Mollusks & Crustaceans

Landings of mollusks and crustaceans totaled 5,800 tons, compared to 2,700 tons in 1970. The lobster catch declined 6% to 1,400 tons. Scallop landings dropped to nearly three-quarters of 1970 catch; however, new stocks have been located in many areas. Encouraging results were reported for experimental scallop farming introduced in 1971. After 3 seasons of virtual failure, squid are showing signs of reappearing; landings totaled 1,800 tons in 1971, compared to 80 tons in 1970.

Bait Subsidized

The Newfoundland Bait Service provided 4 million pounds of bait at subsidized prices to inshore fishermen in 1971. Some problems were encountered in catching enough herring for bait as a result of accelerated demands for food processing. However, there were enough capelin for bait purposes. Squid have been extremely scarce recently, but fishermen have found mackerel an acceptable bait substitute. Good signs of mackerel in Newfoundland waters were noted; limited landings were used by food processors and for bait.

The Fishing Vessel Assistance Program approved applications to construct 83 vessels 45 to 50 feet. Approximate construction costs amounted to $3,265,000. (Canadian Department of the Environment Fisheries Service.)

LATIN AMERICA

MEXICO'S FISH INDUSTRY GAINED 7% IN 1971

In 1971, Mexico's fish industry produced 273,154 metric tons of all species, a gain of 7.3% over 1970, according to preliminary figures of the Secretary of Industry and Commerce.

Among edible species, sardines gained the most: 37.6%; anchovies and turtles showed the biggest declines: 42.2 and 44.8%. Production of shrimp, the biggest money crop, fell 3.1%. Fish meal continued upward, although more slowly than in 1970; it increased 10.8% to 21,509 tons. However, production is still far below Mexico's requirements.

Shrimp Exports Rose

Despite slightly lower shrimp production, Mexico's exports of shrimp increased 6.2% to 30,582 tons, and 9.7% in value to US$69.3 million. Although most shrimp exports went to the U.S., the traditional principal market, exports to Japan increased 91% over 1970, totaling 1,999.3 tons. This trend is expected to continue in 1972. As a result of record shrimp prices in the U.S. and Japan, shrimp exports for the first time ranked third in total exports, although well behind tomatoes and sugar.

NORWAY'S LOFOTEN FISHERIES ARE THE BEST SINCE 1951

The Lofoten cod fisheries in North Norway, which ended April 26, were the best since 1951, reports the Royal Ministry of Foreign Affairs. Six thousand men landed 97,000 tons of cod, 17,500 tons more than in 1971. The 1951 catch was 115,000 tons, but the number of fishermen was 20,000--more than 3 times this year's.

Average earnings of fishermen in the Lofoten fisheries this year are estimated at almost 50,000 kroner (£3,000, $7,000).

About 58,000 tons of the catch have been salted, about 17,000 tons dried, and the remainder filleted for freezing or sold fresh.

FISHERMEN DOWN 40%

In 10 years, the number of fishermen in Norway fell 40%--from 61,000 in 1960 to 35,000 in 1970--according to census returns of the Central Statistical Office, Oslo. Johan Toft, chairman of the Fishermen's Federation, attributes the reduction to rationalization: "Crews have been reduced, but the catch per man has increased and is bigger today than ever before."

FROZEN FISH EXPORTS RISE 41% IN VALUE

The frozen-fish marketing organization Frionor, Oslo, reports that exports in first-quarter 1972 were up 22% in volume and 41% in value over the 1971 period. Shipments totaled 17,000 tons worth more than 100 million kroner (£6 million, $14 million).

NORWEGIAN FISH-OIL PRODUCTION ROSE 3% IN 1971

In 1971, Norwegian fish-oil production was 194,400 metric tons, an increase of 3% from 1970. Year-end supplies were 150,000 metric tons larger than at year-end 1970. Increased production is expected during 1972. The main fish used for fish oil and meal in 1971 was capelin, caught primarily off the north Norway coast.

Little Whale Oil

In 1971, whale-oil production totaled only 194 metric tons. In earlier years, it had been the main source for the oil industry. Two land stations won approval to operate in 1971, but only one considered it profitable enough to do so. In first-quarter 1972, the Norwegians have not sought Antarctic whales. One result is the shortage of raw material for the refining and hardening industry. The U.S. has been a main foreign supplier of oil for this industry; it has supplied nearly half the oil imports. ('Foreign Agricultural Service', U.S. Dept. of Agric., April 12.)

'GIVE A MAN A FISH HOOK. . .'

The fish-hook manufacturer O. Mustad & Son A/S, Oslo, reputedly the world's largest, has sent 300,000 fish hooks to the Red Cross in Bangladesh. The gift followed a letter home from the owner's daughter, Anne Mustad, a physiochemist working with a Norwegian medical team in Bangladesh. Her letter quoted the Bangladesh adage: "Give a man a fish and he has food for a day. Give him a fish hook and he has food for life."

ICELAND IS ADDING 27 STERN TRAWLERS

Iceland has authorized 27 stern trawlers 400 to 1,000 gross registered tons, reported 'Fishing News' of London on March 17. An agreement was being negotiated with Japanese shipyards to build 10 stern trawlers averaging about 500 GRT each. Four vessels have been ordered from Spain (one has been completed). Norway is building 10 vessels of about 500 tons each; two are being built in Poland. Iceland's shipyard will construct one 500-ton vessel.

Fleet Modernization

The fleet-modernization program, with deliveries slated for 1972-73, is the first recruitment to the trawler fleet since 1960. Total investment will be US$30 million, supported by loans from the Fisheries Fund that

ICELAND (Contd.):

may cover two-thirds of cost of vessels built abroad. In 1970, the trawler fleet caught 16% of the production of groundfish species and, in 1971, 23%.

If Iceland succeeds in extending her fishing limits to 50 miles, as proposed, it could create a vast protected area for the incoming fleet of stern trawlers.

Iceland's 1971 Frozen-Fish Production

In 1971, Iceland produced 93,000 metric tons of frozen fishery products. Cod fillets and blocks were 35,000 tons of total, down 4,000 tons from 1970. About 47% was fillets and 53% blocks. Haddock fillets totaled 6,220 tons (up 22% from 1970) and blocks 348 tons. Saith (coalfish) totaled 13,745 tons, the bulk fillets for the Soviet and Czechoslovak market; there also was an increase in blocks for the U.S. Shrimp and Norway lobster production rose 14% to 1,504 tons, while scallops increased 58% to 380 tons.

The U.S. was Iceland's leading export market for frozen fillets and blocks with 53,230 tons; the Soviet Union was second with 12,383 tons. ('Aegir', March 1972.)

MARINE FISH FARMING PROGRESSES IN UNITED KINGDOM

Experiments are underway in the United Kindgom (UK) to develop a profitable marine fish-farming industry. They have concentrated on the marine flatfish--plaice, Dover sole and, more recently, turbot and lemon sole.

Results have shown that these species can be spawned under artificial conditions. Large numbers of plaice and Dover sole have been hatched, reared, and marketed. Each species is assessed by these criteria: high market price, fast gain in weight, and ease of breeding and rearing of young in captivity.

High Priced Are Profitable

In terms of profitability, those species found to give economic returns are the high-priced ones: turbot, Dover sole, hake, and halibut; those most unlikely to give economic returns are red sea bream and plaice. ('Marine Fish Farming', Suffolk and Lowestoft Laboratories, UK.)

SCOTTISH SHRIMP AND SHELLFISH BOOM

There has been a marked increase in Scottish shellfish landings in the past 20 years. Shellfish landings reached 22,220 metric tons in 1971, and value US$10.9 million.

The growing popularity of Norway lobster (or prawn) spurred growth of landings form 152 metric tons in 1950 to 1,981 metric tons in 1960 and 8,178 tons in 1970. The value of this catch in 1970 was nearly US$4.5 million. Scallop fisheries began in the 1960s and, by 1970, totaled 8,788 tons worth US$2.1 million. Recently, the pink shrimp (Pandalus sp.) became a target. Three species are found around the Scottish coast.

Rich Fladen Grounds

The prolific Fladen grounds near Scotland, long fished by Scandinavian shrimp vessels, are providing an increasing catch for Scottish vessels. The latter's early efforts failed because a market did not exist in Britain. The growing demand in Britain for pink shrimp has led to an import trade worth US$12.4 million a year. This market has stimulated Scottish fishermen. Both pink and brown shrimp are available close to shore. Expansion of this fishery is expected. Peeling machines have been installed to handle the growing catch.

Norway Lobster

Norway lobster now is caught only during short periods at dawn and dusk in shallow waters. Investigation is underway to learn whether electrified trawl will extend fishing results. Tests in natural habitat have shown positive results in making a significant percentage of these lobsters leave their burrows. Eventually, the electrified trawl likely will become a practical commercial proposition to stimulate production of Norway lobster and shrimp. ('Scottish Fisheries Bulletin')

VALUE OF IRISH CATCH + EXPORTS UP IN 1971

In 1971, Ireland's catch, excluding salmon, was worth a record £4.2 million, 7% above 1970, according to the Department of Agriculture and Fisheries. This was reported in 'The Irish Skipper', May 1972. The industry contributes about £10 million to the national economy. It "reflects the substantial increase from added value to landings in the processing, distribution and export sectors."

The value of fish and fishery products increased 22% to £5.6 million. Herring and shellfish were mainly responsible: their values rose £500,000 and over £250,000.

The whitefish catch increased from 302,000 hundredweight (cwt.) to 406,000 cwts. Value went up 11%--from £1.4 m to £1.6 m. Landings of cod and haddock were responsible for the improved results. Catches of pollock, megrims, and dabs dropped slightly.

Shellfish Up 18%

In 1971, shellfish values rose 18%, from £1,102,000 to £1,302,000. The increase was brought about by a striking increase in some catches (1970 figures in parentheses):

crawfish	179,000 fish	(155,000)
crabs	1,847,000	(1,265,000)
escallops	2,281,000	(323,000)
oysters	2,940,000	(1,619,000)

Mussel production went up nearly 50% in 1971: from 56,000 cwts. to 93,000.

Herring Returns

The 1971 statistics do not cover the 1971/72 winter herring season. Good returns were reported despite the season's late start. In a few weeks, the fleet landed 27,000 tons worth £1,119,000.

These landings put Ireland ahead of Belgium and Holland and closing quickly on France and Germany.

During the winter herring season, Killybegs alone exported salted and spiced herring worth £150,000 to Scandinavia, including Norway.

France has imported salted herring and frozen herring fillets worth £112,000; Belgium and Germany mainly frozen fillets valued at £180,000.

Britain and Holland bought more than £250,000 worth of herring.

FRANCE ORDERS 13 STERN TRAWLERS FROM POLAND

Poland's Gdynia shipyards will deliver 13 vessels to France by 1973. Known as the B423, they are medium-range, highly efficient, stern trawlers, 178 ft. long and average 320 tons (dwt).

The vessels are designed for demersal and pelagic fishing in the North Atlantic and North Sea. The 'Otter Bank' and the 'Cap-Sainte-Marie', first of the new class to be completed, are in operation. From 1960 to 1970, Poland delivered 27 trawlers to France.

CONSTRUCTS 4 DISTANT-WATER TUNA SEINERS

Under the French Sixth Fisheries Plan, 4 distant-water tuna purse seiner-freezers are to be built by 1975. Two were launched in Dec. 1971. One, the 'Morgat', is 189 ft.; the other, the Sapnish-built 'Guipuzkoa', 248 ft. The French say this is Europe's largest tuna freezer.

French shipyards will build the remaining two tuna vessels.

These 4 new vessels will increase the freezer fleet to 28 tuna vessels, all constructed recently. Total production capability will be 50,000 tons/year. In addition, reconverted seiners will add another 10,000 tons.

BELGIUM'S 1971 CATCH ROSE, PRICES FELL

Belgium's catch rose about 7% in 1971, but average market prices fell. The catch increase was attributable mainly to the cod catch, which was 84% above 1970. Catches of almost all other species showed declines for 1971.

Belgian fishermen operate in the southern part of the North Sea, the Irish Sea, and Icelandic waters. ('France Peche,' Mar. 1972.)

Soviet factory ship 'Vsevolod' in Bering Sea.

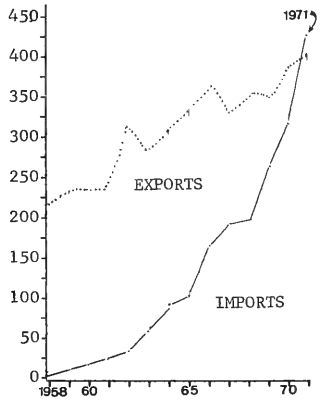
JAPAN BECOMES MAJOR IMPORTER OF FISHERY PRODUCTS

In 1971, Japan became a major importer of fishery products. Thus ended a long tradition as one of the world's principal suppliers.

In 1971, the value of Japanese fishery imports reached US$426 million. For the first time, this exceeded exports of fishery products, which were valued at $406 million.

YEAR	EXPORTS	IMPORTS
1971	406	426
1970	391	318
1969	347	261
1968	351	200
1967	326	192
1966	362	168
1965	331	104
1964	311	90
1963	283	59
1962	313	30
1961	229	23
1960	234	15
1959	233	8
1958	221	3

Shrimp, octopus, squid, and skipjack tuna were nearly 78% of the total value of imports. At the same time exports of tuna declined, due to mercury and canned-tuna decomposition problems, from $40 million to $13 million. Swordfish exports fell to nearly zero. ('Suisan Keizai', Apr. 10.)



Value of marine imports and exports, 1958-1971 (in US$1 million).

* * *

PLANS GIANT FISH FARM

Japan's largest fish farm is planned for the waters off Kushimoto, Wakayama Prefecture. It is expected to be partly operational in 1974, but it will not be completed until 1976. Cost is estimated at US$7 million.

The farm will enclose 114 hectares (1,140,000 square-meters) of water, surrounded by concrete breakwaters in the sea. About $7.3 million worth of lobster, yellowtail, and sea bream is expected to be harvested annually.

The fish farm is one of 15 planned under the Japan Fishery Agency modernization program that began in 1970. ('Japan Times', Apr. 21.)

* * *

VESSEL EXPORTS INCREASE

Japanese exports of fishing vessels have increased from about 100 a year up to 1966, to 166 in 1967, 145 in 1968, 152 in 1969, 139 in 1970, and 301 in 1971. One explanation for the sharp increase in 1971 was that fishermen rushed to replace their vessels with new ones because exports of used vessels were slated to be prohibited at the beginning of fiscal year 1972 (April 1, 1972).

* * *

JAPAN

DECLINE IN 1972 FISHERY EXPORTS PREDICTED

A report on fishery exports in fiscal years (FY) 1970 and 1971 and FY 1972 outlook has been published by the Japanese Agriculture and Fishery Products Export Council. A fiscal year begins in April and ends in March the following year.

Projections for FY 1972 show a decline in value of exports from FY 1971 for most items. Fresh-and frozen-tuna exports are likely to approximate the 1971 figure. A 43% gain is projected for canned tuna. The outlook for canned-crab sales is for a 69% reduction.

Why Decline?

The outlook for a decline in fishery exports is based on the effect of currency revaluation and foreign currency reduction measures in FY 1972. Another contributing factor is the reversion of Okinawa to Japan. Shipments to Okinawa no longer will be treated as exports.

Frozen-Tuna Exports

Frozen-tuna exports are likely to reach 77,607 metric tons and US$41.4 million--the same amount but worth slightly more--than FY1971 exports. The latter totaled 77,607 tons worth $41.05 million. Exports in FY1970 reached 66,760 tons worth $35,068,000.

The outlook for frozen-tuna exports in FY 1972 is that albacore and skipjack shipment will increase; yellowfin exports will decline because mercury problem in Italy remains unsolved. ('Suisan Tsushin', May 30, 'Katsuo-Maguro Tsushin', June 1.)

* * *

FISHERY INFORMATION CENTER OPENS

An organization to provide fishery information to Japanese coastal and offshore fishermen has opened in Tokyo. It is named Fishery Information Service Center. Director is Ryuichi Kikuta, president, National Federation of Fishery Cooperatives (ZENGYOREN).

The center replaces the former fishery forecasting service, a government-subsidized program in existence from July 1965 until March 1972. The new center will be financed primarily by the users, but it also will receive government aid.

Its Services

Services to be provided include: 1) continuation of existing program of disseminating fish bulletins and long-term forecasts for 10 fish species--including albacore and skipjack tuna, anchovy, saury, salmon, and sardines--fished off Japan's Pacific coast; 2) expansion of present investigations by survey vessels; 3) transfer from government laboratories of the program of processing sea-surface temperature data transmitted by aircraft (activity to be partly subsidized by government); 4) collection and dissemination of information obtained from fishing vessels (government to subsidize 50% of this work); and 5) distribution of red-tide warnings to fish-culture operators in shallow waters and in bays.

By Radio & Facsimile

Information will be transmitted to the vessels by radio and facsimile. At present, only about 3,000 of the 8,000 vessels equipped with facsimile recorders are operating off Japan's Pacific coast. To improve fishing efficiency, facsimile is likely to become more important in the Japanese coastal and offshore fisheries. ('Suisan Keizai Shimbun', Apr. 27.)

* * *

NEW YORK OFFICE TO SERVICE TUNA LONGLINERS

NIKKATSUREN will open an office in New York on July 1 to provide better refueling and other other services to its member vessels fishing off the U.S. East Coast. NIKKATSUREN is the Federation of Japan Tuna Fisheries Cooperative Associations.

The need to refuel at foreign ports is increasing for Japanese tuna longliners because their hook rate is declining and trips must be extended.

NIKKATSUREN also will open an office in Panama. It already has agents in South Africa, Australia, New Zealand, and other places ('Suisan Keizai Shimbun', May 25.)

* * *

JAPAN (Contd.):

SITUATION EASES ON CANNED-TUNA EXPORTS TO U.S.

On Feb. 24, 1972, the Tokyo Canned Tuna Sales Co. resumed sales of canned-tuna-in-brine for export to the U.S. Sales had been suspended because of decomposition problem. Since Feb. 24, 700,000 cases (600,000 cases of canned white-meat tuna and 100,000 cases of canned light-meat tuna) have been sold to trading firms; some early shipments were arriving in U.S. ports in late April. U.S. customs clearance is proceeding smoothly. There were no rejections at major ports of entry, notably New York, where much is received. Easing of the situation is attributed to voluntary inspection and self-certification by Japanese tuna packers. ('Suisan Tsushin', Apr. 26.)

* * *

CANNED TANNER CRAB PRICES ARE LIKELY TO INCREASE

The 1972 Japanese quota for tanner crab off East Sakhalin is 13 million crabs, same as for 1971. The production of canned product from that catch is expected to be around 135,000 cases (70,000 cases for home and 65,000 cases for export). The 1972 sales prices for canned tanner crab, domestic market and foreign, are likely to increase over 10% above 1971 levels. This outlook is based on the rapidly rising domestic demand: possibly 120,000-130,000 cases will be sold because of the sharply reduced supply of canned king crab that will be available this year. Practically all Bristol Bay king crab are being frozen, so the 105,000 cases to be packed from the West Kamchatka catch will be all the canned king crab available this year.

Prices to Rise

Japanese export-price quotations for canned tanner crab can be expected to increase to $33-35 a case from the $30 quoted in late 1971. (In 1971, export prices rose from $25.50 to $27 and, finally, to $30 in November.) However, such high prices likely will limit sales to certain established brands, such as "Geisha" label. U.S. will be the only large market. As for canned king crab, if they are exported in 1972, prices would have to be substantially increased above the 1971 quotation of $60 a case. ('Suisan Tsushin', May 11.)

* * *

SALMON MOTHERSHIP FLEETS DEPART FOR NORTH PACIFIC OCEAN

On May 17, 10 Japanese salmon motherships departed Hakodate, Hokkaido, for the North Pacific Ocean. The 332 catcher vessels assigned to the motherships left May 15. The 1972 fleet was reduced 10% (or by one mothership and 37 catcher vessels) from the 1971 total of 11 motherships and 369 catcher vessels.

The fleets proceeded to the area west of 168° E. longitude south of Komandorskiye Islands. They took up positions for fishing in the central fishing grounds in Area A (north of 45° N.) of the Convention waters. By May 22, all vessels were scheduled to commence fishing. They will fish the North Pacific for about 3 months with a catch target of 35,326 tons.

1972 Outlook

The outlook for the 1972 high-seas salmon fishery is about the same, or slightly better, than in 1971. The somewhat-higher-than-normal water temperature is likely to accelerate the northward migration of the salmon runs. Catch predictions are for a medium catch of red salmon, good landings of pinks for a lean season, better-than-average run of chums, and a substantial increase in catch of silvers if the vessels delay their departure from the fishing grounds. ('Suisan Tsushin', May 18.)

* * *

WHALING FLEETS DEPART FOR NORTH PACIFIC OCEAN

In mid-May, 3 Japanese whale factoryship fleets departed for the North Pacific whaling operations. The quota for the 21st (1972) North Pacific whaling season has been reduced 20% to 554 blue whale units (BWUs). Each fleet has a Soviet observer aboard.

AUSTRALIAN FISHERIES SET VALUE RECORD IN 1970-71

The value of Australia's fishery production for 1970-71 exceeded US$112 million, 27.5% higher than 1969-70 period. This increase is attributed primarily to the rise in production and value of crustaceans. The value of lobster catch alone rose over 43% to a record US$45.1 million; this reflected high prices paid for Australian rock-lobster tails in the U.S.

Rock-lobster production rose more than 13% between 1970 and 1971; it reached 28.5 million pounds in 1971. In the main lobster-producing area, Western Australia, the catch rose to 17.8 million pounds worth a record US$28.8 million.

In 1971, prawn production showed spectacular increases in value (32%) and quantity (43%). In quantity, prawns are now Australia's most important single fishery item.

Mollusks Increased

Production of mollusks increased in quantity and value. Oyster production rose 5% to 21.7 million pounds, its value almost 11% to US$8.6 million. The downward production trend of scallops and abalone of the last two years was reversed in 1970-71. Scallop production rose 47% in quantity and 88% in value to almost 18 million pounds worth US$2.6 million. Abalone production rose 31% in quantity and 81% in value to 17.6 million pounds worth US$5.9 million.

Prices for Australia's wetfish catch also increased despite a catch decline of almost 7% to 113.6 million pounds--due mainly to lower shark, snook, and Australian salmon catches. However, total earnings for 1970-71 decreased only marginally to US$24.5 million.

Western Australia No. 1

Western Australia continued as leading fishery State. Its production in 1970-71 was valued at US$35.8 million, compared with US$16.1 million in 1969-70. New South Wales was second: its production value increased from US$21.6 million in 1969-70 to US$24.5 million in 1970-71. Queensland's production value increased sharply from US$10.1 million in 1969-70 to 15.5 million in 1970-71. The increase was attributed mainly to the large jump in Queensland's prawn production. South Australia, Victoria, Tasmania, and Northern Territory also registered increases in catch value in 1970-71.

Early-1972 Situation

In early 1972, the 1971-72 fishery season showed fairly good rock-lobster catches. The price paid to lobster fishermen was about US$1.95 per lb. Catches in Tasmania and Victoria were generally encouraging, while in South Australia the fishing season was poor. South Australia's fishermen have been hampered by poor weather and late running lobsters, but market prices, nevertheless, have remained favorable.

N. Australia Shrimp Leader

Northern Australia is now the top shrimp-producing area. The fishery includes waters north of 20th parallel off Queensland, north of Bowen, in Gulf of Carpentaria, off Northern Territory, and in the Arafura Sea. It started on major scale in 1968 with a catch of about 5 million pounds, more than double 1969 catch, and climbed to 15 million pounds in 1970. In 1971, a catch of 23 million pounds was anticipated. In 1971, 230 boats were fishing shrimp.

The area's potential is good. About half the shrimp were landed at Darwin. The fishery is still developing, so it is likely to maintain present growth rate.

About 86% of catch was banana prawn, (Penaeus merguiensis), 9% tiger prawn (Penaeus esculentus).

Gulf of Carpentaria

The Gulf of Carpenteria catch of over 12 million pounds set a record. The lowest price paid was 30 cents (Australia) per pound, rising to 50 cents; it was worth over A$5 million to fishermen. (A$1 equals US$1.12.) Other northern fisheries also were expected to set new records. Shrimp also are found off south, east, and west coasts.

OYSTER DREDGING: NEW ZEALAND'S UNIQUE INDUSTRY

The New Zealand dredge oyster industry is unique: it is the world's only remaining natural fishery for "flat" oysters, which are cropped without any attempt at cultivation. So states the country's Information Service. Elsewhere, fishing has been controlled, and similar resources of naturally occurring stocks have ceased to be commercially exploited.

The industry is one of New Zealand's oldest. Small quantities from Stewart Island were being marketed back in 1830. The industry was centered there. But, as stocks around the island became exhausted, the oyster boats explored out to Foveaux Strait, Centre Island, and Ruapuke Island up to 1880. Early this century, the industry was transferred to Bluff.

Oyster Grounds

Oysters occur over 300 square nautical miles in Foveaux Strait. The commercially fishable grounds cover about 120 square miles, mainly along the Strait's central regions, in 9 to 21 fathoms.

There has been concern for the oyster stocks and the possibility of exhausting them through overfishing. The fishery now is self-guarded by regulations varying according to circumstances. Among conservation measures are the quota, closed season, and number of boats permitted to dredge.

The Quota

Fixing a maximum amount of oysters that may be taken commercially during the season ensures that an adequate stock remains to maintain the fishery.

The quota was introduced in 1963 at 170,000 sacks. It has been reduced in recent years to reflect declining numbers of oysters. Now it is 110,000 sacks to be taken by the 23 oyster boats at Bluff. Although much smaller than total annual catches from 1966 to 1968, it is still higher than the average annual catch for the past 25 years.

The Marine Department has been interested actively in conservation measures that may assist regeneration of the natural stock. These include farming and the return of shell to the oyster grounds.

Fig. 1 - In Foveaux Strait oyster beds, there are 600 million oysters that may be taken for eating. About one-sixth will reach market. During the coming season, from March 1 to about end of August, 23 oyster boats, some seen here, will take 110,000 sacks.

Fig. 2 - Dredge nets are used on New Zealand oyster boats that fish out of Bluff harbor into Foveaux Strait. Here a net is being swung inboard, and the catch tipped onto a cultching bench for sorting. (Cultching is separating the shells of takable size, believed to contain oysters, from material dredged from bottom.)

The New Zealand Marine Department advocates return of opened shell to the sea. From 1970 trials, when 1,000 sacks of shell were returned to an area of Foveaux Strait, the results of regeneration have been encouraging.

Returning Open Shell to Sea

The return of opened oyster shell to the sea has been advocated for two reasons. Oyster larvae usually settle on living or newly dead oysters. When beds are thinned by dredging, the material on which "spat" settle is removed, and so the number of oysters settling successfully is reduced. Adhering to the shells of the larger oysters are small oysters called "wing." Wings are still alive when the shells are opened. If they were returned to the sea in reasonable time, they would have a good chance of surviving and growing.

In 1970, 1,000 sacks of shell were returned to part of Foveaux Strait as a trial. The sacks were put down in a small area not dredged by boats. Then, it was roped off and samples taken every two months. Results have been encouraging. There was a high survival and good growth of wing oysters and a reasonable spat fall on the shell in the summer.

Foveaux Strait's Beds

There are 600 million oysters in the Foveaux Strait oyster beds that may be taken for eating. Only about one-sixth will reach the market. Conditions are reviewed months before the season starts (March 1 to about end of August). Management decisions, backed by scientific evidence, ensure that oysters are reasonably available to the public, profitable to fishermen, and protect a unique New Zealand industry.

TRANSLATIONS OF FISHERY BOOKS

The National Marine Fisheries Service (NMFS), under Public Law 480 Translation Program, contracts for the translation of books on fishery subjects. Supervising the operation is Milton Rose, Head, Translation Unit, International Activities Staff.

The following three Soviet monographs were translated recently in Israel. Paperbacks are $3.00 each--from National Technical Information Service (NTIS), Springfield, Va. 22151. When ordering, include the number following the number of pages in the translation: for example, TT 71-50066 after 207 pp. in item below.

MARINE NEUSTONOLOGY

"Marine Neustronology," by Yu. P. Zaitsev, "Naukova Dumka" Publishers, Kiev, 1970, 207 pp., TT 71 50066.

Neustonology deals with the minute organisms that float in surface film of water. This is the first monograph published on the biology of the sea surface. It describes methods of analyzing the structure, composition, density, ecology, dynamics, and distribution of the neuston. It discusses the neuston's important role in the reproduction of marine organisms and the cycle of substances in nature. The book evaluates the significance of neustonology in measuring the utilization, regeneration, and protection of the world's marine resources.

Hard-cover copies are sold for $16 each by Keter Inc., 104 East 40th St., New York, N.Y. 10016.

NEW FISHERY PRODUCTS

"Products from New Ocean Fish," by A. S. Lazunova and S. A. Lukoshkin, "Pishchevaia Promyshlennost'" Publishers, Moscow, 1969, 21 pp., TT 71-50031. It describes marine fish species that are new to the Soviet fishing and fish-processing industries. It discusses the possibilities of increasing the variety of manufactured fishery products. Methods for working out cost estimates, and wholesale and retail prices for new products are included.

TRAWLING N. ATLANTIC SLOPE

"Trawling Resources on the North Atlantic Continental Slope," by L. N. Pechenik and F. M. Troianovskii, "Murmanskoe Knizhnoe" Publishers, Murmansk, 1970, 66 pp., TT 71-50065.

Describes the results of exploratory fishing along the North Atlantic continental slope, 1963-1968, by vessels of the Soviet Northern Fishing Reconnaissance Fleet. During 34 cruises, more than 3,500 deepwater trawls were made. From the accumulations of fish discovered in these regions, the fleet caught about 200,000 metric tons, even though a limited number of vessels fished sporadically. Also, the booklet describes the main features of trawling at great depths. This is based on the experience of the skippers of search and fishing vessels--"pioneers of deepwater trawling."

GENETICS

"Genetics, Selection, and Hybridization of Fish," edited by B. I. Cherfas, published in 1969 under auspices of Ichthyological Commission, USSR Academy of Sciences. Contains 28 papers delivered at First All-Union Conference on Genetics, Selection, and Hybridization of Fish, Leningrad, March 1967. Covers these topics on freshwater fishes: genetics and karyotype of carp and other commercial species; theoretical and practical aspects in selection and breeding of carp, trout, and other pond fishes; biochemical and hereditary polymorphism in various species; and hybridization and heterosis of fish. The 269-pp. book is sold in paperback as TT 71-50112 for $3.00 each by National

Technical Information Service (NTIS), Springfield, Va. 22151.

Hard-cover copies are available for $21 each from Keter Inc. (above).

ECHOGRAMS

"Interpretation of Echograms of Hydroacoustic Fish-Finding Instruments," by K. I. Yudanov, "Pishchevaia Promyshlennost'" Publishers, Moscow, 1967, 101 pp. TT 71-50032.

It is a systematic survey of the principles of reading and interpreting echograms of hydroacoustic fish-finding instruments. It investigates technical and biological principles affecting the character of echograms. It describes types of distortion in recordings of fish concentrations and the masking of indicators of demersal fish. The author analyzes the possibilities of determining the species and quantities of fish recorded in the echograms of hydroacoustic instruments.

Paperbacks $3.00 each NTIS. Hard-cover copies $10 from Keter Inc.

FISH BEHAVIOR & FISHING TECHNIQUES

"Fish Behavior and Fishing Techniques," edited by A. P. Alekseev, published by Polar Research Institute of Marine Fisheries and Oceanography (PINRO), Murmansk, 1968, 193 pp., TT 71-50010.

Contains 28 papers presented at the All-Union Conference on Fish Behavior and Fishing Techniques, Murmansk, Feb. 27-March 1, 1968. Some subjects covered are trends and results of Soviet research; means to achieve productive fisheries; underwater research techniques; behavior in electric fields; use of communication and orientation signals of fish; light fishing for saury and squid; optomotor reaction and fishing; behavior in trawl's zone of action; underwater illumination; behavior in a zone affected by a curtain of air bubbles; daily rhythm in trawl catches; diurnal vertical migration; importance of fish's sense of smell; swimming speeds of fish.

Paperbacks $3 each from NTIS. Hard-cover copies $14 each from Keter Inc.

ATLANTIC SWORDFISHES & BILLFISHES

"Swordfishes and Billfishes in the Atlantic Ocean," by V. V. Ovchinnikov, published by Atlantic Scientific Research Institute of Fisheries and Oceanography (AtlantNIRO), Kaliningrad, 1970, 77 pp., TT 71-50011.

This studies biology and behavior of swordfishes, sailfishes, marlins, and spearfishes--all belonging to superfamily Xiphioidae. It stresses ecology and functional morphology of swordfishes and sailfishes.

OCEAN'S LIVING RESOURCES

"The Living Resources of the World Ocean," by Prof. P. A. Moiseev, Assistant Director, All-Union Research Institute of Marine Fisheries and Oceanography (VNIRO), published by "Pishchevaia Promyshlennost'," Moscow, 1969.

Moiseev attempts to solve two chief modern problems: the productivity of the world ocean at various trophic levels, and the evaluation of potential fish productivity. He studies the world ocean on the basis of biological data and on the physicochemical properties of the ocean as producer of living resources. He bases his evaluation on analysis of the varied and complex interrelationships of the marine ecosystems. He singles out the most important factors determining the volume and composition of fishery products. These include fishes, large invertebrates, and aquatic mammals. Moiseev discusses volume of commercial productivity of the world ocean and the prospects of fishery developments. He expresses his opinion of previous evaluations.

The 334-page book, paperback, costs $6 from NTIS, Springfield, Va. 22151, as TT 71-50026. Hard-cover copies are $26 each from Keter Inc.

COMMERCIAL FISH CONCENTRATIONS

"Biological and Oceanographic Conditions for the Formation of Commercial Concentrations of Fish," edited by P. A. Moiseev, published in "Proceedings of the All-Union Research Institute of Marine Fisheries and Oceanography (VNIRO)," Vol. 60, Moscow, 1966.

It contains 25 papers by Soviet scientists on conditions for formation of concentrations,

behavior, and structure of fish. The major species covered are Pacific saury, cod, jack mackerel, herring, haddock, and black halibut.

Other topics are: peculiarities in biological system of Polar Basin and Soviet Northern Seas; force and speeds of migration of fish, dolphins, and whales; hydrochemical, hydrometerological, and hydrobiological characteristics of formation of primary production in marine waters; principles of classification of shelf zone; and underwater observations of the Bering Sea.

The book, TT 67-59063, costs $3, from NTIS.

THE PERCOIDEI

"Fishes of the Sea of Japan and Adjacent Areas of the Sea of Okhotsk and the Yellow Sea," Part 3, Telcostomi, XXIX, Perciformes, by G.U. Lindberg and Z. V. Krasyukova, published by Soviet Academy of Sciences in 1969.

The book covers the Percoidei, the most extensive suborder in the order of Perciformes. It includes 13 superfamilies; 10 of these are known from the Sea of Japan and adjacent waters. The book includes 55 families, 137 genera, and 248 species that comprise almost a quarter of the known species in the oceans under investigation. Keys to the suborders of Perciformes, to superfamilies of suborder Percoidei, and 10 of the 13 families are included.

The 498-page book, paperback, TT-31-50045, is $6 from NTIS. Hard-cover copies are $32 each from Keter Inc.

CRAYFISH

"Manual for Crayfish Catchers," by Jerzy Paladino, published in Warsaw in 1966, translated in Poland.

The book tells you how to distinguish between species of crayfish, their biology, including external appearance, internal anatomy, sexual organs and reproduction, development, habitats, distinction between males and females, and mode of life.

Also discussed are types of crayfish-catching gear, baits, packaging methods, and the legal and financial statutes and regulations covering crayfish in Poland.

The book, 67 pages, TT 70-55115, costs $3, from NTIS.

INDEX

BACK COVER: A sea of shells at Puerto Montt, southern Chile.

(FAO/S. Larrain)

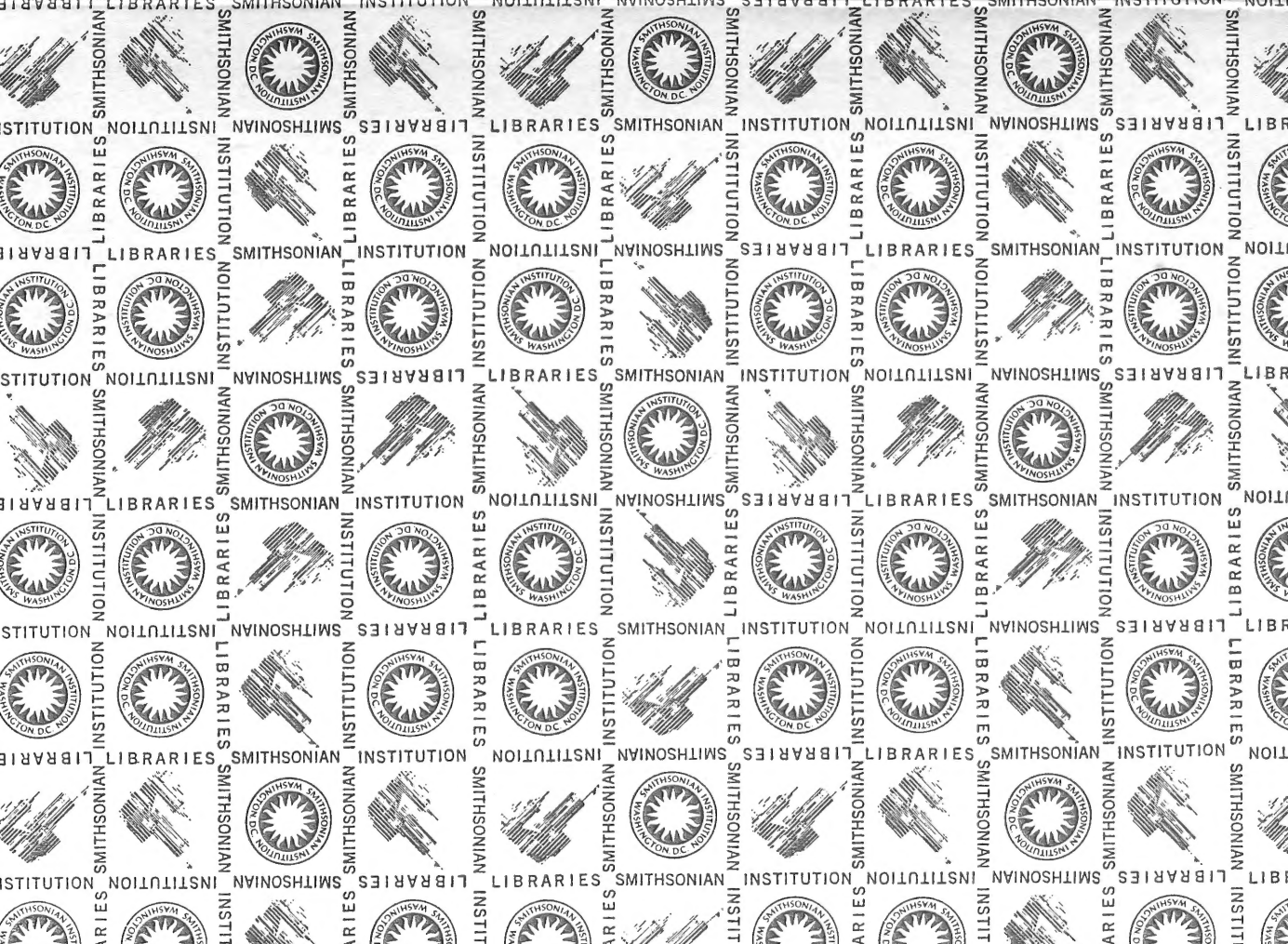
UNITED STATES
GOVERNMENT PRINTING OFFICE
PUBLIC DOCUMENTS DEPARTMENT
WASHINGTON, D.C. 20402

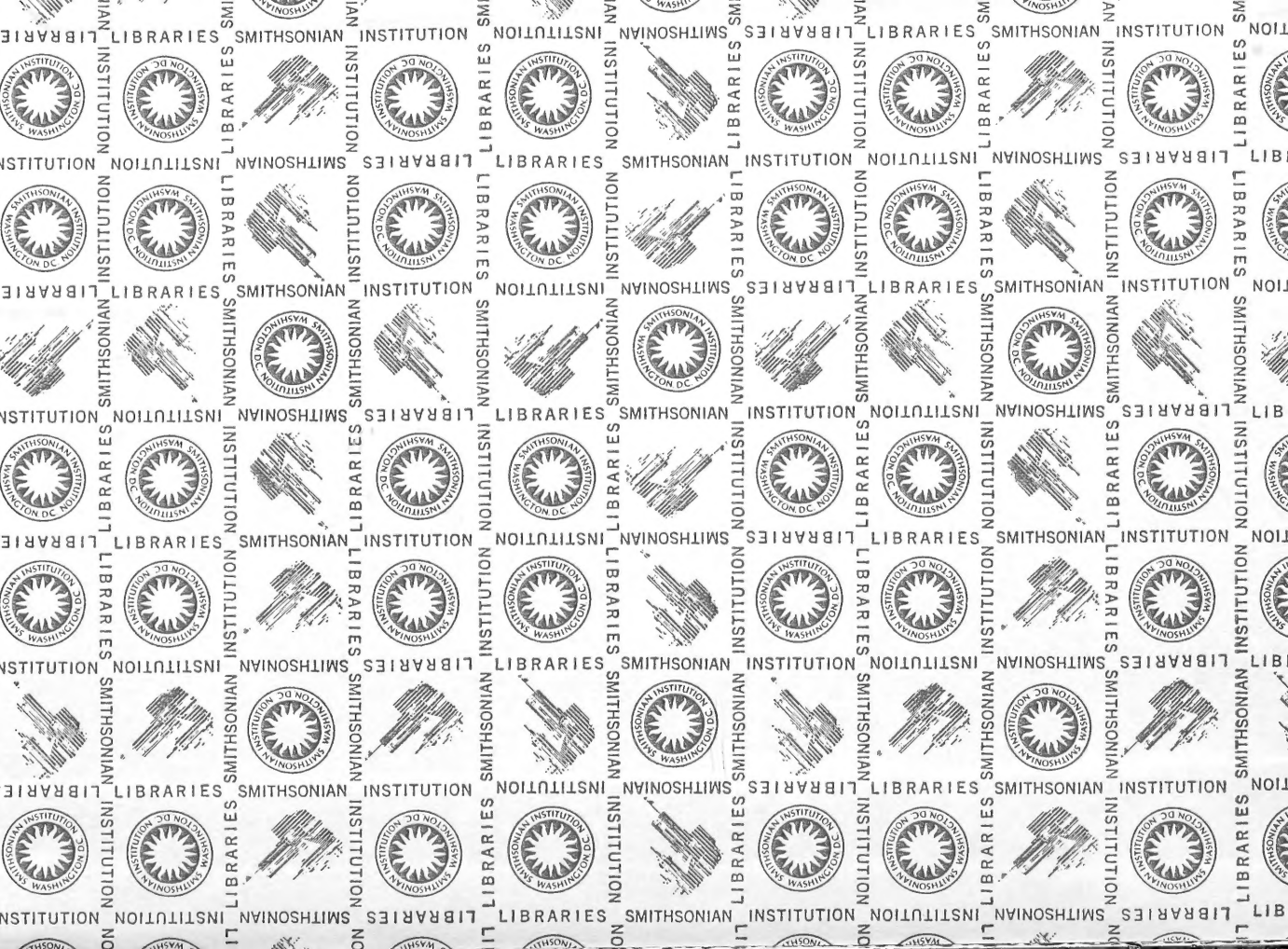
OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
U.S. GOVERNMENT PRINTING OFFICE

U.S.MAIL


SMITHSONIAN INSTITUTION LIBRARIES


SMITHSONIAN INSTITUTION LIBRARIES