COMMERCIAL FISHERIES *Review*

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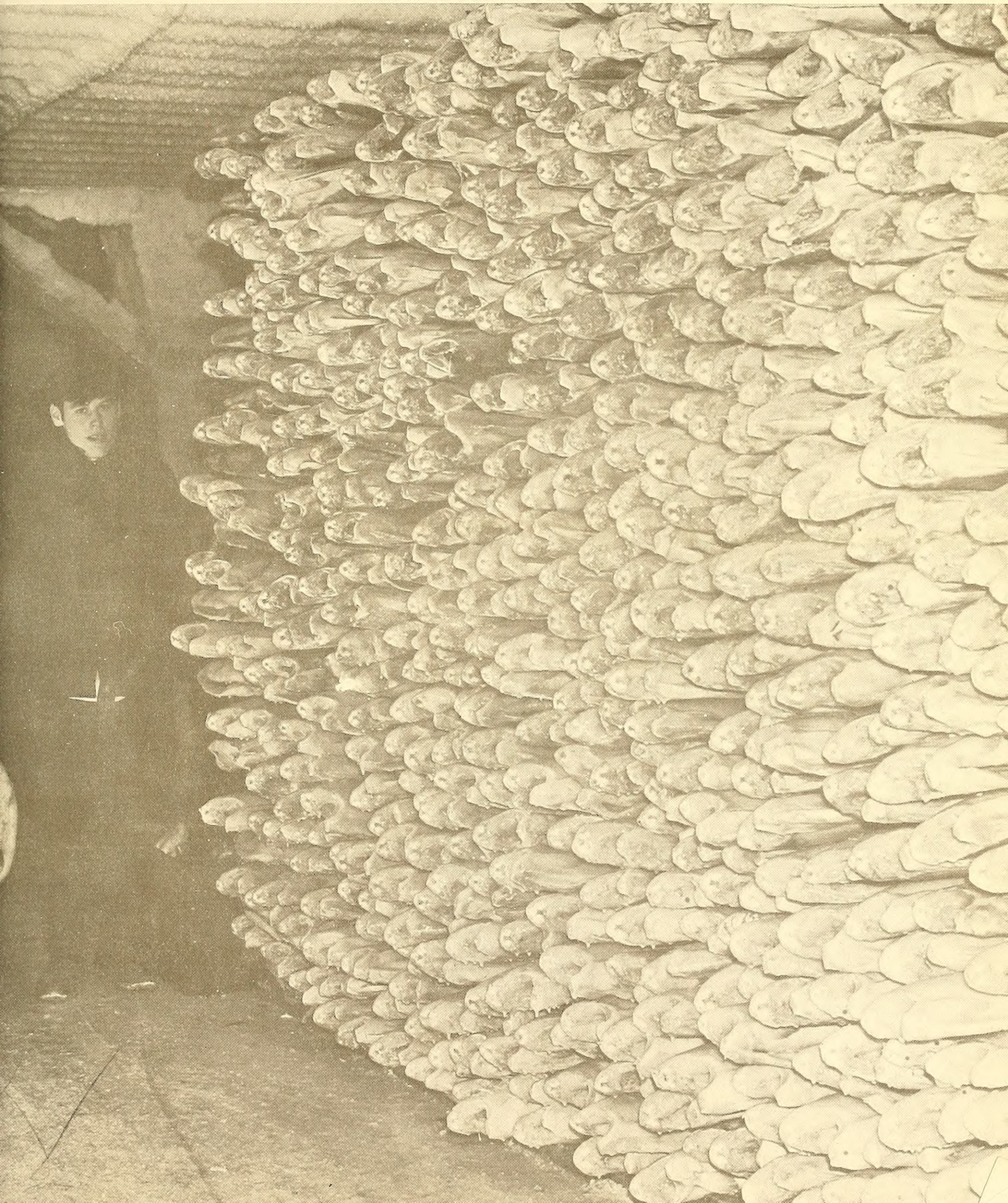

COVER: Cords of salmon are stored in this Juneau, Alaska, cold-storage plant. (BCF-Alaska photo: J. M. Olson)

COMMERCIAL FISHERIES

Review

A comprehensive view of United States and foreign fishing industries--including catch, processing, marketing, research, and legislation--prepared by the Bureau of Commercial Fisheries.

Fishermen's Memorial
Gloucester, Mass.

The Bureau of Commercial Fisheries and The Bureau of Sport Fisheries and Wildlife make up The Fish and Wildlife Service of The United States Department of the Interior.

Throughout this book, the initials BCF stand for the Bureau of Commercial Fisheries.

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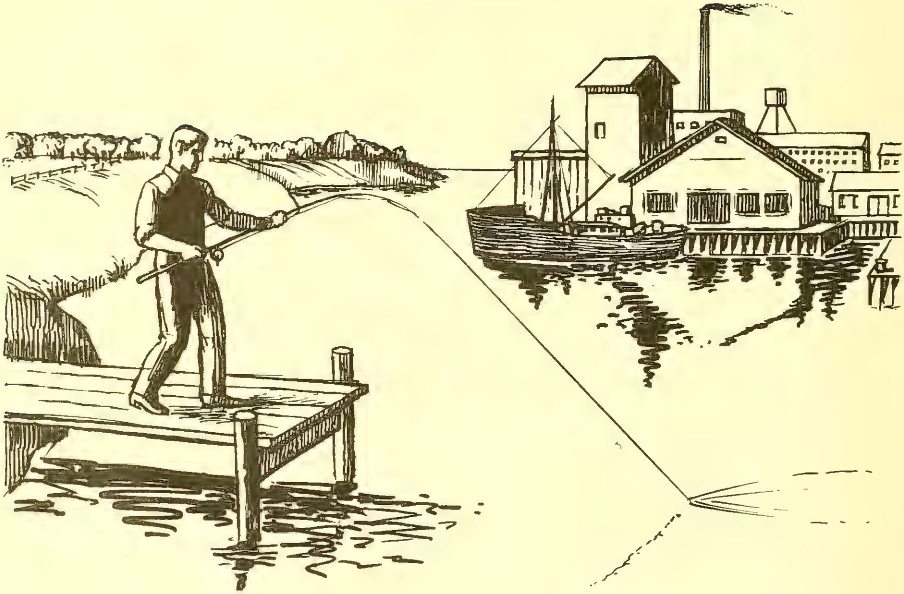


U. S. 1969 CATCH OF FISH & SHELLFISH IS 4.2-4.3 BILLION POUNDS

U.S. fishermen caught between 4.2 and 4.3 billion pounds of fish and shellfish in 1969. The catch brought them a record income exceeding $475 million and approaching $480 million. The previous record year was $472 million. These preliminary data were reported by BCF's Division of Statistics and Market News.

In 1968, 4.1 billion pounds sold for $471.5 million.

The 1969 catch was only slightly larger than the two previous low-volume years and the third smallest domestic catch since 1942. (Record catch--5.4 billion pounds in 1962.)

Some Sharp Declines

Landings declined sharply for haddock, sea herring, whiting, and sea-scallop meats at New England ports. In the Pacific Northwest, the salmon harvest ranked with the smallest of the 20th Century. Fishing for menhaden along the Atlantic Coast generally was poor, but the Gulf of Mexico catch was a record.

Some Good Increases

There were good increases in landings of anchovies, cod, halibut, jack mackerel, and tuna.

Shrimp Slips in Gulf of Mexico

Production of shrimp in the Gulf slipped below 1968 but, for the first time, fishermen received more than $100 million. The catch dropped also in the South Atlantic States, but the developing shrimp fisheries off New England and the Pacific Northwest kept the U.S. shrimp catch at about the 1968 level.

Total Supply Drops

The supply of all fishery products (round weight) was 12.6 to 13 billion pounds--about 25% below 1968's record 17.3 billion pounds. The loss was entirely in nonedible products--resulting from a 40-45% decrease in fishmeal imports. The supply for food was a little higher than 1968's $5\frac{1}{2}$ billion pounds. Of all fishery products, domestic fisheries accounted for 33% (24% in 1968); imports were 67% (76% in 1968).

Per-Capita Use & Consumption

It was predicted that per-capita utilization of all products (round weight) would drop 28%: from 87 pounds in 1968 to 63 pounds in 1969. Per-capita consumption would remain near the high 1968 level of 11 pounds per person.

PHILIP M. ROEDEL NAMED BCF DIRECTOR

Philip M. Roedel, Chief of California's Marine Resources Program, has been named Director of the Bureau of Commercial Fisheries. He succeeds H. E. Crowther, recently appointed Deputy Commissioner of Fish and Wildlife.

Roedel, 56, an internationally known fishery scientist and administrator, has been actively engaged in the fishery world for more than 30 years.

Secretary of the Interior Walter J. Hickel said: "Mr. Roedel is eminently qualified to head the Bureau. We know he will bring to this position the same talent and energy which has earned him such an enviable reputation in the fishing industry as well as in the scientific community."

He Sees Opportunity

Mr. Roedel said it was a great opportunity to join BCF at this time to help strengthen all aspects of the U.S. fishing industry. "Many problems face both government and industry. We must help the industry and, at the same time, make the best use of the resources available to us. We have to take a hard look at what we are doing now--to chart a course that will provide the best service in the future to our Nation and its people. We must select our goals and priorities carefully." He said he looked forward to working at the national level with all segments of the fishing business to achieve the goals selected.

Mr. Roedel, who had close professional associations with BCF for many years, emphasized his great respect for the organization and his pleasure at joining it.

Background

The new director received an AB from Stanford University in 1935. In 1936, he began his professional career as a marine biologist with California's State Fisheries Laboratory.

During World War II, he served in the Army 4 years, first as an enlisted man in the Medical Department, and later as a commissioned officer in the Medical Administrative Corps.

He resumed his professional career in 1946 and earned his master's degree in biological sciences at Stanford in 1952.

State, U.S., World Duties

Roedel held positions of increasing responsibility in California, specializing in marine fisheries. He served on U.S. delegations to international fishery conferences and as consultant to FAO.

He represented California at national fishery meetings and, in 1967 and 1969, on the U.S. State Department Fishing Industry Advisory Council.

He is the author of many scientific papers, a Fellow of American Institute of Fisheries Research Biologists, and a member of fishery societies and other scientific groups.

Director Roedel is married to the former Geraldine Harney. They have two children: David, 20, and Deborah, 18.

BCF SCUBA TEAM STUDIES LOBSTER BEHAVIOR

Studies of lobster behavior by a SCUBA team of BCF's Boothbay Biological Laboratory (Maine) show relative abundance of lobsters in the inshore waters remains constant throughout the year. This suggests that these lobsters do not make extensive seasonal onshore-offshore migrations.

Active At Night

Small-scale movements do occur during stormy weather and strong vertical turbulence in the water. During stormy weather, the divers saw lobsters occupying relatively shallow burrows in 40 feet of water or less move to greater depths. The movements generally involved horizontal distances of 100 yards or less, and an increase in depth of 20 to 30 feet. Lobsters were nocturnally active throughout the year. They left their burrows at about sundown and returned just before sunrise. Lobsters less than 45 mm. were not active at night.

5 GREAT LAKES STATES CONDUCT PESTICIDE MONITORING PROGRAM

The natural resources agencies of Michigan, Indiana, Illinois, Minnesota, and Wisconsin have mobilized a $300,000 pesticide monitoring program in the upper Great Lakes. Their targets: "Tributary streams to pinpoint major sources of pesticide pollution along this big body of water."

The states acted after the U.S. Food and Drug Administration seized more than 30,000 pounds of Lake Michigan coho salmon containing too much DDT.

DR. A. R. LONGHURST HONORED BY LONDON UNIVERSITY

The Senate of the University of London has conferred the Degree of Doctor of Science on Dr. Alan R. Longhurst, Director, Fishery-Oceanography Center, BCF, La Jolla, Calif. The degree honors his work in marine biology. Dr. Longhurst earned his Ph. D. at London.

SAFE-BOATING BILL PROPOSED BY TRANSPORTATION DEPARTMENT

The Secretary of Transportation has sent to Congress a Federal Safe Boating proposal. It would allow the Department to establish minimum safe standards for boats and equipment. The proposal includes a 5-year financial assistance program to encourage States to increase their safe-boating efforts.

INTERIOR ASKS CHANGES IN FISH PROTEIN CONCENTRATE RULES

The Department of the Interior has asked the U.S. Food and Drug Administration to permit the use of fish species besides hake in the making of fish protein concentrate (FPC). The notice was published in the 'Federal Register' Dec. 24, 1969.

Under current regulations, FPC may be manufactured only from "hake or hakelike" fish. Continuing research has shown that a safe and wholesome product also can be made from fatty fish, such as herring and menhaden.

Closer to Commercial Reality

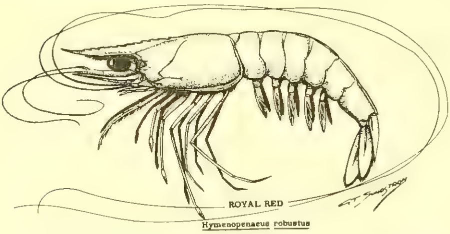
Dr. Leslie L. Glasgow, Assistant Secretary of the Interior for Fish and Wildlife, Parks and Marine Resources, said:

"Permission to use fatty fish, which are found in abundance off our shores, and small, bony, or other unused fish, will put industry into a more favorable position to get into the FPC business.

"We believe the United States must assume leadership in research to increase the world food base. The FPC research of our Department, which has had the benefit of advice from the National Academy of Sciences, is a firm step in the direction of that leadership."

ROYAL-RED SHRIMP CONCENTRATED IN 3 POTENTIAL COMMERCIAL AREAS

The royal-red shrimp (Hymenopenoeus robustus) is an underused species. Although it is a typical penaeid, it differs from commercial penaeids of the genus Penaeus because it prefers deep, cold water. It inhabits the upper Continental Slope from as far north



as Cape Hatteras, North Carolina, to as far south as the coast of the Guianas in South America. But it is abundant in only a few areas. Little is known of its biology, particularly its reproduction and early life history.

3 Potential Commercial Areas

Royal-red shrimp concentrations in the Gulf of Mexico were discovered in 1950. Since then, BCF's Exploratory Fishing and Gear Research Base, Pascagoula, Miss., has made periodic trawling surveys along the Continental Slope from North Carolina to Brazil to evaluate the commercial potential. The results indicate that three grounds off the U.S. coast support commercial quantities of royal-red shrimp: east of St. Augustine, Florida, in the western Atlantic; south-southwest of the Dry Tortugas in the Florida Straits; and southeast of the Mississippi River Delta in the Gulf of Mexico.

How Catch Divided

Preliminary records indicate the 1968 U.S. commercial catch of royal-red shrimp was less than 120,000 pounds (heads-off). Of this total, 53% came from the Mississippi River Delta area, 39% from off St. Augustine, and 8% from Dry Tortugas area.

Soft Bottom, 8°-12° C.

The distribution of royal-red shrimp is restricted to soft-bottom types and to water temperatures of 8° to 12° C. The highest shrimp concentration is in 9° to 10° C. water.

Shrimp densities vary seasonally on all three grounds. Late summer and fall are periods of high density on the St. Augustine and Mississippi Delta grounds; late spring and summer for the Dry Tortugas grounds.

Depth Distribution Varies Seasonally

The depth distribution of shrimp also varies seasonally: the shrimp move offshore in summer and inshore in winter. Shrimp occur at 255 to 550 meters on St. Augustine grounds; 275 to over 550 meters on Dry Tortugas; and at 275 to over 550 meters on Mississippi Delta area. Within each range, seasonal variation in concentration is considerable.

BLUE CRABS ABOUND IN CHESAPEAKE BAY

Blue crabs are more abundant in Chesapeake Bay now than at any time in the past 90 years. Not since commercial fishing started in the 1870s have so many been reported.

This bountiful supply was predicted in October 1968 by W. A. Van Engel of the Virginia Institute of Marine Science, and Robert L. Lippson of Maryland's Chesapeake Biological Laboratory. The 2 scientists predicted a Virginia-Maryland catch--barring trouble from weather, labor, and markets--of over 100 million pounds from September 1969 through August 1970. The previous 12-month high was $97\frac{1}{2}$ million pounds in 1966. They also predicted the catch could remain high through December 1970.

Hatched In 1968

Many of the crabs hatched in 1968 had reached mature size by September 1969; these will support the commercial fishery until early summer 1970. Crabs hatched late in 1968 will reach maturity in early summer 1970, supporting the fishery until the end of the year.

Catch Doubled in Fall 1969

This abundance follows almost 2 years of scarcity--1968 and first two-thirds of 1969--when production fell to less than half former levels, and prices rose to record highs. Through November 1969, crab potters already had doubled their fall 1968 catches. The winter dredge fishing began on December 1, 1969. Virginia vessels should have been able to take the 25 barrels a day per-boat-catch limits in record time.

Hurricane Damage

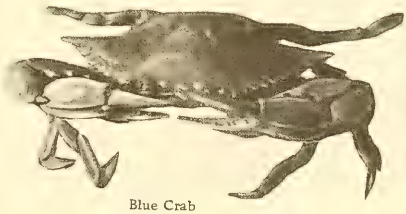
Van Engel warned that the full effect of Hurricane Camille on Virginia stocks may not yet be known. Torrential rains and high runoff caused substantial reductions in river and bay salinities. This resulted in some freshwater kill of crabs on the James and York rivers. Since experimental trawl and dredge surveys have not located as many crabs as expected, the kill might have been even greater than originally thought.

Crab dredge boat.

Poor 1969 Hatch

Van Engel and Lippson are pessimistic about the 1969 hatch, which will provide the fishery from September 1970 through August 1971. Surveys made in fall 1969 failed to locate more than a few small crabs $\frac{1}{3}$ to $1\frac{1}{2}$ inches wide, about the same number found in fall 1966 and 1967. The small numbers in those years resulted in the scarcities of 1968 and 1969.

Both states expect to keep a close watch on the new crop during 1970. The prospects, good or poor, for the season starting September 1970 should be discernible in early summer 1970.



Blue Crab

'DELAWARE II' MAKES LARGE BUT NOT PROFITABLE SEA-HERRING CATCHES

The Delaware II of BCF's Exploratory Fishing and Gear Research Base (Gloucester, Mass.) conducted industrial-fish investigations in the western Gulf of Maine between Sept. 30 and Oct. 31, 1969.

Fifty-nine tows caught 0 to 60,000 pounds of herring per tow. Despite large catches, the scientific personnel emphasize: "At current market prices for industrial fish species, the fish caught during this cruise would not have equaled the size of catch needed for profitable commercial operations. However, the demonstrated capabilities of the midwater fishing method should be adequate and suitable for commercial use at times and in areas whenever herring can be found in some abundance. The next scheduled industrial fish cruise is planned to continue evaluation of the suitability of this fishing method in areas of seasonal herring abundance."

Cruise's Primary Purpose

The primary purpose of this cruise was to evaluate the commercial potentials of the midwater trawl fishing method for taking fish species of value for reduction to meal and oil. A closely associated objective was refinement of the midwater trawling technique.

Tows & Catches

The tows varied from 20 minutes to 4 hours; larger catches were made on fairly short tows on good traces of fish.

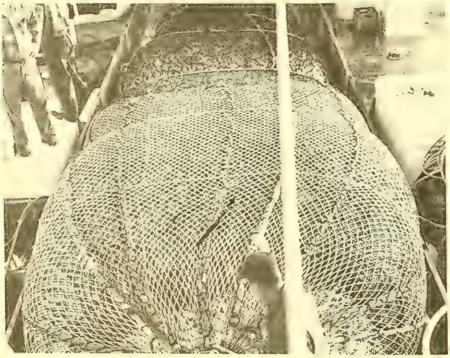


Fig. 1 - A 55,000-pound catch of sea herring.

The two largest catches--60,000 and 55,000 pounds--were taken on 40-minute sets; these short sets were terminated to prevent overloading the net.

A total of 322,188 pounds of fish were caught: 307,627 pounds herring; 12,380 pounds mackerel, 1,380 pounds whiting, 134 pounds cod, and 667 pounds other species.

Cruise 69-9 was broken from October 10 to 17 for shipyard installation of a transducer for the scientific sounder and to change scientific personnel.

Fishing Gear Used

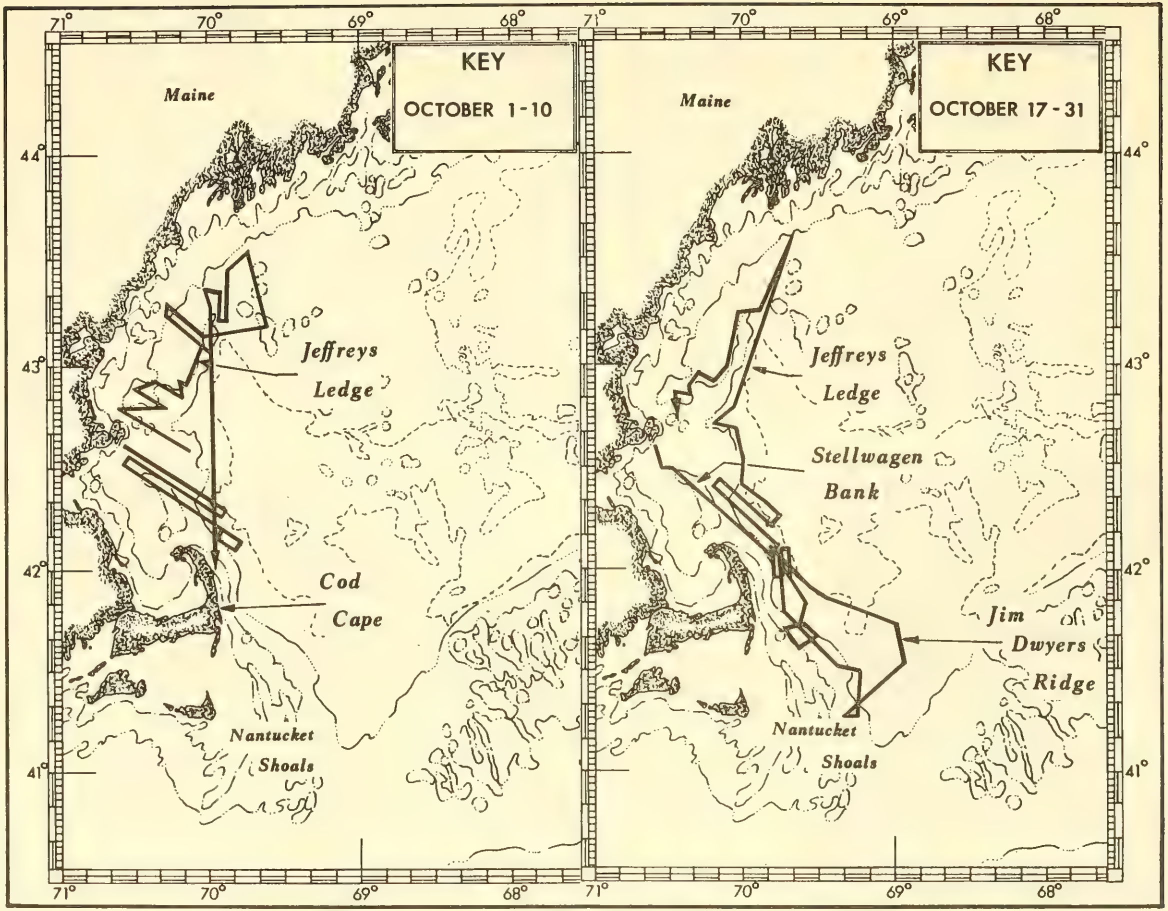
A medium-sized, West German-type midwater trawl was fished exclusively. This 4-seam (Herman Engel) net measures 1,400 meshes around the net at the front of the bellies. Mesh size is 8 inches (stretched mesh) in the wings and forward part of the bellies. The mesh tapers from 8 inches to $1\frac{1}{2}$ inches in the lower part of the bellies, extension, and cod end. The length of the net (from tips of wing ends to extremity of cod end) is about 380 feet.

A set of "beefed-up" 8-foot (height) by 4-foot (width) Suberkrub doors was used to spread this net. Although these doors were very stable while fishing, it is recommended that larger size (10' x 6') doors should be used. The larger doors should give greater horizontal opening to the net.

Improved lifting devices on headrope with heavier chain on footrope should increase net's vertical opening from 7 fathoms generally experienced during cruise to perhaps 10 fathoms. With higher and wider opening, larger catches could be made in less time. This would be feasible only if straining the extra amount of water did not increase the net's drag beyond vessel's towing capabilities.

Fishing Procedure

An acoustical search was conducted to find good fish traces before the net was set. During this cruise, the productive areas located were fished much more intensively than during earlier cruises. Fishing was broken off and scouting begun only when good fish targets


KEY
OCTOBER 1-10
Maine
Jeffreys Ledge
Cod Cape
Nantucket Shoals
KEY
OCTOBER 17-31
Maine
Jeffreys Ledge
Stellwagen Bank
Jim Dwyers Ridge
Nantucket Shoals
71°
70°
69°
68°
44°
43°
42°
41°

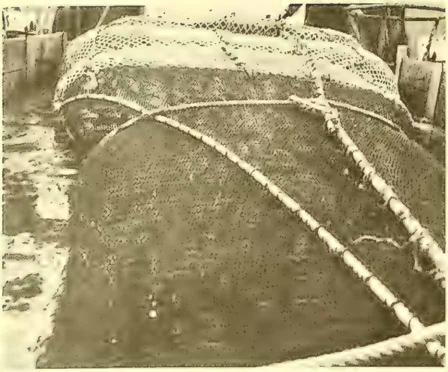


Fig. 3 - A 20,000-pound herring catch.

could no longer be found. While fishing on good signs of fish, the tows were terminated when a fairly good catch had been made. The crew avoided making the largest catch possible because of handling difficulty and time lost in bringing very large catches aboard. For the Delaware II's present catch-handling arrangement, 20,000 to 30,000 pounds are fair-sized catches for ready handling.

Area Fished

Three areas were generally scouted and fished when fish concentrations were found: Jeffreys Ledge, Stellwagen Bank, and eastern offing of Cape Cod and Nantucket Shoals.

The most productive area was in offing of Cape Cod between Highlands and Nauset. However, foreign fleets had just recently heavily fished these areas (outside 12-mile Contiguous Zone). Each fleet had departed in a generally successive north-to-southward movement. The foreign fleet was reported concentrated in offing of Martha's Vineyard to Block Island.

Near the end of the cruise, a quick look was taken over Jim Dwyer's Ridge (on eastern side of Great South Channel). Only scattered traces of fish were found; samples were mostly whiting.

Results and Observations

Cruise results were excellent in regard to primary purpose. In areas recently fished heavily by foreign fleets, a daily production rate of 70,000 pounds of herring was maintained on October 7, 8, and 9. The largest catches curtailed production because of excessive time lost bringing the catches aboard. If herring were available, the midwater trawl probably could catch as many fish during a set as any boat could bring aboard. Each vessel's capability would depend on how the vessel was rigged.

Herring's Behavior

Sustained and uninterrupted fishing production depends largely on the herring's continuous availability. It was found that availability is not simply a matter of supply--but also of the herring's schooling behavior. During bright days, herring were found to be hard on the bottom during midday hours. They bunched up in the afternoon, and rose to surface in large concentrations during late afternoon and early evening. Upon reaching surface, the herring spread out and dispersed in a shallow surface water layer. As light increased in the morning, the fish gathered in small groups to return to the bottom. The groups that left the surface seemed to consolidate into larger schools before dispersing over the bottom. On dark and overcast days, the fish tended to remain in lower levels of water column without settling to bottom. On bright moonlit nights, they were slow in rising to surface. In any case, the fish were most susceptible to capture between bottom and surface. A successful technique for surface trawling at night (when developed) could extend production hours correspondingly.

Night Trawling Caught Mackerel

Mackerel predominated during nighttime trawling; one tow took 6,000 pounds. It is possible that mackerel may occur at different distances than herring below the surface. So an improved surface-towing technique could increase nighttime herring catch over mackerel catch. However, the market value should determine which fish would be primary target.

ANCHOVY--SMALL FISH, BIG PROBLEM

James D. Messersmith

A small but valuable fish of great interest to sports and commercial fishermen has been the subject of considerable concern in California recently. This is the anchovy--more properly known as the northern anchovy or Engraulis mordax.

It might be said that the basic use of the anchovy is as food for larger fish. Sportsmen are interested in the anchovy because it is the most desirable live bait available, and they yearly use more than 5,000 tons as live bait.

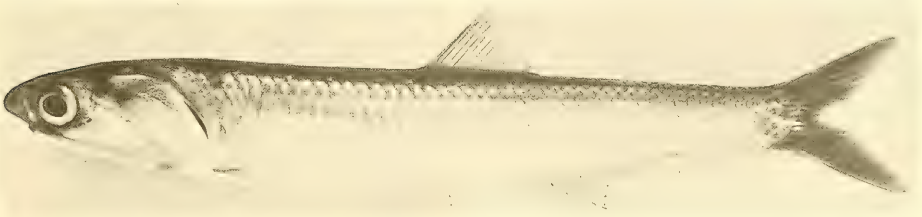
The anchovy also supports an important commercial fishery. Some of the commercial catch is canned, primarily for export, and a share is used in canned pet foods. In addition, huge quantities of the fish are reduced for use as a protein supplement in animal and poultry foods and for fertilizer.

The controversy is intensified because the anchovy is important as forage for fishes of interest to sportfishermen and because of the history of the overharvested Pacific sardine resource.

What happened to the sardine?

The sardine fishery reached its peak in California in the thirties and early forties. In 1936 Dr. Frances N. Clark, then director of the State Fisheries Laboratory, predicted a decline of the sardine fishery on the basis of studies she made on the catch-per-effort of fishing boats. It had become increasingly more difficult for the boats to make high catches by that time. A succession of exceptionally good years delayed the decline, but the sardine fishery eventually collapsed.

Then, as now, the Fish and Game Commission and the Department of Fish and Game were in favor of scientific management of fisheries, but they were unable to achieve a curtailment in the rate of harvest, and this contributed to the collapse.



(DFG photo: Jack W. Schott.)

During the past few years a spirited controversy over the anchovy has arisen among special interest groups concerned with fisheries. This controversy revolves around:

1. Recommendations by state, university, and federal marine scientists that a larger percentage of the available anchovy resource be harvested;

2. Requests by the fishing industry for larger reduction quotas; and,

3. Unyielding opposition to such proposals by sport fishermen who use anchovies for live bait and chum.

Although the sardine population was allowed to decline, this does not mean now that nothing should be harvested. While scientific management implies that resources must not be overharvested, it also implies that resources should be utilized fully.

The Department's position is still consistent. It is still in favor of management--in favor of not overharvesting any of the marine resources--and in favor of not "giving away" the anchovies, either.

Mr. Messersmith is Assistant Chief, Marine Resources Branch, California Department of Fish and Game.
Article reprinted from OUTDOOR CALIFORNIA, Sept.-Oct. 1969.

Reliable records of commercial anchovy landings used for human consumption, dead bait, feeding in fish hatcheries and mink farms, and reduction to oil and meal date from 1916. Average annual landings through 1921 were only 504.5 tons, mostly for reduction to oil and meal.

In 1919 a law was passed prohibiting the reduction of whole fish except under permit. Teeth were put into the law in 1921, resulting in reduced landings averaging 159 tons for the next 17 years. Between 1939 and 1946, landings averaged 1,454 tons.

Fig. 2 - DFG biologist inserts a metal tag in an anchovy to record its movements.
(Photo: Bill Beebe, Santa Monica Outlook.)

Scarcity of sardines in 1946 caused processors to begin canning anchovies in quantity, and in 1947 the catch jumped six-fold to 9,470 tons. The landing capacity of the fishing boats exceeded the canning needs of plants, and excess deliveries were diverted to reduction plants.

To lower the amount of anchovies reduced, the Fish and Game Commission required each processor to place a high proportion of each ton of anchovies in cans.

With the temporary resurgence of the sardine through 1951, anchovy canning declined. But with the collapse of the sardine fishery in 1952, anchovy landings increased to 27,891 tons and to 42,918 tons in 1953.

Because of economic conditions and presumably low consumer acceptance of the canned product, landings declined to 19,400 tons in 1957 and 5,200 tons in 1958. Landings did not again exceed 5,000 tons until 1966 when, for the first time in more than forty years, anchovies were fished solely for reduction purposes.

Anchovies are very important in California as live and dead bait. Records of the live bait catch were initiated in 1939 and, except during World War II, have been submitted voluntarily ever since. These records account for most of the catch, but are not complete because some operators do not submit records.

When records were first started, live bait landings were 1,074 tons and accounted for 58 percent of the statewide anchovy catch. Since 1950, anchovy live bait landings have fluctuated between 3,800 and 6,800 tons, averaging 5,570 tons for the past several years.

Why the interest in harvesting anchovies in large quantities?

In 1964 the California Cooperative Oceanic Fisheries Investigations (CalCOFI) Committee proposed an ecological experiment to assist the return of the sardine by simultaneously reducing fishing pressure on the sardine and imposing pressure on the sardine's chief natural competitor, the anchovy.

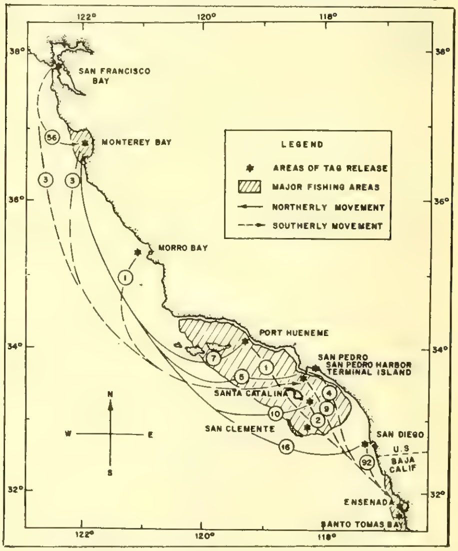


Fig. 3 - DFG chart depicts gross movements of anchovies tagged and recaptured from March 14, 1966 through May 31, 1969.

The proposed experiment consisted of three phases:

1. A controlled anchovy harvest of 200,000 tons with an annual quota for approximately three years.

2. Quota adjustments on the basis of findings during phase 1.

3. Restoring ultimately the predecline balance between sardines and anchovies and maximizing the harvest of both species consistent with all uses.

CalCOFI noted that if both the sardine fishery and competition from anchovies are affecting the sardine population--and if the objective was to bring back the sardine in the shortest possible time--there should be fishing on anchovies and a complete moratorium on sardine fishing.

At the time of this proposal the total spawning biomass of anchovies in the California Current was estimated to be between 1.8 and 2.25 million tons based on egg and larva data available through 1958. (The anchovy population continued to increase since 1958, and in 1962 it reached a plateau roughly 2.5 to 4 times greater than the 1958 estimate. It remains there today.)

In 1965 the Fish and Game Commission adopted regulations providing for an experimental fishery to take and use 75,000 tons of anchovies by a reduction process. Thus the anchovy reduction fishery began, and zones were established. A season was set and fishing was prohibited within three miles of the mainland shore.

When the Commission authorized the anchovy reduction fishery, the Department of Fish and Game initiated a project responsible for monitoring the fishery and conducting any biological studies on the anchovy necessary for resource management.

Project objectives included determination of migratory habits, estimates of population size and mortality rates, catch locations, catch per unit of effort, number and pounds of anchovies landed, the age-composition of the catch, and other fishery statistics. Initial efforts were directed toward tagging and tag recovery, and fishery monitoring of the commercial reduction and live bait fisheries.

Fig. 4 - This commercial fish net holds between 60 and 80 tons of sparkling anchovies. The average size is $5\frac{1}{2}$ to 6 inches. (DFG photo: The author.)

When the Fish and Game Commission established the reduction fishery, it laid down rules under which the fishery was to operate, rules based on the state of the Department's knowledge of the resource and of fishing methods.

For example, an experimental reduction fishery was authorized because of the consensus that there was a large under-utilized resource. Quotas were set and processor permits were required in order to control the growth of the fishery. Declarations of intent were required of fishermen when it became apparent that it would simplify enforcement problems.

Fishing zones were established because, in the absence of migration data, it was thought necessary in order to prevent overfishing in local areas, especially where these areas bordered prime live bait fishing grounds.

The concern was that areas bordering the live bait fishing grounds might be depleted and that they may not be replenished, by migrations, during the closed season and prior to the critical live bait period of July and August.

At a meeting of the Commission in San Diego on July 25, 1969, DFG Director Ray Arnett said, "It is my contention that we now know enough about the anchovy movements and the reduction and live bait fisheries to state that a reduction fishery of the magnitude proposed has no effect on the live bait fishery."

He said the 1968 live bait fishery was the best on record.

"To help understand anchovy movement behavior," he said, "a tagging program was begun in March of 1966. Since then we have tagged nearly 400,000 anchovies and recovered 959 tags. . .We have learned that anchovies can and do move long distances (360 miles, for example, from San Diego to Monterey) in a short period of time (129 days, or 2.8 miles per day).

"In the light of these data, it is apparent that the zones do not provide the function for which they were created, at least as long as the season remains unchanged and the fishery continues to operate farther from shore than three miles."

Arnett said the three-year experimental program has cost about $285,000, largely license buyers' money. Patroling these zones costs approximately $60,000 each year, and the tagging program runs about $35,000 annually.

"Therefore," he said, "since the consensus is that zones no longer contribute a useful function to this experimental fishery, we recommend abolishing them."

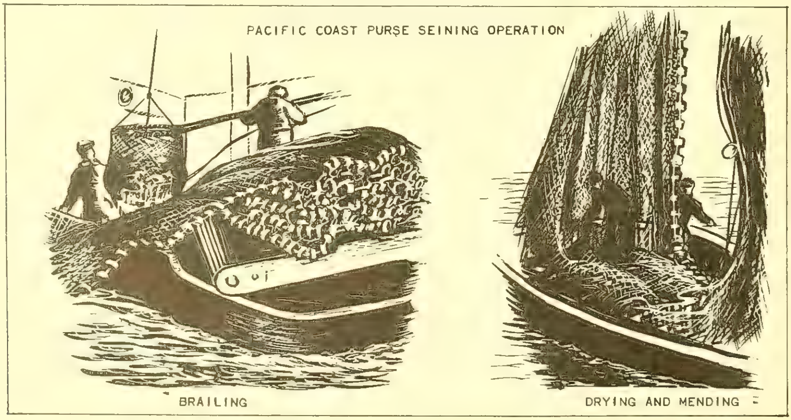
While the Commission at that meeting did not abolish the zones, it referred to the experimental nature of the fishery and reduced the number of zones from five to three.

Arnett called the Commission's action a "workable compromise" between the Department's proposal and the desire of most sportsmen to retain the five zones.

What of the future? Will the controversy over the little anchovy continue?

Top DFG biologists look to the future with confidence. While the ocean is not a bottomless cornucopia, scientific findings point toward the existence of anchovy stocks that could support a commercial fishery greater than has ever been known in this state. And they have no reason to believe that their harvest would impinge on the legitimate requirements of sportfishermen, given only realistic controls by reasonable men.

The anchovy will not go the way of the sardine. On the contrary, judicious harvesting of the anchovy could some day lead the sardine back to a position of prominence in the coastal waters of California.



SQUID RAISED TO ADULT SIZE IN LABORATORY

One of the most important animals used in medical research--the squid--has been reared to maturity in the laboratory for the first time. Edward T. LaRoe, a graduate student at the University of Miami, has succeeded in aquarium-rearing the fast-moving, excitable Sepioteuthis sepioides, a member of the family Loliginidae from egg to adult size.

Useful in Neurological Research

Because squid have the largest nerve fibers of any animal (over 1,000 times thicker than human nerves), they are in great demand for neurological research. But the nerve fibers must be fresh, and the availability of fresh squid is a critical problem.

Seasonal & Easily Damaged

The occurrence of squid in the sea is seasonal. Loliginids are found off the northeast U.S. only in summer. During the winter, entire research teams must go to Chile and Peru for fresh squid. Squid generally undergo a true physiological shock when captured, and often are damaged by the trawls used to catch them. Once in an aquarium, they tend to swim head-on into the glass walls.

Aquaria May Provide Steady Supply

Researchers studying behavior, learning, and memory processes also need aquarium-adapted squid. With its well-developed brain and eyes, the squid has great potential for such studies. In demonstrating that laboratory-reared squid adapt to aquariums, LaRoe may have discovered a way to provide researchers a year-round, healthy supply.

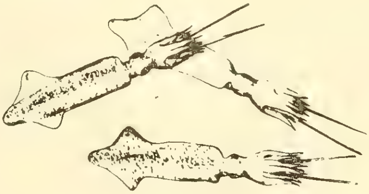
Squid reared from the egg by Edward T. LaRoe. At this age, 125 days, the squid is fed small fishes.

Benefits Commercial Fishery

Squid, valued as food in many parts of the world, is the 5th most valuable fishery product in Japan. LaRoe is gathering data on growth, food preferences, light requirements, and behavior patterns that, ultimately, will benefit the commercial fishery. He already has proved that the tropical loliginid squid grow much faster than previously believed. His squid reached maturity within 5 months after hatching, disproving a long-held theory that it took 3 years.

Laboratory Techniques

LaRoe feels his success has been due largely to his discovery of proper types of food for young squid. He feeds them small shrimp-like animals (mysids). By the time a squid is 5 days old, it will eat 50 mysids a day. Constantly studying the behavior patterns of the hatchlings, he has found certain things they prefer or like. He has adapted his rearing program to the needs of the squid.



Squid

1969 PACIFIC COAST ALBACORE TUNA CATCH IS ABOUT 24,000 TONS

Fall weather in 1969 settled on the U.S. Pacific Coast in October. It terminated virtually all fishing activity in Washington and Oregon waters. But relatively good weather off central California permitted a fleet of about 50 jigboats to continue fishing for albacore into the first week of December.

The 1969 season promises to tally between 48 and 49 million pounds (24,000-24,500 tons), reports Glenn A. Flittner, Leader of the Fishery-Oceanography Group, BCF La Jolla, Calif. Oregon and Washington again led the production race in 1969 with about $34\frac{1}{2}$ million pounds (17,250 tons). California landings pulled up from an extremely poor start of 200,000 pounds (100 tons) in July 1969 to an estimated $11\frac{1}{2}$ to 12 million pounds (5,750-6,000 tons) when December totals were included; nevertheless, the late-season finish failed to equal the 1968 season. The 1969 season was the worst on record in the state since 1942. British Columbia albacore landings totaled 2.4 million pounds (1,200 tons). Thus, despite heavy fishing effort again in 1969, the season's totals fell right on the 1963-68 average of 48 million pounds (24,000 tons).

Production Centers Dislocated

For the third consecutive year, major dislocations in the centers of production were observed. BCF La Jolla estimated that nearly half the entire season's production originated from waters north of Cape Flattery and off Vancouver Island; less than $\frac{1}{2}$ million pounds (250 tons) originated from the district south of San Juan Seamount. The farthest northward penetration of the albacore commercial fishery was recorded in 1969: in the district northwest of Dellwood Hills, near $51^{\circ}30'$ N. latitude, off northwest corner of Vancouver Island. A few albacore were even taken inside Hecate Strait in late August 1969.

Larger Fleet

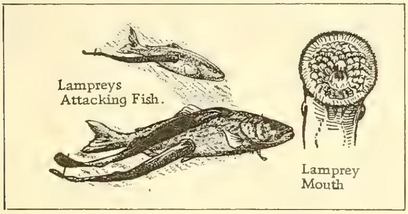
BCF La Jolla estimates the albacore fleet in 1969 was larger than usual. The regular fleet was augmented by an appreciable number of Oregon, Washington, and British Columbia salmon trollers, and a few halibut schooners. Total fishing effort was estimated to be higher than normal. The 1969 middling catch was distributed more unevenly among participants than in 1968. Also, the 1969 season lasted appreciably longer than in 1968; this added to production costs that were not offset by other factors.

SEA LAMPREY PREYS ON LAKE HURON SALMON

Sea lamprey depredation on chinook salmon in Lake Huron is increasing. BCF scientists found 68% of the chinook from a recent catch bore lamprey scars or marks. Michigan Department of Natural Resources biologists report that over 90% are scarred in some areas of the lake. The salmon were planted in 1967.

The Lamprey

The adult sea lamprey, an eel-like parasite with sharp rasping teeth, feeds on the blood of its victims, weakening and often killing them. Entering through the St. Lawrence,



it has preyed on fishes in Lake Ontario for centuries. The deepening of the Welland Canal between Lakes Ontario and Erie during 1913-18 apparently provided the means for lampreys to enter the upper Great Lakes.

Control

Lamprey control, a joint U.S.-Canadian venture, dates from 1965, when a once-prosperous lake trout fishery had been virtually destroyed. While some trout still remained in Lake Superior, commercial catches in Lakes Huron and Michigan had dropped to less than 1% of 1930-1939 levels. About 68 million pounds were taken from the 2 lakes in those years.

Lampricide Treatment

Lamprey hatch in tributaries, where they remain for several years before transforming into the parasitic stage and migrating into the lakes. A chemical lampricide that is highly effective against the young lamprey was discovered in 1958. Properly applied, it is harmless to other fish. Chemical control was extended from Lake Superior to Lake Michigan in the 1960's; it reduced the lamprey population as much as 80-90%. While the lampricide has been used in some of Lake Huron's tributaries, many are still untreated.

OCEANOGRAPHY

NEW FILM IMPROVES UNDERWATER PHOTOS

A new film "that could help make aerial charting the most efficient method of charting shallow water areas" has been created by a technologist of the U.S. Naval Oceanographic Office (NOO). The film is insensitive to all blue light.

Willard E. Vary, the technologist, has been working in NOO experiments photographing coastlines from aircraft to chart coastal areas.

His search for a solution to the blue-light problem began after NOO's first airborne charting test in March 1967. To record ocean-bottom detail at greatest water depths with aerial photography, that test revealed, it would be necessary to filter out all or most blue light.

He Explains Problem

Mr. Vary explained:

"Aerial haze is caused by blue light scatter in the air. In the water, the blue light is the most scattered and least absorbed and this is referred to as underwater haze. These effects of blue light result in non-image-forming densities on the photographs and cause veiling or lowering of contrast in the photographs. Yellow filters on the camera partially eliminate the blue light but also decrease the exposure, often resulting in underexposed photography."

Since increased yellow filtration was not the answer, Vary thought of eliminating the blue-sensitive layer in the color film. "Color films have three layers," he explained. "One layer records the red light, one the green light and the other records the blue light. I thought it would be possible to eliminate the blue layer altogether and, with a yellow filter layer coated over the green and red sensitive layers, blue light would be prevented from affecting those layers."

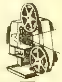
Film Tested Successfully

The General Aniline Film (GAF) Corporation devised a film to meet his specifications. The new film was first used successfully in February 1968 in the Bahamas to take continuous stereo photographs of the coastal area.

Vary reported: "We recorded ocean bottom to a depth of 150 feet. The increased contrast provided by the new non-blue-sensitive film showed various underwater features in more detail."

Major Charting Method

With the new film, NOO believes, "aerial photography may now be on its way to becoming a major method of charting the ocean bottom and measuring water depths."



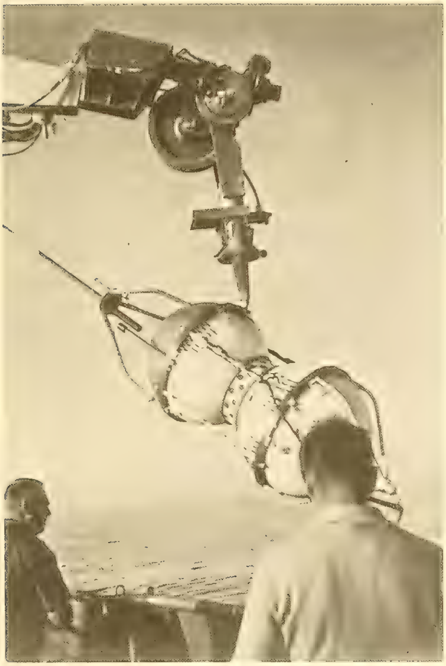
ANTARCTIC TIDES ARE BEING MEASURED

Man's first attempt to measure tides in the deep oceans surrounding Antarctica is being carried out along a 2,000-mile track running south from Australia.

Three free-falling, deep-sea, tide gauges, or capsules, were launched from the RV 'Eltanin' after her departure from Adelaide on Dec. 15, 1969. Placed 600 miles apart, at depths of 18,000, 12,000, and 15,000 feet, they will remain on the ocean floor for one lunar month.

Sophisticated Instrumentation

The gauges were designed by Frank E. Snodgrass, a research engineer with Scripps Institution of Oceanography and chief scientist aboard (Fig.). They are 'free' vehicles, not tethered to the ship. Their capsules, or hulls, are pressure-resistant aluminum spheres. Instruments attached to the capsules are measuring water temperature, current, and pressure. The capsules, which communicate with the 'mother' ship through acoustic signals, describe their operations and condition. Commands from the ship will cause them to surface at the end of the experiment. Data recorded on magnetic tape in the capsules can be computer-analyzed after recovery.



The 3 deep-sea tide gauges are similar to the one shown here. Out of photo at lower right and attached to capsule is set of storage batteries that anchors capsule on ocean floor and provides power for operating instruments and data-recording apparatus in capsule. Battery pack-anchor remains on sea bottom after capsule is recalled to surface. Frank E. Snodgrass, capsule designer, is at left.

Current Meters

Free-falling current meters also will be installed along the Eltanin's track to supplement current measurements made by the tide gauges. Similar metering was done in the Drake Passage (between the tip of South America and the Palmer Peninsula) in January 1969. From data recorded by meters placed $2\frac{1}{2}$ miles down, it was estimated that 270 million gallons of water a second flow through the Drake Passage from the Pacific to the Atlantic.

Studying Flinders Current

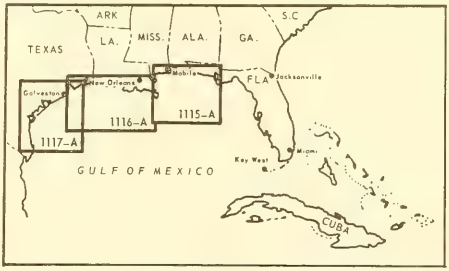
Australian scientists aboard the Eltanin are studying the Flinders Current south of Australia. They are installing gauges across the 150-mile-wide continental shelf near Adelaide and making extensive salinity, temperature, and depth measurements.

Mapping Sea Floor

A scientist from the Lamont-Doherty Geological Observatory is taking magnetic, seismic, and gravity readings while the ship is underway. This is part of a continuing program to map the sea floor and the earth's magnetic and gravity fields.

CHARTS LIST OIL-LEASE AREAS IN GULF OF MEXICO

The Coast and Geodetic Survey has announced that it will issue nautical charts before the end of 1970 showing virtually all offshore oil-lease areas in the Gulf of Mexico. The charts will cover an estimated 161,444-square-mile area containing thousands of oil wells and platforms. They will not show oil-lease areas in river estuaries, bays, inlets, etc.



ESSA Coast and Geodetic Survey nautical charts will show location of virtually all Gulf of Mexico offshore oil lease areas.

New overprinted charts, 1115-A and 1117-A, add oil-lease areas to already-existing charts 1115 and 1117.

Chart 1115-A shows the area off Mississippi and Alabama. Publication was scheduled for December 1969.

Chart 1117-A shows the area off Texas. It probably will be published in August 1970.

Chart 1116-A shows the area off Louisiana and northeast Texas. It has been available since 1957. Since an oil-lease area is referred to as a lease block, 1116-A has come to be known as the "Block Chart."

Heavy Demand

Demand for the Block Chart has increased greatly in recent years. Requests have come from operators of shrimping and fishing craft, tug boats, and other vessels frequenting the area. Originally, the lease blocks were added to help maintenance craft locate a lease area or oil rig for servicing.

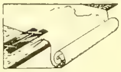
How It Works

There are more than 2,400 platforms in the Gulf of Mexico. Each carries a large sign with the owner's name, the area, and the block number. A block is generally $2\frac{1}{2}$ miles square. The chart carries the block number; any boat operator can determine his position in the square by identifying a platform.

Aid to Fishermen

The new charts will help fishermen locate fishing grounds and avoid underwater capped wells that could damage their nets. The charts also will assist the Coast Guard in air-sea rescue work, and help commercial shipping and recreational boating.

The new charts will sell for $1.50 each. They may be purchased from Coast and Geodetic Survey nautical chart agents, or from the Coast and Geodetic Survey (C44), Washington, D.C. 20235.



WHO IS THE MOST FAMOUS OCEANOGRAPHER?

This is a difficult question. The scientists best known for their exploits on and in the ocean have been explorers and aquanauts. Many men who have contributed most to oceanography are virtually unknown to the public.

One man who was both an explorer and oceanographer was Fridtjof Nansen, a Norwegian who froze his ship, the "Fram," into the Arctic ice off the coast of Siberia to prove the theory that an ocean current would drift a ship across the Arctic Basin. During the 3-year drift he came within 360 miles of the North Pole and then proceeded by sledge to a point 226 miles from the Pole. He is the inventor of the Nansen bottle, which has been the basic oceanographic instrument for decades and is still widely used. A special museum in Oslo houses the Fram and many other Nansen mementos, awards, and expedition materials.

Lt. Matthew Fontaine Maury, USN, often called the father of American oceanography, was the first man to undertake systematic study of the ocean as a full-time occupation and to write an English language textbook on oceanography. The present U.S. Naval Oceanographic Office is an outgrowth of the work he started before the Civil War.

Two other Americans who contributed much to oceanography were William Beebe and Henry Bigelow. Beebe, although best known for his work with the bathysphere in which he reached a depth of 3,028 feet in 1934, also directed a number of shipboard oceanographic surveys.

During his long association with the Woods Hole Oceanographic Institution, Bigelow contributed greatly to the coordination of physical, chemical, and geological studies of the oceans, leading to a more complete understanding of the interrelationships of life in the sea.

Many men who were famous for other reasons have been interested in study of the oceans. Included in the long list are Alexander the Great, Prince Albert of Monaco, Captain James Cook, Benjamin Franklin, and Commander Scott Carpenter. ("Questions About The Oceans," U.S. Naval Oceanographic Office.)

FOREIGN FISHING OFF U.S., NOVEMBER 1969

NORTHWEST ATLANTIC (Fig. 1)

105 individual fishing and support vessels sighted (256 in October 1969; 92 in November 1969).

USSR: 51 medium side trawlers, 18 factory stern trawlers, 1 factory base ship, 3 refrigerated transports, 2 tankers (about 107 vessels in October 1969; 50 early in November 1968 to about 10 at month's end). Side trawlers took moderate-to-heavy catches of herring and mackerel south of Long Island to Nantucket. Limited amounts of red hake observed on stern trawlers south of Nantucket.

Poland: 9 large side trawlers, 7 stern trawlers, 1 factory base ship (44 in October 1969; 46 in November 1968). Vessels scattered east of Cape Cod and Cultivator Shoals, and southeast of Nantucket, during first 2

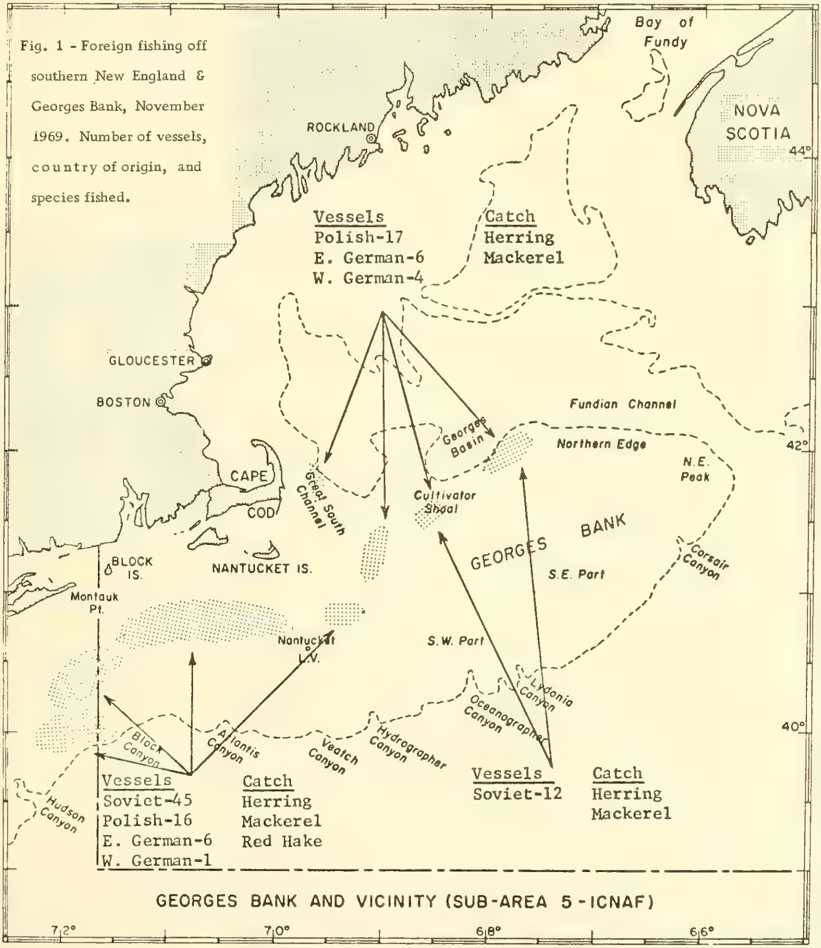


Fig. 1 - Foreign fishing off southern New England & Georges Bank, November 1969. Number of vessels, country of origin, and species fished.

weeks; south of Martha's Vineyard and Nantucket from mid-month. Moderate-to-heavy catches of herring and mackerel.

East Germany: 9 factory and freezer stern trawlers (45 in October 1969; 14 in November 1968). Principal catch probably herring.

West Germany: 4 freezer stern trawlers (28 in October 1969; 7 in November 1968). Herring was principal catch.

GULF OF MEXICO & SOUTH ATLANTIC

No fishing vessels reported.

OFF CALIFORNIA

No fishing vessels sighted. (One Soviet medium side trawler, 1 Soviet whale catcher en route to Peru, and 1 Japanese stern trawler in October 1969; 4 Soviet vessels near Channel Islands off Santa Barbara in November 1968.)

OFF PACIFIC NORTHWEST

USSR: 11 stern and 2 side trawlers, generally of Oregon from Cape Argo to Columbia River; 2 stern trawlers off Washington near Cape Flattery, Grays Harbor, and Cape Disappointment. (In November 1968, 20 vessels, including 14 stern trawlers.) Modest catches of Pacific hake. In mid-month, one catch by stern trawler off Columbia River estimated at 10,000 pounds.

Japan: 4 longliners off Washington; 2 longliners, 4 side trawlers, and 1 support vessel off Oregon. (In November 1968, 1 stern trawler and 3 longliners off Washington.) Longliners made good catches of 10" to 15" black cod.

OFF ALASKA (Fig. 2)

USSR: 31 vessels by month's end, 2.5 times number in October 1969, most since end of April 1969 (30-34 in November 1968). In November 1968, most fished ocean perch in Gulf of Alaska; remainder fished groundfish in Bering Sea. Distribution was reversed in November 1969; most fished groundfish in Bering, and rest fished ocean perch in Gulf.

By mid-month, 1 stern trawler and 3 medium trawlers exploring for herring north of Pribilofs, 2-3 weeks earlier than previous years.

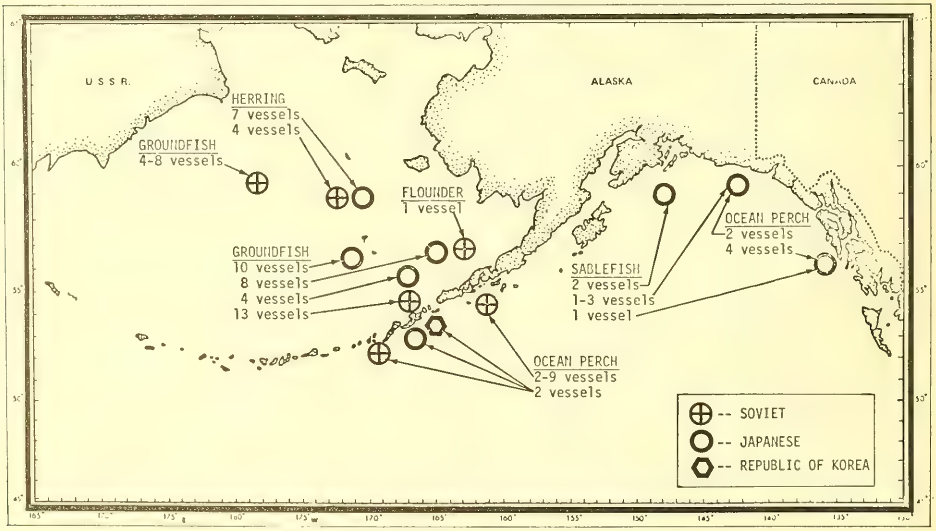


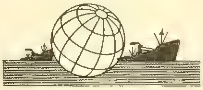
Fig. 2 - Foreign fisheries off Alaska, November 1969.

One medium trawler began flounder explorations in eastern Bering, on Continental Shelf north of Alaska Peninsula, 2-3 weeks earlier than previous years.

Japan: 40-45 vessels, about same as October 1969 (about 40 in November 1968).

By mid-month, 6 stern trawlers and 1 refrigerated transport, previously in groundfishery along Shelf edge, began fishing herring on Shelf north of Pribilofs, about a month earlier than in 1968.

Republic of Korea (South Korea): Late in month, 2 stern trawlers in Gulf, south of Unimak Pass. Catches presumably ocean perch, Alaska pollock, and other bottomfish. (South Korea's first fishing in Gulf since 1967.)



HOW ACCURATELY CAN OCEANOGRAPHERS PREDICT ICE FORMATION, SIZE, AND MOVEMENT?

The accuracy of ice forecasting depends on the locale, details required, time range of the prediction, and accuracy of the input weather information. Ice formation predictions are based on heat content and salinity of the water mass, currents, and expected heat exchange from water to atmosphere (weather prediction and climatology). The required heat, salinity, and current information is obtained by oceanographers aboard icebreaker survey ships when the ice coverage of the sea is at its annual minimum. From ocean data so obtained, the "ice potential" of the water can be determined.

With a known ice potential and expected air temperature data applied to the basic laws of thermodynamics one can derive the ice formation "forecast".

In the far north, long-range predictions of ice formation are accurate within 2 to 4 days. Farther south, however, where the environmental conditions tend to be more variable, the formation predictions are accurate within 8 to 12 days.

Size of the ice pack varies relatively little from year to year in the general area. Variations occur mostly on the southernmost fringes where shipping must travel; here variations are of critical importance. Predictions of the size of the pack are therefore generally quite accurate, but the predictions of ice in the shipping lanes need to be improved.

The movement of ice in and out of shipping lanes, or leads, depends substantially on the wind; therefore the accuracy of an ice forecast is dependent on a good wind forecast. An accurate 48-hour to 5-day ice forecast is possible because meteorologists can produce reasonably good wind forecasts. For long-range (seasonal) ice prediction, which must be based in part on the area climatology, the dates for opening or closing of leads on the Labrador coast may be in error by as much as 6 weeks.

Recently the problem of predicting "heavy ice" and "open" areas in the polar ice pack for submarine operations has been tackled by oceanographers using aerial and submarine surveys and wind climatology. ("Questions About The Oceans," U.S. Naval Oceanographic Office.)

Man-size halibut are common in Alaska. (BCF-Alaska photo: J. M. Olson)

STATES

ALASKA

1970 KODIAK PINK SALMON RECORD RUN PREDICTED

"The Kodiak pink salmon forecast for 1970 is unique because it projects a record return for the even-year cycle," reports the Alaska Department of Fish and Game. Of further significance, the Department notes, the 1969 return has the highest odd-year run since 1939, although the parent year (1967) return was the poorest.

If 1970 forecast is substantially correct, Kodiak catch should approach 15 million. Also, a catch of 563,000 is projected for the Mainland District. This would mark first time since 1945 and 1946 that catches of successive years exceeded 10 million pinks. These catches are the estimates of the harvestable portion of a predicted run of 20.2 million fish.

Pre-Emergent Fry Densities

Forecasting would not be possible without a backlog of pre-emergent fry sampling data. The Department says a relationship exists between pre-emergent fry densities and later total returns. Hydraulic sampling of 31 major pink-salmon-producing streams in 1969 yielded the highest fry density in the 6 years of data collecting. "A ratio of the parent year pre-emergent fry density with the 1970 index for 29 comparable streams indicates the 1970 return at 20,200,000 pink salmon."

The Kodiak-Afognak Island 1970 forecasts of returns for the major districts are:

1. Afognak-Kizhuvak: The excellent fry densities in the streams indicate a 1970 return of 1.9 million pinks. Malina River should be primary producer.

2. Westside: The area from Outlet Cape to Rocky Point, including Terror, Uganik, and Uyak Bays, should contribute 3.5 million pinks.

3. Karluk-Red River: An exceptionally high fry density in Red River indicates near-record return of 6.3 million fish.

4. Alitak Bay: Fry densities were above parent-year index in all streams except Humpy River. Return is projected at 3.3 million pinks.

5. Eastside-Chiniak: Area from Monaska Bay to Cape Trinity should produce 5.2 million fish. Chiniak Bay should produce exceptionally strong return.

Chignik Area

The Eastern District, Chignik area (Kelokak Rocks to Kupreanof Point) is the primary pink-salmon-producing area in this cycle year. Parent escapements in Eastern District were good, and fry survival probably was normal. Good fry densities also were obtained in Western and Perryville Districts. Therefore, 1970 return is forecast above even-year average of 1.7 million.

* * *

SOUTHEASTERN PINK SALMON FORECAST FOR 1970

Of the 85 salmon streams sampled in Southeastern Alaska in 1969, 39 were in Southern half and 46 in Northern.

27.7 Million Pinks

In 1970, a run of 18.7 million pink salmon is expected to return to Southern Southeastern and 9 million to Northern Southeastern. Escapement indices for Southern area for 1964 and 1966 of about 5 million pinks produced returns of slightly over 20 million in 1966 and 1968. Escapement indices for northern area of 2 to 3 million in 1964 through 1967 produced highly variable returns of 5 to 12 million for return years 1966 through 1969. From this information, it is assumed that in 1970 about 5.5 million pinks will be allowed to escape to Southern Southeastern streams and 3.5 million to Northern streams. This would leave balance of 13.2 million in Southern and 5.5 million in Northern Southeastern available for harvest--a total Southeastern catch of 18.7 million pinks.

The Alaska Department of Fish and Game points out that this 1970 forecast is based on cumulative knowledge of the past 6 years' pre-emergent work in Southeastern Alaska.

* * *

EFFICIENCY OF SHRIMP POTS STUDIED

Fishermen in Southeastern Alaska have used shrimp pots (traps) for many years. In the past, the efficiency of shrimp pots was evaluated by catch analysis. This was indispensable for evaluation of fishing gear. However, direct observations answer some questions not apparent from other methods of analysis.

Aims of Study

The staff of BCF's Exploratory Fishing Gear Research Base at Juneau, Alaska, made the first use of the observational technique in studies of shrimp-pot efficiency. Shrimp pots were studied under controlled conditions in a large test tank at Little Port Walter, Alaska. One primary goal was to determine how shrimp escape from the pots. Another was to measure relative efficiency in terms of number of shrimp entering and escaping pots with different types of entrances.

5 Types of Pots

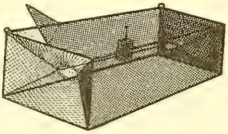
Shrimp pots with 5 types of entrances were used: short tunnel, long tunnel, top loader, ramp, and plastic pipe.

The long-tunneled pot was found most efficient type because fewer shrimp escaped from it than from all the others. Also, more shrimp entered it than either the ramp or top-loading pot. The ramp pot was least efficient: more shrimp escaped and fewer shrimp entered than pots with conical tunnels.

Details of these studies are in "Test-Tank Studies of Shrimp Pot Efficiency," by Doyne W. Kessler. The report is available from BCF Division of Publications, Bldg. 67, U.S. Naval Air Station, Seattle, Wash. 98115.

Fig. 1 - A husband and wife crew unloading day's catch of shrimp at a Wrangell, Alaska, processing plant.

Fig. 2 - Shrimp from a peeler passes this team before being canned at a Wrangell, Alaska, processing plant.
(BCF-Alaska photos: J. M. Olson)



1969 SHRIMP & TANNER CRAB LANDINGS AT KODIAK SET RECORDS

The 1969 shrimp landings at Kodiak, Alaska, through November were 38.7 million pounds, a new annual record. It was an increase of 6.1 million pounds, or 19%, over 1968's record 32.6 million pounds.

The 1969 landings were made in 854 trips, or 40 trips fewer than comparable 1968 trips. Average catch per trip of 45,350 pounds in 1969 was 8,793 pounds more than 1968 average.

Tanner Crab Landings

Most Alaska Tanner crab landings are made in the Kodiak area. Through Nov. 1969, landings there were 6.7 million pounds--a rise of 4.2 million pounds, or 168%, over comparable 1968 landings.

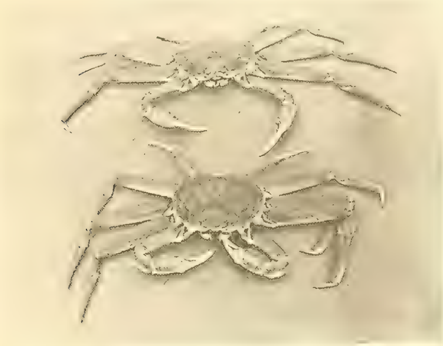


Fig. 1 - Male and female tanner crab.

Fig. 2 - A bucket load of tanner crab about to be placed in holding tank at a Kodiak, Alaska, processing plant.

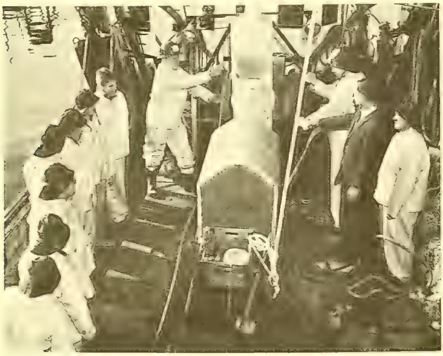
Fig. 3 - A bucket load of tanner crab being unloaded at a Cordova, Alaska, processing plant. Note larger king crab lying on deck.

Fig. 4 - Tanner crab wait processing at a Cordova, Alaska, processing plant. (BCF-Alaska photos: J. M. Olson)

MASSACHUSETTS

APPRENTICE FISHERMEN WILL BE TRAINED BY BOSTON FLEET

The Boston fleet is setting up an apprenticeship training program. Men will be trained aboard large otter trawlers during 3 trips. The trawler owners will pay them $15 for an 8-hour day.



Fishermen's training program at New Bedford, Mass.

When the training is completed, the men will be ready to be signed on as full-fledged crew members.

MICHIGAN

RECORD SALMON CATCH IN 1969

Lake Michigan salmon fishermen set a record in 1969 by catching 175,000 cohos and chinooks weighing an estimated 2 million pounds. This was reported by the Department of Natural Resources. The catch was 75% above 1968's 100,000 fish. The Department says the increase reflects several plus factors:

(1) Bigger plants of cohos.

(2) The first substantial returns of adult chinooks: 43,000 of the total catch.

(3) More liberal regulations, including relaxed rule on foul-hooking.

(4) More "salmon savvy" by fishermen. Each year they come up with new and better techniques and tackle.

How Catch Divided

The total catch was about evenly divided between the open waters of Lake Michigan and tributary streams. In the streams, the rule permitting fishermen to keep accidentally foul-hooked salmon helped considerably to boost the harvest.

The Department of Natural Resources predicts that a record in 1970 seems all but certain. This is because the plants that will produce 1970's salmon crop were three times the size that yielded 1969's catch. This year also will see the first runs of four-year-old chinooks that may reach 40 pounds or more.

COMMONWEALTH OF PUERTO RICO

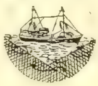
'STAHL' FINDS MARKET-SIZED FISH OFF SAN JUAN

Experimental fishing by the 'Agustin Stahl' has located productive grounds of silk, vermillion, and lane snappers. The grounds are in 35-45 fathoms directly east and west of the entrance to San Juan harbor. The vessel is operated by Puerto Rico's Department of Agriculture. Earlier, she found snappers and groupers between Vega Baja and Cerro Gordo.

The Catch

Production per pot was 10 to 40 pounds. Average size for the 3 species was $1\frac{1}{2}$ to 2 per pound. This is considered excellent market size for pan-fry fish.

The Department of Agriculture states: "Considering these results, it is apparent that many areas from Arecibo (north coast) eastward could be exploited commercially to a much greater degree than is presently done, specifically during the calmer summer season."



ARTICLES

OYSTER CULTURE IN LONG ISLAND SOUND 1966-69

Clyde L. MacKenzie Jr.

The oyster industry in the Long Island Sound waters of Connecticut and New York (Fig. 1) is rapidly developing improved methods for raising oysters. Prospects are good for a return to production levels equaling or exceeding those of some earlier periods. The resurgence of the industry has resulted from determination of the causes of seed oyster mortalities, and the development and application of methods for preventing these mortalities. Future increases in production will probably be made through even more effective control of mortalities--and collection of much larger numbers of seed oysters as a result of better preparation of private setting beds and restoration of public seed areas.

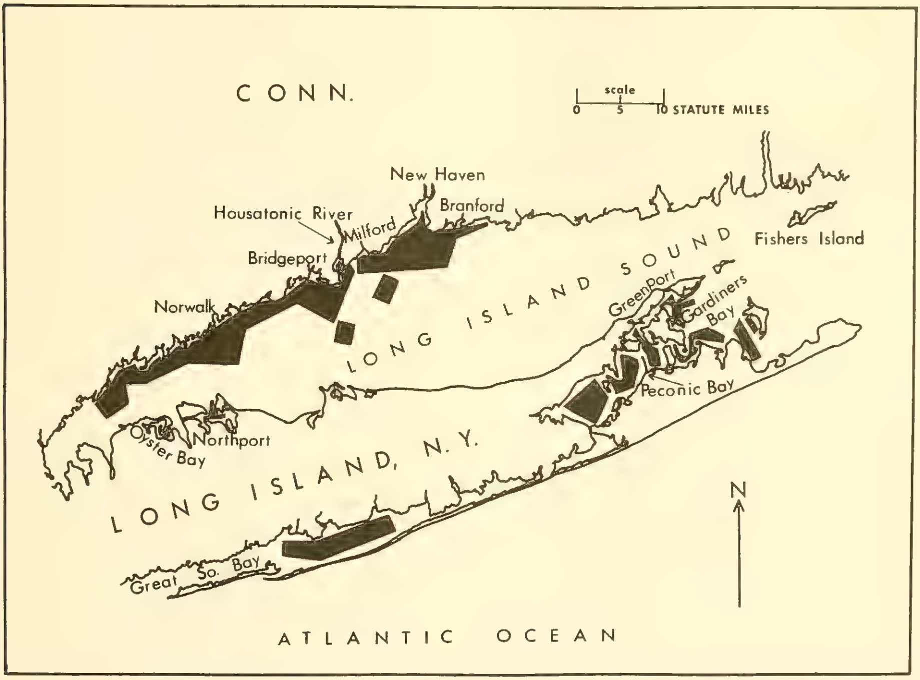


Fig. 1 - Chart of Long Island Sound showing coastlines of Connecticut and New York. Solid black areas show extent of oyster bottoms, only about 1 percent of which were actually planted with oysters in 1969.

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U.S. DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service
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Production of oysters in the Sound declined sharply after the early 1950s from an average of about 1,300,000 bushels in 1950-52 to only 40,000 bushels in 1967 (Lyles, 1969). Traditionally, oyster companies held all their seed oysters on storage beds, totaling several thousand acres, under 30 to 50 feet of water in Connecticut. The quantity of these oysters was always several times larger than that marketed. Each year, a portion, depending on the size of beds and market demand, was transplanted to growing and fattening beds in Connecticut, but mostly in bays around Long Island. Companies merely filled vacant sections of storage beds when an oyster set occurred. Thus, the supply of market oysters did not fluctuate with annual fluctuations in setting.

Seed Oysters Decline

After 1950, not enough seed oysters were available to plant on storage beds. Reasons for the decline were: (1) Deterioration of public beds and their failure to produce significant quantities of seed oysters after 1948; (2) Inability of oyster companies to obtain significant quantities of seed from their private beds in most years; (3) A storm in November 1950 that destroyed most seed oysters on setting and storage beds in Connecticut; (4) Low availability of shells to be used as cultch on setting beds after 1950 because companies sold nearly all their oysters in the shell rather than shucked; and (5) A large increase in numbers of starfish after 1957.

During the early stages of this study, I observed that seed beds were poorly prepared, and that most seed oysters were wasted due to poor management. The main reasons were because oystermen could not see the bottom where oysters were being cultured, and no assistance was available to them through state or Federal extension services.

Study Oyster Deaths

Material for this article was obtained by the Predator Control Program, Biological Laboratory, BCF, Milford, Conn., while pursuing studies, long overdue, to determine the causes and patterns of mortalities of oysters on commercial beds.

The project involved: (1) Studying about 30 beds of oysters in Connecticut and New York by SCUBA diving once or twice a month; (2) Identifying causes of oyster mortality and determining the percentage killed by each cause at different periods; (3) Finding or developing methods for reducing the effects of these causes and other that limit production; and (4) Assisting oyster companies to fit better methods into their system of oyster culture.

Material was also obtained from extensive interviews with commercial oyster growers. Limited literature is available on any recent phase of oyster culture in Long Island Sound; most of this article consists of original material gathered from these sources.

LOCATION AND PHYSICAL CONDITION OF OYSTER BEDS

Seed beds in Long Island Sound are between Norwalk and Branford, Conn., within a mile of the shore, and under water that ranges in depth from 5 to 28 feet. There are no seed beds around Long Island because setting of oysters there is infrequent.

Seed oysters from Connecticut seed beds are grown to market size and marketed from growing beds in Connecticut and New York. Most Connecticut seed, however, is transported to growing beds in New York at Oyster Bay, Northport Harbor, Peconic Bay, and Gardiners Bay, under water that ranges from 10 to 40 feet. Salinity ranges between 25 and 27.5 ‰ (parts per thousand) along the Connecticut shore, and at Oyster Bay and Northport, but is about 31 ‰ in Gardiners Bay.

These beds are considered superior to those in most other sections of the United States because they consist of coarse sand, or mixtures of sand and gravel, which makes them hard enough to support oysters. Nevertheless, silt accumulates on many of them, especially during the winter. Silting is heaviest on beds in the relatively calm sections of harbors, such as those at Norwalk and New Haven, Conn., and Oyster Bay and Northport Harbor, N. Y. The silt is retained more on beds with a dense population of oysters, where it may become as deep as 2 inches.

Water temperatures over oyster beds are 32.5° to 33.5° F. from mid-January through mid-March. In Milford Harbor, Conn., average temperatures are:

Month	Temperature (°F.)[1]
Mid-January through mid-March	32.5 - 33.5
April	38.0 - 40.0
May	52.0 - 60.0
June	65.0 - 67.0
July	66.0 - 73.5
August	72.0 - 74.0
September	61.0 - 72.0
October	52.0 - 61.0
November	46.0 - 53.0
December	38.0 - 42.0

1/BCF records.

SOURCES OF SEED OYSTERS

The principal source of seed oysters in the Long Island Sound area has always been and, for the foreseeable future, will continue to be natural sets on seed beds along the Connecticut coast. These seed beds have always had the capacity to produce more than enough seed oysters to plant on all the growing beds of the Sound. They have never been adequately prepared, however, and in recent years supplies of natural set have been augmented by production of seed oysters in commercial hatcheries and in Ocean Pond, a salt water pond, on Fishers Island, N.Y. Natural setting, in years when goods sets occur, has the advantage of providing enormous quantities of seed oysters at very little cost. The hatcheries and Ocean Pond have produced somewhat more predictable supplies of seed oysters, but the quantities were smaller and the costs higher.

Natural Sets on Private Beds

Oyster sets of high intensity occurred on commercial beds in 1966, 1968, and 1969. Beds in New Haven collected the most seed oysters in each year because they were better prepared for setting by the oyster companies controlling them.

Optimum preparation of a seed bed involves a sequence of operations. The first is removal of predators and debris from the bottom (methods for removal of predators are described later). The second is the spreading of cleaned oyster shells at the rate of 1,500 or more bushels per acre, when ready-to-set oyster larvae become abundant in the water. In some areas, where silt begins to cover shells immediately, the third procedure is the removal of this silt, which can greatly reduce the number of spat obtained. To remove silt, oyster companies can use starfish mops, consisting of a metal frame about 12 feet long from which waste cotton bundles are strung, or cutting boards, measuring 15 feet long and 1 foot wide (Fig. 2). By use of these boards, which lift the silt when towed rapidly, a boat can flush silt from 25 to 50 acres of planted shells during each tide (MacKenzie, in press, 'a'). Companies employed starfish mops to a limited degree during 1968-69, but use of cutting boards for this purpose is a new development.

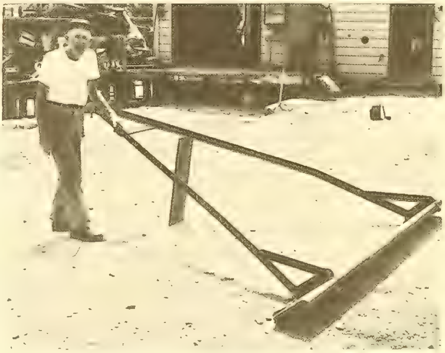

Fig. 2 - Cutting board, or vane, is towed rapidly over bottom, at angle shown, to scour silt off shells. Currents carry suspended silt off bed.

The old procedure of spreading all available clean shells on several beds along the Connecticut coast each year was wasteful. This was because from 1958-69, for example, oyster sets were of commercial significance in 6 of 12 years (1958, 1959, 1962, 1966, 1968, and 1969). In the other 6 years, plantings of shells did not collect a commercial set. Furthermore, in the years of significant sets, setting often occurred in only 1 or 2 areas, such as Bridgeport and New Haven. Each year, oyster companies spread from 150,000 to 200,000 bushels of clean shells on about 175 acres of setting beds. They obtained clean shells by storing on their docks shells that either were gathered from unused beds by suction dredging or saved when market oysters were culled. The cost of clean shells planted on a seed bed obtained by section dredging was about 30 cents per bushel; that of culled shells was much less. So 200,000 bushels of planted shells cost about $55,000.

A common, but less effective, method for collecting seed is the dredging up and respreading of shells, covered with living organisms, that have been on a bed for a year or more. Since this method does little more than expose small clean portions of shells that were laying against the bottom, it presents little additional clean surface where oyster larvae can set. During 1966-69, companies prepared about 100 acres of setting beds by this method.

In 1966 and 1968, several beds prepared with clean dock-stored shells caught as many as 15,000 spat per bushel of shells; in 1968, one bed (on which about 1,500 bushels of clean shells per acre had been planted) collected 50,000 spat per bushel. From this bed, about 2,500 bushels of seed per acre were harvested in spring 1969. At that time, the count of seed oysters had fallen to slightly more than 6,000 per bushel because of mortality and growth of oysters. In 1969, setting of oysters was not as intense; the best beds collected about 8,000 spat per bushel.

In 1968, the highest spatfall on beds prepared by the dredging up and replanting method was only about 2,000 spat per bushel of shells. Beds nearby prepared with clean shells collected from 3.5 to 12 times as many spat (MacKenzie, 'a'). Companies realized few seed oysters from these beds because they did not control starfish and oyster drills. In 1969, spatfalls on beds prepared in this manner were not of commercial intensity.

In 1968, MacKenzie observed that black shells obtained from muddy bottoms could be planted immediately and, being free of fouling organisms, would catch about as many spat as clean dock-stored shells.

Between 1966-69, more than 95 percent of formerly productive seed beds received no preparation. In those years, a small number of unprepared beds received light sets of only 100 to 200 spat per bushel of shells (MacKenzie).

The total quantity of seed oysters obtained from all privately owned beds was about 200,000 bushels in 1966, 300,000 in 1968, and 200,000 in 1969. About a third of the 1968 spatfall occurred on 2-year-old oysters (1966 generation).

Natural Setting on Public Beds in Connecticut

The decline of the Long Island Sound oyster industry was partly due to the relatively few seed oysters produced on public seed beds. The states of Maryland, Virginia, and Louisiana, which produce the largest quantities of oysters in the United States, depend on public beds as the source of most of their seed.

The once-famous Bridgeport-Fairfield public seed bed, 4,500 acres in size, has not collected a significant quantity of seed oysters since 1948 because it has not been adequately prepared. During 1966-69, the few shells on it were completely covered with fouling organisms, and oyster larvae could not set on them. Observations of oyster sets on clean shells in test bags placed on this bed by the BCF Laboratory at Milford indicate that the bed would have received commercial set in more than half the intervening years had it been properly prepared. In 1969, some interest was aroused to restore the bed's productivity.

The only commercial sets on public seed beds were in the Housatonic River in 1966 and 1968. The river had about 65,000 bushels of seed oysters in fall 1968, when about 4,000 bushels of mixed 1966 and 1968 seed were harvested from the river with hand tongs; this was only about 6 percent of the river's total quantity. One of my studies showed that about 75 percent of the remainder were suffocated by silt during spring 1969.

In 1969, a law was passed in the Connecticut Legislature that allowed the use of power to tow hand dredges on public beds. In the past, dredging could be done only by sailboats.

Hatchery Production of Seed

In 1968, 4 commercial hatchers on Long Island and 1 in Connecticut were producing seed oysters (Fig. 3). In the hatcheries, abult oysters are induced to develop ripe eggs and sperm before the normal spawning season by

Fig. 3 - Oyster hatchery at Bayville, Oyster Bay, Long Island, N.Y., is capable of producing 3,000 to 6,000 bushels of seed oysters a year. This hatchery began to rear spat as singles in 1969. Transparent roof and walls allow sunlight to reach tank cultures of algae.

keeping them in warm sea water for several weeks. When the oysters have developed ripe eggs and sperm, they are induced to spawn, and the fertilized eggs are placed in 100-gallon, conical-bottom tanks. These eggs develop into straight-hinge larvae within 48 hours and can be caught on fine Nitex[1] screens as the water is drained from the tanks. Water is changed every 24 or 48 hours, and the larvae are resuspended in fresh sea water. When the larvae reach setting size, 10 to 20 days after fertilization, they are transferred to setting tanks in which a layer of shells has been placed as cultch.

When they were built during 1960-65, the hatcheries depended entirely on the algae present in raw sea water to feed oyster larvae. This water was pumped through centrifuges that removed silt, zooplankton, and the larger phytoplankton--but allowed smaller algae to pass through to large shallow tanks in a warm, lighted room with translucent roof. The water was held there for 24-48 hours to allow the small algae to increase in numbers before it was used to feed the larvae. Most commercial hatcheries now grow algae in special culture units (Davis and Ukeles, 1961) to supplement the natural algae of raw water, and they sometimes use cultured algae exclusively.

By using these techniques, each hatchery can produce 1,000 to 6,000 bushels of seed oysters with a count of 2,000 to 15,000 spat per bushel.

In 1968 and 1969, hatcheries developed techniques to produce single spat. To do this, they placed ready-to-set oyster larvae in 12-inch-diameter cylinders with a bottom of Nitex screening and a continuous flow of water. After 24 hours most larvae had attached to the sides and bottom. These post-set larvae were then washed off as singles, 1/70th of an inch long. These had to be grown in trays, with a fine screen bottom, suspended from rafts until oysters were large enough to be planted on the bottom (Butler Flower, personal communication).

The minimum size of single oysters to be planted on the bottom has not been established. MacKenzie made two observations of planted singles: If they are less than 1 inch long, they are washed about by currents as slow as 2 knots; they are susceptible to predation by the abundant mud crab, *Neopanope texana*, which does not prey on attached spat greater than $\frac{1}{4}$-inch.

Growing single oysters avoids problem of crowding oysters in clusters and of misshapen oysters; culling of market oysters will be easier because they will all be single.

Production of seed oysters in hatcheries has two major advantages: (1) A somewhat more predictable supply of seed oysters is available each year; and (2) New genetic strains of superior quality oysters can be propagated by hatchery methods if and when they are developed.

The two major disadvantages are: (1) Production of oysters (1,000 to 6,000 bushels per hatchery per year) is small compared to that from natural sets in good years (300,000 bushels in 1968); and (2) Cost of hatchery seed ($1.00 per 300 spat) is much higher than that of natural seed ($1.00 per 50,000 spat).

The annual cost of operating a hatchery ranges from 50,000 to 70,000 dollars.

Setting in a Salt Water Pond

Ocean Pond on Fishers Island produces about 10,000 bushels of seed oysters a year, about half sold to 2 oyster companies in Connecticut.

Clean scallop shells strung on wires hung from rafts collect the spat. Each raft holds 400 strings, and each string holds 75 shells. Just before the setting season, the water is sampled daily to determine the presence of ready-to-set oyster larvae. When they have become abundant, the shells are lowered into the water to receive them.

The rafts remain in the Pond until the following spring, when the number of oysters per shell averages between 10 and 30. In May, when the oysters are about 9 months old, companies remove the strings from the Pond, load them onto boats, strip off the oysters, transport them to the beds, and plant them.

GROWING OYSTERS FROM SEED TO MARKET SIZE

Culture Operations

In Connecticut, young-of-year seed oysters are sometimes transplanted from setting beds to growing beds in October, November, or December--but usually not until the following March, April, or May. Ordinarily, they are transplanted in the fall if the quantity of oysters is too large to move the next spring,

1/Mention of commercial products does not imply endorsement by BCF.

or if it is necessary to move them to beds more protected from starfish invasions or winter storms.

Growing beds are cleaned of predators, such as starfish and oyster drills, competitors, such as slipper shells and mussels, and silt before seed oysters are spread. Seed oysters may be transplanted each spring thereafter, or, if not transplanted, thinned out. Companies that do not transplant or thin out growing oysters each year find that they become much too dense on the bottom--in some instances, more then 3,000 bushels per acre. If a significant percentage of seed oysters is covered by silt, which accumulated during the winter, or by sand during winter storms, they must be transplanted during the following March or early April before water temperature reaches about 43° F. (the level at which most begin active pumping), or the buried ones suffocate (Fig. 4). When seed oysters are in clusters, repeated transplanting each year also breaks these apart so that almost all oysters are "singles" by the time they reach market size. A portion of market oysters may be attached in clusters, however, if the original set of seed oysters was very heavy. Most oysters are transplanted 3 or 4 times before they reach market size.

During 1966-69, oyster companies spread seed on growing beds at lower concentrations than they had in the past. They spread 1-year-old 1968 set on growing beds at rates of 175 to 300 bushels (750,000 to 1,000,000 oysters) per acre, depending on number of individuals per bushel. In the past, the rate of spreading of 1-year-olds was 500 to 800 bushels per acre. But survival rates of oysters became much higher, so spreading rates had to be lowered to accommodate growth of the

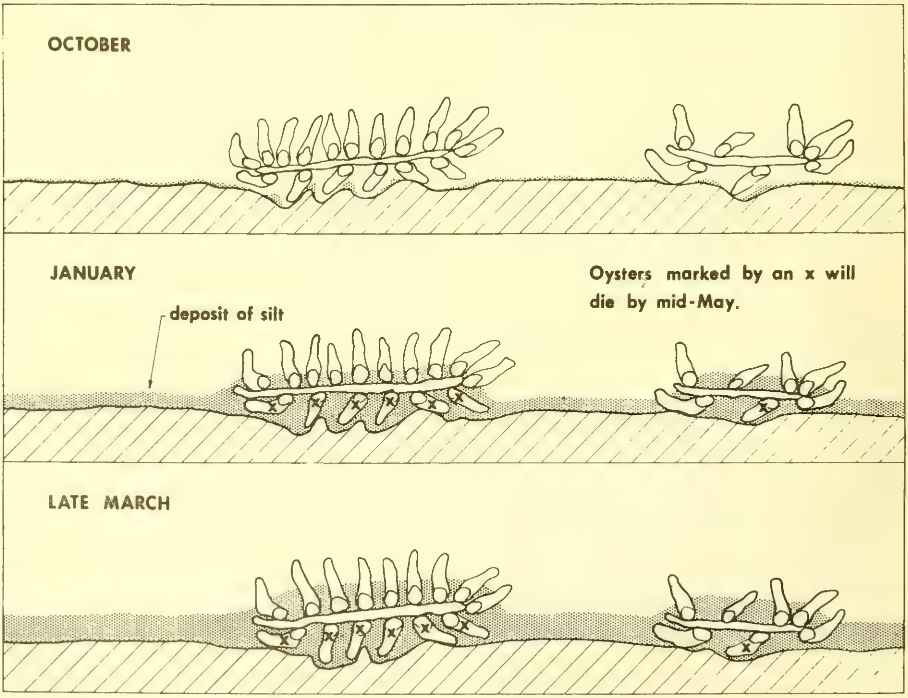

Fig. 4 - Schematic diagram showing deposit of silt around clusters of small oysters during 3 months. Oysters covered by silt suffocate during late April and May.

oysters. A planting of oysters of this age increases 4 to 7 times between April and December. At higher rates of spreading, the concentration of oysters by December, when growth ceased because of cold water temperatures, was greater than 1,500 bushels per acre--too many for high survival and good growth. When the oysters were 2 years or older, they were spread at rates of 300 to 500 bushels per acre. Even though spreading rates of oysters were lower, most growing beds had too dense a population of oysters in 1968-69.

Oysters are usually marketed at 4 to 5 years when 200 to 250 constitute a bushel. During 1966-69, companies sold many oysters 3 years old. Older oysters were in short supply. In fall 1969, however, about 2,000,000 bushels of oysters of various ages were growing on 2,000 acres of bottom in Connecticut and New York.

The total cost of producing a bushel of market oysters, including rental of beds, procurement of seed, control of starfish and oyster drills, use of boats to clean beds and to transplant seed and harvest market oysters, and culling, averages about $2.50. The cost of culling, $1.25 average ($0.60 to $4.50 range) per bushel, is as high as all other expenses combined (Fig. 5). In 1969, oyster companies received as much as $18 per bushel for market oysters. Since the early 1950s, most oysters have been sold unshucked for the half-shell trade.

Fig. 5 - Oysters are culled faster and more cheaply from moving conveyor belt than from culling bench.

Equipment to Transplant & Harvest Oysters

A typical oyster boat in Long Island Sound is equipped with 2 standard oyster dredges: each can be lifted out of the water and over the boat's deck by a boom (Fig. 6). At the bottom of each dredge is a hinged door, which unlatches to empty the oysters on deck. The crew of a boat consists of a captain and usually 2 (sometimes only 1) deckhands. The boat plants, transplants, and harvests oysters. To plant seed oysters, two 4-inch-diameter hoses are used to wash them overboard while the boat travels at fairly high speed to ensure good spreading. The cost of operating an oyster boat is about $100 per day. Since a boat can transplant or harvest for market about 1,000 to 2,400 bushels of oysters per day, the cost is 4 to 10 cents per bushel.

Fig. 6 - Transplanting boat partially loaded with seed oysters. Booms are used to lift dredges over the deck. After boat is loaded, seed oysters are washed overboard on growing beds by hosing with water under low pressure. Cost of transplanting seed oysters ranges from 4 to 10 cents per bushel.

SCUBA divers (Fig. 7) observed oyster dredges being towed over the bottom. They found that the teeth, which are about 4 inches long, were perpendicular to the bottom. As a result, only 10 to 20 percent of the oysters in the dredge's path were gathered. The dredge had to be towed rapidly to gather oysters because of the tooth angle. This caused the breaking and killing of a significant percentage of seed oysters (Medcof, 1961;

Fig. 7 - SCUBA diver entering water to inspect conditions on oyster bed. Depth of water is about 15 feet.

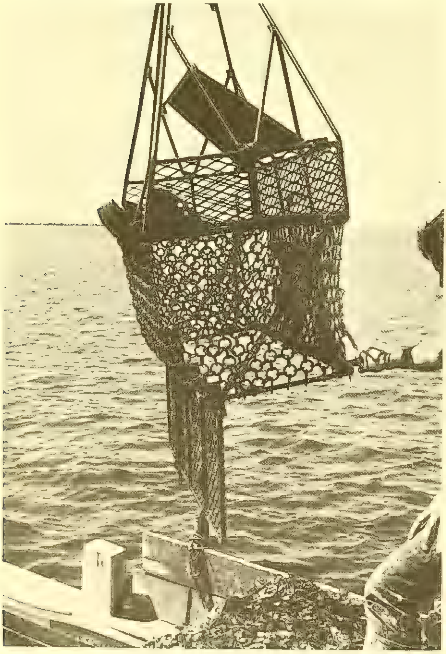

Fig. 8 - Oyster dredge with teeth angled forwards, to pass under oysters laying on bottom. Hinged door at bottom of dredge unlatches to release load of oysters.

Quayle 1969; MacKenzie). The dredges were modified.

The new dredges are built with the teeth pointing forward at a 15° angle in relation to the bottom (Fig. 8). These dredges have some advantages: (1) They can be towed at about half the speed used to tow old dredges, (2) They fill more quickly, (3) Less chain or cable is required to tow them, (4) Nearly all the oysters are gathered from the bottom during each pass, and (5) Apparently, they are less destructive to seed oysters.

Controlling Starfish

Some boats are equipped to control starfish. They are rigged with 2 mops and 2 tanks filled with water near the boiling point. Mops are dragged over the bottom for 10-minute periods and then dipped into the tanks to kill the starfish that have been collected. Boats so equipped can remove scattered starfish from beds more cheaply than by using lime. These boats are also equipped with either lime hoppers or tanks and water hoses to spread quicklime over beds infested with starfish.

Two types of equipment have been used for this work. For many years, the lime was packaged in 80-pound paper bags and delivered, perhaps 500 bags at a time, by cargo truck. The bags were carried by workers from truck to boat. When boat reached bed to be treated, the workers carried the bags to hopper on each side of boat, cut open bags, and poured lime into hopper. The hopper fed the lime into the stream of water at the bottom. Eight men, 4 on each side of boat, were often needed to spread lime.

New equipment, now installed on 2 boats, makes it possible to handle lime in bulk. The cargo truck delivers lime to oyster dock and blows it by air through a pipe into large storage tank, capable of holding 30 tons, at edge of dock. From this tank, the lime is blown by pipe into the tank on the boat, which holds 12 to 15 tons (Fig. 10). When a bed is treated, only 1 worker is required on deck. All he has to do is start water pump and open doors at bottom of lime tank. This system works efficiently; the cost of lime is lowered from \$26 to \$21 per ton because no bagging is required. The annual cost of lime for treating average acre planted with oysters was \$21 to \$42.

Presently, about 15 oyster-dredging boats work in Long Island Sound. Four others are

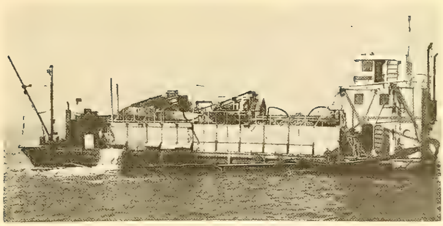

Fig. 9 - Suction dredging system mounted on barge is used to harvest shells to be used as cultch and to remove oyster drills from oyster beds.

Fig. 10 - Spreading quicklime to kill starfish which invaded oyster bed. Tank on boat holds 15 tons of quicklime.

used exclusively to control starfish, and 2 boats and a barge are equipped with suction dredges. The boats are 55 to 85 feet long. The barge (Fig. 9) can dredge up 10,000 bushels of buried shells from the botttom, or remove oyster drills from 1 to 2 acres of bottom a day.

Causes of Oyster Mortality, 1966-69

The most important cause of mortality of oysters was starfish, Asterias forbesi. A single starfish can consume several oyster spat simultaneously. On beds where starfish were numerous, more than 1 per square yard, they reduced good sets of oysters to non-commercial levels within a few weeks; even on beds where good starfish control was practiced, up to 94 percent of spat were killed in bands 15 to 20 feet wide along borders of beds (MacKenzie). The rate of feeding on 1-year-olds has not been determined, but MacKenzie (1969) observed that a starfish can consume as many as five 2-year-old oysters per 28 days.

Silt

The second most important cause of mortality was silt. This settled over beds during winter, and suffocated seed oysters in late April and May when water temperatures rose above 43^{o} F. (Fig. 4). Silt may accumulate to 2 inches by late March in areas where currents are low and wave action is slight. In open waters, where currents are strong or wave action generated by storms disturbs the bottom, silt deposit is usually negligible. In the Housatonic River, a protected area, 75 percent of about 65,000 bushels of 1- and 2-year-old oysters were suffocated by silt in spring 1969. In calm sections of harbors, such as New Haven, the mortality of 1-year-olds due to suffocation was 50 percent. In a more open area of that harbor, it was about 15 percent in spring 1968. Oystermen and biologists formerly termed this cause of mortality "winter kill." They believed it was caused by prolonged low temperatures.

Older-Type Oyster Dredge

The third most important cause was the use of the older-type oyster dredge in transplanting seed oysters. When 3-month-old spat were transplanted, about 15 percent were mechanically broken and killed. In addition, on beds where a large proportion of spat was attached to small fragments of shells, about 20 percent were left behind by the dredges. Usually, these were not protected thereafter and were killed by starfish (MacKenzie). Besides damage to young-of-year oysters, between 3 and 5 percent of 2-year-olds were killed by dredges during transplanting. MacKenzie estimated that if mortalities of seed oysters could be reduced to zero during transplanting, production of market oysters would increase about 50 percent.

Oyster Drill

The fourth most important cause was the oyster drill. In most sections of Connecticut (except for New Haven Harbor), in Oyster Bay and Northport Harbor, the thick-lipped drill, Eupleura caudata, is more common than the Atlantic oyster drill, Urosalpinx cinerea (MacKenzie, in press, 'b'). A single drill can consume at least 10 spat a month, and 18 to 20 one-year-old oysters, between late April and late November. Because drills were under good control by oyster companies, mortality of spat and older seed oysters caused by them was small during 1967-69. The heaviest mortality of spat by oyster drills observed on any bed in 1968 was 25 percent between setting and late November.

Mud Crab

The mud crab, Neopanope texana, was the fifth most important cause. It destroys spat up to $\frac{1}{4}$-inch long. In 1968, it appeared to me that 5 to 15 percent of spat were killed by mud crabs. On 1 bed, however, they killed more than 50 percent.

Mortality of oyster spat also resulted from other causes: overgrowth by slipper shells (double deckers), Crepidula plana and Crepidula fornicata; calcareous (lace) bryozoans, Schizoporella unicornis; jingle shells, Anomia simplex; and barnacles (species not identified). Mortalities from these causes were small--estimated at about 15 percent of spat on typical bed in New Haven Harbor in 1968. On 1 bed, however, where slipper shells were extremely numerous, they alone killed about 60 percent of spat before age of 2 months in both 1968 and 1969. Rock crabs, Cancer irroratus, may also kill small oysters.

I also found additional causes of mortality of older seed oysters: burial during winter storms, predation by whelks and, apparently, some very old oysters were killed by infestations of boring sponges. Also, 3 to 9 percent of oysters 2 years and older died after spawning in 1968.

There is no evidence that mortalities of oysters in Connecticut were attributable to MSX or other diseases.

Controlling Predators & Other Causes

Oyster companies have starfish under adequate control. They use mops to determine their location; if significant numbers (more than 10 starfish per mop frame per 3-minute tow) are found on the border of, or near a bed of oysters, they spread quicklime over bed during next period of slack current, at rate of about 2,000 pounds per acre. Starfish stop feeding instantly and die soon thereafter. Only those starfish protected underneath shells or algae survive liming treatment. During 1967-69, companies spread lime on beds planted with oysters on average of once or twice per acre per year. In practice, companies did not have to treat many areas in center of large beds, but repeated treatment of border areas several times.

During 1968-69, mortalities of oysters resulting from suffocation by silt were reduced to only about 2 percent when companies transplanted oysters to growing beds during March and early April, rather than waiting until traditional May and June.

During 1968-69, mortalities of oysters from transplanting operations were reduced somewhat by modification of tooth angle of oyster dredges, and by transplanting spat as late in the fall as possible to allow them to grow larger and thicker shells. But even the modified dredges kill many seed oysters.

Polystream

Most oyster companies now employ suction dredges or Polystream (Granular) to keep oyster drills under control (Fig. 11). Suction dredges can remove most drills from 1 to 2 acres of bottom per 8-hour day. Polystream (Granular), approved by U.S. Department of Agriculture for commercial use to control oyster drills in Connecticut and New York, is spread evenly over surface of the water, with the same equipment used to spread lime,

Fig. 11 - Pouring clay granules saturated with Polystream into hopper from which they will be hosed overboard. As the granules sink, they spread evenly over the bottom and kill 85 percent of oyster drills within 4 weeks.

at rate of 1,600 pounds per acre. Within a few hours after granules fall to bottom, the drills stop feeding, an average of 85 percent die, and the survivors are unable to feed for several months. The cost of treating 1 acre of bottom is about $200. The bottom remains relatively free of drills for at least 5 years; a treatment averages no more than $40 a year. By using either suction dredges or Polystream (Granular), the number of drills on a bed can be reduced to less than 2 per square yard; this is a density which cannot cause significant damage to seed oysters. Polystream (Granular) treatments should be made in late April or early May because they kill fewer drills when made later in the season. I also found that treatment of bottom with quicklime in heavy concentrations will control oyster drills.

Of about 2,000 acres planted with oysters in fall 1969, oyster companies had to control oyster drills on about 400 acres. The remaining areas, not planted with oysters for many years, did not have drills. Control of drills was achieved by suction dredging on about half the infested area, and by treatment with Polystream (Granular) on the other half.

No specific attempt has been made to control mud crabs, but most are removed incidentally when beds are cleaned by suction dredges or by standard oyster dredges before cultch or seed oysters are planted.

The fouling organisms that cause spat mortalities are controlled partially by delaying planting of cultch on setting beds until oyster larvae are ready to set. This avoids the competitors and fouling organisms that set earlier.

ESTIMATES OF POSSIBLE OYSTER YIELDS

Development of new predator-control methods, avoidance of mortalities from smothering, and better surveillance of beds to detect invasion by predators and accumulations of silt--have resulted in large increase in survival rates of seed oysters and consequent yields, with promise of greatly increased production of market oysters.

In one example, a company planted 1,000 bushels of 1-year-old oysters, counting 6,000 per bushel, in May 1966. I counted a natural set of 9,000 spat which attached to each bushel of these 1-year-olds in July 1966. Oyster drills had killed 40 percent of these 2 groups by mid-August. The company treated bed with Polystream (Granular) on August 24, and this prevented further mortalities from drills. Some 6,000 bushels of oysters were transplanted off this bed in May 1967, a sixfold increase; these oysters had increased to 15,000 bushels by May 1968. I estimated the volume at 20,000 bushels by late fall 1969. Had the bed been treated with Polystream (Granular) earlier than August 24, the final yield would have been considerably larger. This production is far superior to past yields, which averaged only 1 bushel of market oysters from 1 bushel of 1-year-old oysters.

Since all phases of the much improved system of caring for seed oysters had not been practiced before 1966, no oysters that had this intensive care had reached market size by fall 1969. The following percentage survival estimates are based on studies of different beds of different ages that had the most intensive care during study period:

Age of Oysters[1]	Percentages of Survival Recorded		Number of Beds Studied
	Average	Highest	
Setting to 1 mo.	60	85	15
1 mo. to 9 mo.	75	90	18
9 mo. to 1 yr. 9 mo.	80	90	13
1 yr. 9 mo. to 2 yr. 9 mo.	85	94	7
2 yr. 9 mo. to 3 yr. 9 mo.	93	95	7
5 yr. to 6 yr.	90	90	1[2]

1/Oysters of age 3 yr. 9 m. to 4 yr. 9 mo. were not studied.
2/Estimate made from 100 oysters held in tray on bottom.

From these average percentages of survival, and assuming a 90 percent survival from 3 yr. 9 mo. to 4 yr. 9 mos., the following yields of certain ages can be expected:

One bushel of 1-month-old spat, counting 10,000 per bushel, will yield about 21 bushels of market oysters (200 oysters per bushel).

One bushel of 9-month-old seed (1-year-olds), counting 6,000 per bushel in April, will yield about 18 bushels of market oysters.

One bushel of 1 year 9-month-old seed (2-year-olds), counting 700 per bushel in April, will yield about 2.5 bushels of market oysters.

One bushel of 2 year 9-month-old seed (3-year-olds), counting 400 per bushel in April, will yield about 1.7 bushels of market oysters.

In summer 1969, many beds were planted with seed oysters maintained under intensive care. If, from time of 9 months, 40 to 50 percent should survive to market size, they will yield 5 to 30 bushels of market oysters for each bushel planted.

SIGNIFICANT DEVELOPMENTS SINCE 1966 THAT MADE HIGHER YIELDS POSSIBLE

The most important factors in bringing about the remarkable increase in yields, and the promise for much greater increases in yields and in total production in the future, were: (1) Systematic identification of causes that limited production; (2) Monthly counts of living and dead seed oysters on many beds, which established relative importance of these causes; (3) Use by most companies of superior methods, previously employed by only 1 or 2 companies; (4) Introduction of new methods; and (5) The speed with which oyster companies adopted these methods to overcome or minimize effects of these limiting causes.

The use of SCUBA diving techniques was instrumental in determining the causes of oyster mortalities and the effectiveness of remedies. Divers can observe conditions as they actually exist on a bed. By quantitative sampling techniques, they can determine precisely when predators, accumulations of silt, and burial by storms endanger a bed. Divers found that deposits of silt on shells significantly interfered with setting of oysters. They found that companies often planted seed oysters in scattered, too-dense patches, rather than uniformly over bottom. By using divers, incorrect estimates of the situation on beds are avoided, the efficiency of culturing oysters can be sharply upgraded, and oyster companies can avoid many management errors.

PROBLEMS THAT NEED TO BE SOLVED

It has been estimated that the enormous number of ready-to-set larvae in Connecticut waters from July to October 1968 would have yielded up to 500,000,000 bushels of market oysters if--sufficient shells of good quality had been provided to catch them; they had been protected from predators, competitors, and suffocation; enough equipment had been available to handle them; and sufficient space had been available to grow them. At most, only 0.4 percent of this potential will be realized since the total 1968 set saved will grow into about 2,000,000 bushels of market oysters.

The following problems must be solved before oyster companies will be able to obtain larger percentage of the potential from a crop of larvae.

Seed Beds Need Better Preparation

Companies must prepare their seed beds better to increase the number of oyster spat obtained. They should store larger quantities of shells on their docks. These shells should be spread on beds only in years when oyster larvae set, and only in areas where the larvae are present (extensive sampling of larvae would be required to do this). After the supply of shells on their docks has been planted, black clean shells dredged from under the bottom should be harvested and planted on setting beds. Silt should be removed from setting beds. Also, larger quantities of shells per acre, perhaps up to 3,000 bushels, should be planted, experimentally at first. My recent observations indicate that filter feeders, such as clams, oysters, and mussels, should be removed from a setting bed because they may reduce setting by ingesting oyster larvae.

The Bridgeport-Fairfield public seed bed should be restored to full production as an additional source of seed oysters by a good management plan. Clean shells should be spread on the bed, and starfish should be controlled. Oyster drills are uncommon on the bed.

Seed Oysters Require More Care

To raise a higher percentage of seed oysters and to increase yields even further, companies need to give them more care. Accordingly, I am attempting to develop methods for reducing mortalities and to determine the optimum levels of care seed oysters require.

More Efficient & Specialized Equipment Needed

The standard oyster dredge is used to perform nearly all tasks in oyster culture, including: (1) Transplanting seed oysters; (2) Harvesting market oysters; (3) Recovering shells from setting beds to be replanted; (4) Sampling oysters to determine their condition; and (5) Even checking beds for the presence of starfish.

This dredge was used to harvest oysters since the 1800s and was still employed in the late 1960s with little significant change in design. It is grossly inadequate to perform any of these tasks for the following reasons: (1) It loads a boat at the slow rate of only 300 to 500 bushels per hour or, at most, 2,400 bushels a day. (Actually, it harvests oysters from the bottom only 5 to 7 percent of the time); (2) It kills too many spat and larger seed and leaves too many behind on a bed; (3) It takes inadequate biased samples of oysters from the bottom to determine their condition; and (4) It covers too little area when used to check beds for the presence of starfish.

Because of a short supply of boats, a great need exists for a harvester that will load a boat or barge with seed (with less breakage) or market oysters much faster. A harvester that could remove all spat from a bed probably would also remove enemies from the bottom--such as starfish, oyster drills, mud crabs, and slipper shells. The Bailey hydraulic-escalator oyster harvester used on the Pacific Coast (Quayle, 1969), or the Chesapeake Bay escalator clam harvester modifield to harvest oysters in Eastern Canada (Medcof, 1961), would probably satisfy these requirements. But these harvesters would have to be modified to retain small predators and to function on beds under the deeper waters of Long Island Sound (MacKenzie).

Most seed beds have at least 1,000 and many more than 5,000 bushels of shells per acre buried under the bottom. A device such as a wide agricultural cultivator with deep-penetrating, curved, rigid tines could be towed to raise the buried, but clean, shells to the surface. Silt might have to be flushed off these raised shells afterwards. Uncovering these shells would greatly expand the area available for a set of oysters.

Many unused seed beds have more than 1,000 bushels of shells per acre on the surface of the bottom. These shells are virtually useless as cultch for setting oyster larvae, however, because they are covered with fouling organisms. BCF is trying to develop a method for killing these organisms before oyster setting. If this can be done, the area available for a set of oysters would be greatly expanded.

Silt can be removed from a setting bed effectively by use of starfish mops or cutting boards. The design of both, however, can be improved. The starfish mop could be constructed wider than 12 feet, and the cutting board could be constructed so not to disturb sediments under planted shells. I found that most silt on shells originates from the bottom directly beneath the shells. The quantity of silt in bottom sediments varies widely. For this reason, a cutting board that scours the bottom vigorously might stir up additional silt and worsen the condition of the shells on some beds. A cutting board that could be towed at predetermined distances above the bottom might remove silt from shells without disturbing the bottom, regardless of its consistency.

A device such as a wide agricultural cultivator with shallow-penetrating, curved spring tines needs to be used to recover oysters buried by storms. Divers have found that oysters are seldom buried more than an inch under the bottom; recovery should be easy. Oysters buried by storms have always died because companies have never attempted to recover them.

The cost of labor for culling oysters is much too high. A system such as a conveyor belt with holes, and with a side-to-side motion to separate oysters from small empty shells and stones, could be used to lower this cost.

CONCLUSION

The level of efficiency of oyster culture in Long Island Sound increased sharply during 1966-69. Undoubtedly, it will continue to increase because the differential between the cost of producing oysters and the selling price is extremely wide. Companies will make large profits on any oysters sold. New developments are needed to increase the quantities of oysters available.

ACKNOWLEDGMENTS

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WHAT ARE ALGAE?

Algae are primitive plants ranging in size from a single cell, which can only be seen with a microscope, to the giant kelps, which grow to a length of 100 feet. Algae are dominant in the sea, both in number of species (approximately 6,600) and in number of individual plants. Although algal cells contain chlorophyll and other pigments, these plants do not have roots, stems, or leaves. However, some larger forms do have structures which resemble these organs.

Algae do not need roots, because they live in a solution of nutrients and the whole plant can absorb water and nutrients from this solution. Some algae have a holdfast that resembles a root. The holdfast is simply a structure that holds the plant in place; it does not absorb water or nutrients from the "soil"; therefore, it cannot be called a root. Since most of the plant can absorb materials needed for sustenance and growth, there is no need for an elaborate system to transport water, nutrients, and food; therefore, algae do not have stems. The supporting structure of kelp that resembles a stem is called a stipe; it does not serve a transport function and it does carry on photosynthesis.

Some algae have blades that resemble leaves, but these are extensions of the plant body and are not the primary site of photosynthesis as in terrestrial plants. Because the entire body of the algal plant carries on photosynthesis, the blades are adapted to increase the surface area to make absorption and photosynthesis more efficient.

Photosynthesis requires light, and, since the amount of light available in the water is limited by suspended particles, the blades with their larger surface area enable the algae to receive more of the available light. When the water is very turbid, light penetration is poor and plants grow only in shoaler areas. Plants with large surface areas have a better chance of survival.

Large plants do not usually grow in the open ocean, but are restricted to water less than 300 feet deep; one exception is the sargassum weed which floats in the surface layers of the Sargasso Sea. Algae in the open ocean are generally one-celled forms and are limited to the lighted zone (surface to approximately 600 feet). These algae are extremely numerous and are referred to as the "grass of the sea" because they are the very beginning of the food chain in the sea. ("Questions About the Oceans," U.S. Naval Oceanographic Office.)

SNAPPERS OF THE WESTERN ATLANTIC

Luis R. Rivas

This paper is based on observations obtained during 18 years (1950-68) of exploratory fishing by the U.S. Fish and Wildlife Service and the BCF Exploratory Fishing and Gear Research Base at Pascagoula, Miss. The data may be readily retrieved by the Base's UNIVAC 9200 computer.

In this study, information is presented on the geographical, depth, and temperature distributions of the 11 species of *Lutjanus* that occur in the western Atlantic.

L. analis	Muttonfish or mutton snapper
L. apodus	Schoolmaster
L. buccanella	Blackfin or hambone snapper
L. campechanus	Gulf red snapper
L. cyanopterus	Cubera or Cuban snapper
L. griseus	Mangrove or gray snapper
L. jocu	Dog snapper
L. mahogoni	Mahogany snapper
L. purpureus	Caribbean red snapper
L. synagris	Lane snapper
L. vivanus	Silk or yelloweye snapper

Throughout this paper the species will be referred to by common name with the word 'snapper' omitted.

For keys, descriptions, and figures serving to identify species of snappers, see Rivas (1949; 1966), Anderson (1967), and Randall (1968: 120).

The exploratory work of the Pascagoula Base extends from Cape Hatteras, N.C., to the bulge of Brazil (Fortaleza). Because these snappers are tropical and subtropical, horizontal distribution is adequately covered. Throughout this area, 2,809 stations were occupied during the 18-year period that yielded species of *Lutjanus*. Only the Gulf red was collected north of Cape Fear, N.C.

The species of *Lutjanus* are essentially bottom fishes, so we have considered only bottom-sampling gear and bottom temperatures. Bottom temperatures were not always taken this way, thus there are few or no records for some species.

The vertical coverage, which extends from 2 to 2,685 fathoms, is considered adequate, except perhaps for species such as the mangrove and cubera in the very shallow waters of estuaries. However, the mangrove was recorded from 102 stations; the cubera from only 3. Figure and Table 1 show the preferred depth for the mangrove as 17 to 27 fathoms, despite its known occurrence in estuaries. The three records for the cubera are from 23, 25, and 26 fathoms on Campeche Bank well offshore from estuarine conditions. This would seem to indicate that the cubera is a much less abundant species, rather than that vertical coverage was inadequate.

Table 1 - Depth Distribution of Eight Species of Western Atlantic *Lutjanus*. The Cubera, Dog, and Mahogany Are Not Included Because of Insufficient Records (See Text and Figure)

Species	Catch	Depth		
		Mean	Total Range	70% Range[1/]
	No.	. . .	. . (Fathoms) . . .	. . .
Mangrove	102	22	4-42	17-27
Lane	742	24	2-60	16-32
Schoolmaster	81	26	10-38	22-30
Mutton	253	27	4-47	22-32
Gulf red	1,223	29	5-80	17-41
Caribbean red	167	32	14-105	22-42
Blackfin	65	48	4-104	27-69
Silk	163	65	15-180	32-98

1/Where 68.26% of the records occur. Obtained from one standard deviation on each side of the mean and here rounded to 70% for convenience.

Seasonal coverage is also adequate except perhaps for July and December. The 2,809 stations that yielded *Lutjanus* are distributed (in percent of total) by month:

Jan.	Feb.	Mar.	Apr.	May	June
9%	9%	8%	13%	15%	5%
July	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**
2%	5%	11%	7%	12%	4%

The lower percentage in July, compared with April and May, results from decreased

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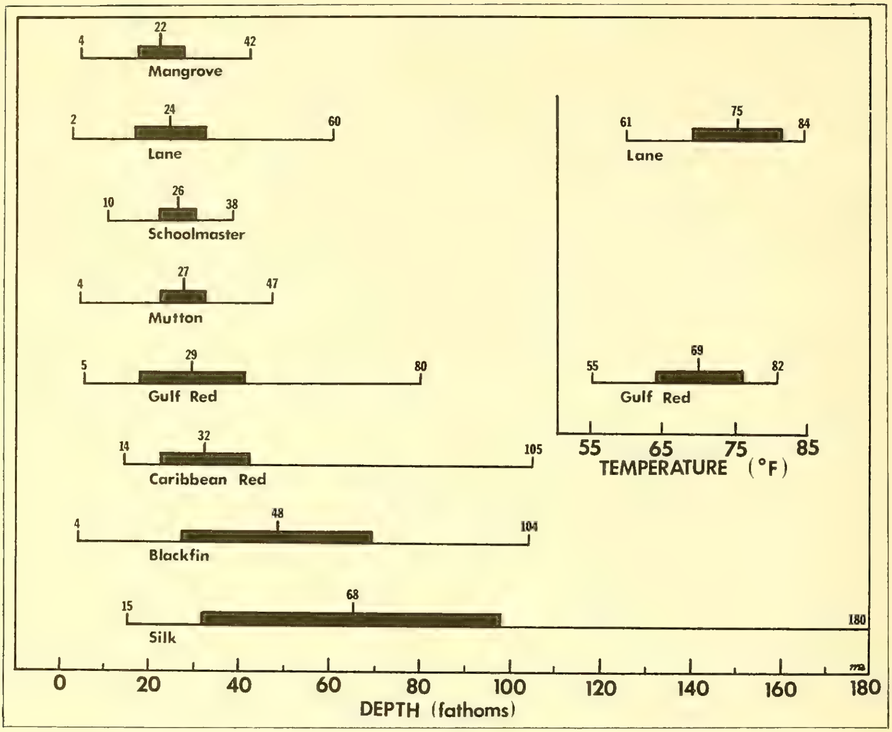

(Figure) Depth and temperature distributions of species of western Atlantic Lutjanus. Black bar indicates 68.26% of the records, obtained from one standard deviation on each side of the mean and rounded to 70% for convenience. Some species are not included because of insufficient records (see text and tables 1 and 2).

fishing effort; it is not to be interpreted as a change in seasonal abundance. When the monthly percentages on page 41 are combined by seasons, the coverage for spring is 33 percent, summer 18 percent, fall 23 percent, and winter 26 percent.

GEOGRAPHICAL DISTRIBUTION

The Gulf red and Caribbean red have separate geographic ranges, but the other species occupy about the same range, and the Gulf red and Caribbean red each occur with them.

Our data show the Gulf red is the species occurring farthest north. It was collected from Cape Hatteras southward and, apparently, is restricted to southeastern United States and the Gulf of Mexico. Mutton, mangrove, blackfin, lane, and silk do not occur north of Cape Fear, except perhaps as stragglers. The schoolmaster was not taken north of Jacksonville, Fla., and the Caribbean red apparently is confined to the Caribbean and southward to Brazil. Our data do not show any records north of the Honduran Banks for the Caribbean red, but records (Rivas, 1966) indicate that it occurs along Cuba's south coast. The data for cubera, dog, and mahogany are not sufficient to outline their distribution. All three records available for the cubera are from Campeche Bank. The five records for the dog are from off British Honduras and the coast of Colombia; however, it is known to occur as far north as south Florida and the Bahamas. There are only three records for mahogany--one from off Jupiter Inlet, Fla., another from Serrana

Bank in the central Caribbean, and a third from off French Guiana. In view of the extensive exploratory effort, it would seem that the few records for cubera, dog, and mahogany indicate less abundance rather than inadequate geographical coverage.

With the exception of the Gulf red, the other western Atlantic species of Lutjanus have been reported as occurring as far south as Brazil. Because our exploratory coverage in Brazil has so far extended only to off Fortaleza, the southern limits of distribution cannot be established from our records.

VERTICAL DISTRIBUTION

Vertical distribution of the eight most common western Atlantic species of Lutjanus is summarized in Table 1 and Figure. Because of insufficient records, cubera, dog, and mahogany are not included. The three records for cubera are from 23, 25, and 26 fathoms. Of the five records for the dog, two are from 5 fathoms, and three from 13 fathoms. The three records for mahogany are from 1, 14, and 16 fathoms.

The depth distribution of the lane, mutton, Gulf red, blackfin, and silk herein recorded agree with the findings of Camber (1955: 23) and Carpenter (1965: 8).

Table 1 and Figure show the depth range greater in the deeper occurring species, and that the blackfin and silk occur at significantly greater depths than the others. A study of catch composition shows that the mangrove, lane, schoolmaster, mutton, Gulf red, and Caribbean red--with mean depths of 22 to 32 fathoms--are often taken together; these are seldom taken with the blackfin and the silk, with mean depths of 48 and 65 fathoms, which are often taken together.

The relation of fish size to depth of occurrence indicates that in most, if not all, species, the juveniles and young occur shallower than the mean depth, and the larger adults deeper than the mean depth. For example, in the Gulf red, fish weighing less than $\frac{1}{4}$ to 2 pounds occur at 5 to 29 fathoms; 2- to 20-pound fish, at 30 to 34 fathoms; and 20- to 35-pound fish, at 35 to 80 fathoms. This relation agrees with findings by Caldwell (1955) for the longspined porgy, Stenotomus caprinus, and by Caldwell (1957) for the pinfish, Lagodon rhomboides.

TEMPERATURES OF OCCURRENCE

Despite few records of bottom temperatures, the data available suggest trends at least for some species. Here, only depth records with bottom temperature records are considered.

The seven records for the blackfin range from 64° to 77° F., with a mean of 71.1° F. at a mean depth of 64 fathoms; this is 16 fathoms deeper than the mean depth for the species (figure; table 1).

The eight records for the mangrove range from 65° to 81° F., with a mean of 70.8° F. at a mean depth of 18 fathoms; this is 4 fathoms shallower than the mean depth for the species (figure; table 1).

The 11 records for the mutton range from 66° to 82° F., with a mean of 76.6° F. at a mean depth of 27.5 fathoms--practically the mean depth for the species (figure; table 1).

The 15 records for the Caribbean red range from 64° to 84° F., with a mean of 78.4° F. corresponding to a mean depth of 35 fathoms; this is 3 fathoms deeper than the mean depth for this species (figure; table 1).

The 38 records for the silk range from 56° to 81° F., with a mean of 68.9° F. corresponding to a mean depth of 84 fathoms--19 fathoms deeper than the mean depth for this species (figure; table 1).

The 100 records for the lane (table 2) include all seasons and practically the species' entire geographical range. Bottom temperatures range from 61° to 84° F., with a mean of 75.2° F. at a mean depth of 23 fathoms; this is nearly the same as the mean depth for this species, 24 fathoms (figure; table 1).

The 268 records for the Gulf red (table 2) may be subdivided into three subregions that

Table 2 - Temperature Distribution of Two Species of Western Atlantic Lutjanus. The Other Nine Species Are Not Included Because of Insufficient Records (See Text and Figure)

Species	Catch[1]	Temperature		
		Mean	Total Range	70% Range[2]
	No.	F.	F.	F.
Lane	100	75°	61°-84°	68°-82°
Gulf red	268	69°	55°-82°	62°-76°

1/Catches for which bottom temperature records are available.
2/Where 68.26% of the records occur. Obtained from one standard deviation on each side of the mean and here rounded to 70% for convenience.

constitute the entire known geographical range of the species. The 53 records from Cape Hatteras to Cape Kennedy, Fla., range from 55° to 80° F.; the mean is 68.2° F., corresponding to a mean depth of 24 fathoms; this is 5 fathoms shallower than the mean depth of 29 fathoms for the species (figure; table 1). The 160 records for the northern Gulf of Mexico--from Cape Sable to the mouth of the Rio Grande--range from 59° to 80° F., with a mean of 67.5° F. corresponding to a mean depth of 31 fathoms; the mean is only 2 fathoms deeper than the mean depth for this species (figure; table 1). The 55 records from Cape Kennedy to Cape Sable, Fla., including the Florida Keys and the southern Gulf of Mexico to the mouth of the Rio Grande, range from 59° to 83° F. The mean is 71.7° F., corresponding to a mean depth of 27 fathoms, only 2 fathoms shallower than the mean depth for this species (table 1). As would be expected, the area from Cape Hatteras to Cape Kennedy and the northern Gulf of Mexico have about the same mean temperature--about 4° F. lower than that of the southern Gulf and south Florida. The similar and wide ranges of temperature variation in the three subregions indicate that the Gulf red is able to tolerate 55° to 82° F.

Bottom temperature records are absent or insufficient for schoolmaster, cubera, dog, and mahogany; as shown above, the records are weak for the remaining species, except the lane and Gulf red. Depth distribution within the same geographic range is similar, so temperature distribution for mangrove and schoolmaster may be inferred from the lane--and for mutton from that of the Gulf red, at least for the area in which both occur together.

The temperature variations discussed in this section may be attributed to season as well as depth.

HABITAT

Optimal bottom temperatures and depths are not necessarily indicative of snapper abundance unless they are associated with suitable bottoms. Camber (1955: 22) and Carpenter (1965: 8) reported that snappers prefer hard bottoms of broken relief covered with coral heads and outcrops of rocks. This bottom type is described and called "live-bottom habitat" by Struhsaker (1969: 272). According to Smiley (1885: 92), the Gulf red is almost certain to be found in the northern Gulf of Mexico where there is coral rock or gravel.

These comments apply to species of snapper that occur on the Continental Shelf to depths of about 100 fathoms, but mostly at depths below 70 fathoms. This would partly exclude the silk, which abounds also along the shelf edge or even on the upper Continental Slope. In this region, described and called "lower-shelf habitat" by Struhsaker (1969: 273), smooth mud bottom predominates. Apparently the silk may be found on this type of bottom, although it is not suitable for the other species.

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FISHERY OCEANOGRAPHY--VI
OCEAN FOOD OF SOCKEYE SALMON

Felix Favorite

A vital part of fishery oceanography is the knowledge of food chains and of the locations of high abundance of food organisms. Life stems from the sun; this is as true in the sea as it is on land. Microscopic single-cell plants, or phytoplankton, drifting in a thick soup of chemical nutrients (compared to the quantities available in most soils) use radiant energy from the sun to live and to multiply. In spring, a quart jar filled with water from the sea surface may contain a million of these cells--in some areas, many millions. Some cells, diatoms for instance, divide and produce two cells within the span of a day or less; if this process continued for a month, each cell would produce over a billion cells. One can easily visualize the significance of the so-called bloom of phytoplankton, which occurs each spring in high latitudes under the required environmental conditions of light, nutrients, and vertical stability in the water column. In the absence of large numbers of marine animals that graze on plankton, such blooms continue until one of the numerous nutrients required for plant growth is depleted.

Only a limited amount of research on nutrient chemistry has been accomplished in the Subarctic Pacific Region. However, if we consider the phosphate-phosphorus distribution (which has been studied) as indicative of nutrient concentrations (even though phosphate is recycled more rapidly than nitrate), it appears that nutrient concentrations are high and show no depletion in any season. Concentrations in the upper 100 meters of these waters are from 5 to over 10 the concentrations in waters farther south between 40° and 20° N., except off the west coast of North America where upwelling carries nutrients from deep water into the surface layer. The high concentrations in the Subarctic Region are also attributed to a vertical movement of deep water (explained in article IV of this series, November 1969 CFR). Some chemical studies indicate that nitrate may be limiting at times, but there is increasing evidence that the phytoplankton may be cropped by herbivorous zooplankton before the bloom reaches the immense proportions suggested by the high phosphate concentrations. Until more exhaustive chemical studies are made, we must accept this conclusion.

Measuring Plant Production Important

Nevertheless, there are methods of measuring the production of plant material over short periods of time, and estimates have been made of the animal life it is capable of supporting. These estimates are important in our control, or management, of the stocks of Pacific salmon (genus Oncorhynchus). Natural spawning areas in some river systems could be expanded and the capacity and number of salmon hatcheries increased to accommodate greater oceanic production. We believe that the hundreds of millions of salmon in the Subarctic Region constitute only a small fraction of the actual number of fish. We are unable, however, to determine how successful increased numbers of salmon would be in competing for food with the other organisms in this ecosystem. We know that the average weight of mature pink salmon (O. gorbuscha), which spend only 1 to $1\frac{1}{2}$ years at sea, can vary 50 percent or more between years, and that it is not uncommon for mature pink and sockeye salmon (O. nerka) to be smaller in years when large numbers return to their natal river for spawning than in years when few return. Even though sockeye salmon usually spend the last 2 or 3 years of their lives growing and maturing in the ocean, their reduced size may be due to increased competition for food during the first year or two after hatching, which are spent in a fresh-water lake.

Experimental Fishing Catches More Salmon At Night

Pacific salmon grow and mature in the marine environment, but the effect of food

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distribution and abundance on their movements is not clear. In our experimental fishing, conducted with gill nets (approximately 3 m. in depth), it was obvious from the start that more salmon were caught at night than during the day. Almost without exception, when our fishing was conducted at night the majority of salmon were caught in the upper third of the nets. This was sometimes interpreted to signify that salmon rose to the surface at night to feed upon plankton or other organisms closely associated with plankton; others believed that salmon can see and avoid the gill net more readily during the day. But studies with sunken gill nets (as deep as 60 m.) have revealed sockeye and chum salmon (O. keta) during day or night at depths of at least 40 m. Chinook salmon (O. tshawytscha) are believed to be at much greater depths at times.

3 Major Species Eat Mostly Plankton

We know that three (sockeye, pink, and chum) of the five major species of Pacific salmon are predominately plankton feeders, but that they also consume small fish and squid. To ascertain their feeding habits, the stomach contents of over 5,000 sockeye salmon (caught in gillnets at 82 locations in the central Subarctic Region in 1960) were analyzed. Although another method of capture would have been preferable because salmon tend to regurgitate food when caught in a gill net, the results are interesting. The stomachs were divided into two categories--those collected in May and June, and those collected in July and August. Sockeye salmon caught in the Subarctic Region in May and June are mainly mature fish returning to river systems to spawn; those caught in July and August are mostly immature and will probably spend at least 1 more year in the ocean. Neither group had difficulty finding food over a wide area of the ocean (fig. 1). At 68 of the stations, over 50 percent of the stomachs were at least $\frac{1}{4}$ full. This suggests that salmon obtain food in areas other than the immediate Aleutian Island area, which has been considered the primary "feeding ground" for salmon. The average percentages of the total stomach contents contributed by different taxonomic groups were: amphipods - 43, fish - 18, squid - 16, euphausiids - 12, copepods - 7, pteropods - 2, and unidentified - 2. Other investigators found for other years that copepods or euphausiids were the dominant organisms in stomachs of sockeye salmon, but it is not known whether these organisms were predominant in the plankton during those years.

No particular organism dominated in the stomachs of fish taken at individual locations (fig. 2), nor was there any particular distribution pattern. This was not surprising because all stations were within the subarctic regime. The distribution of species within taxonomic groups probably differed among stations or groups of stations. But such differences are difficult to demonstrate because identifying characteristics are usually obliterated by ingestion and digestion.

Estimating Food Abundance Near Fishing Stations

Because of the great variety of food eaten by sockeye salmon, an estimate of the abundance of all food organisms in the vicinity of a fishing station would require the towing of numerous sampling devices (with various mesh sizes). These would have to be at various speeds and depths, throughout the water column, and over a large area. Such studies have not been possible. Although we have made vertical plankton hauls with small-mesh nets, the samples were inadequate to estimate the food organisms available to salmon. Once, during the early phases of our work, a two-ship operation took place in which a fishing vessel set a gillnet and an oceanographic research vessel made exhaustive plankton hauls throughout the night at various distances from the net. Unfortunately, no salmon were caught, and we have not had an opportunity to repeat this kind of experiment. Such studies of the relation between food available and food eaten would also require knowledge (still largely lacking) of the rate at which salmon digest food organisms. This merely points out, again, the frustrations and difficulties encountered in fishery oceanography.

Nevertheless, in spring and summer 1961, we made 24-hour investigations of the vertical distribution of macro-plankton at numerous locations. A modified Isaacs-Kidd trawl was towed at 25-m. depth intervals from the surface to 200 m. At three representative stations, the maximum biomasses were at 50, 125, and 125 m. during the day, and 25, 25, and 100 m. at night (fig. 3). The effects of these distributions of food organisms upon the vertical distributions of salmon are still unresolved. The analysis of the contents of a limited number of stomachs from sockeye salmon caught during late winter in 1962 indicated active feeding on amphipods and lanternfishes. It was previously believed that little, if any, food is consumed during this period because

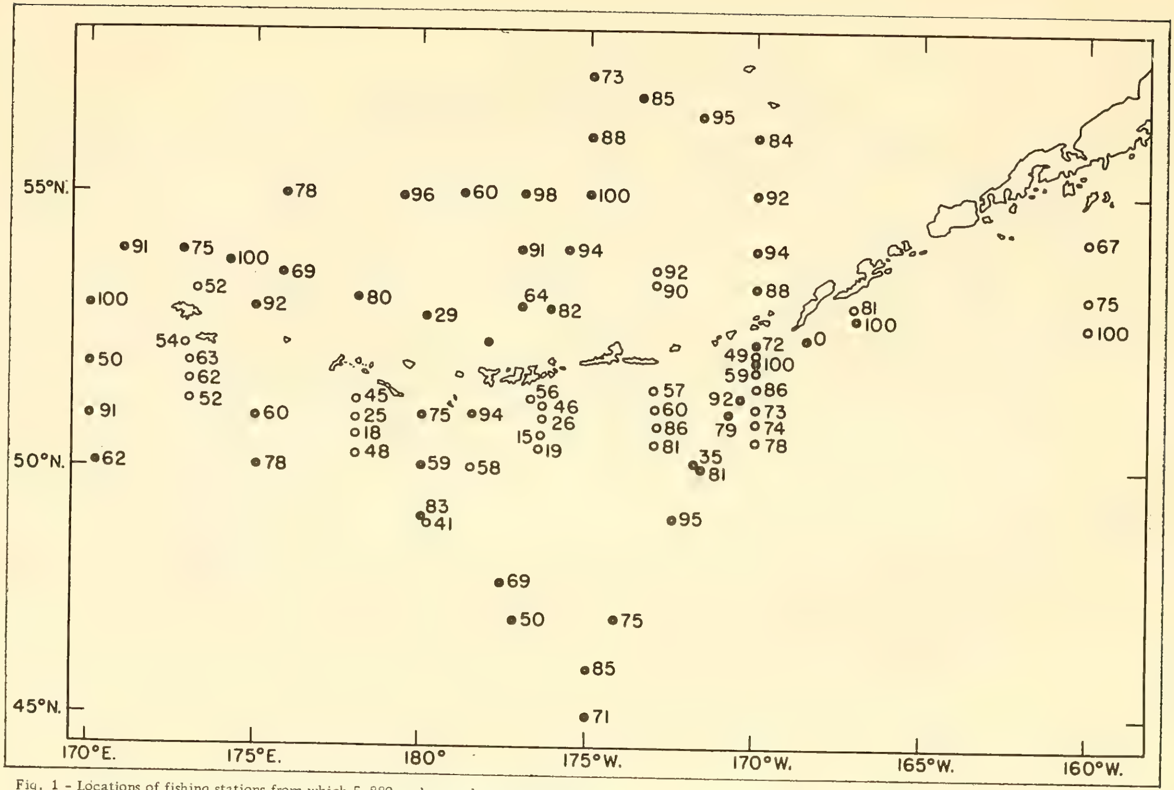

Fig. 1 - Locations of fishing stations from which 5, 880 sockeye salmon stomachs were obtained in May and June (closed circles) and July and August (open circles), 1960. Numbers indicate percentages of stomachs having a significant food content.

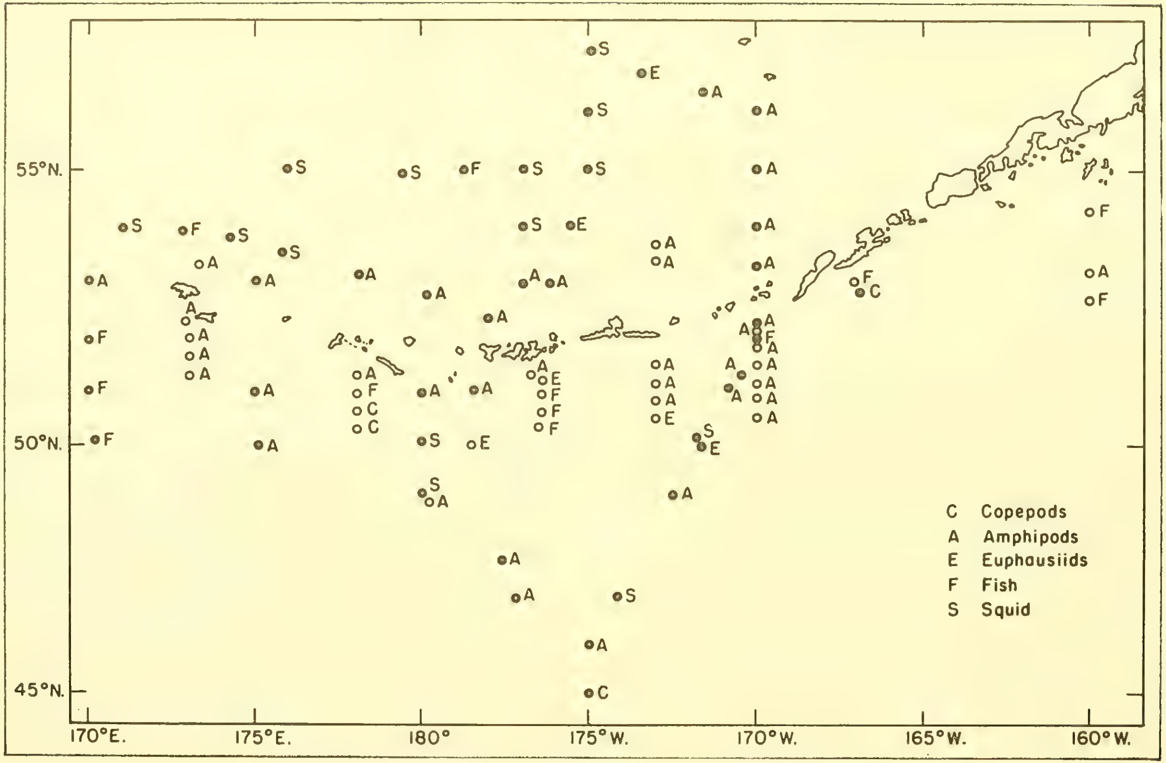

Fig. 2 - Dominant food organisms in stomachs of sockeye salmon at individual stations.

Fig. 4 - Photograph of sockeye salmon scale showing winter growth zones that formed in fresh water (narrow arrows) and salt water (wide arrows). The salmon was in its sixth year at time of capture: it had spent 2 winters in fresh water and 3 in salt water. (Photo: K. Mosher)

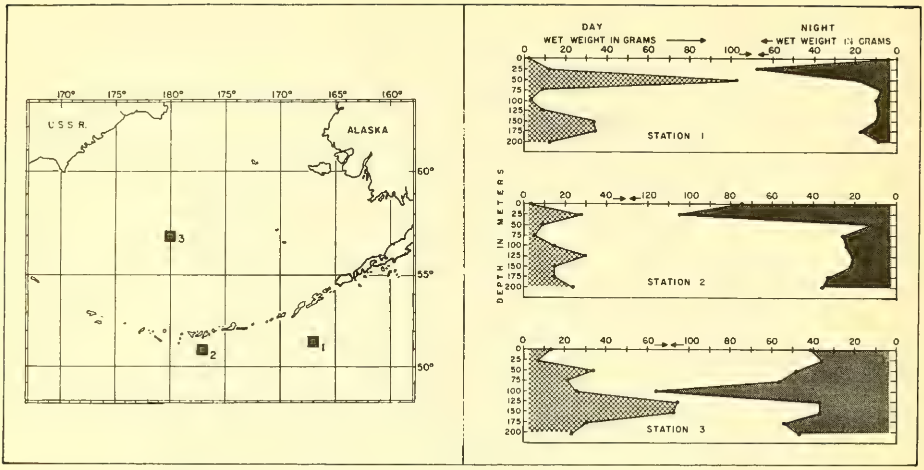

Fig. 3 - Vertical distribution of biomass at 25-m. depth intervals at three stations, during the day and at night, as determined by catches in a 3-foot Isaacs-Kidd midwater trawl.

the narrow spacing of circuli on the scales suggests little growth. The narrow spacing during winter is significant. It permits us to ascertain the age of the salmon by counting year-marks, which are analogous to the rings in a cross-section of a tree trunk (fig. 4).

Study Biomasses of Environmental Waters

We are completing biological studies along a line of stations south of Adak Island to ascertain if the various environmental waters, such as the Alaskan Stream and the Subarctic Current, and the Ridge Area which separates these two systems, have characteristic biomasses. It appears that the phytoplankton bloom is greatest inshore in early spring--but that the standing stock of zooplankton is greatest in the Ridge Area. This has been interpreted to mean that grazing by large numbers of zooplankton in offshore areas prevents the standing stock of phytoplankton (as indicated by the nutrients) to attain its immense potential. Extensive grazing in turn seriously restricts the potential plankton production in the Subarctic Region.

Further estimates of potential primary production are being made on the basis of cloud cover data obtained from ESSA satellite photographs. Monthly averages of daily cloud cover indicate that previous estimates based upon sporadic ship reports are not representative; thus values of incident radiation, corrected for shielding by clouds, are in error. Production of phytoplankton is directly related to incident radiation. Even though zooplankton cropping may exist, knowledge of areas of minimum cloud cover in spring could possibly denote areas of high primary production and, therefore, possible feeding areas for adult salmon before or during their spawning migration to natal streams in late spring.

Thus we are entering a predictive phase. This, of course, is the ultimate goal of all oceanography programs--to obtain enough knowledge of the conditions and processes in a particular system to make long- and short-range predictions. Some scientists feel that we are at least 10 years, and perhaps many decades, away from such a goal. This period of time may be a gross underestimate or overestimate, depending upon the requirements and use of the prediction. Yet each step should pave the way to ultimate success. In the next article, the last in this series, I will describe our attempts to forecast ocean current flow in the salmon environment.

OTTER TRAWLING INTRODUCED TO COLUMBIA RIVER SMELT FISHERY

A Progress Report

Ian E. Ellis and Clint Stockley

An otter trawl net was test fished in the Columbia River to catch eulachon. Limited commercial trawling caught about three times as many eulachons per day as gill netting did during the same period. Trawl gear costs less than gill nets and produces higher quality fish with less effort.

The fishery on the eulachon or Columbia River smelt, Thaleichthys pacificus, has used gill nets for many years (Pruter, 1966). The excessive handling and associated time loss using this method, plus high wastage and the product's frequently poor appearance, inspired a search for a better harvesting method. Initial results of a joint study by the Columbia River Laboratory of the Washington State Department of Fisheries and BCF's Exploratory Fishing and Gear Research Base at Seattle, Washington, indicate the potential value of using small trawl nets in the eulachon fishery (figure 1).

THE FISHERY

Eulachon enter the Columbia River in November and are subjected to the commercial gill net fishery until they enter the tributaries, where they are taken by dip nets. While in the main river, the fish move up and down the river as well as vertically through the water column (Snyder, 1969). Eulachon form dense schools near the bottom on the ebb tide and are taken by weighted "diver" (sunken) nets. At the turn of the tide, and on the flood tide, the fish are at intermediate depths where they are caught by "bobber nets" (gill nets

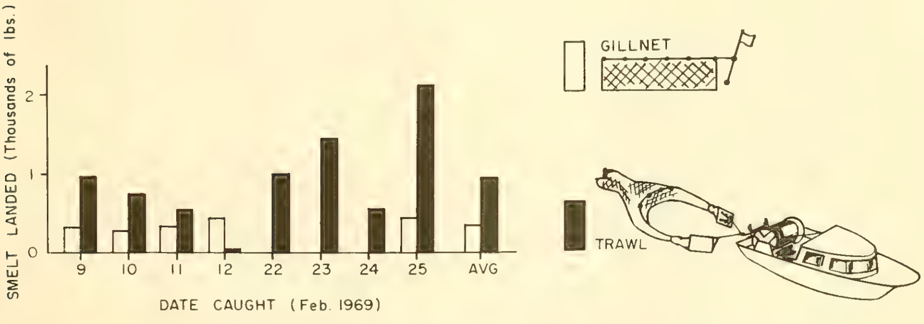

Fig. 1 - A comparison of daily catch of eulachon by an otter trawl (table 3) with the daily average catch of a sample of gill net fishermen (table 4).

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suspended below the surface by dropper lines). At high slack water, the fish are scattered near the surface and are taken with surface-floating gill nets.

Gill netting, normally a one-man operation, involves considerable handling, duplication of gear, and travel time. It is customary to fish two or more gill nets. Each net is fished by repeatedly drifting through the fishing area until the net is loaded. When all nets are loaded, the fisherman runs the boat to his shaking raft or dock. Then he removes each net from the boat, pulls it free in sections, and shakes each section vigorously to remove the smelt. When the smelt are clear of the net, he shovels them into boxes.

This process produces a poor-quality product. A net may be set and retrieved two or three times before the fish are removed (recapping); this causes some of the catch to be dragged over the boat rail several times. The fish are carried on the vessel tangled in the net with bodies distorted for some time before removal. Many fish have their heads snapped off during the shaking process, and the catch may include dirt and slivers off the floor of the shaking area when shoveled into boxes. In many cases hand sorting is required to remove badly damaged fish. These problems of the gill net fishery have led fishermen to seek alternative harvesting methods. In the past, at least two attempts to trawl for eulachon have been made. Trigve Tover of Puget Island, Washington, made and fished a trawl successfully in 1941 (personal communication, Max Holland, commercial fisherman, Puget Island, Wash., 1969). In 1942, Albert Coles, a commercial fisherman of Longview, Wash., made a beam trawl with a water pipe frame, and installed bicycle wheels at the ends to hold the net off the bottom. He made good catches until he snagged and lost his gear (personal communication, Albert Coles, 1968).

Most Columbia River gill net vessels seem suitable for handling small trawls. Several have gasoline engines in the 200- to 400-horsepower range, whereas trawls have been towed by vessels with engines as small as 25 horsepower (Baldwin, 1961). Also, some of the vessels have power-drive gill-net reels that could facilitate handling of the gear.

Washington State fishery regulations do not permit trawling in the Columbia River; however, the Department of Fisheries can issue permits for trawling provided permittees obtain trawl licenses. Because the 1969 effort was experimental, the State issued a special test-fishing permit, at no cost, which allowed experimental trawling while a Department representative was aboard. All catches had to be returned to the water. The success of the initial attempts led the fishermen to purchase a trawling license and to obtain a special permit to use trawl gear on a commercial basis.

METHODS AND MATERIALS

Several sources contributed to the program. The Washington Department of Fisheries provided background knowledge, a special fishing permit, and program monitoring. The BCF Exploratory Fishing and Gear Research Base furnished the trawling gear and technical advice on using it. Captain Arthur Peterson provided his and his mate's services and his vessel for the trawling trials in the main stem of the Columbia River near Longview, Washington.

Vessel

The vessel used was the stern fishing, gillnet 'Sandy,' 32 feet long and with a 325-horsepower gasoline engine. The net was hauled on a gill net reel, which has a hydraulic drive system powered by the main engine. A shallow-water echo sounder with recording paper readout was operated during test fishing. The transducer was suspended over the side during use.

Model Shrimp Trawl

The principal net used was a modified model of a four-seam Gulf of Mexico shrimp trawl (figure 2). The footrope was 22 feet long, and the headrope was 17 feet long. The body had four panels of $1\frac{1}{4}$-inch stretched mesh 15-thread nylon webbing. The net was 175 meshes across the wingtips.

The net was originally constructed with a horizontal separator panel and upper and lower cod ends, similar to the French "trouser trawl" (Boddeke, 1965) to test the French shrimp-sorting techniques in Pacific Northwest waters. The separator panel was removed from the net and a body liner of $\frac{5}{8}$-inch stretched mesh webbing was constructed and installed in the trawl. The liner was hung to the meshes along an imaginary line 50 meshes behind the center of the headrope and 20 meshes behind the center of the footrope. The

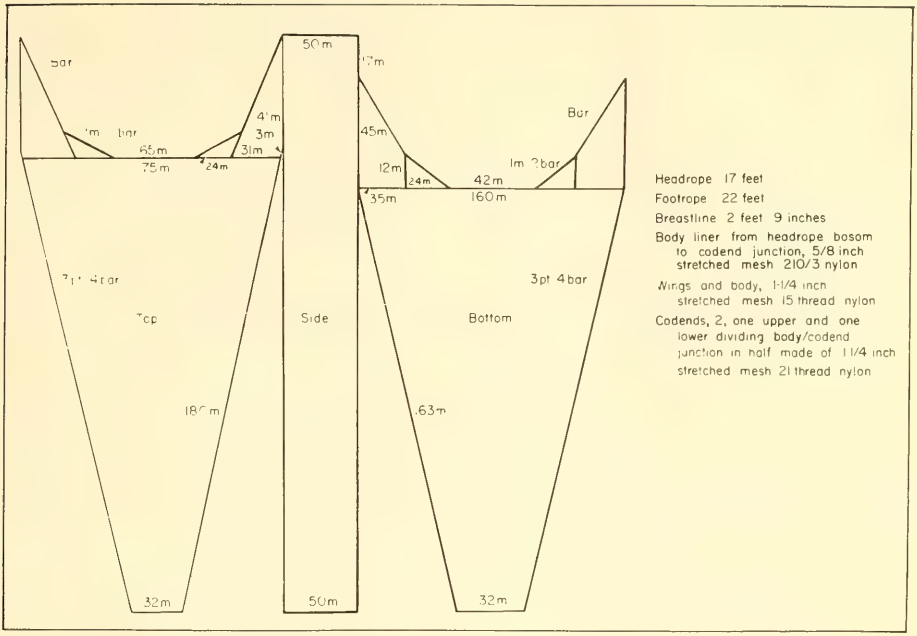

Fig. 2 - The model shrimp trawl modified for use in the smelt fishery.

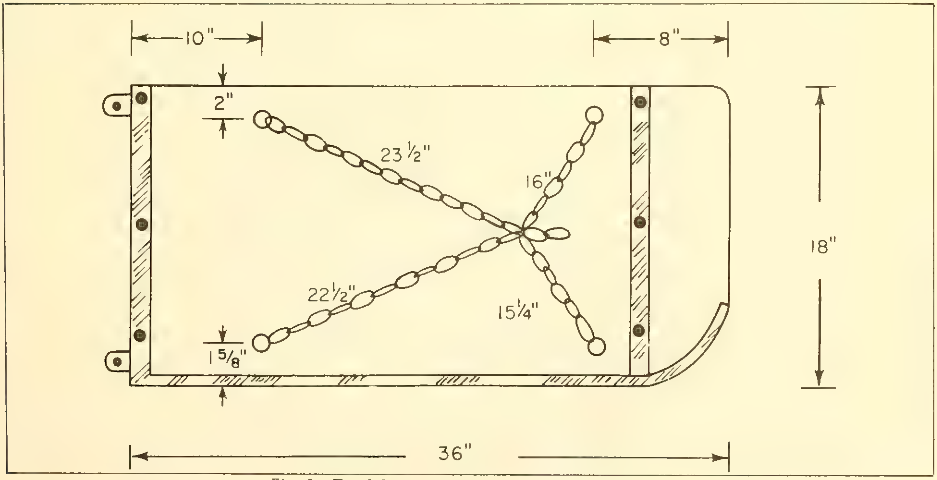

Fig. 3 - Trawl doors used with the model shrimp trawl.

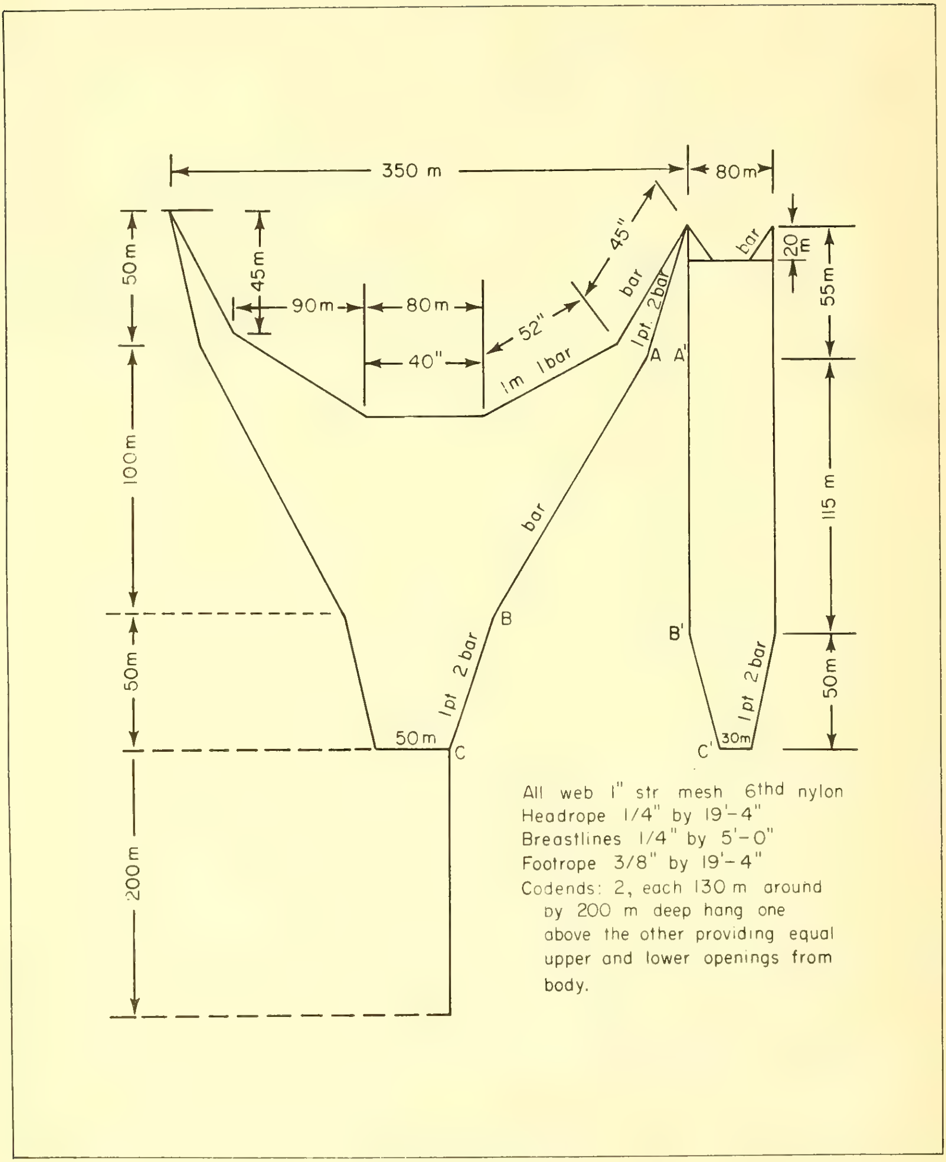

Fig. 4 - BCF Smelt Trawl

liner was allowed to lie free within the net and lay back beyond the body-cod end junction. During fishing trials, the liner was shortened to reduce fouling. We felt that stretching of the cod end would elongate the meshes--constricting them enough to prevent a significant loss of smelt.

Wooden shrimp trawl doors were used to spread the net (figure 3). The doors were 18 inches high by 36 inches long with a steel shoe. The after edge of each door was connected to the wingtip at top and bottom by a 3-foot pennant. A 26-foot-long tickler chain of $\frac{5}{64}$-inch proof coil chain was shackled to the lower wingtip eye of the door. A four-point chain bridle was used to connect each door to the 3-foot-long, $\frac{3}{8}$-inch nylon groundline.

BCF Smelt Trawl

The fishermen's desire for a larger net led to the design and construction of the BCF smelt trawl (figure 4). The wings and body are of 1-inch stretched mesh 6-thread nylon. The $19\frac{1}{3}$-foot headrope and 5-foot breastlines are of $\frac{1}{4}$-inch braided dacron over polyethylene, and the footrope is a $19\frac{1}{3}$-foot piece of $\frac{3}{8}$-inch dacron/polypropylene. The net has a 350-mesh wingtip spread and 80-mesh high side panels. Two cod ends were used--one upper and one lower--each of 1-inch mesh 9-thread "Marlon."1/ A $2\frac{1}{2}$-inch, 36-thread nylon chafing gear was installed below the lower cod end.

The BCF smelt trawl was spread by $\frac{3}{4}$-inch-thick plywood doors, 24 inches high by 42 inches long (figure 5). An experimental hookup system was tried but proved impractical. A later hookup system was similar to that used with the smaller model shrimp trawl doors. Each door was connected by separate pennants to upper and lower wingtips and was attached to the 50-foot long, $\frac{3}{8}$-inch polypropylene groundline by a four-point chain bridle.

Towing Warp and Net Reel

A $\frac{1}{2}$-inch, 3-strand nylon warp was used to tow the trawls because the gear often fouled in the river and the nylon warp stretched, slowing the boat gradually rather than putting a damaging sudden shock on the gear. A towing

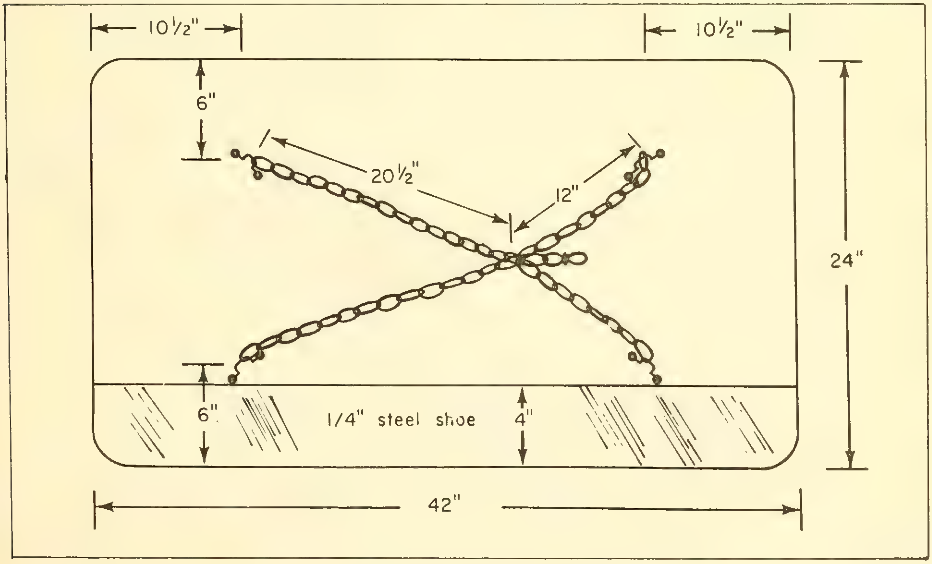

Fig. 5 - Trawl doors used with the BCF smelt trawl.

1/Trade names referred to in this publication do not imply endorsement of commercial products.

eye was tied into the warp at each anticipated towing point, and a towing bridle, anchored to hull cleats, was used to take the strain off the reel while towing. The nylon warp and groundlines were wound on the gill net reel (figure 6). The depth of the net was altered by paying out or taking up line on the powered reel; this eliminated much physical labor. The reel had sufficient power to haul easily and unaided one catch of 600 pounds over the rail and into the vessel.

Gear Costs

Table 1 compared costs of the major components of trawl system and gill nets.

Diver Observations

The trawl gear was observed by divers in Puget Sound. The model shrimp net with 18-inch by 36-inch doors rigged as in the commercial tests was found to be $3\frac{1}{2}$ to 4 feet high at the center of the headrope and 8 feet wide. The BCF smelt trawl with 18-inch by 36-inch doors was 4 to 8 feet high and $12\frac{1}{2}$ feet wide. With 24-inch by 42-inch doors, the BCF net was 4 to 8 feet high and $13\frac{1}{2}$ feet wide. The mouth openings were, therefore, about 25 to 30 square feet for the shrimp trawl, 35 to 75 square feet for the smelt trawl with small doors, and 40 to 85 square feet for the smelt trawl with large doors.

These nets were set and retrieved by hand without difficulty from BCF's 23-foot vessel 'Sea Probe.'

Test Fishing

The model shrimp trawl was tested in the Columbia River on February 6 and 7 under the conditions of a permit from the Washington Department of Fisheries to conduct experimental fishing. Four bottom tows were made each day during the ebb tide. Catches varied up to 350 pounds in a 14-minute tow (table 2). These catch rates were sufficiently encouraging so that the fishermen purchased a trawling license to fish commercially.

Useful information was obtained from these tests. The Washington Department of Fisheries observer, using a portable recording echo sounder, saw apparent fish signs on bottom during the ebb tide rise in a 2-foot-thick band to a depth of 35 feet over a 55-foot bottom depth as slack water approached. The

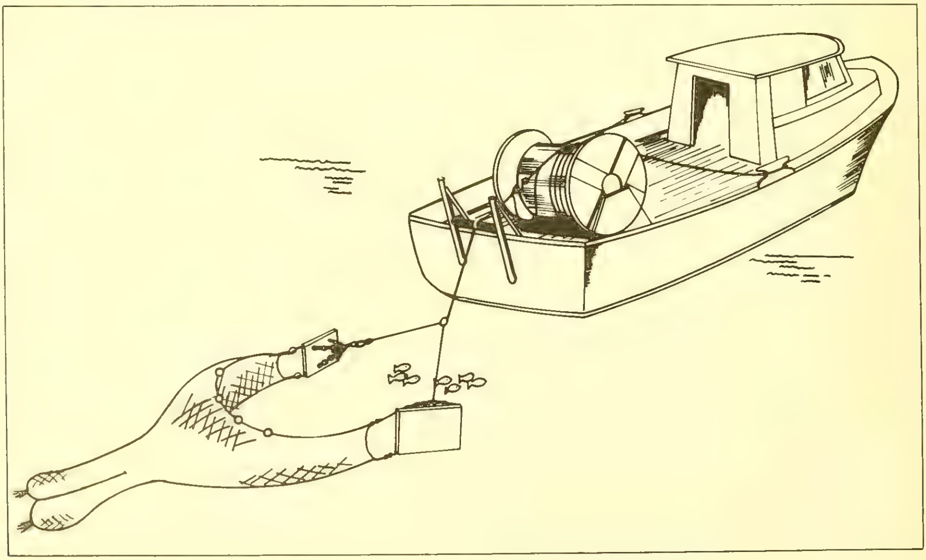

Fig. 6 - Stern picking gill net vessel with reel as rigged for smelt trawling.

Table 1 - Smelt Gear Costs

		Materials Only		Complete
GILL NETS				
Diver gill net 90 fms. long x 60 meshes deep	1/	$ 251.80		
Floater gill net 100 fms. long x 100 meshes deep	1/	315.10		
Bobber gill net 130 fms. long x 125 meshes deep	1/	479.29		
TRAWLS				
Model shrimp trawl				
Trawl (20' headrope, 1¼" mesh, 2 cod ends)				$ 110.00
Trawl doors (18" x 36")				75.00
Groundline (3/8" x 150', polydac)				25.00
Package Price			2/	$ 200.00
Model shrimp trawl				
Trawl (20' headrope, 1" mesh, 2 cod ends)				$ 135.00
Trawl doors (18" x 36")				75.00
Groundline (3/8" x 150', polydac)				25.00
Package Price			2/	$ 225.00
BCF smelt trawl				
Trawl (per drawing)		$ 100.00 est.	3/	$ 431.00
Trawl doors (24" x 42", plywood)		50.00		
Groundline (3/8" x 150', 3-strand polypropylene)		7.80		
Total		$ 157.80		
TRAWL WARP				
½", 3-strand twisted nylon		$ 13.25 per 100 ft.		

1/Prices quoted for materials by a major fishery supply house in Seattle on July 1, 1969.
2/Price quoted for completely assembled gear by a major manufacturer on July 1, 1969.
3/Price paid for a special fast service order of one net.

Table 2 - Tows Made With Model Shrimp Trawl During Fishing Tests

Date	Elapsed Time Minutes	Water Depth Feet	Warp Length Feet	Smelt Caught Pounds
February 6	15	20-25	150	3/4
" 6	15	20-54	250	76
" 6	32	50-80	350	50
" 6	33	30-55	540	22
February 7	19	50-80	300	10
" 7	14	50-80	300	98
" 7	18	50-80	350	3
" 7	14	50-65	350	350

1/Log in net.
2/Log in the net tore the webbing.

Table 3 - Trawl Caught Smelt Landings by the Vessel Sandy

Date 1969	Drags Made No.	Mean Drag Time Minutes	Total Drag Time Minutes	Eulachon Catch Pounds	Catch per Effort Lbs./Min.
2/9	5	20	100	975	9.8
2/10	6	20	120	750	6.2
2/11 1/	6	22	132	550	4.2
2/12	1	19	19	67	3.5
2/22	5	12	60	1,000	16.7
2/23	5	30	150	1,450	9.7
2/24	3	30	90	550	6.1
2/25 2/	5	30	150	2,100	14.0

Total eulachon landed (pounds) - - - - - 7,442

Days fished (number)- - - - - - - - - - - 8

Average catch per day (pounds)- - - - - - 930.3

Average catch per drag (pounds) - - - - - 212.7

1/Smelt run entered Cowlitz River--trawl fishermen made one tow then switched to dip netting from 2/15 to 2/20.
2/Large run entered Cowlitz River--trawl fishermen switched to dip netting.

upper and lower cod ends were also found useful. The eulachon mainly entered the upper bag while gravel and heavy trash went into the bottom bag.

The BCF smelt trawl was completed after the end of the gill net season. On March 6, near Mayger, Oregon, an 8-minute tow with the trawl spread by 24-inch by 42-inch doors yielded 61 pounds of eulachon. On March 21, near Puget Island, Washington, a 20-minute tow with the trawl opened by 18-inch by 36-inch doors yielded 25 pounds, and an 18-minute tow caught 15 pounds.

Commercial Fishing

Commercial trawling with the model shrimp net was conducted during two periods--February 8 to 12 and February 21 to 25. The trawl fishermen shifted to dip netting for eulachon in the Cowlitz River from February 15 through 20. A total of 35 commercial drags were made. Daily landings by the commercial trawling vessel ranged from 67 pounds on February 12 to 2,100 pounds on February 25 (table 3). The average landing per day was 930 pounds or 465 pounds per man-day. These numbers do not include about 200 pounds of fish given to the BCF Biological Station at Prescott, Oregon, for studies.

No commercial trawling was done after February 25 because the trawl fishermen were engaged in the Cowlitz River dip net fishery, which finally glutted the market.

Representative landings by the gill net fishery during this period are presented in table 4 for comparison. Each landing represents one fisherman's catch for 1 day. The average landings, 339 pounds of eulachon per man-day, is about two-thirds the daily average trawl caught landing per man during this period.

CONCLUSIONS

Trawling for smelt in the Columbia River indicated that this method may be superior to the present method of gill netting. Trawl gear is less expensive, more durable, and may be used at different tidal stages. There is less time loss with trawl gear because net shaking

Table 4 - Representative Landings of Columbia River Smelt Taken by Commercial Gill Net Fishermen
(Each Figure Is One Fisherman's Catch in Pounds for 1 Day)

Date	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	Daily Average
2/9	457	407	364	400	-	400	400	53	250	84	313
2/10	250	400	368	250	250	25	250	250	250	350	264
2/11	425	250	617	600	300	250	250	250	300	145	339
2/12	275	460	550	-	-	575	450	300	-	-	435
2/13 1/											
2/25	250	250	625	625	-	-	-	-	-	-	438
2/26 1/											

Total eulachon landed (pounds) - - - - - 13,205

Vessel-days fishes (number) 39

Average landing (pounds) 338.6

1/Smelt run entered Cowlitz River--gill net fishermen switched to dip netting.

is not required. The product is in much better condition. The method can be used with little or no modification to many existing vessels.

SUMMARY

Otter trawls were used to take smelt in the Columbia River. Two days of test fishing encouraged fishermen to engage in a commercial trawl fishery during the period open to the gill net fishery. The trawlers landed nearly three times as many fish per day as the average of a sample of gill netters. The trawl-caught fish were in excellent condition. Some held in an aquarium suffered no mortality from the time of capture through the first 2 days.

ACKNOWLEDGEMENTS

We thank sincerely Albert Coles of Longview, Wash., whose suggestions and comments led to this program. Captain Arthur Peterson and his mate, Max Holland, of the 'Sandy' volunteered and made the field tests. Dennis Austin, Washington Department of Fisheries, monitored the test fishery. Jerry Jurkovich, BCF gear specialist, suggested changes that were incorporated in both trawl systems.

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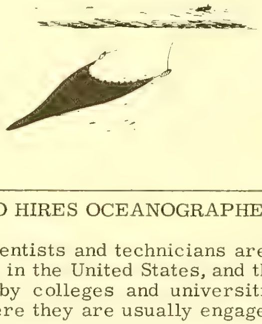
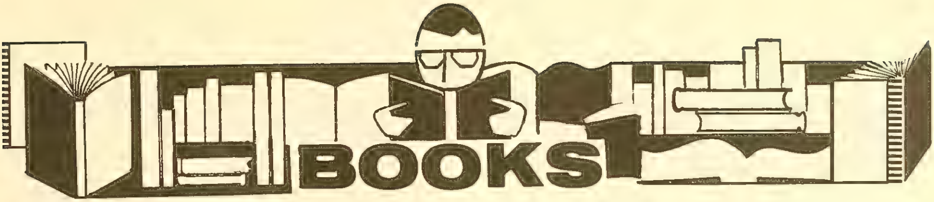


WHO HIRES OCEANOGRAPHERS?

Between 2,500 and 3,000 scientists and technicians are employed in oceanography and related fields of marine science in the United States, and the number is growing. Most of these scientists are employed by colleges and universities and by university-operated oceanographic laboratories, where they are usually engaged primarily in research.

The Federal Government employs a substantial number of oceanographers. Many oceanographic positions are in activities of the Navy; the Naval Oceanographic Office in the Washington, D.C., area probably employs more than any other single activity. Government agencies with sizable oceanographic staffs are ESSA (Environmental Science Services Administration), with laboratories located in Miami and Seattle; BCF (Bureau of Commercial Fisheries) with laboratories at 14 coastal locations; and Public Health Service, with three shoreside research stations. The Bureau of Mines marine work is at Tiburon Island, California. Marine scientists employed by the U.S. Coast Guard and the CERC (Army Engineers) are usually based in Washington, D.C. A total of 22 Government agencies conduct oceanographic work of some kind. States bordering the ocean and Gulf of Mexico also employ quite a number of marine specialists.

Oceanographers are employed in limited but growing numbers by private industry (manufacturers and consulting firms), independent nonprofit laboratories, fishery laboratories, and local Governments. ("Questions About The Oceans," U.S. Naval Oceanographic Office.)



CATFISH FARMING

"A Synopsis of Catfish Farming," by E. Evan Brown, M. G. LaPlante and L. H. Covey, Bulletin 69, College of Agriculture Experiment Stations, University of Georgia, Athens, Georgia, September 1969, 50 pp., illus.

This is a report on contemporary channel catfish research and farming. Particular attention is paid to: 1) spawning and hatching, 2) chemical control of diseases and parasites, 3) pond construction and water quality control, 4) feeding, 5) harvesting, 6) marketing, and 7) expected costs and returns.

CUISINE

"Seafood Moods," sold by Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402, $0.60.

A new recipe booklet, illustrated in color, featuring seafoods from the states of Washington, Oregon, and Alaska. For years, many of the marine delicacies from these states were available only locally. Now, advanced processing techniques, packaging methods, and transportation make it possible for housewives all over the nation to prepare the traditional culinary favorites of the Northwest.

DESALTING

"Desalination," by Roy Popkin, Praeger, New York, 1968, 235 pp.

Sea and brackish water can be made safe for drinking, farming, and industry by desalting. Mr. Popkin reviews the latest methods of desalination, its future direction, and its costs and values in different circumstances. He also suggests ways to evaluate desalting's role in solving local, national, or regional water problems.

GREAT LAKES LEGAL PROBLEMS

"The Land-Sea Interface of the Great Lakes States of the United States: Legal Problems Arising out of Multiple Use and Conflicts of Private and Public Rights and Interests," sold by Clearinghouse for Federal Scientific and Technical Information, 5285 Port Royal Rd., Springfield, Va. 22151, as P.B. No. 186,000 (3 reels of 16 mm. microfilm), $27.

A compilation of all the laws and their impact on activities related to the Great Lakes. Hundreds of legal cases, claims, and questions arising from use and exploitation of the lakes, their contiguous waterways, and land areas are listed and summarized. Grouped systematically, they cover such diverse activities as fishing, boating, shoreline construction, dredging, flood control, pollution, etc.

The report is a remarkable repository for the jurist, lawyer, conservationist, developer, and others interested in developing an effective legal machinery to evaluate competing claims and interests.

PACIFIC COAST

"Between Pacific Tides," by E. F. Ricketts and Jack Calvin (4th edition), revised by Joel W. Hedgpeth, Stanford University Press, 1968, 614 pp., illus.

There are few guides to seashore animals based on original observation. This is one of them. First published in 1939, it is still in demand. Perhaps this is because no one else has presented the information in such a readable manner. Although meant for the student or amateur observer, who is limited to the shore, it is equally interesting to the armchair explorer. Dr. Hedgpeth's contributions, both scholarly and pungent, add much to the reader's enjoyment. An annotated systematic index and a general bibliography form valuable parts of the book.

RESOURCE MANAGEMENT

"Advances in Marine Biology," vol. 6, edited by F. S. Russell and M. Yonge, Academic Press, New York, 1968, 406 pp., indexed, illus. (3 papers by different authors).

I. Resource Management

"Management of Fishery Resources," by J. A. Gulland, pp. 1-71.

World catches are increasing due to the expansion of local fisheries and the rapidly growing numbers of factory and other vessels operating far from their home bases. These trends have intensified the problems of overfishing, and developed an urgent need for the regulation and management of the resources.

Historically, the fishing industry's classic response to overfishing in one stock has been to move to other, usually more distant, stocks. But this process cannot continue much longer. At the present rate, few substantial unexploited stocks of fish accessible to the present types of gear will remain in another 20 years. The problem is not confined to the high seas; it occurs also in inland waters, where biological problems are essentially the same.

Mr. Gulland urges immediate attention to the problems of proper fishery-resource management. Without some fundamentally new approach, he doubts that the production of world fisheries can keep up with the increase in world population.

The paper covers: depletion of marine resources; methods of regulation and limitation; mechanics of management and international law; territorial seas and specialized fishery bodies, and problems and prospects of future progress.

II. Fish Culture

"A General Account of the Fauna and Flora of Mangrove Swamps and Forests in the Indo-West-Pacific Region," by William Macnae, pp. 73-270.

Contains some interesting information on pond culture of fish and prawns in mangrove swamps.

III. Arrow worms

"Some Aspects of the Biology of the Chaetognaths," by Elvezio Ghirardelli, pp. 271-375.

This review of certain aspects of the biology of chaetognaths pays particular attention to the biology of reproduction, and to some organs and functions not previously studied.

SHELLFISH SANITATION

"Proceedings, Sixth National Shellfish Sanitation Workshop," edited by George Morrison, Department of Health, Education, and Welfare, 115 pp. Copies may be obtained from Shellfish Sanitation Branch (RC-310), Bureau of Compliance, Food and Drug Administration, 200 C St. SW., Washington, D. C. 20204.

The Workshop was held February 7-9, 1968, to discuss administrative and technical problems, review current research and technical developments, and consider proposals for changes in the "Manual of Recommended Practice for Sanitary Control of the Shellfish Industry."

This report, based on the papers presented, includes a verbatim transcript of the proceedings. The workshop dealt with market standards, refrigeration, sewage outfalls, depuration, imports, and waste dumping at sea and its effects on continental shelf resources.

The report includes the guides for pesticides, radionuclides and ciguatera-like toxins in shellfish adopted for inclusion in the Manual.

SOCIO-ECONOMIC RESEARCH

"An Evaluation of Lake Trout Ice Fishing on Three New Hampshire Lakes," by Robert H. Forste, Research Report No. 6, New Hampshire Agricultural Experiment Station, Durham, New Hampshire, January 1969, 16 pp., illus.

The report analyzes data on value of equipment and expenditures associated with the fishery. It identifies selected social characteristics of the fishermen, and some characteristics of the fishery itself. Mr. Forste also describes his methodology and statistical procedures.

TROUT

"Trout Streams," by Paul R. Needham, annotated by Carl E. Bond, Holden-Day, Inc., 500 Sansome St., San Francisco, Calif. 94111, 241 pp., illus., $8.50.

This classic guide to trout and the streams in which they live was first published in 1938. It contains a wealth of information as pertinent now as the day it was written. The annotations cover the advances in fishery research and management made in the intervening 30 years. The notes both complement the text and refer the reader to sources of additional information. Scientific nomenclature has been brought up to date. The result is a single reference bringing together the most reliable and up-to-date information on trout, trout foods, and stream biology.

THE FOLLOWING PUBLICATIONS ARE AVAILABLE FROM PUBLICATIONS UNIT, BCF, 1801 N. MOORE ST., ARLINGTON, VIRGINIA 22209:

FISH & CRAB MEALS

"Value of Menhaden, Brevoortia tyrannus, Meal as a Protein Supplement to Cottonseed-Corn Diets for Pigs," by Robert R. Kifer and Edgar P. Young, "Fishery Industrial Research," Vol. 5, No. 4, pp. 133-142.

Although cottonseed meal has been used successfully in pig diets as a protein supplement to corn, the quality of the protein in these tests apparently is not the best for growth. This paper describes the methods and results of studies made to determine the value of menhaden meal as a supplement to such diets.

"Relative Chemical Composition and nutritive Values of King Crab, Paralithodes camtschatcia, and Blue Crab, Callinectes sapidus," by Robert R. Kifer and Paul E. Bauersfeld, "Fishery Industrial Research," Vol. 5, No. 3, pp. 121-131.

Blue crab meal has a high supplementary nutritive value for poultry when combined with other protein supplements. Alaska king crabs often are harvested in such volume that quantities of processing waste are sufficient for reduction into meal. This report describes the suitability of king crab meal for use in broiler diets.

QUALITY CONTROL

"Evaluation of Muscle Hypoxanthine and Volatile Bases as Potential Quality Indices for Industrial Bottomfishes from the Gulf of Mexico," by Enrique J. Guardia and Gerhard J. Haas, "Fishery Industrial Research," Vol. 5, No. 3, pp. 117-120.

Croaker and Spot are the 2 fishes found most commonly in industrial bottomfish catches in the Gulf of Mexico. A hypoxanthine test can indicate the quality of both and, presumably, that of the whole catch. A test for volatile bases can not be used for freshness because total volatile bases do not increase until after the fish has been stored one week on ice. It can be used as an index of spoilage. The authors describe their material, methods, and results.

LIPIDS

"Use of Electron Paramagnetism in Research on Fish Lipids," by William T. Roubal, "Fishery Industrial Research," Vol. 5, No. 3, pp. 107-115, illus.

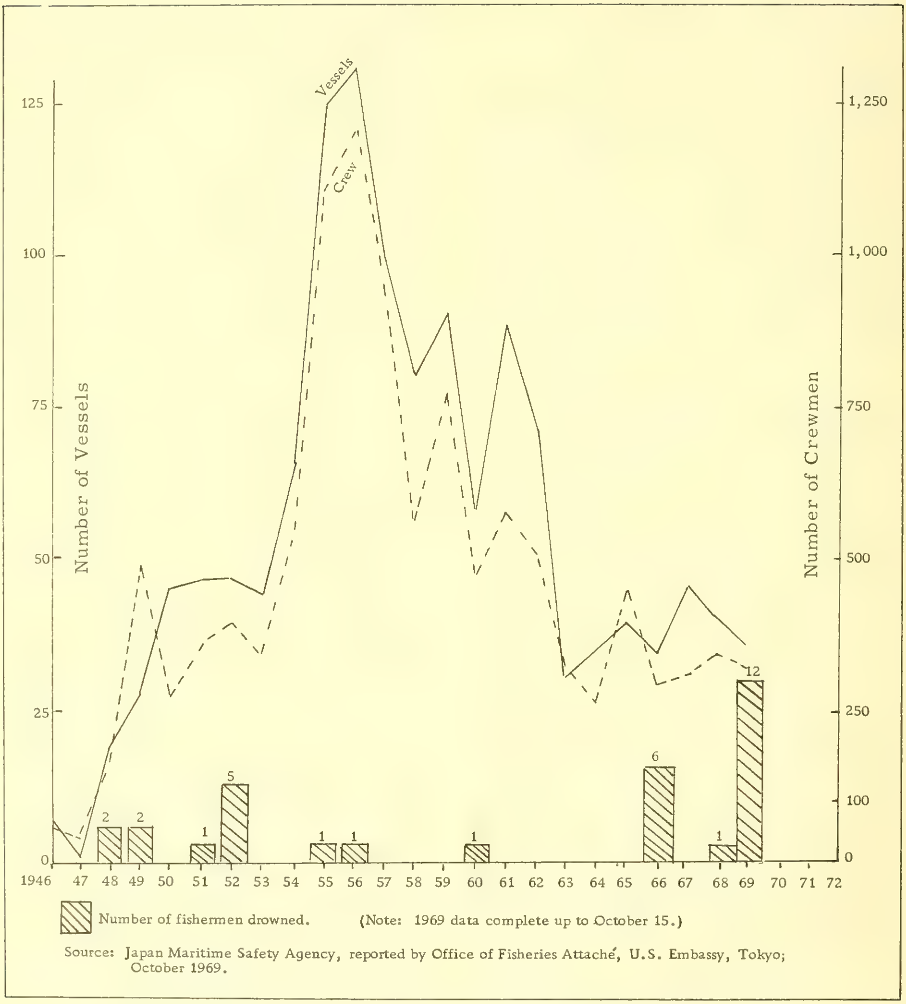
The products of lipid oxidation cause undesirable alterations, not only in lipids themselves, but also in the quality of associated proteins, enzymes, and other biomolecules. Mr. Roubal explains the technique of measuring the paramagnetic properties of biochemical systems, and gives examples of how measurement of these properties can be applied in research on fish lipids.

SHRIMP POTS

"Test-Tank Studies of Shrimp-Pot Efficiency," by Doyne W. Kessler, "Fishery Industrial Research," Vol. 5, No. 4, pp. 151-160, illus.

The design of the entrance to a shrimp pot may be an important factor in the pot's efficiency. In the past, efficiency was evaluated by catch analysis, rather than by observation. The studies described in this paper represent the first use of the observational technique by the BCF staff at Juneau, Alaska. Efficiency was measured in terms of the number of shrimp entering and escaping pots with different types of entrances.

--Barbara Lundy



Japanese fishing vessels and crewmen seized by Soviets, 1946-1969.

(See p. 68: "Soviets Seize Japanese Vessels")

INTERNATIONAL

WORLD FISHING IN 1968 SET RECORD

In 1968, the world's fishermen caught a record 64 million metric tons; the 1967 figure was 60,700,000 tons. The Food and Agriculture Organization reported these data on Dec. 7, 1969.

The 1968 total included 7,400,000 tons of fish from rivers, lakes, ponds, and other inland waters, an increase of 100,000 tons.

The marine catch--fish, crustaceans, molluscs, and other marine animals--was 56,600,000 tons. The 1967 total was 53,400,000 tons.

The estimates, based on official data, are reported in the new 'Yearbook of Fishery Statistics, Catches and Landings, 1968,' Volume 24, published by FAO's Department of Fisheries.

Peru No. 1

Peru was No. 1 again with a record 10,520,300 tons; her catch was 10,133,700 tons in 1967. Almost all of it was anchoveta--converted into fishmeal for export.

Japan was second with 8,669,800 tons (7,850,400 tons in 1967). The USSR, No. 3, reported 6,082,100 tons--the first time she exceeded 6 million tons. (The 1967 Soviet catch was about 5,777,100 tons.) Mainland China was fourth with 5,800,000 tons. The figure was based on a 1960 estimate because no recent figures were available.

Norway was fifth with 2,800,100 tons, a drop from the 3,268,700 tons of 1967. The United States followed with 2,442,000 tons. This was only slightly over the 2,430,500 tons of 1967.

Then followed the Republic of South Africa with over 2,000,000 tons; Denmark and the Faroe Islands, 1,633,100 tons; India, 1,526,000 tons; Spain, 1,503,100 tons; Canada, 1,490,300 tons; Chile, 1,376,100 tons; Indonesia, 1,175,800 tons; Thailand, 1,088,000 tons; and the United Kingdom, 1,040,300 tons.

Iceland dropped to 600,700 tons in 1968. She had caught 1,240,000 tons in 1966 and almost 900,000 tons in 1967. Between 500,000 and 1,000,000 tons were: Republic of China, France, Federal Republic of Germany, Portugal, Republic of Korea, and North Korea.

About 26 other countries reported 1968 catches between 100,000 and 500,000 tons. The remainder caught fewer than 100,000 tons.

Catches by Continents

All continents showed significant catch increases except Europe, excluding the USSR.

Asia led with 24,250,000 tons, up from 22,590,000 in 1967. South America was second with 12,880,000 tons (12,130,000 tons in 1967). Europe was third with 11,800,000 tons (11,900,000 tons in 1967). North America had 4,570,000 tons (4,430,000 tons in 1967); Africa 4,220,000 tons (3,730,000 tons), and Oceania, 210,000 tons (200,000 tons).

Catches by Species

Almost a third of the 1968 catch were Peruvian anchoveta, sardinellas, pilchards, North Pacific herring, and oil sardines. These totaled 20,500,000 tons, an increase of 900,000 tons above 1967.

Catches of the mackerel species reached a record 2,300,000 tons, compared with 2,000,000 tons in 1967. Cods, hakes, and haddocks were a record 9,500,000 tons, an increase of almost 1,300,000 tons. Increases were recorded in Alaska pollock, Atlantic cod, and Cape hakes; but Patagonian hake dropped from 600,000 tons in 1967 to fewer than 200,000 tons in 1968.

Flatfish, such as flounders, halibut, soles, and tonguefishes, totaled 1,200,000 tons. Redfishes, basses, congers, croakers, drums, sand eels, and porgies remained stable at 3,200,000 tons. Stable, too, were catches of amberjacks, horse and jack mackerels, and scads; for the past 6 years these have stayed at 2,000,000.

The catch of albacore, bigeye, bluefin, bonito, skipjack, and yellowfin tuna remained about 1,400,000 tons.

Sharks and rays appeared to be leveling off between 400,000 and 500,000 tons.

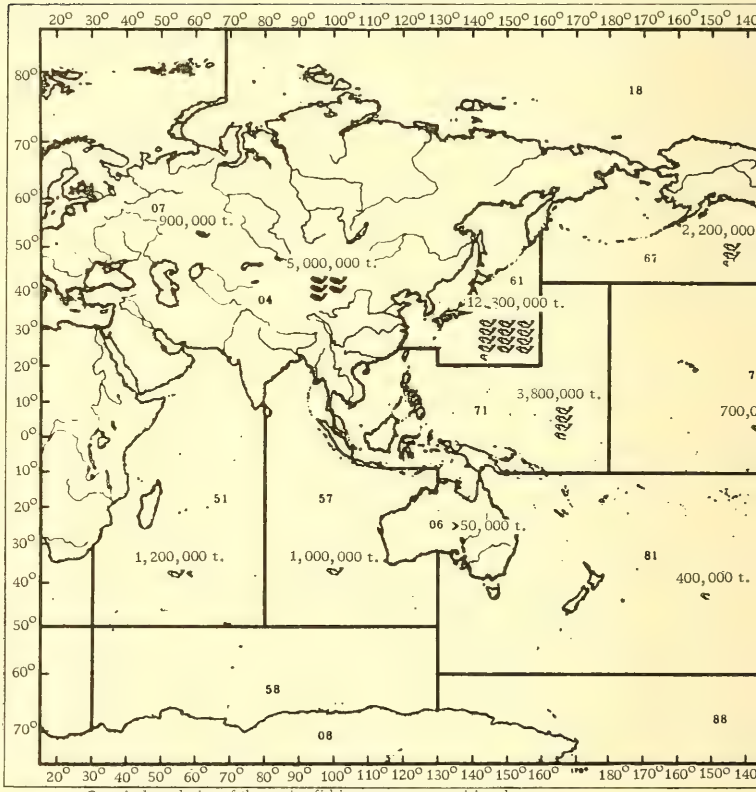
1968 WORLD CATCH BY

INLAND WATERS

01 Africa
02 America, North
03 America, South
04 Asia
05 Europe
06 Oceania
07 USSR
08 (Antarctic)

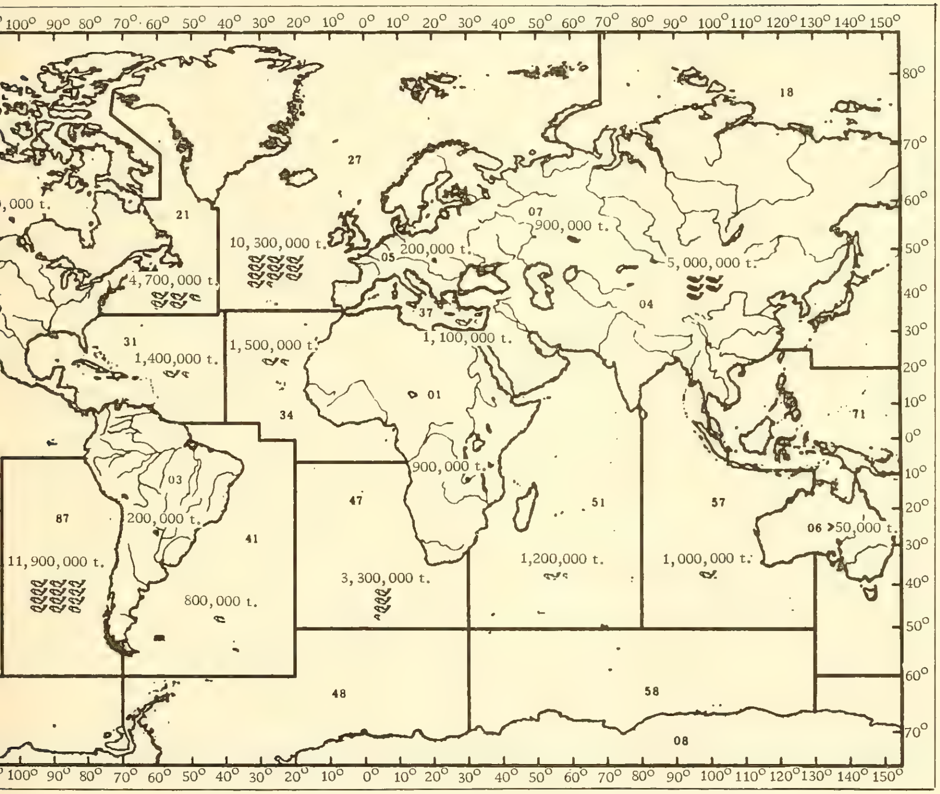
MARINE AREAS

18 Arctic
21 Northwest Atlantic
27 Northeast Atlantic
31 Western Central Atlantic
34 Eastern Central Atlantic
37 Mediterranean and Black Sea
41 Southwest Atlantic
47 Southeast Atlantic
48 Antarctic Atlantic
51 Western Indian Ocean
57 Eastern Indian Ocean
58 Antarctic Indian Ocean
61 Northwest Pacific
67 Northeast Pacific
71 Western Central Pacific
77 Eastern Central Pacific
81 Southwest Pacific
87 Southeast Pacific
88 Antarctic Pacific



Certain boundaries of the major fishing areas are provisional, particularly those in the Indian and Pacific Oceans.

MAJOR FISHING AREAS (FAO)



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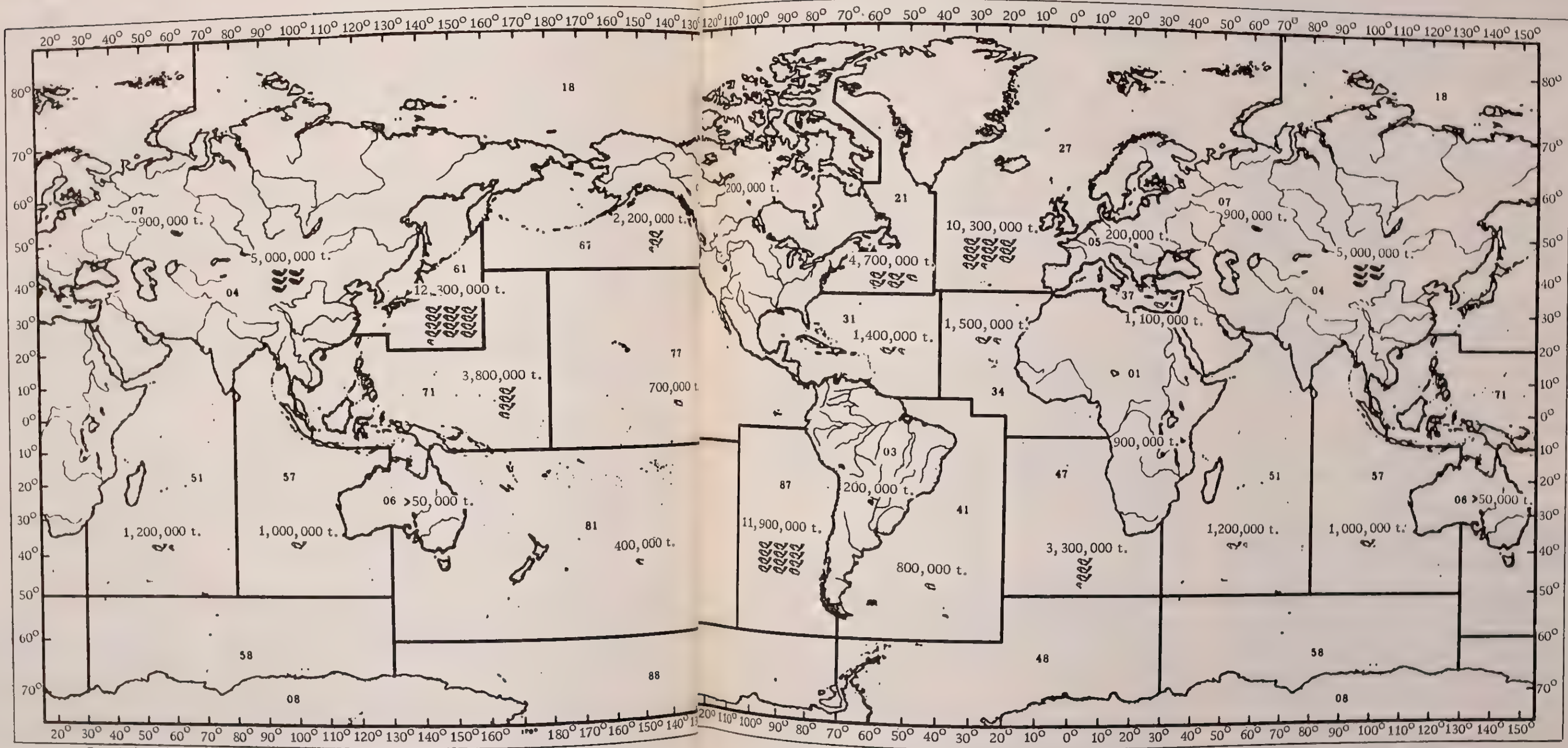
1968 WORLD CATCH BY MAJOR FISHING AREAS (FAO)

INLAND WATERS

01 Africa
02 America, North
03 America, South
04 Asia
05 Europe
06 Oceania
07 USSR
08 (Antarctic)

MARINE AREAS

18 Arctic
21 Northwest Atlantic
27 Northeast Atlantic
31 Western Central Atlantic
34 Eastern Central Atlantic
37 Mediterranean and Black Sea
41 Southwest Atlantic
47 Southeast Atlantic
48 Antarctic Atlantic
51 Western Indian Ocean
57 Eastern Indian Ocean
58 Antarctic Indian Ocean
61 Northwest Pacific
67 Northeast Pacific
71 Western Central Pacific
77 Eastern Central Pacific
81 Southwest Pacific
87 Southeast Pacific
88 Antarctic Pacific



Certain boundaries of the major fishing areas are provisional, particularly those in the Indian and Pacific Oceans.

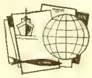
= 1,000,000 m.t. =

Catches by Sea Areas

The FAO Yearbook also showed the distribution of catches by areas. The Northwest Atlantic yielded a record 4,700,000 tons, compared with 1967's 4,000,000 tons. Catches increased also in the Eastern Central Atlantic (up to 1,500,000 tons from the 1,000,000 of 1965); in the Southeast Atlantic (up to 3,300,000 tons from 2,600,000 tons in 1967); and in the Northwest and Northeast Pacific (14,500,000 tons compared with 13,800,000 in 1967). Steady increases were recorded in the Western Central and Southeast Pacific.

In 1968, catches in the Southwest Atlantic dropped to 800,000 tons from 1967's 1,300,000 tons mainly because of decreased Soviet fishing. In 1968, catches in the Northeast Atlantic leveled off at 10,300,000; in the Indian Ocean at 2,200,000 tons. Catches in the Mediterranean Sea remained at the 5-year level of about 1,000,000 tons; in the Western Central Atlantic, at 1,400,000 tons.

The catch of crustaceans--marine crabs, lobsters, shrimps and prawns--hit a record 1,400,000 tons, slightly above 1967. There was an increase in mollusc catch to 3,400,000 tons (3,100,000 tons in 1967). This was due mainly to increased catches of squids, cuttle fish, octopus, and to production of oysters and mussels at about 1,000,000 tons.



SCIENTISTS TO DISCUSS SEA HERRING STOCK DECLINE IN 1970

Scientists and government officials, seriously worried about the North Sea herring stocks, will meet in the Hague, Holland, in June 1970. They will prepare a report for the North-East Atlantic Fisheries Commission. The report will outline the herring stock's future.

Maximum Sustainable Catch

An international plan adopted years ago said the North Sea herring stock could withstand an annual catch of up to 800,000 metric tons. Later, this limit was exceeded and a sharp decrease in the herring fishery resulted. It was impossible for fishermen to find the fish. The herring reappeared slowly.

Larger Vessels & Better Gear

Larger vessels and more effective gear, such as purse-seine nets, caught younger and younger year-classes. It became possible to maintain a fishery of about 800,000 tons.

However, a significant decrease in herring stock in recent years makes observers feel that the stock has become so weak it no longer can reproduce and survive. The doubt is increased by the results of taggings in the North Sea. ('Vestkysten,' Oct. 4, 1969.)

SOVIETS SEIZE JAPANESE VESSELS

During Aug. 7-12, 1969, the Soviets seized 8 Japanese vessels fishing for cuttlefish near Habomai Islands, Kuril Chain. About 500 vessels were fishing cuttlefish north of Hokkaido. With so many fishing, some were bound to trespass Soviet 12-mile territorial waters off the Kurils, said Radio Tokyo, Aug. 16, 1969.

Reaction To Japanese Demands

Soviet seizures continued through August. One was witnessed by the Director General for Administrative Affairs, Japan's Office of the Prime Minister. He explained later that Soviet seizures were a reaction to increasing demands by Japan for return of her "northern territories" (southernmost Kuril Islands). ('Tokyo Shimbun,' Aug. 21, 1969.)

Eyewitness

According to Tokyo Radio, Aug. 21, the official was aboard a fishery patrol vessel in Nemuro Strait when seizure occurred. His account moved Tokyo to consider a protest to Moscow. It was not lodged until Sept. 2, 1969, when the USSR notified Japan that 11 of her fishermen died on Aug. 9 in a collision between the 16-gross-ton 'Fukuju Maru No. 13' and an unnamed Soviet fishery and border patrol vessel. The lone Japanese survivor stated that the Soviet vessel rammed his vessel without warning.

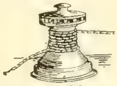
Japanese Protest

The Japanese protested that the USSR had failed to report incident for 20 days despite a clause in Soviet-Japanese Consular Treaty.

The treaty states that in case of marine accidents both countries are "mutually obligated to inform each other immediately." ('Washington Post,' Sept. 12, 1969.)

Startling Record of Seizures

The situation is serious. Startling figures obtained recently by Regional Fisheries Attaché, U.S. Embassy, Tokyo, from Japan's Maritime Safety Agency, show: Between 1946 and 1969, the Soviets seized over 1,300 Japanese vessels and arrested more than 11,000 crewmen. By Oct. 15, 1969, 135 fishermen were still in Soviet custody. The Soviets had not returned over one-third (482) of the seized vessels. During 1946-69, 21 Japanese fishing vessels were sunk and 32 fishermen drowned during Soviet seizures.



BALTIC SEA POLLUTION-CONTROL CONFERENCE HELD

In early Sept. 1969, the Swedish Government invited the Baltic countries (Finland, USSR, Poland, East Germany, West Germany, and Denmark) to Visby, on Gotland Island, to discuss the world's most polluted sea: the Baltic.

This sea is threatened by increasing concentrations of poisonous hydrogen sulfides in stagnant shallow waters. Its deep waters also are becoming a problem. Parts of the Baltic Sea around Gotland are completely lifeless: no fishery stocks have survived pollution. Elsewhere in the Baltic, the pesticide content in marine birds and fish is 10 times higher than in similar North Sea animals. The problems are compounded by a high-lying ocean floor between Denmark and Norway. This prevents exchange of Baltic waters with the Atlantic Ocean.

Political Differences Block Action

The meeting's main purpose--adoption of joint measures to fight coastal pollution--was not realized because of political differences. The East European countries wanted a high-level, ministerial follow-up (implying diplomatic recognition of East Germany), while the Western countries favored a simple "administrative approach." So the conference results were inconclusive.

"Nothing practical ensued," reported the research director of Sweden's Board of Nature Conservation ('New York Times,' Oct. 26, 1969).

Soviet Comments

Soviet sources confirm the 'Times' story. The 'Komunist Armenii,' on Sept. 28, said the Baltic's oxygen content is 2.5 times "below the normal content," even in "open waters." A Tass correspondent interviewed the head Soviet delegate, Ivan Borodavchenko, Deputy Minister for Reclamation and Water Conservation. He complained that "political problems" and the "unrealistic policy of Western countries" prevent strong measures to solve the problem. He said it is necessary to "sign an international treaty" to prevent Baltic pollution. East Germany must sign as a sovereign and "independent state." It is not possible to solve the problem on a "bureaucratic level when only heads of various departments participate."

At the end of the conference, a protocol was signed expressing the Baltic states' "interest in keeping the Baltic clean." ('Sov. Latviia,' Sept. 18, 1969.)

NEW ATLANTIC TUNA BODY MEETS IN ROME

The great mobility of tunas and of fishing fleets necessitates prompt action to conserve heavily fished tuna stocks in the Atlantic Ocean, Roy I. Jackson, FAO's Assistant Director-General of Fisheries, said in Rome on Dec. 1, 1969. He spoke at the first meeting, Dec. 1-6, of the new International Commission for the Conservation of Atlantic Tunas called to work out its future program. The commission was established under a 1966 convention. It went into force in 1969.

8-Year Delay

Jackson said that almost 8 years had passed since it became apparent that international action was needed to conserve Atlantic tuna stocks. In that time, tuna fishing there had increased from 292,000 metric tons in 1961 to 382,000 tons in 1968 and was still increasing.

The commission was formed because experts of several nations recognized that certain stocks were being heavily fished and that there would be increasing pressure in the future. It was formed "with the hope that the problems which the tuna fisheries of the Atlantic are presently facing and which endanger its future may be solved."

Tuna & Vessel Mobility

Jackson noted the great mobility of some tuna stocks, which migrate from ocean to ocean. He said that "tuna fishing vessels themselves are becoming more and more mobile and can move rapidly to more profitable fishing grounds."

He added: "This mobility of the fish themselves as well as the fishing fleets necessitate close cooperation between international and national bodies in order that effective conservation methods may be devised."

He urged attention also to the problem of overconcentration of fishing on particular stocks. He suggested that the commission give high priority to assessment studies. And he hoped for close cooperation between the commission and FAO, which helped to draft the tuna convention. It was signed in Rio de Janeiro, Brazil, in May 1966.

Rome Conference

At its Rome session, the commission considered proposals to study tuna and tuna-like populations, statistics and research, enforcement of recommendations, relationships with other international organizations, and a permanent site.

JAPAN-USSR DISCUSS DECLINE OF PACIFIC SAURY STOCKS

The 2nd Japan-USSR scientific meeting on northwest Pacific saury resource was held in Tokyo, Nov. 4-8, 1969. Their scientists agreed that saury resource has declined. They attributed this primarily to poor reproduction during past few years. However, as during 1968 meeting, they disagreed on population and age structures of saury.

Disagreement

The Japanese believe the northwest Pacific saury population consists of 2 groups: one spawns in spring, the other in fall. The large fish are 2-year-olds spawned in fall; medium are 1.5-year-olds spawned in spring; small fish are 1-year-olds spawned in fall.

The Soviets pointed out there was only one group, which spawns in the winter. They estimated large fish to be 3.5 years old, medium 2.5 years old, and small 1.5 years old.

Soviet & Japanese Interpretations

The Soviets explained that the resource's decline is due largely to overfishing. They cautioned that taking large fish would prevent adequate spawning. They noted that mackerel and saury compete for food, and that mackerel eat saury larvae and contribute to decline.

The Japanese blamed decline more on natural loss, and advised against taking small fish.

The 3rd meeting will be held in the Soviet Union. ('Shin Suisan Shimbun Sokuho,' Nov. 11, 1969.)

EUROPE

USSR

ARTIFICIAL SATELLITES USED FOR MARINE RESEARCH

The Soviets have been using artificial satellites for oceanographic and marine-resources studies, according to TASS. The press agency announced on Oct. 12, 1969, that experiments during the flights of Soyuz 6, 7, and 8 showed "it would be possible to change the climate of the planet and to use correctly its resources."

Space-Flight Data

In the next 2 days, more information became available, including photographs of "characteristic sections of the Earth surface....cyclones and cloud formations." The Soyuz-7 crew photographed the Caspian Sea--the test area for aerospace-oceanography experiments.

Ground tracking stations in Soviet territory and 7 research vessels of the Academy of Sciences continuously received and processed information from the spaceships and kept in contact with their crews.

In the first 42 hours in orbit, Soyuz 6 and 7 made successful "observations of. . .our country carried out simultaneously from Soyuz-6, from an aircraft, and from ground stations."

Program Objectives

Aleksei Konstantinov, space scientist of the Soviet Academy of Sciences, said the objective was to "determine correction coefficients necessary to move from experiments carried out with aircraft to experiments in orbit with an artificial satellite."

When analyzed, data would be used in "elaborating geological and geographical maps, both for our own country and for our planet in general." The data also would be used ". . .in other fields of the national economy, such as in the study of the wealth of the world's oceans."

* * *

NEW WASTE-WATER FILTER IS DESIGNED

A new waste-water filter for medium trawlers prevents pollution by oil products. The filter is a sand box that retains oil impurities by combining with them. It can process 300-400 kilos of water per hour.

The filter is 90x72x47 cm. and weighs 50 kilos. It will be introduced into all vessels of the Soviet Western Fisheries Administration's Tallin Trawler Fleet Base. ('Rybnoe Khoziaistvo,' No. 9, 1969.)

1954 International Convention

The new filter meets the requirement of the 1954 international convention to prevent oil pollution of sea water. The convention prohibits dumping waste water containing more than 100 milligrams of oil per liter.

Inadequate Production

The Soviet industry does not produce enough conventional waste-water filters; also, these cannot be used aboard medium trawlers because they are too bulky and heavy.

SPAIN

FISHING FLEET GROWS

Larger Spanish trawlers and freezers with increased fishing capabilities continue to enter the fisheries. Since 1964, the government has authorized official credits and tax rebates to construct vessels; special loans are available for large vessels. The objective is to promote development of a modern fleet of about 600,000 gross registered tons (GRT) by the end of 1970. This is considered sufficient for an average annual catch of about 1,500,000 metric tons of fish.

Distant-Water Fleet

The fleet's long-range sectors, trawling cod in the Northwest Atlantic and fishing hake in the South Atlantic, have made sizable gains (Table 1).

Spain began producing frozen fish relatively late but, since 1960, this part of fleet has

SPAIN (Contd.):

Table 1 - Spain: Fishing Fleet, 1965-68 (000 Gross Registered Tons)

Tonnage Group	1965	1966	1967	1968	Objective 1970
Over 250 GRT	135.9	155.3	193.6	216.5	250
20-250 GRT	307.0	313.5	328.3	339.7	350
Total	442.9	468.8	521.9	556.2	600

developed rapidly. At the end of 1967, 103 modern freezer trawlers of 82,803 GRT were operating. Of these, 55 were put into service between 1963 and 1966, and about 48 vessels in 1967 and 1968. Many others are under construction and will enter the fisheries in 1969 and 1970; many replace smaller, old vessels.

Codfish Fleet

The codfish fleet in 1968 also had increased: to 26 trawlers and 126 pair trawlers totaling 58,955 GRT. These operated exclusively on the fishing grounds of Northwest Atlantic (Greenland, Labrador, Newfoundland, and Nova Scotia). Their catches were 95% cod.

Freezer Trawlers

In 1968, catches by freezer trawlers were 240,000 metric tons, almost 5 times 1964 catch (Table 2). Catches frequently were greater than home demand, so shipowners restricted output and limited catches. In 1969, shipowners turned increasingly toward greater export markets for some products. This fleet operated mainly in Southeast Atlantic off Africa. Catches included 80% hake.

Table 2 - Spain: Estimated Catch by Fleet, 1964-68 (In 000 Metric Tons)

Type of Fleet	1964	1965	1966	1967	1968
Long-range fleet:					
Freezer vessels	53	133	195	230	240
Codfish vessels	231	234	239	290	340
Medium & coastal	746	744	690	690	680
Other	170	229	221	229	240
Total	1,200	1,340	1,345	1,439	1,500

Cod Catch

Cod trawlers caught 340,000 tons, up 109,000 tons, about 50%, above 1964. This fleet operated in Northwest Atlantic, where catches were 95% cod.

Government Plans

The fleet appears to be nearing its objective and may exceed goal set by initial plan. The government plans to restrict increase of freezer fleet, grant no official aid to construct conventional cod vessels used only for salting cod, develop deep-water tuna fleet, concentrate on modernizing small coastal fleet, and improve marketing. (Reg. Fish. Attaché, Europe, Nov. 25, 1969.)

SWEDEN

FISHING INDUSTRY FUTURE IS NOT PROMISING

For the fourth successive year, Sweden's fishing industry faces great difficulties. Until 1965, profits trended upward. Since then, catches and income have gradually decreased, affecting owners of larger boats in particular.

In 1968, Swedish fishermen landed 307,172 metric tons of fish worth 218.1 million kronor,1/ the lowest quantity since 1962 and lowest value since 1963.

While other workers have received more pay each year, the estimated fishermen's income in 1969 will be only a little more than half of what they earned in 1965. The industry's prospects are not promising.

Recent Developments

In 1962, Swedish fishermen caught two-thirds of domestic consumption; now imported fish are the larger part. Since 1965, import of fish and fish products have more than doubled. In 1968, these totaled 72,900 metric tons worth 279 million kronor.

Norway, Denmark, and Iceland, the main suppliers, account for 73% or 204 million kronor, of total imports. Imports from Canada, tripled since 1967, reached 21 million kronor. This expansion was attributed to a large increase in shrimp imports. However, 90% of this reportedly is U.S. shrimp exported from Canadian ports. Direct imports from U.S. declined 5 million kronor to 9.2 million kronor. This was because less canned crab meat was imported, whereas its import from Japan and Soviet Union rose 5 and 3 million kronor, to 8.4 and 15.2 million kronor.

Foreign Trade

In 1968, total foreign trade in fish and fish products resulted in import surplus of 154

1/Skr. 5.17 equal US$1.

SWEDEN (Contd.):

million kronor. Export quantities dropped 7% from 1967 and totaled 187,600 metric tons, although value stayed at 124.5 million kronor.

Exports to Denmark were 75% of total value and 93% of quantity. To a large extent, these were direct landings by Swedish fishermen in Danish ports.

Swedish fishermen prefer to land larger part of herring catches in Danish ports for 2 reasons: shorter distances from fishing grounds, and Denmark has efficient processing industry and is convenient for shipments to West Germany.

In 1968, imports of frozen fish fillets were 44% of Swedish fish consumption by weight. They increased during 10-year period from 4,000 metric tons to 14,000 metric tons worth almost 50 million kronor. The European Free Trade Association (EFTA) agreement has removed the import protection Swedish fishermen had enjoyed.

Fewer Fishermen

Reduced income has reduced number of fishermen. This is not exceptional in an industrialized country where agriculture and fishing employ less of the work force. Among young fishermen on west coast, the industry center, 18% under 40 years switched in 1968 to other employment. For over 40, rate was 6%.

Jellyfish Invasion

The invasion of jellyfish (medusa Tima Bairdii) in recent years has hit shrimp fishermen especially hard. During certain periods, the jellyfish have stopped shrimp fishing entirely. Trawls were quickly filled and became so heavy they split, or caused enormous workload in sorting out the shrimp. Swedish researchers claim that inflow of cold water from North Sea has caused invasion.

Nordic Economic Union

The report and draft treaty covering fishery policy for Nordic economic union (NORDEK) has been criticized by National Fisheries Board and fishermen's organizations. The present proposal would abolish all restrictions on trade in fishery products between Nordic countries on Jan. 1, 1972. Authorities claim abrupt removal of restrictions would seriously affect Swedish industry. They have proposed transition period of 5 years.

Norwegian Subsidies & NORDEK

Another serious problem for Swedish fisheries is Norwegian subsidies to fishing industry. These have been increased yearly and now are estimated at 30% of catch value. The NORDEK report states national support should not affect trade competition between Nordic countries, or exports to a third country. However, the report states that support can be given fishermen to promote social, economic, and political objectives. Swedish fishing organizations claim this leaves open possibility of continuing subsidies and, to a large extent, eliminates basis for common fishery policy.

Swedish Aid

Although Sweden is unwilling to subsidize fisheries, it provides some loans. From July 1, 1969, Swedish fishermen could apply for:

Consolidation loans: to assist fishermen with working capital problems, maximum 200,000 kronor, to be paid off during 10-year period.

Rationalization loans: to improve efficiency of fishing craft, maximum 200,000 kronor, 10-year period.

Conversion loans: aid to fishermen who have been continuously engaged in the industry during last 5 years and intend to take up another trade. Maximum 12,000 kronor, repayment required if recipients return to fishing within 2 years.

Gear loans: to assist fishermen who have lost gear, or whose gear has been damaged. Maximum: 15,000 kronor.

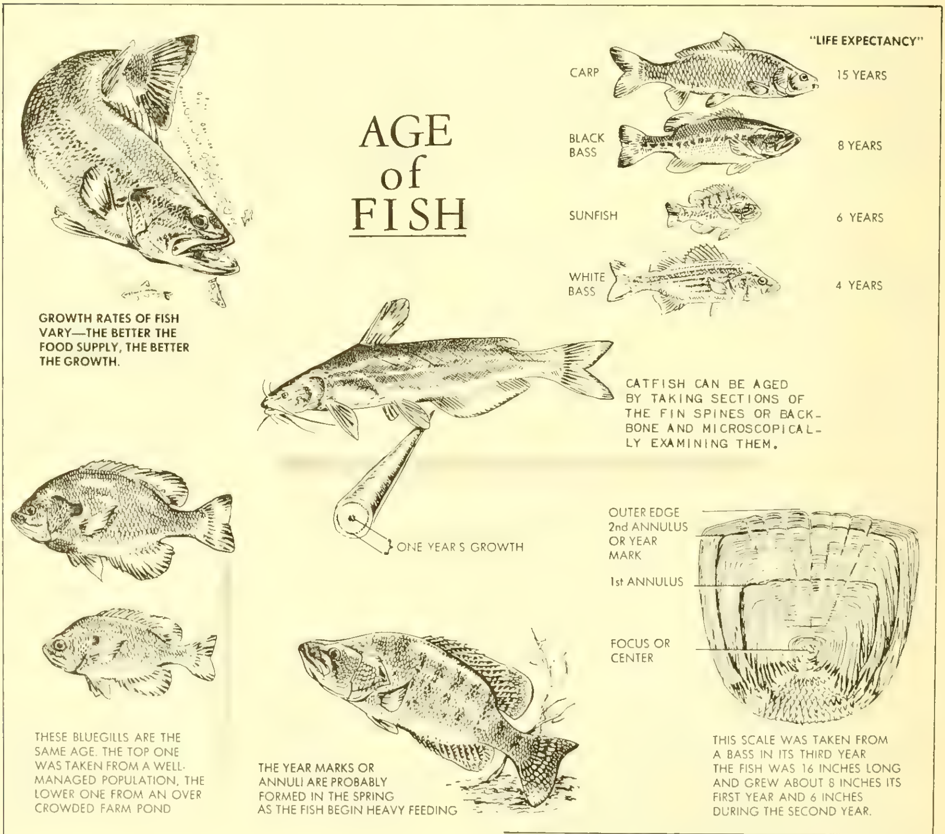
Other help will be given by 'Svensk Fisk.' It has started campaign to increase consumption of Swedish fish. It is responsible for setting guaranteed and minimum prices paid to fishermen and for making up difference when prices fall below these levels. Funds for these purposes previously came entirely from government. Since July 1, 1969, they have been obtained in large part from a fee of 3% of sales value of landed and imported cod, haddock, redfish, and saithe.

SWEDEN (Contd.):

OUTLOOK

The prospects for Swedish fisheries are not bright. The decline in number of fishermen probably will continue and could be accelerated if herring stocks decline further. Crew size will have to be cut to make fishing more profitable. There is a safety limit however. The government has no plans for subsidies to maintain present size of fishing fleet.

Imports of fish and fish products are expected to remain relatively high in the future. This should offer sales opportunities, especially for U.S. shrimp and fresh frozen salmon. (U.S. Consul, Goteborg, Dec. 4, 1969.)



(Georgia 'Game and Fish')

LATIN AMERICA

CHILE

SEEKS JAPANESE ADVICE ON SAURY FISHING

The Chilean Institute for the Study of Fishery Problems has asked guidance from a large firm in Japan on these aspects of the Japanese method of saury fishing: (1) converting anchovy purse seiners for saury fishing; (2) method of freezing and packing catch and (3) fish size used for tuna bait.

Plans Saury Fishery

Apparently, Chile plans to harvest the unexploited saury off her coast and export them as tuna bait to Japan, where bait saury is in short supply due to poor fishing.

The size of saury resource off Chile is estimated by FAO to be at least 50 million metric tons. ('Nihon Suisan Shimbun,' Nov. 7, 1969.)

ECUADOR

REPORT OF NEW SHRIMP BEDS IS PREMATURE

New information indicates that Oct. 1969 announcement of substantial new shrimp beds off Ecuador was overly optimistic.

The U.S. Consulate, Guayaquil, originally reported new beds 30 miles offshore in 40 to 100 fathoms and extending from Manta south. Catches up to 30,000 pounds for a single boat in 2 days fishing were reported.

Shrimp Disappeared

During late Sept.-early Oct. 1969, 90 vessels fished the new area and caught about 200,000 pounds. The shrimp disappeared after 3 weeks' fishing.

Good Year Nonetheless

Despite this failure, 1969 looked like a good shrimp year. The catch was up considerably over 1968. Exports for first 8 months were 6.2 million pounds, compared to 4.5 million pounds for 1968 period. According to industry sources, the reason for increased catch is better boats and more intense fishing. (U.S. Consulate, Guayaquil, Nov. 19, 1969.)

BRITISH HONDURAS

FISHERY EXPORTS RISE

The reported value of British Honduras' 1968 fishery exports was US$0.6 million, over 33% more than in 1967. Shipments continued high in 1969.

Exports of spiny lobster tail accounted for roughly two-thirds of the 1968 earnings. These exports now are being more accurately valued and will probably total more than US$1 million annually.

Conch Exports Up

Conch exports are up substantially. With 543,000 lbs. shipped through August 1969, they were up more than 50% over first 8 months of 1968.

In the long run, however, major expansion can occur only in fin fish or in fish farming. These probably will require foreign capital and organization. (U.S. Consulate, Belize City, Oct. 31, 1969.)

SOUTH PACIFIC

AMERICAN SAMOA

TUNA PRICES INCREASED IN NOV. 1969

Japanese tuna suppliers and U.S. packers at American Samoa increased prices for November 1969 tuna deliveries to that island by US$10 a ton for albacore, and $5 a ton for yellowfin. This was the first price increase since August 1969.

The new prices represent an all-time high for American Samoa (per short ton): round albacore: frozen $440, iced $425; gilled-and-gutted yellowfin: frozen $325.50, iced $332.50.

Japanese Fleet Dwindles

Price negotiations are conducted monthly between Japanese firms and Samoa-based U.S. packers. But the size of Japanese tuna fleet supplying the island has dwindled to 5-6 vessels compared with 70-75 South Korean and 55-60 Taiwanese vessels. So indications are that from 1970 the three countries, alternately, will conduct price negotiations with U.S. packers. ('Katsuo-maguro Tsushin,' Nov. 20, 1969.)

ASIA

JAPAN

FISH SHORTAGE TO BECOME ACUTE

By 1977, fish supplies will be short about 2,000,000 metric tons in Japan, according to the Coastal Fishing Promotion Council. Reporting to the Fisheries Agency, the council said a price rise in marine products would be unavoidable, unless substantial innovations were made in fishing technology.

Demand Exceeds Supply

In 1968, Japan produced 8,600,000 tons of marine products, excluding about 700,000 tons of imports, but demand was substantially higher than supply. Demand for shrimp and tuna had risen conspicuously because of rising living standards.

Long-Range Forecast

Domestic per-capita consumption of fish is expected to grow from 122 pounds (whole or round weight) in 1967 to 148 pounds in 1977.

Demand for fish and marine products would increase to 12,400,000 tons by 1977, including about 800,000 tons of seaweed, the council forecast.

However, supplies will be limited to about 8,900,000 tons of fish and shellfish and to about 2,000,000 by imports. ('Yomiori,' Oct. 28, 1969.)

* * *

1969 E. BERING SEA CRAB OUTPUT EXCEEDS PLANS

In 1969, Bristol Bay crab production surpassed original plans. The factoryships 'Keiko Maru' (7,536 gross tons) and 'Koyo Maru' (7,758 gross tons) ended operations in late Sept. Their combined quota was 85,000 cases of king crabs, and 16 million tanner crabs.

Keiko Maru reached her king crab quota, packing 43,400 cases. Her tanner crab quota was 8.2 million crabs plus an allowance; actually, catch reached 9 million crabs: 4,600 metric tons were frozen shell on, 2,700 tons were canned, and 7 tons frozen shell on.

Koyo Maru Catches Quota

Koyo Maru had been assigned a quota of 41,600 cases of king crabs and 7.8 million tanner crabs plus an allowance. She packed her king crab quota and harvested 8.6 million tanner crabs (4,700 tons were frozen shell on and 10 tons shelled).

Both fleets experimented with shrink-packaging, using about 10% of the tanner crab catches. This method (heating and shrinking the meat before packaging) serves to increase the market value of tanner crab meat considerably. The factoryship owners are considering full-scale shrink-packaging of tanner crabs in 1970.

1969 Fishing Appraised

Keiko Maru fleet's tanner-crab fishing gear was 60% tangle nets and 40% crab pots; Koyo Maru fleet used about 50% each.

Both fleet commanders said they would like to increase pot gear in 1970; fishing and sea conditions were different in 1969: the more productive grounds were found on the southwestern part of Bristol Bay.

They found king-crab fishing poor in late spring, but it began to improve toward fall. Tanner crabs were large and more abundant than anticipated. ('Suisan Keizai Shimbun,' Oct. 27, 1969.)

* * *

FISHERIES AGENCY EXPERIMENTS WITH PETROLEUM FISH FOOD

The Japanese Fisheries Agency is experimenting with production of synthetic petroleum protein as fish food. Projects are underway at 19 fishery experiment stations throughout Japan.

Petroleum protein is produced by microorganic fermentation of liquid hydrocarbons. A solution of water, ammonia, dextrose, and other nutrients is seeded with pure cultures of yeast or bacteria. This mixture is introduced into a fermentation tank together with a paraffin feed-stock. Compressed air provides the necessary oxygen. The microorganisms feed on the hydrocarbon molecules, converting them into living cells. These cells, harvested, dried and powdered, are the end product, usually referred to as single-cell protein (SCP).

High Growth Rates in Fish

In laboratory tests at stations in Nagano and Shizuoka prefectures, a compound of SCP

JAPAN (Contd.)

and fish meal produced excellent results in raising eel, rainbow trout and, particularly, carp. At a marine fish farm, 20,000 rainbow trout, fed a formula of SCP (yeast grown on paraffin), fish meal, bean pulp, various minerals, and cuttlefish flesh, gained weight in a relatively short period.

Mass Production of SCP

Judging from the remarkable results in preliminary experiments, the Agency believes that an annual production of 3,000,000 tons should be possible. This would equal about half the feed now imported. Coastal fishing enterprises, suffering from a feed shortage, would get a real 'shot in the arm' if this goal is achieved.

Private Industry Begins Production

Many private companies already have done considerable research on SCP. Several plan to start production in 1970. Kyowa Hakko has produced several thousand tons in test runs. It plans to achieve an annual production rate of more than 100,000 metric tons before the end of 1970.

Kanegafuchi Chemical also plans to begin annual production of 60,000 tons by the end of 1970.

Dai Nippon Ink and Chemical has been making several tons a month and expects to produce 12,000 tons a month.

Mitsui Toatsu hopes to begin producing about 1,500 tons a year in mid-1970.

Ashahi Chemical and Ajinomoto also are experimenting with SCP. ('Youmuri,' July 18; 'Chemical Week,' August 2; 'Food Engineering,' May 1969; 'Fish Trades Gazette,' Aug. 16, 1969.)

* * *

EXPORTS MORE S. KOREAN & TAIWANESE TUNA

Tuna caught by South Korean and Taiwanese vessels and exported through Japanese trading firms during Jan.-Aug. 1969 were near 43,000 metric tons. This was reported by the Japanese Ministry of International Trade and Industry (MITI).

Record in 1969 Possible

If exports continued at July-Aug. 1969 level (averaged around 6,000 tons), 1969 sales of foreign-caught tuna would easily surpass 1968's 61,000 tons.

Exports by area showed 34,563 short tons shipped to U.S. and Canada, and 11,442 metric tons to Italy, Spain, France, etc.

In addition to exports approved by MITI, foreign-caught tuna are sold directly by overseas-based Japanese firms and some is brought back to Japan for re-export. So the actual quantity of "third nation" tuna exports handled by Japanese firms are believed far greater than MITI's figures. ('Suisancho Nippo,' Oct. 23, 1969.)

* * *

MORE WHALE MEAT NEEDED

Japanese domestic sales of frozen whale meat have been so good that all 72,538 metric tons produced during the 23rd Antarctic whaling season were sold to dealers. The 5,000 tons imported from USSR were selling well. The 39,234 tons produced during the 18th North Pacific whaling season probably would be sold as soon as the carriers returned to Japan. Such a favorable market has not been experienced before. The cost of storing the meat was less in 1969 than before.

Normal Supply Cycle

In the past, whaling companies did not exhaust the supply during the year. In the normal cycle, whale meat from the Antarctic landed in Japan February or March remained available until North Pacific whale meat appeared in the market in July or August. The supply of North Pacific whale meat lasted until appearance of whale meat from next Antarctic season. In 1969, however, all 3 whaling firms completed sales of Antarctic whale meat by end of April. By August all North Pacific whale meat had been sold.

Selling Price Rises Yearly

The selling price to wholesalers has increased each year. In 1969, it was about 26 U.S. cents a pound. The favorable market is due partly to shortage caused by reduced international whaling quotas.

The demand for whale meat in 1970 will depend on the supply of fish and pork. However, demand is expected to increase. Then Japan would have to increase her imports of whale meat from the Soviet Union, South Africa, or Peru. These countries now see Japan as potential market. ('Suisancho Nippo,' Sept. 12, 1969.)

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JAPAN (Contd.)

U.S. FIRMS MAY BUY WHALE OIL

Two U.S. fat-and-oil processing firms recently sent representatives to Japan to buy sperm whale oil. Soviet-produced sperm oil is in short supply in Europe. The 2 firms are seeking a stable source in Japan.

U.S. Demand

The U.S. representatives said a U.S. demand for 24,000-25,000 tons exists. They would like to obtain a stable supply of 15,000 to 18,000 tons from Japan--at cost, insurance, freight (c.i.f.) prices of around US$180 a ton.

European Market Improves

An agent for the British Unilever Company said in Japan that the fish and whale oil market in Europe was improving; U.S. menhaden oil was bringing about $150 a ton. He guessed that the fin whale oil price was around £80 c.i.f. (about US$191) a long ton. ('Suisan Tsushin,' Oct. 27, 1969.)

* * *

3 FLEETS ARE WHALING IN ANTARCTIC

Three Japanese fleets began Antarctic whaling operations on Dec. 12, 1969. Japan has been assigned a national quota of 1,493 blue-whale units (BWUs) for the 1969/70 season.

The other active whaling nations, the USSR and Norway, have been assigned national quotas of 976 and 231 BWUs.

The overall quota--2,700 BWUs--set by the International Whaling Commission is 500 BWUs below 1968/69. ('Suisan Shuho,' Oct. 25, 1969.)

* * *

TRAWLS OFF NEW YORK

In first-half 1969, 10 Japanese trawlers fished off New York.

The 3 companies involved did not detail results. They agreed that "catches in the area off New York are slightly better than off Africa but the trip to and from Las Palmas is costly. From an economic point of view, therefore, the two areas will be of equal value."

The Catch

The bulk of catch off New York was "yari-ika" (squid), "shizu" (butterfish), sea bream, herring, and hake. Price for squid, as high as US$550 a metric ton, supports the fishery in that area.

The 3 firms consider the New York area part of year-round operation. They fish octopus off Africa in summer, and squid off New York in winter. Two other companies are planning to send trawlers to the New York grounds. ('Shin Suisan Shimbun,' Sept. 12, 1969.)

* * *

RESUMES EXPLORATORY FISHING IN NORTHEAST ATLANTIC

On April 15, 1969, Nichiro Gyogyo sent its stern trawler 'Akebono Maru No. 51' (1,454 gross tons) to Bay of Biscay and other northeast Atlantic areas on 3-month exploratory fishing trip. The firm planned a second survey of that region during December 1969-March 1970.

The first trip did not produce satisfactory results because of the unfavorable season.

Second Survey

The vessel will begin in Bay of Biscay seeking 'monko' squid, octopus, and snapper. It will proceed toward Shetland Islands, north of Scotland, where herring fishing was reported promising. Nichiro's survey is supported by a government subsidy of about US$222,000. ('Suisan Tsushin,' Nov. 19, 1969.)

* * *

JAPAN (Contd.)

7 SHRIMP FIRMS FORM COMPANY IN SOUTH AMERICA

On Nov. 19, 1969, 7 Japanese fishery firms fishing shrimp off Guianas in northeastern South America formed South America Northern Coast Fishery Development Co. The company has authorized capital of about US$278,000 and paid-up capital of $69,400 to be invested equally by all partners.

To Invest in Plant

The firm plans to invest in shrimp-processing plant scheduled to be constructed in Georgetown, Guyana, by the British-owned Guyana Industry Holding Co. Plant will cost about $2.5 million. It will have freezing capacity of 100 tons a day, and cold-storage capacity of 1,000 tons. The British firm reportedly invited also the participation of U.S. shrimp vessel owners in the region.

Fleet Fishing Since 1963

Japanese firms have been fishing shrimp off Guianas since 1963. Their fleet consists of 69 shrimpers belonging to 7 firms: Nichiro, 24 vessels; Shinyo Gyogyo, 15; Yutaka Gyogyo, 10; Hokoku Suisan, Hakodate Kokai, Kagawa Godo Suisan, Nanbei Ebi Gyogyo--5 each.

Their catches, processed at shore plants in Georgetown, are either exported to U.S. or Japan. ('Minato Shimbun,' Nov. 23, 1969.)

* * *

ANTARCTIC KRILL FISHERY IS CONSIDERED

The Japanese Fisheries Agency is studying use of euphausia (krill) found in limitless quantities in the Antarctic. Krill is similar to a small shrimp growing to five centimeters in 2 years. They are abundant near surface along the Antarctic ice pack and are regarded only as food for whales.

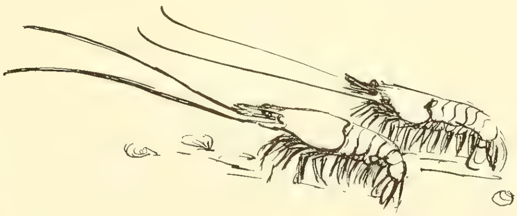
Unlimited Stocks

Whale stocks have declined and so krill have increased explosively. The resource is estimated at 100 million metric tons with maximum sustainable yield of 500,000 tons. Because of limitless stocks, there will be no difficulty obtaining enough to process into food, but the problem lies in fishing method.

The Problems

One company has offered to cooperate with the Agency in experimental fishing. They say "commercial fishing for euphausia will be difficult." Although the sea's red color ahead of vessel indicates abundance of plankton, only a few krill can be taken even with a large plankton net. The problem is that krill's swimming speed is faster than first thought. The surface and midwater trawls cannot be used.

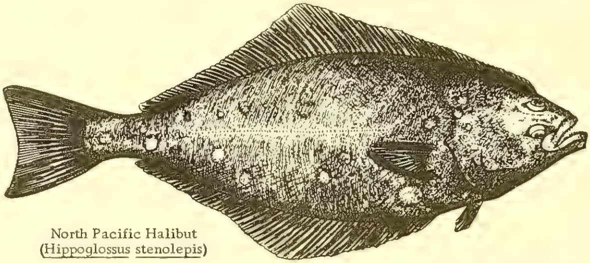
Also, there are economic factors. It takes about one month to reach Antarctic ice pack from Japan via Pacific. ('Minato Shimbun,' Sept. 18, 1969.)



FOOD FISH FACTS

Halibut has been a popular food for people of northern countries since ancient times. Scandinavian fjords and Scottish firths provided halibut for the rugged, early settlers in those regions. The English thought highly of halibut and served it on holy days, calling it "holy-day butte." "Butte" was the middle English word for flatfish or flounder. Over the years "holy butte" evolved into halibut. In America, early explorers along the Pacific Coast found halibut highly prized by coastal Indians. Today, North Pacific halibut, the proud name of the king of flatfishes, is the main commercial source of true halibut.

Description: North Pacific halibut is the largest member of the flatfish family. Halibut matures at about 10 years and may live to be 50. Females, which grow larger than the males, often weigh from 150 to 200 pounds or more. Commercially, halibut is graded according to size: "chicken"--5 to 10 pounds; "medium"--10 to 60 pounds; "large"--60 to 80 pounds; and "whales"--80 pounds and over.



North Pacific Halibut
(Hippoglossus stenolepis)

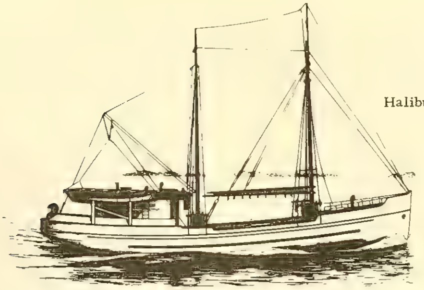
A curious fact about halibut, and other flatfishes, is the position of the eyes. They, like most fish, start life swimming upright and with eyes set wide apart. However, before they are an inch long, one eye, usually the left, begins migrating to the other side of the head and the fish begins to lean instead of swimming upright. Within a few days the migrating eye has moved nearly 120 degrees to join the right eye, and the fish swims with its eyeless side parallel to the bottom. The dark, top side of the flatfish allows it to hide in the sand or rocks and not be seen easily. The white, belly side blends with the light filtering down through the water, thus protecting it from enemies below. The mouth, distorted in the process of becoming a flatfish, wears a crooked, painted look.

Habitat: North Pacific halibut are taken along the continental shelf and slope of the North Pacific adjacent to Alaska, British Columbia in Canada, and off the shores of Washington State. Halibut was once taken from the cold waters of the Atlantic as well as the Pacific but, due to poor conservation methods in the past, Atlantic halibut has become scarce.

Halibut Fishing: North Pacific halibut is brought aboard the fishing vessel alive, dressed at sea, and stored immediately in ice. As soon as the fishing vessel reaches port, the halibut is rushed to processing plants where it is headed, graded for quality and size, and washed. Some of the halibut is packed in ice for fresh shipment to distant markets. Approximately 20 percent or more of the halibut is sold fresh. The bulk of the catch is frozen in -40° F. freezers. After freezing, the fish is glazed by being dipped several times in water at the freezing point. This builds up a jacket of ice over the entire fish and prevents dehydration or oxidation in storage. This process assures the consumer of a top-quality product.

(Continued page 81.)

FOOD FISH FACTS (Contd.)



Halibut Fishing Vessel

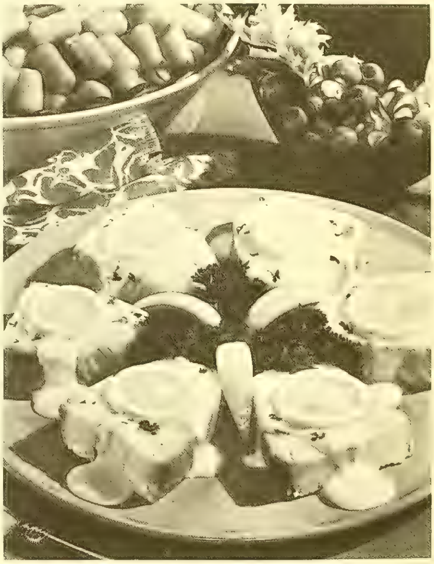
Conservation: A fine example of conservation through cooperation was exhibited by Canada and the United States in the early 1920's when the catch of halibut declined because of overfishing. An international commission was created to study the halibut fishery and make recommendations toward conservation. In 1930, the International Pacific Halibut Commission was formed and fishing for halibut by the two countries came under its control.

In 1967, however, the North Pacific halibut industry began to feel the effect of incidental catches of halibut by foreign and domestic trawlers. Halibut fishermen use longlines, since net-gear is prohibited, and catch 8- to 9-year old fish. Although the trawlers were seeking other species, the massive volume of their catches, especially by the foreign vessels, meant that millions of young halibut were caught and did not survive. Many halibut were taken before maturity also, as halibut do not spawn until they are 8 to 16 years old. Thus the effects of the trawler catches of young halibut has resulted in greatly reduced catches for the halibut fishermen. Negotiations are underway to correct this problem.

Use of Halibut: North Pacific halibut is usually sold as steaks, either fresh or frozen. One pound will make two or three servings. Halibut is an excellent source of high-quality protein and minerals while being low in sodium, fat, and calories. The true North Pacific halibut, which has lean, white, tender flesh with a mild flavor, should not be confused with other species of fish which are sometimes sold as halibut. Ask for true North Pacific halibut at your seafood counter. (Source: National Marketing Services Office, BCF, U.S. Dept. of the Interior, 100 East Ohio, Rm. 526, Chicago, Ill. 60611.)

HEY DIETERS--CHEAT A LITTLE!

Want to crown your dinner with compliments? Try Halibut in Lemon Cream Sauce. Buy tender and tasty North Pacific halibut steaks and cover them with a sauce that is rich with cream, tangy with lemon, and zippy with grated onion--just enough to bring out the flavor. Bake and serve, then sit back and listen to the compliments. With this quick and easy recipe from BCF, the stay-slim guys and gals, who are aware of calories but love to eat well, can cheat a little with discretion.



North Pacific halibut is a lean fish noted for its energy-giving protein, vitamin, and mineral content while being low in sodium, fat, and calories. It is distinguished by its white, flavorful, firm flesh which takes on a flaky texture after cooking. It is a versatile fish, readily adaptable to a wide variety of cooking methods and recipes and is wonderful for dieters when rich sauces are not used. Halibut steaks are available fresh in many markets and frozen in most markets. One pound will make two or three servings. Be sure to ask for true North Pacific halibut when you buy.

HALIBUT IN LEMON CREAM SAUCE

- 2 pounds halibut steaks, fresh or frozen
- 1 cup whipping cream
- 1 tablespoon lemon juice
- 1 tablespoon grated onion
- 1 teaspoon salt
- Lemon slices
- Chopped parsley

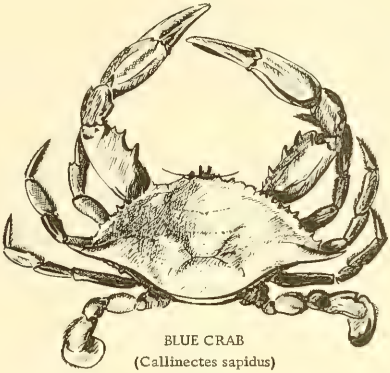
Thaw frozen steaks. Remove skin and bones and cut into 6 portions. Place fish in a single layer in a well-greased baking dish, 12 x 8 x 2 inches. Combine remaining ingredients except lemon slices and parsley. Pour sauce over fish. Bake in a moderate oven, 350° F., for 20 to 25 minutes or until fish flake easily when tested with a fork. Garnish with lemon slices and parsley. Makes 6 servings.

How can you tell when the halibut is cooked? Raw fish have a watery, translucent look. During the cooking process the watery juices become milky colored, giving the flesh an opaque, whitish tint. This color change is unmistakable. When the flesh has taken on this opaque whitish tint to the center of the thickest part, fish are completely cooked. At this point the flesh will easily separate into flakes, and if there are bones present, the flesh will come away from them readily.

Would you like to know more about how to cook fish? Let's Cook Fish (1 49.49/2:8) is a complete guide to fish cookery. This full-color booklet costs 60¢ and gives detailed information on market forms, how to buy, store, and thaw (if frozen), as well as how to cook fishery products. The booklet has many tested recipes and a handy timetable for easy reference on amounts to buy, cooking temperatures, and cooking methods.

How to Cook Halibut (1 49.39:9) is all about halibut, filled with tasty recipes, and costs 20¢. Both booklets are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. (Source: National Marketing Services Office, BCF, U.S. Dept. of the Interior, 100 East Ohio, Rm. 526, Chicago, Illinois 60611.)

FOOD FISH FACTS



BLUE CRAB
(Callinectes sapidus)

The blue crab, one of the most valuable crustaceans in the United States, is partially described by its scientific name. Calli - beautiful, plus nected - swimmer, and sapidus - savory. The blue crab is a savory shellfish that spends most of its time walking along the bottom of the bays and sounds where it lives. However, when necessary, it swims beautifully through the water with great speed and ease.

DESCRIPTION

Blue crabs, like other crabs, possess five pairs of legs with the first pair always equipped with pincers. Crabs have hard shells or exoskeletons. Periodically, in order to grow, they shed this external armor or shell. This process is called molting. Before the molt starts, a new, soft exoskeleton forms inside and the crab backs out of the old shell as it looses. The new shell is soft and elastic allowing the crab to grow. It is particularly vulnerable to attack during the soft-shell stage and seeks refuge in a secluded spot until the new shell hardens. Crabs also lose one or more legs during their lifetimes and are able to grow new ones through a regeneration process.

Blue crabs, when fully grown, average 5 to 7 inches across the back of the shell. The shell is brownish green or dark green and is drawn out on each side into a long spine. The underside of the body and the legs are white, while the tops of the claws in both male and female show varying amounts of blue. The tips of the claws in the femald blue crab are bright red.

HABITAT

Blue crabs are found along the Atlantic and Gulf coasts from Massachusetts to Texas. Essentially a shallow water crab, it lives in bays, sounds, and channels near the mouths of coastal rivers. Normally an inhabitant of salt water, the blue crab is also found in brackish water or fresh water.

BLUE CRAB FISHING

Blue crabs are caught with trawls, dredges, and baited lines such as the trotline. The trotline is a long length of rope with pieces of bait attached at intervals. It is laid on the bottom, ends anchored and marked with buoys. When the fisherman collects his catch he runs his boat along the line, forcing it to pass over a roller attached to the boat. As the boat

(Continued page 84.)

BLUE CRAB FISHING (Contd.)

runs his boat along the line, forcing it to pass over a roller attached to the boat. As the boat moves forward, the crabs cling to the bait until they reach the surface where they are caught with a dip net and placed in a basket or barrel.

Another efficient method used in catching blue crabs is the crab pot. This traplike device allows the crab to enter through funnels which also make escape difficult. The crab pot is usually baited with fresh fish.

Most conservation measures concerning the blue crab fishery are administered by the individual states involved. However, where the need exists, cost-sharing, cooperative Federal Aid Programs are in effect and are administered by the Bureau of Commercial Fisheries. These programs, made possible through the Commercial Fisheries Research and Development Act of 1964, have resulted in studies to determine the effects of temperature, salinity, and other factors which affect the survival and abundance of this important seafood.

Crab and trotline

USES OF BLUE CRABMEAT

Blue crabs are caught and marketed in both the hard-shelled and soft-shelled states. Soft-shelled crabs are considered a delicacy and bring higher prices. The entire body of a soft-shelled crab may be eaten after cooking. Hard-shelled crabs are either sold alive to the consumer; or they are steamed, the meat picked from the shell and packed into containers, refrigerated, and sold as fresh crabmeat. Crabmeat is marketed as lump meat - whole lumps from the large body muscles which operate the swimming legs; flake meat - small pieces of white meat from the body, flake and lump - a combination of the first two; and claw meat - a brownish tinted meat from the claws.

Pasteurization of blue crabmeat is another method of preparation for marketing. With pasteurization, the crabs are steamed, the meat picked from the shell and immediately packed into cans. The cans are hermetically sealed and immersed in a hog-water bath. This method does not alter the taste or texture of the meat, and it is fresh and table ready. Pasteurized crabmeat must be refrigerated until ready to use. Blue crabmeat is seldom frozen or canned. All crabmeat provides excellent high-quality protein, vitamins, and minerals. (Source: National Marketing Services Office, BCF, U.S. Dept. of the Interior, 100 East Ohio, Room 526, Chicago, Ill. 60611.)

CRAB-IN CREATED FOR CULINARY COMPETITION

"The West Coast is renowned for the tender, succulent meat from the Dungeness crab," says San Francisco. "No, no," says Baltimore, "it's the East coast that is renowned for the tender, succulent meat from the blue crab." This coast-to-coast argument has gone on for years, so the two cities have challenged each other to a CRAB-IN! Each city has rounded up famous, crab-cooking cronies in chef's hats and challenged them to a face-to-face, recipe-to-recipe encounter. Both cities have left no shell unturned in order to establish their claim to the "finest crab cookery in the world." The first National Crab-Cooking Olympics was held in spring of 1969 on Fisherman's Wharf in San Francisco.

The Bureau of Commercial Fisheries, remaining impartial in this great crustacean cooking competition, maintains that all crabmeat is delicious and can be used interchangeably in most recipes. In honor of the crab competition, however, the Bureau offers a sophisticated seafood treat to enjoy as a family luncheon or when you entertain. "Crab Stuffed Artichokes" will make any occasion a memorable affair. Everyone likes crab salad, and in this recipe the crabmeat is nested in tender, cooked artichokes, then topped with a gently-flavored sauce to enhance and blend the flavors. This winning combination can be prepared ahead of time, so, if you are having guests, you will be free to greet and mingle. They will say you have a "touch of genius" when they relish this gorumet salad served with such ease.

Crabmeat wins many popularity polls because it is tender and has a distinctive flavor. It is an excellent source of protein and is rich in the vitamins and minerals needed for good nutrition. Crabmeat is available in the following market forms: live; cooked in the shell; cooked meat, fresh or frozen; canned; or pasteurized.

Among crabs marketed in the United States are the blue crabs found along the Atlantic and Gulf coasts, Dungeness crabs found along the Pacific coast, king and snow or tanner crabs from Alaska, rock crabs found along New England and California coasts, stone crabs found mainly off Florida, and the queen crab found in waters of the North Atlantic.

CRAB STUFFED ARTICHOKES

1 pound crabmeat, fresh, frozen, or pasteurized
1 cup chopped celery
$\frac{1}{2}$ cup mayonnaise or salad dressing
2 hard-cooked eggs, chopped
2 tablespoons chopped green onion
2 tablespoons chopped pimiento
2 tablespoons chopped sweet pickle
$\frac{1}{2}$ teaspoon salt
Dash pepper
6 cooked artichokes
Vinaigrette Sauce

Thaw frozen crabmeat. Drain crabmeat. Remove any shell or cartilage. Combine all ingredients except artichokes and Vinaigrette Sauce. Gently open artichokes and fill each with $\frac{2}{3}$ cup crab mixture. Chill. Serve with Vinaigrette Sauce. Makes 6 servings.

HOW TO COOK ARTICHOKES

6 artichokes
$1\frac{1}{2}$ quarts boiling water
$1\frac{1}{2}$ teaspoons salt
1 tablespoon oil
1 clove garlic, sliced

Wash artichokes. Trim stems. Cut 1 inch off tops of artichokes. With scissors, trim leaf tips. Stand upright in a 5-quart Dutch oven. Add boiling water and seasonings. Cover and cook gently for 20 to 35 minutes or until base can be pierced easily with a fork. Turn upside down to drain. Chill.

VANAIGRETTE SAUCE

$\frac{1}{2}$ cup salad oil
3 tablespoons vinegar
1 teaspoon salt
$\frac{1}{4}$ teaspoon paprika
1 teaspoon minced parsley

Combine all ingredients. Makes approximately $\frac{2}{3}$ cup sauce.

(Source: National Marketing Services Office, BCF, U.S. Dept. of the Interior, 100 E. Ohio, Room 526, Chicago, Ill. 60611.)

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UNITED STATES DEPARTMENT OF THE INTERIOR

Walter J. Hickel, *Secretary*
Russell E. Train, *Under Secretary*
Leslie L. Glasgow, *Assistant Secretary*
for Fish and Wildlife, Parks, and Marine Resources
Charles H. Meacham, *Commissioner,* U.S. FISH AND WILDLIFE SERVICE
Philip M. Roedel, Director, BUREAU OF COMMERCIAL FISHERIES

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States -- now and in the future.

BACK COVER: Gill netter on Johnstone Strait, British Columbia. Vancouver Island in background. (Photo: F. Bruce Sanford)

COMMERCIAL FISHERIES Review

VOL. 32, NO. 2

FEBRUARY 1970

COVER: A biologist collects sample of the catch.

COMMERCIAL FISHERIES
Review

A comprehensive view of United States and foreign fishing industries--including catch, processing, marketing, research, and legislation--prepared by the Bureau of Commercial Fisheries.

Managing Editor: Edward Edelsberg
Asst. Managing Editor: Barbara Lundy

Production: Jean Zalevsky
Alma Greene

The Bureau of Commercial Fisheries and The Bureau of Sport Fisheries and Wildlife make up The Fish and Wildlife Service of The United States Department of the Interior.

Throughout this book, the initials BCF stand for the Bureau of Commercial Fisheries.

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CONTENTS

Cod-end swinging aboard BCF-chartered vessel during explorations off South Carolina. (Photo: J. B. Rivers)

GROUP APPOINTED TO ADVISE INTERIOR ON MARINE AFFAIRS

A Marine Affairs Action Group has been appointed to advise Interior Department on strengthening its marine programs, Secretary Walter J. Hickel announced on Jan. 20, 1970.

Dr. John C. Calhoun Jr. was named chairman of an 8-man group of leaders in science and industry specializing in marine activities. Dr. Calhoun is vice president for programs and director of the sea grant program, Texas A & M University, and former science adviser to Interior.

Background & Mission

Secretary Hickel explained: "Since I became Secretary, I have given priority attention to this Department's marine programs. Interior's budget for ocean affairs is about 35 percent of the total federal civilian effort in marine activities. Scattered among some 11 bureaus and offices, however, these Departmental programs require greater coordination and integration.

"A start in this direction was made through the establishment of the Office of Marine Resources. It has become apparent, however, that a stronger organizational thrust is needed.

"This need has been given increased urgency by the recent announcement of the Administration's five-point initiative in the field of ocean science and marine resource development. In two of these programs, this Department has been assigned lead agency responsibility, namely, Coastal Zone Management and the establishment of Coastal Zone Laboratories. If we are to meet our increasing responsibilities for developing the ocean's resources and for protecting the nation's marine environment, we must streamline our management structure.

"Accordingly, I have selected a special Marine Affairs Action Group and directed it to recommend a detailed restructuring of departmental entities engaged in marine related activities toward the specific end of efficiently achieving priority objectives. This task will include:

"(1) A complete review of this Department's marine programs;

"(2) An examination of the recommendations and conclusions of recent ocean policy studies, including the report of the Commission on Marine Science, Engineering and Resources;

"(3) A selection of concrete departmental goals for ocean use and development, in light of new Administration directives; and

"(4) A determination of relative priorities for these goals and time frames for their attainment."

The Group

Secretary Hickel also appointed these members of the Marine Affairs Action group:

Dr. Douglas L. Brooks, Special Assistant to the Director, National Science Foundation;

Dr. John V. Byrne, Chairman, Department of Oceanography, Oregon State University;

Wilbert M. Chapman, Director, Marine Resources, Ralston Purina Company;

Dr. Earl G. Droessler, Vice President for Research, University of New York at Albany;

Dr. Mason L. Hill, former Manager of Exploration, International Division, Atlantic Richfield Company;

Taylor A. Pryor, President, The Oceanic Foundation, Hawaii;

Dr. Lyle St. Amant, Director, Louisiana Wildlife and Fisheries Commission.

HICKEL ENDORSES LAKE SUPERIOR POLLUTION REPORT

Secretary of the Interior Walter J. Hickel endorsed on Jan. 29 the recommendations of a 1969 conference dealing with pollution in Lake Superior. He urged water-pollution-control agencies in Minnesota, Wisconsin, and Michigan to ensure that the recommendations are effectively carried out.

The conference was convened May 13-15, 1969, and reconvened Sept. 30-Oct. 1, 1969, in Duluth, Minn. It sought measures to curb contamination of Lake Superior, the largest, deepest, and cleanest of the Great Lakes. One topic discussed was the daily discharge into the lake of thousands of tons of taconite tailings by the Reserve Mining Co. in Silver Bay, Minn.

Conference Recommendations

The conference recommended the development of guidelines by a specially appointed committee to tighten water-quality standards in Lake Superior. It called for continuing surveillance of Reserve's taconite discharges--and for company efforts to reduce these.

Federal and state agencies were asked to strengthen their surveillance procedures in the Lake Superior Basin to detect more effectively changes in water quality. A minimum of secondary treatment was recommended for all municipalities discharging wastes into the lake and its tributaries.

Eliminate Oil

The conference report urged the elimination of visible discharges of oil from any source--and prohibition of the dumping of polluted dredged material into the lake. Also recommended was adoption of uniform state requirements for controlling wastes from water craft.

CONSTRUCTION OF FPC PLANT IN WASHINGTON STATE BEGINS

Groundbreaking ceremonies marking the start of construction of a demonstration plant that will produce Fish Protein Concentrate (FPC) were held Jan. 31 at Aberdeen, Wash.

"The plant will be a major step forward in developing the technology needed to produce FPC in quantity," said Dr. Leslie L. Glasgow, Assistant Secretary of the Interior for Fish and Wildlife, Parks, and Marine Resources.

FPC has been produced under laboratory conditions and in a small model unit by BCF scientists.

Aberdeen Plant's Purpose

The Aberdeen plant will demonstrate the technical and economic feasibility of producing FPC in large quantities. Information resulting from the design, processing, and costs of manufacture will be made available to interested companies--so the technologic advances achieved can be applied to commercial production.

Dr. Glasgow noted that many species of fish rich in protein are now used for industrial purposes, or are not harvested at all. "I see FPC as only the start of a new concept in utilizing these vast aquatic resources and converting them into high quality protein for human benefit."

U. S. TUNA FLEET EXPANDS

On Jan. 1, 1968, the carrying capacity of the U. S. tuna fleet (including bait boats) was about 43,600 tons, reports BCF's Pacific Southwest Region. During 1968, capacity increased by 4,710 tons--to about 48,310 tons.

In 1969, the fleet added 8,000 tons of new capacity and lost about 700 tons through sinkings.

It is estimated that 9,400 tons will be added in 1970. Including 1970 preliminary estimates, the fleet will have increased 49.1% in 3 years.

EASTROPAC OBSERVATIONS MADE AVAILABLE TO TUNA FISHERMEN

Observations during the Eastern Tropical Pacific (EASTROPAC) cruises have been made available to tuna fishermen, discloses BCF's Pacific Southwest Region. The fishermen had expressed much interest in the oceanographic information collected during these cruises. The information may help them locate and catch tuna.

Cruise Reports

One report contains information dealing with seabird, porpoise, whale, and surface tuna school observations. Another report in preparation will contain summaries of "surface temperature, mixed layer depth, water clarity, forage, seabird, porpoise and tuna school sightings for winter and summer months in three areas outside the regions where the U.S. tuna fleet has historically fished."

Oceanographic Information Valuable

BCF Pacific Southwest adds: "Since tuna fishing operations are being extended beyond the traditional fishing regions, oceanographic information which may aid in locating tuna in the new areas is of prime interest to fishermen."

INTERNATIONAL FISHERIES SURVEY CONTINUES OFF CALIFORNIA

The Soviet fishery research vessel 'Ogon' arrived in Port of Los Angeles, Calif., January 26 to join BCF scientists in a survey of Pacific hake populations off California.

The object is to continue the assessment begun last year by U.S. and Soviet fishery scientists. In recent years, these hake stocks have been fished heavily by the Soviet fleet. Data are needed to provide a scientific basis for agreements to protect the species.

Hake are recognized in the U.S. as valuable raw material for producing fish protein concentrate.

U. S. AND JAPANESE TUNA EXPERTS CONFER AT BCF MIAMI LAB

Japanese scientists of the Far Seas Fisheries Research Laboratory, Shimuzu, spent the first week of January 1970 as guests of BCF's Tropical Atlantic Biological Laboratory (TABL) in Miami. The scientists, all experts in the biology and ecology of tunas, arrived in Florida Dec. 30, 1969, aboard the 'Shoyo Maru,' research vessel of Japan's Fisheries Agency.

The ship is well known to the world's tuna researchers. She left Tokyo in October 1969 on a 6-month Pacific fishery-oceanography investigation--off Mexico and Panama, then in the Atlantic Ocean. She departed Miami for Tokyo, Jan. 6, 1970, retracing her route.

Led By Dr. Ueyanagi

The Japanese group was led by Dr. Shoji Ueyanagi, renowned tuna researcher. He was accompanied by Yasuo Nishigawa and Yoshio Nonagami, also of the Shimuzu laboratory. Joining the vessel at Guayaquil, Ecuador, was Phillipe Serene of the French CNEXO Tuna Program and Dr. Phillip Edmunds, U.S. Bureau of Sport Fisheries and Wildlife, Narragansett, R. I.

Much In Common

The Japanese and U.S. scientists have been leaders in the multination study of tropical Atlantic tunas begun 5 years ago. Since its inception in 1965, BCF TABL has researched tropical Atlantic tunas. By mid-1969, TABL had completed 27 cruises to study the ecology and biology of the 7 species of tuna native to Atlantic waters; the 'Shoyo Maru' has completed 4 Atlantic and many Pacific cruises on similar investigations. Both TABL and the Shimuzu laboratory have prepared and circulated volumes of scientific data on the tunas.

Atlantic Tuna Commission

The scientists discussed the newly established Atlantic Tuna Commission scheduled to open headquarters in Madrid, Spain, soon. The Convention that established the Commission was ratified in 1968 after the "Working Party on Tuna Stock Assessment"--set up by FAO--met for 4 days at TABL in August 1968 to discuss a plan of operation. Ten nations are members: Brazil, Canada, France, Ghana, Japan, Morocco, Portugal, South Africa, Spain, and the U.S. The Commission met for the first time at FAO, Rome, Dec. 1-7, 1969. The nations will work closely on a long-term examination of Atlantic tuna populations--toward the goal of conserving, yet exploiting to the fullest, these commercially valuable food fishes.

TABL & BCF Honored

During the Shoyo Maru's visit, Dr. Ueyanagi honored TABL and BCF on behalf of Japan by presenting TABL Director Carl J. Sindermann and Assistant Director Albert C. Jones with two objects of Japanese art--a lacquered serving platter and a figurine of Princess Michiko.

The vessel held open house on January 2 for members of the Miami marine-science complex.

17 U. S. FIRMS PARTICIPATE IN LONDON TRADE SHOW

BCF participated in the Hotelympia International Catering Exhibit, London, England, Jan. 6-15, for the third time. Seventeen U.S. firms displayed and promoted samples.

Sales of fishery products were about $203,000. These included orders for live and frozen eels, shrimp, and King crabmeat. Keen interest was shown in frozen crayfish products, King crab, Maine and Alaskan shrimp, fresh and frozen North Atlantic lobsters, canned Gulf shrimp, and tanner crab.

1969 WHALE SEASON YIELDS 108

The only U. S. whaling station, operated by Del Monte Fishing Company, ended its 1969 operation on December 5 because of bad weather and scarcity of whales. The 1969 season, which had opened about May 1, produced a catch of 108 animals. Included were 31 fin, 10 sei, and 67 sperm whales. The total also included 34 undersized or lactating sperm whales taken under a special scientific permit for studies by BCF's Marine Mammal Laboratory.

Gray Whales

Visual counts of gray whales passing Yankee Point, Calif., during the southward migration began in mid-December. Over 1,900 were counted by Jan. 21. Rough weather at peak of the run made counting difficult; counts probably were low. During the first week of January, up to 200 whales a day were counted.

LIVE CRABS HELD IN SEA-WATER SPRAY SYSTEM

A continuing problem in the Dungeness crab fishery is the cost of live-holding tanks on the boats, reports BCF's Seattle Technological Laboratory. The circulating sea-water tanks, usually constructed of iron, corrode. They must be replaced frequently. The cost of replacement ranges from $1,000 to $5,000, depending on boat size.

Laboratory personnel say one possible solution is to eliminate the tank and store the crabs in the hold by "a sea-water spray system that provides the essential moisture, oxygen exchange, and temperature control to maintain the crabs healthy but quiescent." Estimates are that such a spray system could be installed on a 50-foot boat for about $500.

Lab Experiments

Experiments with sea-water spray for holding live Dungeness crabs aboard vessels were begun in Willapa Harbor, Washington. The large RSW holding tank was installed on the after deck of the M/V 'Ethel May,' a 52-foot crab boat. Hard-shelled crabs were taken from 60 pots to provide about 600 lbs. of crabs. They were loaded immediately into the tank when brought aboard vessel. To limit damage to crabs, the holding tank was flooded prior to loading operation. After all crabs had been loaded, the tank was drained and the spray system put into operation.

Poly-Vinyl Chloride Spray System

The spray system consists of pumping sea water through 3 spray nozzles attached to a 1-inch diameter poly-vinyl chloride pipe frame mounted inside holding tank. Water flows through the system at about 35 gallons per minute. The angle at which the water sprays from each nozzle is about 150°. The spray pattern is wide and flat; it is uniformly distributed over top layer of crabs.

Few Died

After 48 hours under the spray--and a total of about 55 hours out of the ocean--only 4 of over 300 crabs have died. If Dungeness crabs can be held this way for 3 or 4 days with a mortality of less than 5%, the experiment will be considered a success.

The operation, which will continue, is being watched closely by crab fishermen from California to Washington, reports the Seattle Technological Laboratory.

FISH-GUTTING MACHINES DESIGNED FOR FISHING VESSELS

Fish-gutting machines in the past have been too big and costly for any but the largest factory trawlers. Now two types of gutting machines have been developed for medium vessels. Their introduction may enable trawlers to carry smaller crews and handle their catch more quickly and efficiently.

BCF's 'Vacuum Eviscerator'

The 'vacuum eviscerator' was developed by BCF's Technological Laboratory in Gloucester, Mass. It is designed to handle 60 fish per minute, compared to manual rate of 16 fish per minute. The operator holds a fish (head first) against a nozzle and depresses a foot pedal. The gut is removed and the fish washed and flushed by the machine. The prototype system is not fully automatic, but a fully automatic system should evolve. It is estimated that a complete eviscerator will cost about $5,000.

'Shetland Gutter'

A second gutting machine is the "Shetland gutter," invented by a farmer. It is simple and sturdy. The British White Fish Authority sought to improve the basic design but was able to make only minor changes to components. Already in production, the Shetland gutter is designed for small draggers and handles 45 fish per minute. It costs less than $3,000 and can take fish up to 17 inches long. Later models will handle larger fish.

BCF EXPLORES PRAWN FISHING OFF SURINAM

In 1969, BCF's research vessel 'Oregon II' discovered commercial concentrations of giant scarlet prawns off Surinam, South America, in 350 to 450 fathoms. More recently, the vessel completed a followup cruise in the same general area for the same species. She fished with large shrimp trawls.

During 13 days of fishing, 23 of 30 sets were considered successful, producing over 1,500 pounds of scarlet prawn tails (7 to 30 count).

These prawns are a desirable commercial commodity. BCF's efforts will assist in development of a fishery.

INTEREST RATE ON FISHERY LOANS IS RAISED

BCF announced on Jan. 30, 1970, that interest charged on Bureau-approved fishery loans has been raised from $7\frac{1}{2}\%$ to 8%.

Philip M. Roedel, Bureau director, said that by law the interest rate is based on the average yield of Government obligations with maturities of 7 years. On Dec. 31, 1969, this yield increased to $7\frac{5}{8}\%$, necessitating a corresponding increase in the interest rate on fishery loans.

How Loans Used

Fishery loans are direct Government loans to owners of fishing vessels. The loans may be used to finance and refinance the purchase, construction, equipping, maintenance, repair, or operation of commercial fishing vessels or gear--when funds are not otherwise available on reasonable terms.

NEARLY $6 MILLION IN COMMERCIAL FISHERIES AID AVAILABLE TO STATES

Commercial fisheries grants in aid of $5,950,000 have been made available to the States, Commonwealth of Puerto Rico, Virgin Islands, Guam, and American Samoa. This was announced Jan. 27, 1970, by Assistant Secretary of the Interior Leslie L. Glasgow.

The funds partially reimburse the recipients for completed work on commercial fishery projects. The funds are used on a cost-sharing basis for research, development, construction, and improvement of facilities and vessels designed to benefit the Nation's commercial fisheries. Projects are selected, designed, and carried out by the States, with up to 75% of cost financed by Federal funds.

Nearly $28 Million Since 1965

Since 1965, nearly $28 million in Federal funds have been made available for 348 commercial fisheries projects under two Acts: Commercial Fisheries Research and Development Act of 1964 (P.L. 88-309) and Anadromous Fish Act of 1965 (P.L. 89-304).

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SHRIMP-FISHERMEN TRAINING SUPPORTED BY LABOR DEPT.

Because there is a shortage of shrimp fishermen in the U.S., the Department of Labor is supporting a program to train shrimpers for the Gulf Coast. This was reported by the Department's magazine 'Manpower' in Dec. 1969.

Under a contract awarded to the Freeport (Texas) Shrimp Assoc., a consortium of boat owners is sponsoring the program. The owners place qualified recruits on board their vessels during the on-the-job phase. Since training began in Feb. 1969, 80 men have taken jobs and gone to sea; 70 more will be trained. The total cost will be more than $471,000. Training is conducted by Fitzgerald Laboratories, Inc., Annapolis, Md., which has established in Freeport a dockside training center.

The Program

Groups of 10 trainees certified by the Texas Employment Commission begin training at 2-week intervals. The first phase is 8 weeks of on-shore instruction; then 44 weeks of on-the-job training aboard shrimp boats.

The training is divided into 3 parts: 1) Fundamentals: seamanship, oceanography, navigation, communications, engine maintenance, trawls and rigging, net making and repair. 2) Practical experience in workshops at the center and on board a training vessel staffed by instructors. 3) Student signs on a fishing trawler. There he will get his "sea legs" and the experience to make him a competent shrimper.

Trainees Counseled

The program includes job adjustment and counseling to help trainees with discipline, adjustment to the sea, social skills, budgeting. The center uses industrial psychologists and job counselors because many trainees have little schooling or job experience.

Paid During Training & After

Trainees are paid at least $1.60 an hour during training, and $5,000 annually afterward.

A typical off-coast vessel with a 3-man crew may be at sea 4 to 20 days.

NEW FISH-LOCATING TECHNIQUES

In some fisheries, as much as 85% of a vessel's operating time is spent locating fish. Reducing searching time as much as possible is very important. Experiments with airborne and/or spaceborne equipment have been promising. A qualified observer can distinguish many species of pelagic fish on the basis of color. These color differences are used by spotter pilots of the commercial fishing industry to locate and identify fish.

The experienced spotter also uses other features: the presence of fish oil films, diving birds, ripples and, sometimes, a churning of surface waters. Airborne and spaceborne sensors, which are better than the human eye in many important respects, may be used to locate and identify surface and near-surface fish stocks.

Measure Color Patterns

The distinctive color of certain species suggests that spectral measurements of the color patterns with analytical equipment may be used to locate and identify fish schools in their natural environment under certain conditions. During September 1968, BCF's Pascagoula Base (Miss.) obtained spectral-reflectance measurements of 15 schooling species in the northern Gulf of Mexico. Measurements were made on single fish, fish in small groups, and fish in schools inside impoundments using a water-color spectrometer. Results of these preliminary measurements indicated the idea has merit; equipment to continue studies in this area is available.

To Study Captive Schools

During the coming months, observations will be made of the color patterns of some commercially important species in their natural environment. These observations will be made on captive schools under a wide range of known (monitored) environmental conditions of sea-state, lighting conditions, and water turbidity. The results will determine the feasibility of an airborne or spaceborne operational system to locate and identify fish schools from observations and automatic analysis of color patterns.

Light Sensors

Another promising approach to locating and identifying pelagic fish is the low-level light sensors, such as image intensifiers. These detect the bioluminescence, or "fire" as fishermen call it, associated with most schools. The Spanish mackerel fishery, which yields an annual catch of 7 to 8 million pounds, illustrates the potential application of this method. In Florida, this fishery is carried on chiefly with gill nets and haul seines at night. The fish are sighted by "fire" in the water. This "fire" results from the movement of fish schools that cause luminescent organisms to glow momentarily. The bodies of rapidly swimming fish are outlined with light; each leaves a trail of fire as it moves. Large schools of mackerel, 5 to 10 tons, are identified by individual flashes within a larger glowing sphere of bioluminescence. The "fire" can be seen best with the naked eye on moonless nights; however, fishing is also done on cloudy nights.

A series of tests has been conducted by BCF Pascagoula from Coast Guard helicopters, fixed-wing aircraft, a stationary oceanographic platform, and surface vessels using a television-image intensifier system. They amplify 40,000 times the ambient light or, in this case, the bioluminescence.

This system has been used to observe fish schools, individual fish, SCUBA divers, and objects towed at subsurface depths in water masses containing both low and high concentrations of luminescing organisms. Off Florida's west coast, imagery was obtained of thread-herring schools at night from altitudes of 500 to 5,000 feet. Test results strongly suggest that low-level light sensors may be used effectively from high altitudes to locate, and possibly identify, pelagic fish stocks over large oceanic area.

The remote sensing system expected to evolve will have daytime and nighttime sensing capabilities. It will scan wide areas at high speeds--and provide real time data on the location, quantity, and species of pelagic fish stocks with much accuracy.

DECADE OF NORTH ATLANTIC FISHING REVIEWED BY BCF

BCF Gloucester (Mass.) provides this review of a decade of fishing in the North Atlantic region:

Generally, the condition of domestic fisheries in the region is not good, but there are some bright spots. There is room for optimism in U.S. international negotiations. We appear to be approaching the day when country quotas will become a reality in the Northwest Atlantic. It is imperative that our research efforts be maintained at a level that will give our international experts the facts they need at the conference table.

Foreign Vessels Appear

Foremost in many minds are the foreign fisheries off U.S. shores. The 1960s began with Soviet exploratory vessels appearing off New England. These were followed by large fleets of several nations. At first, these fleets caught herring. But in 1969 the Soviets began taking substantial quantities of silver hake.

Unloading fish during a snow storm in Gloucester, Mass. (Photo: Robert K. Brigham)

By 1965 the Soviet catch of silver hake was 7 times the U.S. landing of this major food species.

Haddock Catch Declines

The 1963 year-class of haddock was one of the largest on record. In 1965 and 1966, over 430,000 metric tons of haddock were taken by the Soviets, Canadians, and the U.S. The landings in each of these years were about double the average annual landings by all nations in previous years. Since 1963, there has not been a successful year-class of haddock. In 1969, U.S. landings were down to about 20,000 metric tons. The Soviet and other European fleets are no longer interested in haddock. They are continuing their efforts on silver hake, herring, and other industrial species.

Silver Hake Declines

At the end of the decade, landings of both haddock and silver hake were less than 50% of 1960 landings. In recent years, these species have been the backbone of Boston and Gloucester fisheries. Landings of ocean perch, the leading New England food fish in 1960, are down 60%, and scallop landings even more.

New Bedford Still No. 2

The sea-scallop situation has adversely affected New Bedford, but it has not ousted that port from second position in the Nation in value of fishery landings. Largely responsible for New Bedford's position is the yellowtail fishery. Strong broods have appeared year after year. Landings have held up well with an annual value 3 times greater than 10 years ago. However, this fishery is being exploited at about the maximum it can sustain, and there is always the possibility of foreign competition.

Menhaden Industry Grim

To the south of New England, the situation in the menhaden industry is grim. Some plants are idle; others have been operating at a minimum.

Oyster Industry

Although the oyster industry in Connecticut and on Long Island is encouraged by excellent sets in 1966 and 1968, recovery from the MSX disaster in Delaware and Chesapeake Bay has been slow. However, there are some signs of improvement.

Alternate Resources

BCF Gloucester hopes that such alternate resources as sea herring and pollock will be utilized more fully by U.S. vessels. The Soviets, Poles, and Germans are still harvesting vast quantities of herring off shore. Recently, East and West German vessels have been taking substantial numbers of pollock which, BCF Gloucester believes, will serve as an excellent substitute for haddock.

Clam Fisheries

The three existing clam fisheries of the North Atlantic region continue to thrive. Surf clam and soft clam production here doubled since the beginning of the decade. The blue crab industry has had its usual fluctuations in supply--but the greatest year-class in history is now entering the fishery in Chesapeake Bay.

New Fisheries

Several new fisheries have considerable potential in the North Atlantic. The offshore lobster trawl fishery has developed largely during the past 10 years. Landings now exceed five million pounds annually. Interest in the offshore pot fishery for lobsters is also increasing. Two latent resources worth watching are the ocean quahog and red crab; the former is already being landed in small quantities.

Shrimp Promising

One of the most encouraging developments of the decade is the northern shrimp fishery. Annual landings have gone from virtually nothing to thirty million pounds during the past 10 years. This fishery started in Maine and is now bolstering the Gloucester economy, which was damaged badly by the drop in landings of ocean perch and silver hake.

BCF Gloucester concludes: "While we cannot look to the seventies without some apprehension, we do believe that if our industry can be assured proper access to the resources off our shores, brighter days lie ahead."

PACIFIC SAURY: LARGE LATENT RESOURCE

The Pacific saury (Cololabis saira) is a slender teleost resembling, superficially, a wingless flying fish. It is one of three species of the family Scomberesocidae. Adult saury, 28-32 cm. long, are expectionally firm-fleshed. The meat is oily.

The saury is highly regarded as a fresh and canned product in Japan and the Soviet Union. Large amounts also are frozen for use as bait in tuna longlining.

3 Stocks

The Pacific Ocean contains three main stocks: The Asian is located off the Soviet Union, Korea, and Japan; the central Pacific stock surrounds the Hawaiian Islands; and the eastern Pacific stock occupies coastal waters from Baja California to northern British Columbia. Although the three stocks generally are considered geographically isolated, some intermixing may occur.

Large Resource Off California

U.S. scientists who have conducted egg and larval studies off California report a very large saury resource. Soviet surveys off the U.S. west coast showed saury in coastal region 50-150 miles wide and 450 miles long between northern California and Washington.

Albacore fishermen off Oregon often observe schools of saury miles wide and up to 20 miles long. During September 1967, BCF's research vessel, 'John N. Cobb,' encountered a school covering a 3-4-mile area 30 miles offshore near Destruction Island, Washington.

Estimates of Stock

Minimum estimates of the eastern Pacific saury's standing stock range between 450,000 and 800,000 tons. Some researchers feel the figures may be 4-5 times greater. The stock is believed at least as large--and possibly several times as large--as the Pacific hake population.

Japan & USSR Fishery

Both Japan and the Soviet Union fish the Asian Pacific saury on a large commercial scale. Nearly 1,000 vessels support the Japanese saury industry. Although the size of the Soviet saury fleet is unknown, it is believed comparable to the Japanese fleet.

The Japanese catch was 210,000 tons in 1967 and about 150,000 tons in 1968. In recent years, Japanese catches have exceeded 500,000 tons. In 1968, near Tokyo, fishermen sold large saury to fresh-fish market for $375-958 a short ton. The tuna longline industry was paying up to $500 a ton (25 cents a pound) for bait saury.

Potential for U.S.

Saury has been sold in the U.S. only in very isolated instances, so its potential price in U.S. is unknown. Assuming comparable prices with average Japanese markets, the exvessel value of potential annual harvest of eastern Pacific saury is at least $100 million. The value of saury for Fish Protein Concentrate (FPC) would also be large after procedures for using this species were developed. Possibly, saury exports to Japan would be very profitable because Asian saury catches have been declining in recent years. The export of bait saury to American Samoa for sale to foreign tuna longline vessels might be profitable.

Soviet Interest

Foreign interest in the eastern Pacific saury stock is obvious. The Soviets have conducted at least two extensive surveys off U.S. U.S. fishing vessels have reported a few Soviet vessels fishing saury off U.S., probably exploratory. Soviet publications indicate great interest in this resource and report Soviet intentions for a commercial fishery.

The Japanese realize the potential of this resource, but they have not investigated it as much as the Soviets.

Obstacles to U.S. Fishery

There are problems in developing a U.S. saury fishing industry. The harvesting methods of Japanese and Soviet vessels differ completely from U.S. methods; they require considerable manpower. Either foreign technology must be modified to U.S. needs--or completely new harvesting methods must be developed. If the former, manpower requirements must be greatly reduced by mechanization to make saury fishing profitable in the U.S. Many U.S. vessels that would be suitable fish other species between August and December, when saury are most available. U.S. markets must be developed, although a large potential export market exists.

Seattle Research

BCF's Seattle Exploratory Fishing and Gear Research Base has conducted preliminary research on saury and plans to expand its program. One exploratory cruise has been completed that provides background for a larger resource-assessment effort.

Much information has been acquired on Japanese and Soviet fishing methods, and plans are being developed to adapt the Japanese technique to U.S. needs and capabilities. Alternate fishing systems, which would be less labor intensive, also are being considered.

CATFISH FARMING IN 1969

BCF Ann Arbor, Mich., and the Bureau of Sport Fisheries & Wildlife laboratories in Stuttgart, Ark., cooperated in reporting the 1969 catfish story. Here are highlights:

The U.S. catfish farming industry received much publicity in 1969, but it is "not all wine and roses. There are trouble spots due to growing pains: Product quality has not always been up to par; market expansion has been limited by inadequate product portion control and high prices; processing plants have not been able to get enough fish to operate efficiently; many producers have yet to show a profit; catfish inventories are building up in ponds; disease incidence is increasing--harvesting and handling techniques are still relatively primitive; and other problems."

Catfish farming acreage continues to expand. Over 40,000 acres across the southern half of the U.S. were under catfish culture in 1969. Around 2,000 of these were devoted to fingerling production.

Close to 1,300 persons and firms are in farm catfish culture in the U.S. (excluding California). The average size of catfish farms (water impoundments) in the South-Central States is about 38 acres, but the majority range between 10 and 30 acres.

Probably not over 20,000 acres were harvested. Possibly 23 to 28 million pounds were produced. These are only estimates--because no reliable data-gathering system exists.

Catfish Use

Local markets (restaurants, retail, live marketing) remained the major market.

Live fish haulers paced prices in spring and early summer. They paid up to 50 cents per pound and took an estimated 2-3 million pounds.

Around 2 million pounds were processed in plants in Arkansas and Mississippi--only 10-15% of capacity. By the time most plants became operable in late spring, competition from live fish haulers drove prices out of their reach and forced them to close over the summer. To resume operations in early fall, processors had to pay 40 cents a pound.

New Outlets

"Fast service restaurants featuring catfish sprang up in several South-Central cities--many with franchise or chain expansion plans. Lack of catfish supplies, inexperience, under-financing, competition, and other factors forced abandonment or postponement of many such plans. The surviving restaurants are prime markets for processed farm catfish and are expected to expand. However, the picture is clouded by special interests of stock promoters of franchise operations."

Supermarkets More Important

Supermarkets became increasingly important as market outlets for fresh and frozen farm catfish. Retail outlets were a major factor in reducing inventories of frozen catfish products not acceptable to restaurants. "Restaurant markets are highly sensitive to product size and form, whereas retail markets are able to accommodate more variation in the product."

Imports

Imports of catfish increased to around 4 million pounds in 1969; 85% came from Brazil, 14% from Mexico. Imports compete successfully in many restaurants because they are much cheaper. "No adverse consumer reaction has been noted."

California Debuts

California now has about 1,500 acres in production, mostly in small ponds. "Climate, water, markets, and increasing interest point to California as a potential major producing and market area for farm catfish."

SOME MAJOR PROBLEMS

Water Quality: The need for adequate supplies of fresh water has been emphasized repeatedly. During summer 1969, numerous farmers lost fish because they were unable to maintain good water conditions. Losses due to oxygen depletion often could have been prevented had fresh water been available in quantity.

Disease: The incidence of bacterial infections was very high. This reflected the relationship of poor water conditions to disease outbreaks.

Agriculture Department's Soil Conservation Service suggested a 13 gpm per acre figure for well capacity. This represents "the absolute minimum a farmer should consider when planning his water system."

Disease control: The incubation period for Aeromonas liquefaciens infections in channel catfish is 10-14 days. Farmers should expect outbreaks of bacterial diseases 10-14 days after any stress. "Parasites, handling, or low oxygen stresses may be involved in disease occurrence. Fish should not be handled for at least two weeks if they have undergone low oxygen stress."

Ichthyophthirius or "ich" disease was observed in fingerlings on several catfish farms as of Oct. 1, 1969, about 6 weeks earlier than usual. "Farmers are urged to use preventive measures in ponds where fingerling catfish are being reared."

Harvesting

Harvesting is still "a rather haphazard procedure." Haul seining has vastly improved over the past few years, but it is still a "cumbersome, time consuming, and often expensive harvesting method." Most producers feel they cannot afford their own equipment and must rely on outside harvesting crews and facilities. The latter have been acquired by most large producers and processors.

The development of more efficient holding, handling, and sorting methods is proceeding slowly. In-line weighing scales now are commonly used while fish are being lifted from nets to hauling conveyances. Mechanical grading devices and catch estimators are under development at the Kelso Gear Research facility, Arkansas.

Lack of adequate catfish supplies and the continuity of deliveries were critical to processing. They caused processing costs to increase up to 20 cents a pound--a cost that eliminates profit margins. Some processors are likely to face this problem again in 1970.

Quality

The catfish image as a superior product was hurt in summer 1969 by reports of poor quality. Maintenance of high quality during processing and storage for "wholesomeness, taste, product form and weight is a major problem facing processors." Off flavor occurred in some catfish traceable to pond sources. Freezer burn (dehydration) was noted in catfish products held in cold storage improperly packaged or glazed. Markets rejected these.

Sanitation measures in some processing plants have been inadequate.

Portions and Packaging

Non-conformance with portion control and packaging requirements of certain market outlets, particularly restaurants, produced a frozen inventory buildup of over one-half million pounds by October 1969. This inventory was being reduced primarily by sales to supermarkets.

Lack of knowledge of the size of markets and the requirements of individual markets limits the ability of producers and processors to plan marketing programs and to choose market alternatives.

Resistance by institution buyers to wholesale prices of over 90 cents per pound for frozen farm catfish developed.

Fast service restaurants cannot compete at these wholesale prices. So many turned to imported products.

Wide-scale consumer reaction to retail prices of \$1.29 to \$1.39 per pound retail is largely untested. There are indications of resistance at the higher price.

Production Costs

Current production costs of 28 to 30 cents or more per pound at farm level is too high to permit processing and marketing to large users--restaurant chains and convenience food processors.

THE CRAWFISH INDUSTRY

A report by BCF's Biological Laboratory, Galveston, Texas, indicates that most of the U.S. crawfish production is in Louisiana. In recent years, annual production in Louisiana has fluctuated from 200,000 to 10,000,000 pounds. The resource is valued at $4 million annually. Crawfish are harvested from natural waters, rice fields, and impoundments. Outside Louisiana, a large species is harvested in Oregon and shipped to west coast cities as "short lobsters"; only $7,000 worth are sold annually.

In Louisiana, the bulk of wild crawfish come from Atchafalaya Basin, where more than 2 million pounds may be harvested in a good year. Most crawfish are caught in chicken wire crawfish cages. It is not unusual for trappers to take 200 or more pounds per day.

Louisiana also produces 3 million pounds of crawfish on 6,000 acres of crawfish farms.

There are four genera and 29 species of crawfish in Louisiana. Only two large species, red swamp crawfish (Procambarus clarkii) and white river crawfish (Procambarus blandingi acutus), are taken for commercial markets. Smaller species are used as bait by sports fishermen.

The species harvested in Oregon is Pacifasticus leniusculus.

Biology

Adults inhabit open waters in winter and spring. About July 1, females dig burrows 24 to 36 inches deep in dry areas. If fields are still flooded, they burrow in levees, high spots in fields, or migrate to adjacent fields. Egg laying begins about September 1. Female fertilizes eggs from sperm receptacle placed in May. Eggs are deposited in balls on swimming legs. Red swamp crawfish produce up to 700 young in 14-21 days. White river crawfish produce 200-400 young in 18 to 29 days. While September and October appear to be the peak hatching time, adults have been observed with young every month of the year.

If water is available, crawfish will come out of their holes about October 1 to rear and scatter their young. The minimum size for edible crawfish is 15 to 20 grams. It takes about 210 days for late-summer or fall-hatched crawfish to reach this size.

Crawfish feed best at temperatures of 65° to 80° F.; little feeding occurs below 45° or above 90° F. Crawfish will eat animal matter in small amounts--in the form of insect larvae, etc.--but they are not active predators; dead and living vegetation makes up the bulk of their diet. They are cannibalistic: females will eat a portion of their brood when confined in small areas without food.

Crawfish can come to the surface and breathe during periods of low oxygen content.

Males become 10 to 35 percent heavier than females at maturity. This difference is caused by differences in size of chelae and is not reflected in tail meats. (A chela is the pincerlike organ or claw borne by certain limbs of crustaceans and arachnids.) Larger individuals have a lesser percentage of tail meats than do smaller crawfish.

Fish are the worst predators of crawfish, but racoons, ibises, herons, boat-tailed grackles, sea gulls, legless salamanders, and predacious water beetles are all known to eat crawfish.

Farm Operations

Some farmers rear crawfish as their main crop and manage impoundments either for this purpose alone--or with possibility of developing crops of bull frogs and turtles. Others raise crawfish in rice fields, or in rotation with rice; crawfish are a winter crop and rice a summer crop.

It is not necessary to stock established fields. New fields are stocked in May. Red swamp crawfish are stocked at 10-15 pounds per acre. White river crawfish are more suited for deep-water impoundment than rice fields. This species is stocked at 25-30 pounds per acre. A farmer should have a constant source of water and be able to control water levels. Water depths of 2 to $2\frac{1}{2}$ feet are ample. Crawfish can be grown in as little as 6 inches of water, but the deeper the water the larger the crawfish will grow before attaining maturity. In addition, shallow water encourages predation. Water with a minimum of 17 p.p.m. total hardness (calcium and magnesium) is required for survival of the young.

Fertilizer requirements are the same as those for raising any crop requiring a high calcium fertilizer in the same type soil. Very acid soils require liming--1 ton per acre lasts several years.

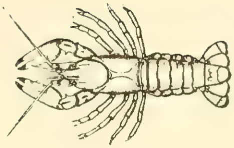
Rotenone is used to control predators remaining in pot holes, etc., during draw-down.

Not much is known of the effects of pesticides and herbicides on crawfish; however, this information is particularly important where crawfish are grown with rice. The herbicide, potassium azide, was found to be toxic to crawfish at concentrations above 0.25 p.p.m. Fields treated at 2.0 p.p.m. had lost their toxicity after 10 days. Sodium azide is more toxic than potassium azide.

One successful procedure for field management was given by Carl H. Thomas in 1965:

Time		Practice
Early spring	-	Field plowed
May 1st*	-	Field replowed and rice planted
May 15-Aug. 1	-	Field flooded--growing rice
Aug. 1*	-	Water drained off rice
Aug. 15*	-	Rice harvested
Sept. 1-Nov. 1*	-	Field reflooded
Sept. 1-June 30	-	Field remains flooded
Dec. -Mar.*	-	Crawfish harvested

*Dates approximate, may vary 10-15 days.



Contracting the Harvest

Some farmers contract out harvesting for a set fee per pound of crawfish harvested, some fish for themselves, and others open land up to the public to fish at a price per pound. Most harvesting is with traps or crawfish nets. Standard cylinder-type or funnel entrance traps are most common. Traps are baited with catfish heads, gizzard shad, buffalo-carp, and beef melt. Well-baited traps will catch $\frac{3}{4}$ to 1 pound in 6 to 8 hours. They are usually checked in the morning and evening.

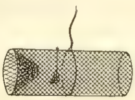
Yields from Good Pond

Annual yields from a good pond vary from 400 to 1,000 pounds per acre. Experimental production with supplemental feeding yielded 1,200 pounds per acre. Individuals harvested in December to early February are large, averaging 10 to 11 per pound. Average size then decreases as young of the year enter the catch.

Early season retail prices start at 35¢ to 50¢ per pound and decline gradually to 12¢ to 15¢. Only the tail meat and fat (hepatopancreas) are used. Tail meat is placed in plastic bags and packed in ice along with small cartons of fat. The peeled tail meat sells for \$2 to \$3.50 per pound.

The State of Louisiana and local institutions are conducting biological research on crawfish. Also underway are studies of predator control, levee maintenance, pond engineering, and optimum soil determination.

There seems to be little need for Federal action along these lines, says the BCF Galveston Biological Laboratory. The need is for advertising, market development, and food technology studies to develop recipes and processing techniques.



LOS ANGELES: FABULOUS FOOD FUNNEL

The Los Angeles District of the U.S. Food and Drug Administration (FDA) is often called the 'Southland.' It includes Arizona, California's 9 southernmost counties, Nevada's Clark County, and American Samoa.

FDA says of Southland:

"We have some of almost every food and drug industry; much of most specialties, and practically all of certain ones; and more quackery than we like to admit.

". . .Imports arrive from all over the world at Southland seaports. We receive 58,000 formal entries of food products a year, representing 12 percent of the United States total. These include basic food commodities produced in Europe and South America, food seeds from the Middle East, copra and spices from the South Pacific, and both basic and exotic foods from the Orient. A total of 190,000 tons of tuna, comprising half of the tonnage handled by the United States and all its possessions, was landed in 1967 to supply the southern California tuna canning industry. Much of this tuna originates in Japan, South America, and other foreign fisheries. This import workload is handled through a working agreement with the Cannery Inspection Section of the California State Bureau of Food and Drug. This agency maintains continuous inspection in tuna canneries, examining every fish that enters the cannery, and rejecting those that fail to meet standards of quality and wholesomeness. This agreement of many years standing is an excellent example of Federal-State cooperation that protects consumers without duplication of effort."

Fig. 2 - FDA Inspector (R.) makes organoleptic (smell, sight) examination of tuna in a Terminal Island tuna-processing plant.

Fig. 1 - The harbor at Terminal Island, Los Angeles. A tuna fleet docks here.

Fig. 3 - Watching the unloading of raw kelp--processed for seasonings and animal food at San Pedro, Calif.

Fig. 4 - In San Diego abalone-processing plant, an inspector watches worker remove abalone from shell in first step of processing. Later, the abalones are cut into steaks. (All photos FDA)

GREAT LAKES FACE ENVIRONMENTAL CRISIS

On Sept. 29-30, 1969, the Subcommittee on Energy, Natural Resources, and the Environment of the Senate Committee on Commerce heard testimony on the effects of pesticides on sports and commercial fishermen. William F. Carbine, BCF Regional Director, Ann Arbor, Mich., stressed "the environmental crisis that we face here in the Great Lakes."

Nearly all of Mr. Carbine's testimony follows:

Although the Great Lakes constitute the largest and most valuable fresh water resource of the world, their environmental quality has been deteriorating at an increasingly rapid rate in recent years. The biological and recreational values of the lakes have suffered most from the environmental changes that have taken place. These values may continue to decline even under proposed pollution abatement measures as the lakes will continue to be enriched at a rapid rate. Such enrichment causes the fouling of shallow areas and beaches with the obnoxious algae cladophora and creates conditions that are increasingly unfavorable for the desirable species.

The value of the water of the Great Lakes for municipal and industrial use has not suffered greatly yet, but may be seriously affected if concerted basinwide action is not taken immediately to stem the tide of environmental deterioration which continues to threaten all uses.

The municipal and industrial uses and value of the Great Lakes are enormous, but the total worth of the Great Lakes includes many other uses of major and increasing value and importance to the Nation's economy. The fishery resources of the Great Lakes provides annually over 80 million pounds of food fish for the United States and Canada and more than 50 million pounds of industrial fish. The value of the recreational industry based on the fishery resource has increased tremendously in the past decade and its total worth is incalculable. Other recreational uses of the Great Lakes such as boating, swimming, and related activities are accelerating greatly.

Areas of the Great Lakes that have been influenced most by the increases in the human population and industry have shown marked changes in fish stocks. The confined areas of southern Green Bay on Lake Michigan and Saginaw Bay on Lake Huron, and the Detroit River and western Lake Erie have long received the wastes of growing populations and expanding industry.

The early superficial changes in water quality of these areas provoked pollution surveys that in some instances have brought about improvement in water quality for domestic use, but highly nutrient wastes that continued to enter these areas eventually created an over-enriched environment that destroyed desirable aquatic life. As this occurred, there was an accompanying gradual, almost unnoticed, retreat of highly prized species such as lake trout, whitefish, lake herring, and walleye, from the inner areas of the bays, the Detroit River, and western Lake Erie. These fish were replaced by increasing populations of alewives, carp, smelt, and stunted yellow perch.

The most recent and alarming aspect of the environmental crisis of the Great Lakes has been the appearance of concentrations of pesticides that seriously threaten the value of even the more desirable fish, and may contribute even more to the rampant environmental instability already triggered by enrichment.

Fish and other aquatic organisms have shown a remarkable capability to concentrate chlorinated hydrocarbon insecticides contained in their food and directly from water. Monitoring studies conducted by the Bureau's Great Lakes Fishery Laboratory, Ann Arbor, over the past 3-year period indicates that on the basis of DDT—this also included DDD and DDE—and dieldrin levels in whole fish, the rank of the Great Lakes in order of highest to lowest concentrations of insecticides is: Michigan, Huron, Ontario, Erie, and Superior.

Insecticide levels calculated on the whole fish basis show a marked difference from species to species; generally, a positive correlation appears between fat content and insecticide concentrations. For any given species, DDT and dieldrin levels appear to increase with an increase in the size of fish.

Laboratory investigations have shown that levels of these insecticides in water, in the low parts per billion range, can be toxic to adult fish. Evidence also exists that levels in the low parts per trillion range, although not toxic to adult fish, may affect reproduction.

Pesticides have already caused serious concern about management and production of lake trout and coho salmon—two of the key species in a program to reduce the problems caused by the alewives and enhance fishery values of the Great Lakes. There have been excessive mortalities of coho salmon eggs that have been attributed to pesticide contamination, and high levels of DDT and dieldrin in large coho and lake trout have raised questions by the Food and Drug Administration about the establishment of safe levels for human consumption.

The fish stocks of the Great Lakes have undergone progressive deterioration for more than a century. In the mid-1800's desirable species abounded in all of the Great Lakes, but subsequently all have been reduced greatly or virtually eliminated at various times throughout the Great Lakes. At no time in the history has there been an overall concerted interstate or international effort to reverse these unfavorable trends.

Once the Atlantic salmon, lake trout, whitefish species, and pike perch species comprised 80 to 90 percent of the total production of all of the lakes, but these species that contributed so greatly to the early fishery now usually constitute, where they are still present, less than 5 percent of the fish taken from the lakes.

The history of the Great Lakes shows a sequence of collapses of stocks without subsequent recovery. The Atlantic salmon inhabited only Lake Ontario where it became virtually extinct by 1880 which was attributed by many to the despoilment of its spawning streams. The whitefish all but disappeared from the St. Clair-Detroit River area by 1900 where pollution was intense and unchecked. The lake herring populations collapsed successively in various lakes between the 1920's and present as a result of intensive fishing, enrichment, and competition with the introduced alewife and smelt which have thrived in the richer environments of the lakes.

Blue pike and walleye have declined greatly or disappeared in the past two decades due to enrichment in Lakes Erie and Ontario, and Saginaw and Green Bays, or sea lamprey predation in other areas. The sea lamprey was the major factor in the decline of lake trout and whitefish in the upper lakes—Superior, Michigan, Huron—since the 1940's, but enrichment appears to be the primary factor for the near disappearance of these species in the lower lakes—Erie and Ontario.

As desirable species have been reduced, there have been population explosions of less desirable species at various times throughout the Great Lakes. Perhaps the most obnoxious and destructive of these has been the alewife which was introduced accidentally in Lake Ontario about 1870. Subsequently, it spread throughout the Great Lakes where under favorable conditions, it has undergone population explosions in Lakes Ontario, Huron, and Michigan, and has caused great distress by undergoing massive spring dieoffs, clogging municipal and industrial water intakes, and reducing greatly or eliminating all of the more productive and stable small species that provided food for preferred large predators such as lake trout and coho salmon.

Other low-value new species that have become widely distributed and very abundant are the carp and smelt. Carp were introduced in the late 1800's and during this century have been extremely abundant and have dominated enriched shallower areas of the Great Lakes. Although carp and smelt are not fished intensively, they rank fourth and fifth in pounds of fish taken from the lakes.

Smelt were introduced into a tributary of Lake Michigan in the early 1900's and have subsequently spread to all of the Great Lakes where they become extremely abundant at various times in the richest areas of the Great Lakes such as Green and Saginaw Bays and Lake Erie. Smelt have contributed heavily to catches, but have also been competitive to the detriment of the more stable and desirable exotic species.

Not all unfavorable population explosions as desirable species declined have involved exotic species. In Lake Erie the gizzard shad increased sharply when accelerated enrichment was first noted in the 1950's, and caused distressing problems and dieoffs. Then, the sheepshead increased to dominate the lake in the 1960's and now holds a competitive advantage that makes difficult the establishment of more desirable species.

The greatest current fishery problems are the great abundance of undesirable species and the extreme instability of the fish stocks due to natural vacillations accompanying population explosions and the continuing accelerated enrichment.

Safeguarding and perpetuating the Great Lakes fishery resource is a major responsibility of the U.S. Department of the Interior's Bureau of Commercial Fisheries. Any practice or series of events which threatens the abundance of fish or a useful and productive balance of fish species is of primary concern to us.

Scientists of the Bureau of Commercial Fisheries have been working with the fisheries of the Great Lakes and their environment over a period of almost 50 years. The Bureau has been in a particularly advantageous position to observe the process of change that has been taking place in this—the largest complex of freshwater resources in the world. We were the first to direct public attention to the now well-publicized deterioration of Lake Erie.

Bureau scientists have found that water quality is detrimental to fish long before the more obvious issues of human safety and welfare are threatened. Before the public is aroused valuable fisheries and the waters that produce them are lost or so deteriorated that trends cannot be reversed or great effort and expense are necessary for rehabilitation.

We urge, therefore, a broad concept of environmental quality and pollution; a definition, not necessarily restricted to bacterial counts, excesses of dissolved solids, gross deficiencies in dissolved oxygen or easily detectable changes in bottom fauna composition. We urge the establishment of environmental quality standards that have prevention of pollution as a goal; not a set of limits that will define the degree of deterioration to be tolerated before action is taken to avert a national disgrace.

Experience has taught us that, frequently, troubles within one portion of this vast drainage have their origins in other, often remote, portions. We must become aware and remain cognizant of the occurrences in the Great Lakes that may threaten any portion of fish and wildlife. We must also strive to develop means of restoring fishes that already have become victims of situations created by the carelessness, greed, and shortsighted planning of parts of our society.

There should be close surveillance of any actions that might aggravate the already deplorable situation that has been developing in the Great Lakes drainage. Unless the practices which have induced these conditions are stopped and the trends toward further deterioration are reversed, the Great Lakes eventually will become the world's largest, but least valuable freshwater resource.

This concludes my formal statement as such. I would, however, like to make a few additional comments relative to the pesticide problem. Although the announced purpose of these field hearings is to consider the effects of pesticides on sport and commercial fisheries, we felt it appropriate that your subcommittee be provided a general review of the environmental deterioration that is taking place in the Great Lakes basin. Pesticide pollution is just one of the many complex influences which are threatening the usefulness of the Great Lakes. It is imperative that we attack these environmental problems on a broad front in a coordinated fashion.

More specifically as regards pesticide pollution, as a fisheries research agency, our most pressing concern is that the levels of hard pesticides in the Great Lakes may already be at a point where they may affect reproduction in certain important species and ultimately negate the rehabilitation efforts undertaken to date. This environmental concern, however, should not be confused with the human health aspects of the pesticide problem. These aspects must be considered separately.

It is not possible for a regulatory agency such as the FDA to set some tolerance level which will automatically take care of both the environmental and the human health concerns. FDA must concern itself solely with the possible threat to human health, whereas fisheries scientists must concern themselves with the environmental aspects.

We have joined with the Michigan Department of Natural Resources in taking a firm stand against any further use of DDT and other hard pesticides. We have been monitoring pesticides in the Great Lakes for 5 years and have extensive data on the subject.

OYSTER INSTITUTE HONORS BUREAU OF COMMERCIAL FISHERIES

The Oyster Institute of North America (OINA) recently awarded identical plaques to the Bureau of Commercial Fisheries (BCF) and to the Bureau's Division of Statistics and Market News.

In a ceremony in Washington, D. C., Cranston Morgan, President of OINA, made the presentations, thanking BCF for its services to the Institute over the years.

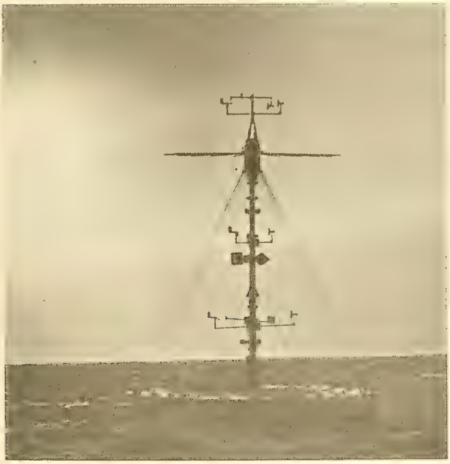
Brief acceptance remarks were made by Charles H. Meacham, Commissioner for Fish and Wildlife; Philip M. Roedel, BCF Director; and Frank Riley, Acting Chief, Division of Statistics and Market News.

Left to Right: Cranston Morgan, President, OINA, Weems, Va.; William R. Woodfield (Former President), Galesville, Md.; Frank P. McGinnes, Vice President, OINA, Irvington, Va.; John L. Plock, Greenport, L. I., New York; Charles H. Meacham, Commissioner, Fish and Wildlife Service, U.S. Dept. of the Interior; Elizabeth M. Wallace (Mrs. David H. Wallace), Executive Director, OINA, Sayville, L. I., New York; Robert L. Doxsee, Point Lookout, L. I., N. Y.; Frank Riley, Bureau of Commercial Fisheries; Edward J. Gruble (Immediate Past President), Seattle, Wash.; Clifford V. Varin, West Sayville, L. I., N. Y.; Nelson Slager, Bay Shore, L. I., N. Y.; Richard H. Loring, Dennis, Mass.; Philip M. Roedel, Director, Bureau of Commercial Fisheries.
Joseph O. Saunders, Newport News, Va., Chairman of OINA's Education, Promotion, and Marketing Committee was not present when photograph was taken. (Photo: Bob Williams)

AUTOMATED WEATHER BUOY AT WORK OFF VIRGINIA

On Jan. 31, the U.S. Coast Guard anchored a 100-ton automated weather buoy approximately 125 miles east of Norfolk, Va. (latitude 36°30' N., longitude 73°30' W.) on northern edge of main Gulf Stream; later, 200 miles to northeast, the Coast Guard cutter 'Gresham' began to man Ocean Weather Station 'Hotel,' the second part of a floating weather station team. The buoy began flashing weather observations across the U.S. to a computer at the Scripps Institution of Oceanography in La Jolla, Calif.

The Coast Guard states that data gathered by these floating weather stations will be transmitted to the main U.S. weather teletype network for use in forecasting. ESSA's Weather Bureau has discovered that severe weather conditions formed in this area can migrate northward along the Atlantic Coast undetected by shore-based facilities.



Automated weather buoy off Virginia.
(Photo: R. E. Tilley, 5th Coast Guard Dist.)

It is hoped the weather buoy and the Gresham will help to improve Weather Bureau forecasting for the East Coast.

The Data Gathered

The 100-ton buoy is 40 feet in diameter and has a 45-foot mast. It gathers hourly data on "air and water temperatures, barometric pressure, winds, dew point, solar radiation, precipitation and surface water currents." The data are stored in a computer inside the buoy. Every 6 hours, the shore-based computer in California interrogates the computer and receives and interprets its radio transmission.

Weather Buoy

The buoy is held on station by a 3-inch plaited nylon line attached to a 3-ton anchor weighted by 18,000 pounds of chain. The 2-mile mooring line allows the buoy to swing in a circle about $1\frac{1}{2}$ miles in diameter. It warns off passing ships with a flashing xenon light, similar to the strobe unit of a flash camera.

National Project

The experimental buoy is part of the Coast Guard-managed National Data Buoy Development Project that began in late 1967. If the project continues to appear feasible, a network of similar buoys may some day be placed to provide oceanographic as well as meteorological data.

The weather buoy is scheduled to remain on station until July 1970, when it will be brought in for overhaul. It will be restationed in August for a year's service.

SEARCH BEGINS IN GULF FOR DANGERS TO SHIPPING

A wide search for dangerous obstructions to shipping in the Gulf of Mexico was launched February by the Coast and Geodetic Survey (CGS). It will be carried out primarily in fairways leading into ports in Texas, Louisiana, Mississippi, Alabama, and Florida.

The only wire drag vessels in the U.S., the 'Rude' and 'Heck', left Norfolk, Va., their home port, for Corpus Christi, Texas, their base this year.

First Charted in 1966

The fairways were first charted in 1966, to guide coastal and ocean-going vessels safely between the numerous oil well platforms rising above Gulf surface as far out as 60 miles. No drilling structures are allowed in the fairways.

The ships' mission will be to search the fairways for partially removed oil platforms, sunken vessels, or other submerged hazards to vessels.

Eastward From Texas

The ships begin off Texas and will work eastward towing a submerged wire between them as they sweep the assigned areas. Shipping will be advised immediately through "Notice to Mariners" of hazardous obstructions. CGS charts will be corrected. The wire, towed at various depths down to 60 feet, will be kept close to bottom in fairways and in shallow areas.

Search for Sunken Wrecks

The sunken wrecks to be searched for include commercial and pleasure ships now noted approximately on nautical charts.

FAST-RESPONSE OXYGEN SENSOR TESTED

A newly developed sensor designed to give accurate, on-the-spot measurements of the water's oxygen content may soon replace present methods of recording oxygen levels.

This is the prediction of Quick Carlson, a civilian oceanographer at the U.S. Naval Oceanographic Office (NOO).

Carlson and his scientific team tested the new sensor to depths of one mile at 23 different Pacific locations while their oceanographic research ship, the USNS 'Davis' steamed from Yokosuka, Japan, to San Francisco.

Oxygen measurements returned by the sensor verified the general oxygen structure of the Pacific Ocean along the ship's route--close to the 34-degree north latitude line. They also revealed details of oxygen layering (oxygen levels at different depths) that could not be captured by the Nansen bottle.

Nansen Bottle Method

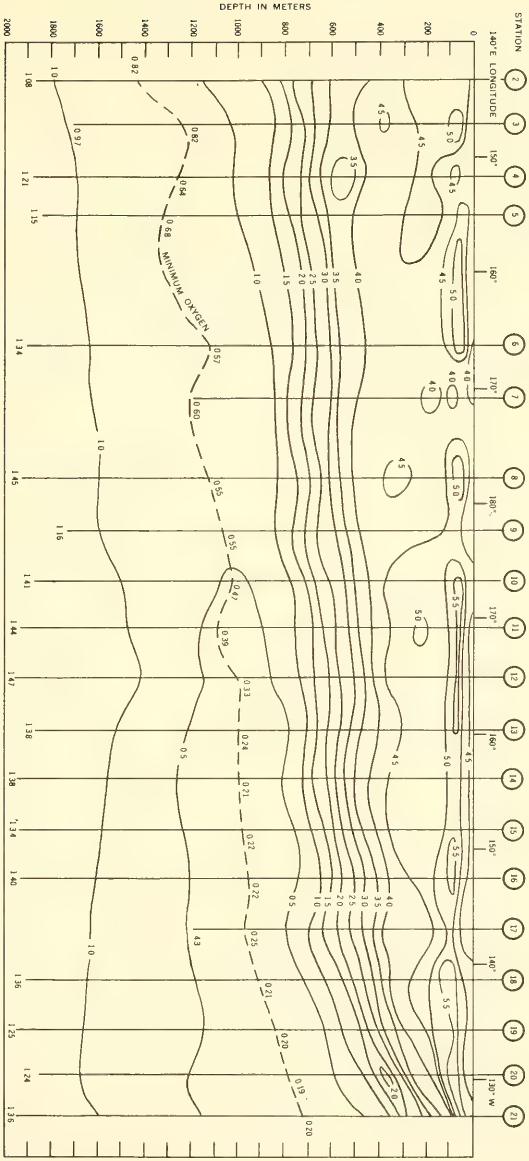
This older method is reliable but tedious. It includes several steps: placing numerous Nansen bottles (water samplers capable of capturing small amounts of water at predetermined depths) on an oceanographic cable, lowering and retrieving these bottles, and chemical analysis of the samples.

Sensor Is 1 Step

The sensor is a one-step method of collecting oxygen data. While it is being lowered through the ocean depths, it can provide continuous oxygen measurements in the form of electrical signals transmitted up a long oceanographic cable.

Carlson predicted: "As a result, the sensor should give us detailed, on-the-spot oxygen levels from all depths, in direct contrast to the spot-check readings we are now getting through the use of the Nansen and similar methods."

If further tests continue to support his view, Carlson predicted, the sensor will become an "easy-to-use, fast-response tool for oceanographers needing accurate oxygen measurements to determine the overall distribution of dissolved oxygen in all ocean waters, regardless of depth and area."



DISSOLVED OXYGEN — ml/LITER

FOREIGN FISHING OFF U.S., DECEMBER 1969

NORTHWEST ATLANTIC (Fig. 1)

In December 1969, 80 vessels were sighted (105 in Nov. 1969; 36 in Dec. 1968).

USSR: 36 medium side trawlers, 11 factory stern trawlers, 1 factory base ship, 4 refrigerated carriers, 2 tankers, 1 tug. Most were along 30-fathom curve south of Block Island and Nantucket, a few on Georges Bank. (50 in Nov. 1969; 29 in Dec. 1968).

Poland: 6 stern and 3 side trawlers (17 in Nov. 1969; 6 in Dec. 1968).

West Germany: 8 freezer stern trawlers (4 in Nov. 1969; none in Dec. 1968).

GULF OF MEXICO & SOUTH ATLANTIC

No foreign fishing vessels reported.

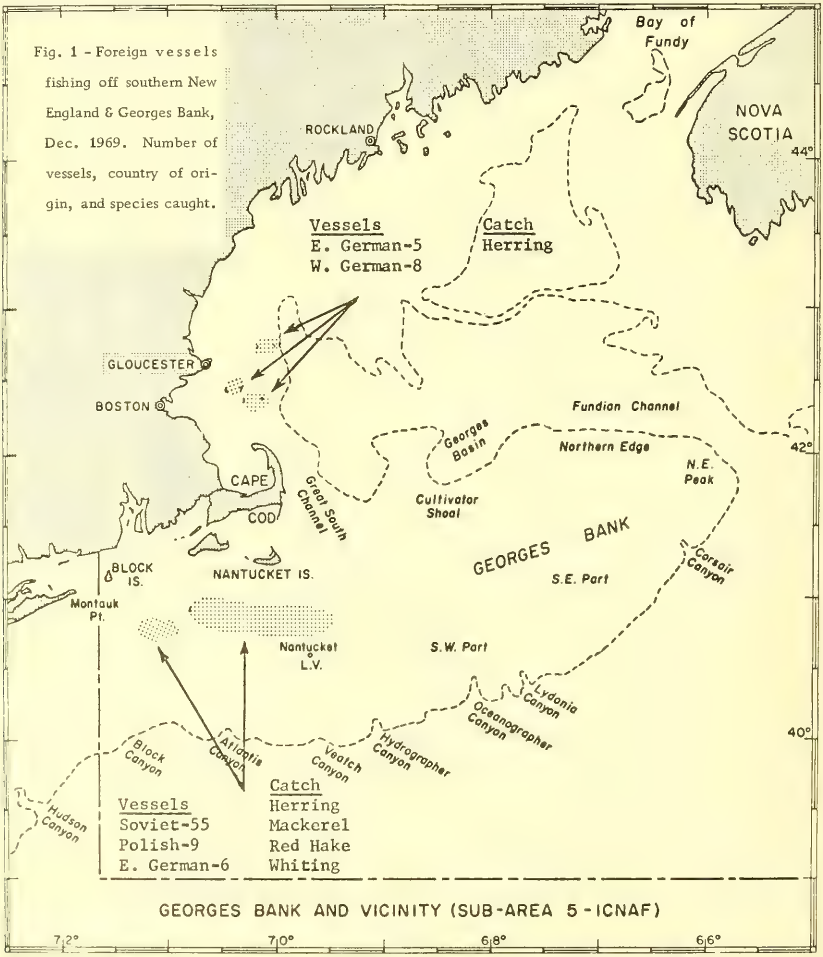


Fig. 1 - Foreign vessels fishing off southern New England & Georges Bank, Dec. 1969. Number of vessels, country of origin, and species caught.

OFF CALIFORNIA

No foreign fishing vessels reported.

OFF PACIFIC NORTHWEST

USSR: No vessels sighted (1 medium trawler off Oregon in Dec. 1968).

Japan: 6 longliners--3 off Washington, 3 off Oregon (1 in Dec. 1968).

OFF ALASKA (Fig. 2)

USSR: 125 vessels (31 in Nov. 1969; 110 in Dec. 1968).

Ocean Perch: 6 stern trawlers 1st week; 2 stern and 2 medium trawlers 2nd week. After mid-month all switched to Bering Sea.

Groundfish: 17 medium trawlers and 1 refrigerated transport.

Herring: 25 stern and 38 medium trawlers, 2 research vessels, over 15 support ships.

Flounder: 12 stern and 10 medium trawlers, 4 support vessels.

Japan: About 35 vessels, 5-10 fewer than in Nov. 1969 (40 in Dec. 1968).

Oceanperch: 4 stern trawlers--3 in eastern Gulf, 1 in eastern Aleutians.

Groundfish: 5-6 stern trawlers.

Flounder: 1 factoryship, 6 trawlers, 1 reefer.

Sablefish: 4 longliners--3 in eastern and 1 in central Gulf.

Herring: 10 stern trawlers, 2 reefers.

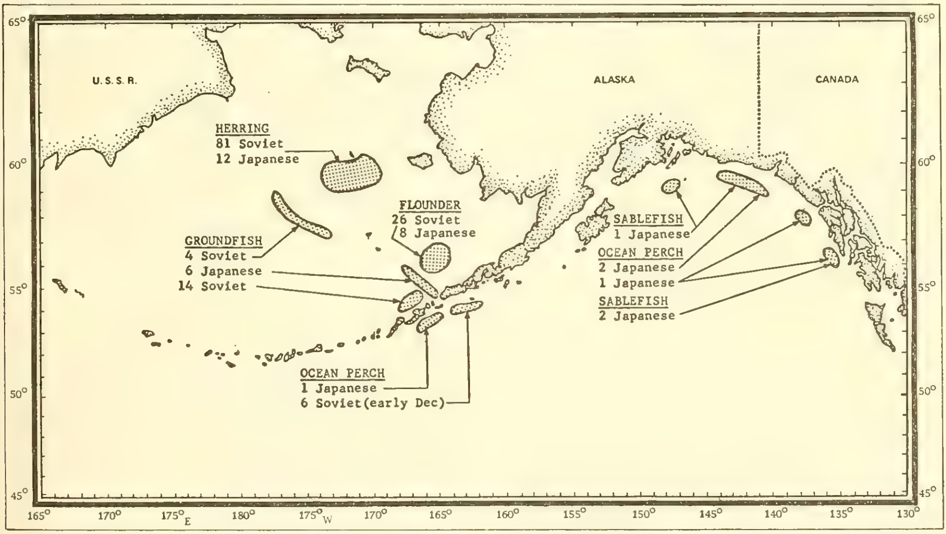


Fig. 2 - Foreign fisheries off Alaska, December 1969.

STATES

RHODE ISLAND

SEED-LOBSTER PROGRAM UNDERWAY

For more than a decade, with Rhode Island's approval, some local trawlers lobstering the offshore regions of the continental shelf have been bringing in egg-bearing female lobsters and releasing them in Rhode Island waters. For identification, the fishermen tie strands of nylon rope to the lobsters before releasing them. Local fishermen reported catching lobsters marked this way and finding the lobsters often had shed their eggs. This information has been collected by Stephen Fougere, Conservation Officer in Rhode Island's Department of Natural Resources.

Tag & Release Berried Females

During March-April 1965, with the cooperation of several off-shore trawlers, conservation officers tagged and released 1258 off-shore berried female lobsters into several areas of Narragansett Bay. All local lobstermen were asked to watch the tagged females and to remove tags only after the lobsters had shed their eggs. Early reports indicated these lobsters were not moving with many being caught in the same areas where they had been released. By midsummer, the tagged lobsters were being recovered without eggs throughout the state's lobster grounds; by April 1966, 495 tags had been returned. The recaptured lobsters represented 39.3% of those released.

Remain Near Release Sites

Analysis of tag recoveries proved berried females tended to remain near the release locations until they had shed their eggs.

Since the introduction of off-shore berried lobsters into state's fishing grounds, local fishermen have reported a noticeable increase in lobster populations. Along with this increase, heavy concentrations are being found in areas never before commercially productive.

Asked by local commercial lobstermen, the 1968 General Assembly appropriated $10,000 to finance transferral of berried female lobsters from off-shore banks into Rhode Island lobster grounds.

Program In 1969

In January 1969, all Rhode Island trawler captains in the off-shore lobster fishery were contacted about the program. Fourteen asked to participate and agreed to comply with rules on transporting berried lobsters.

The Department of Natural Resources agreed to pay fishermen one dollar for each lobster, regardless of size, provided it was fully berried and delivered in good, lively, condition.

From Jan.-May 15, 1969, 4071 female berried lobsters were delivered from the off-shore canyons and released by conservation officers throughout the state's lobster grounds. These lobsters varied from one pound up to 10 pounds. The overall average weight of the seed lobsters was about $2\frac{1}{2}$ pounds. Condition at time of release was excellent; very light mortality occurred throughout program.

The program was ended by mid-May to keep from handling berried females during hatching stages, which generally occur during June and July.

Berried lobsters totaling 714 were tagged prior to liberating; 89 tags have been returned so far. Early analysis of these tags indicates the seeders remain at release locations until their young are hatched.

Summary

Mr. Fougere summarizes the program's findings:

Egg lobster populations on the off-shore grounds at this time are readily available for seeding purposes. With relative ease and little money, large numbers of berried lobsters can be stocked in good, lively, condition throughout the state's inshore lobster grounds.

The displaced berried lobsters definitely remain near release locations until their young are liberated.

After releasing their young, favorable numbers of stocked lobsters are recovered and sold by commercial lobster fishermen.

This recovers a substantial part of the initial cost of moving the breeders inshore.

An annual program of purchasing and releasing 5,000 egg-bearing lobsters into the state's lobster grounds can be conducted without any major state expenditure.

Rhode Island plans to continue the program in 1970.

CALIFORNIA

ANCHOVY CATCH QUOTA RAISED

On Jan. 9, 1970, the California Fish and Game Commission approved a 65,000-ton increase in anchovy catch for use in producing fish meal and oil--32,500 each in inshore and offshore zones of Southern Permit area.

This increases total quota for reduction to 140,000 tons for the season ending May 15, 1970.

From the season's opening in August 1969 to Dec. 28, 1969, landings totaled 48,600 tons.

OREGON

TOWN HALL MEETINGS HELD AT FISHING PORTS

Town Hall meetings were held at Oregon fishing ports during December 1969 to discuss matters of concern to the fishing industry, reports BCF's Pacific Northwest Region. The meetings, sponsored jointly by BCF, Oregon Fish Commission, and Oregon State University, took place at Brookings, Coos Bay, Newport, and Astoria. Representatives of these agencies participated.

ALASKA

NO CLOSED SEASON FOR SCALLOP

Starting Jan. 1, 1970, there would be no closed season on scallops, the Alaska Department of Fish and Game stated Dec. 12, 1969. This action was justified because biologists, monitoring commercial scallop fishing in the Kodiak management area, found a very low incidental catch of king and tanner crabs.

Scallop landings in Kodiak area reached a record 927,000 pounds during January through November 1969; this compared with 607,000 pounds for all of 1968.

* * *

NEW HERRING RESEARCH PROGRAM IN SOUTHEASTERN ALASKA

A new herring research program in Southeastern Alaska has been designed to answer basic management needs concerned with herring abundance. The program's long-range goals are to: 1) determine separate stocks and their boundaries; 2) enumerate, or index yearly, fluctuations of the stocks; 3) determine causes for yearly fluctuations in abundance; and 4) estimate optimum harvest of these stocks.

2 Fisheries

Two herring fisheries are now operating in Southeastern Alaska: the bait fishery and the spawn fishery. Because Ketchikan is close to the greatest fishing activity, studies will be conducted from there. It offers ready access to fishing and spawning areas. Most studies will be conducted in Ketchikan and Craig areas. But there will be some work on abundance and spawning in other Southeastern areas.

* * *

STATEWIDE SALMON-FORECAST PUBLICATION IS AVAILABLE

The Division of Commercial Fisheries has prepared "A Summary of Preliminary 1970 Salmon Forecasts for Alaskan Fisheries" (Informational Leaflet #136). "Preliminary salmon forecasts are presented for specific fisheries and are also combined to provide projected commercial harvest levels for 1970 for the entire state."

Write for copy to: Mrs. June Grant, Alaska Department of Fish and Game, Subport Bldg., Juneau, Alaska 99801.

ATLANTIC COASTAL ZONE

"The Wildlife Wetlands and Shellfish Areas of the Atlantic Coastal Zone," by George P. Spinner, Folio 18, Serial Atlas of the Marine Environment, 4 pages of text and 12 color plates, $12. "A Plan for the Marine Resources of the Atlantic Coastal Zone," $4. Order from the American Geographical Society, Broadway at 156th Street, New York, N. Y. 10032.

The folio summarizes a 3-year study of the marine resources of the Atlantic coast. Data on finfish, shellfish, and wildlife were collected from all available sources. All land-use planning reports and recreation and water-resource development plans on all levels of government were examined to ascertain their probable effects on marine resources.

The 12 maps show the two most reliable indicators of value uncovered: the ownership, or proposed acquisition, of coastal salt marshes by government conservation agencies, and the location of important shellfish beds. Salt marshes believed to be of value for fish and wildlife conservation purposes, but still vulnerable to destruction, also are shown. The maps depict a proposed zoning of the coastal zone from the standpoint of conservation of marine resources.

The book, in conjunction with the folio, gives the opinions of Mr. Spinner and members of his marine resources committee on preserving the remaining wetlands of the Atlantic coastal zone. It includes descriptions of present and proposed preservation programs, examines the economic value, legal aspects, and competing uses of the coastal area, and outlines program goals. It is a plea both for prompt action and for meaningful and effective cooperation by all who share responsibility for the wetlands. This book should generate much discussion, a major purpose of its publication.

BIOLOGY

"Development of Fishes of the Chesapeake Bay Region: An Atlas of Egg, Larval, and Juvenile States: Part I," by Alice J. Mansueti and Jerry D. Hardy Jr., edited by Earl E. Deubler Jr., University of Maryland, Natural Resources Institute, 1967, 202 pp., illus.

Knowledge of early developmental stages of fishes is fundamental to proper understanding of many aspects of fishery biology and ichthyology. However, the eggs, larvae, and juveniles of many species are unknown and undescribed. This book is intended to be an illustrated work manual for biologists in identifying early developmental stages.

It summarizes information on early stages of 45 species from 14 families--sturgeon, gar, bowfin, tarpon, bonefish, herrings, anchovies, mud-minnow, pikes, lizardfishes, minnows, suckers, sea catfishes and catfishes. Although morphological descriptions of early developmental stages are emphasized, descriptions of adults and comments on distribution, ecology and spawning have been included.

EELS

"The Eel Fisheries of Eastern Canada," by J. G. Eales, Bulletin No. 166, Fisheries Research Board of Canada, 1969, 79 pp., illus., $1.75. Order from Queen's Printer, Ottawa, Canada, Cat. No. Fs 94-166.

This bulletin gives the results of a survey of eel fishing in Canada made in summers of 1965 and 1966. The survey was made to describe various methods of capture and to assess the exploitation of eels. Mr. Eales includes a general description of the biology, distribution, and life history of the American eel, *Anguilla restrata*, fishing techniques, optimum times of fishing, and methods for holding, transporting, and processing.

COMMERCIAL SHRIMP FISHING

"Opportunities in the Shrimp Fishing Industry in the Southeastern United States," Sea Grant Information Bulletin No. 3, University of Miami, 1970, 28 pp. Available from Sea Grant Advisory Services, Rosenstiel School of Marine and Atmospheric Sciences, 10 Rickenbacker Causeway, Miami, Florida 33149.

This publication answers the principal questions asked by those interested in participating in the shrimp industry--the amount of initial investment required, the economic return that can be expected, the reasons for fishing regulations, and the location and availability of shrimp at various fishing grounds. Sections on innovations in gear and boat construction, and the list of sources for financing the purchase, reconstruction or reconditioning of a shrimp trawler will be of interest to present shrimp fishermen.

The Sea Grant Bulletins are a new series aimed at transmitting information from the scientific community to the public. Future bulletins will discuss the role of marshes in commercial and sport fish production; lobster and shrimp culture; sanitary problems and standards on fishing vessels; various aspects of ocean law; Sea Grant and the community; and other subjects dealing with the practical problems involved in the development of the oceans. The University would welcome suggestions for other types of information that the public would like to receive under this program.

FISH BEHAVIOR

"The Central Nervous System and Fish Behavior," edited by David Ingle, University of Chicago Press, 1968, 272 pp., illus.

This book is made up of 20 papers presented at a meeting intended to promote an interdisciplinary attack on brain function, and to give impetus to the study of teleost fishes. The 4 major sections are: Anatomy and Function of the Fish Visual System; Anatomy and Function of Fish Forebrain; Physiological Aspects of Fish Behavior; and Behavioral Processes in Fish.

MICROBIOLOGY

"Microbiology of Oceans and Estuaries," by E. J. Ferguson Wood, Elsevier Publishing Co., New York, 1967, 319 pp., illus. Excluding the seaweeds around the coasts, the major part of plant life in the water is microbial. Even in sea-grass beds, the microbial epiphytes represent a biomass of the same order as the accompanying sea-grasses and larger seaweeds. Interest in marine microbiology has grown so great in recent years that all other branches of oceanography and marine biology look increasingly to the microbiologist for help and information.

This book is intended primarily to introduce students to the discipline of the microbiology of oceans and estuaries. It also will aid the researcher desiring a resumé of this microbial world, and brief him in the modern trends of thought about the activities of microorganisms in physical and chemical phenomena in the seas.

PLANKTON

"Marine Plankton: A Practical Guide," by G. E. and R. C. Newell, Hutchinson Educational Ltd., Great Portland St., London, W1, England, revised 1967, 221 pp., illus.

This manual attempts to give zoology students a concise account of the kind of practical study of plankton they might make at sea, or in the lab. Although mainly concerned with species found around the British Isles and adjacent seas, it should be valuable to students everywhere for its examination of methods of plankton collection, sorting, and quantitative estimation.

POND FISH CULTURE

"Proceedings of the World Symposium on Warm-Water Pond Fish Culture," FAO Fisheries Report No. 44, Vol. 4, edited by T.V.R. Pillay, Rome, January 1968, 492 pp.

This is the fourth volume of the symposium proceedings. It contains review, experience, and working papers dealing with breeding and selection, biological and other methods of increasing production, and standardization of research techniques.

PROCESSING

"Use of Sodium Nitrite in Smoked Great Lakes Chub," by K. G. Weckel and Susan Chien. Research Report No. 51, 4 pp., Sept. 1969, University of Wisconsin.

In the past few years, several outbreaks of botulism have resulted from consumption of improperly handled or processed smoked Great Lakes chub. Since sodium nitrite (NaNO2) can inhibit the growth of microorganisms, the use of 100 to 200 p.p.m. in smoked chub has been proposed. This report describes the procedures and results of studies made to determine the rates of uptake and retention of NaNO2 in smoked chub.

RED SALMON

"Further Studies of Alaska Sockeye Salmon," edited by Robert L. Burgner, Publications in Fisheries, New Series, Vol. III, University of Washington, Seattle, 1968, 267 pp., illus., $3.60.

The lake systems of southwestern Alaska produce nearly half the North American pack of sockeye, or red, salmon (Oncorhynchus nerka). Studies of this valuable resource by the University of Washington were initiated in 1946 at the request of the Bristol Bay salmon packers.

The first volume of the series, "Studies of Alaska Red Salmon," reported on research conducted on sockeye runs of Bristol Bay and Kodiak Island. Volume II dealt with salmon gear limitation in northern Washington waters and management of the high-seas fisheries of the northeastern Pacific. This volume, the third, contains 6 articles on sockeye salmon research--5 on Bristol Bay and one on the Chignik lake system. They include a comparison of salmon fry food, distribution and growth of sockeye fry, identification of adult sockeye groups, age determination by otolith, egg development, and surveys of spawning populations. All contribute toward an understanding of the complex factors controlling sockeye population levels in the lake systems, and of the number of spawning salmon needed to produce the highest sustained yield.

WATER POLLUTION

"Trace Metals in Waters of the United States: A Five Year Summary of Trace Metals in Rivers and Lakes of the United States (Oct. 1, 1962-Sept. 30, 1967)," by John F. Kopp and Robert C. Kroner, Department of the Interior, Federal Water Pollution Control Administration, 1969. Copies available from Analytical Quality Control Laboratory, Division of Water Quality Research, 1014 Broadway, Cincinnati, Ohio 45202.

Water for fish propagation must be substantially free from domestic and industrial pollution, and must be able to sustain the flora on which fish feed.

In determining water-quality requirements for aquatic life, it is essential to recognize that there are not only acute and chronic toxic levels, but also tolerable, favorable, and essential levels of dissolved materials. Different species, and different developmental stages of the same or different species, may differ widely in their sensitivity or tolerance to different materials. Also, substances in suspension, as well as in solution, affect aquatic organisms both directly and indirectly.

Adequate water-quality surveillance is essential to identify compliance with water-quality standards--in order to document violations for corrective actions, and to identify new pollution trends, sources, and types before problems develop.

This report provides detailed summaries of data on 19 trace metals detected at over 100 water-quality surveillance stations in the 16 major river basins of the U.S. Numerous tables include percent frequency of detection, observed mean values, highest recorded concentrations, number of violations of quality criteria, and comparisons of suspended and dissolved trace metals in surface water.

--Barbara Lundy

INTERNATIONAL

FAO FISHERY AID TOPS $120 MILLION

During the 1960s, FAO fishery aid to developing countries under the United Nations Development Programme (Special Fund) grew steadily--from 3 projects in 1960, the first year, to 48 in 1969. This was reported by FAO Jan. 15, 1970.

The 48 projects involved 37 countries in 5 continents and almost $120,000,000 in UNDP and government counterpart funds. The first year's projects totaled $6,400,000.

The 48 Projects

The 48 projects, most still operational, range from fishery resources surveys, conducted aboard modern, FAO-designed research vessels, to training personnel and studying marketing and distribution problems. Most projects are fashioned to the needs of nations and are scheduled to run 4-5 years. Also, FAO's Department of Fisheries is studying 21 new projects and is participating in 14 others involving other departments.

Largest project financially is the $13,400,000 High Seas Fishery Research project in Poland; the latter has contributed $12,200,000 to build a modern, computerized fishery research vessel. The 4 year project, launched in 1968, involves training and educating fishery personnel from developing countries.

Central America

Another major project is the 6-year, $5 million Central American Fishery Development program for Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama. Begun in 1966, it aims to increase production and consumption of fish and fish products in a region where fish eating and nutritional standards are low.

S. Korean Training Center

A Deep Sea Fishing Training Centre was established in Pusan, Republic of Korea, under a $2,850,000 project that ended in late 1969. FAO continues to assist through other arrangements. The Centre turns out 150 qualified skippers and engineers a year.

FAO also established a Coastal Fishing Training Centre in Pusan in 1968, under a $2,500,000, five-year project.

In South Vietnam, FAO assists an Off-Shore Fishery Development program in which the Freedom From Hunger Campaign participates with a $2,250,000 contribution. The total UNDP-Government contribution to the 4-year project that started in 1968 is $2,000,000.

Africa & S. America

Lake Victoria in Africa was the site of another FAO fishery survey and development project. A specially built, 56-foot research and exploratory fishing vessel was transported by sea and land from the United Kingdom. Africa's great manmade lakes--Kariba, Volta, Kainji, and Nasser--and its eastern and western coastal waters also are being studied by FAO/UNDP.

In Argentina, noted for its beef, efforts are underway to increase fishery production and consumption.

A study has begun of ways to tap the little-used resources of the Indian Ocean.

50 Smaller Projects

As of December 1969, FAO also was conducting about 50 smaller projects under UNDP Technical Assistance Programme.

FAO Aid Has Changed

The trend towards more and bigger fishery development projects was emphasized by Harry C. Winsor, Director for Operations in FAO's Department of Fisheries and former head of the 16-nation Caribbean Fishery Development project. He said this reflected FAO's evolvement from a fact-gathering organization into a development agency with international financing to provide technical services in all disciplines of food and agriculture.

Mr. Winsor added: "We have come a long way from 1960 when we had two fishery projects going, in Ecuador and Peru, and a third project starting in India. By 1965 we were involved in 17 projects and by the following year with ten more. And this is just in the UNDP Special Fund sector.

He predicted future projects will continue to cover many fields. The projects preferred will be those that benefit nations quickly through orderly expansion of the fishing industry--and make fish available to more consumers everywhere.

FAO BODY GATHERS FACTS ON MEDITERRANEAN POLLUTION

The General Fisheries Council for the Mediterranean, an FAO body, will gather information on pollution of the Mediterranean Sea by sending questionnaires to many scientists, experts, and other interested groups throughout the Mediterranean.

The Council hopes that results of the questionnaire may help the FAO conference on marine pollution, and its effects on living resources and fishing, slated for Rome, Dec. 9-18, 1970.

The Council held its 10th biennial session in Rome in December 1969. It noted an urgent need for Mediterranean countries to obtain the best information on the status and trends of pollution.

Member countries will be asked to nominate pollution experts to be liaison with the Council; nonmember nations bordering the Mediterranean also will be asked to nominate experts.

Rome Meeting

At Rome, the Council noted that pollution of the Mediterranean was a fast-growing problem. It was aggravated by the sea's enclosed nature: "waste may not be rapidly diluted and dispersed by natural processes."

Coastal areas and high seas are contaminated by domestic and industrial waste brought into the sea by rivers, coastal outlets, pipelines, and dumping by vessels.

Overfishing

The Council noted "definite signs of overfishing in the case of some species. This alarming situation has already led several Mediterranean countries to promote measures to reduce fishing effort." It recommended "rational measures" to protect and renew threatened stocks. Stocks could be protected by limiting fishing effort and by using more selective types of gear.

Norway lobster was among species whose size had declined appreciably in the last 20 years. Deep-water fishing was having a "negative effect" on species.

COMMON MARKET'S FISHERIES POLICY DELAYED AGAIN

The effective date of the European Communities (EC) Common Fisheries Policy has been moved to May 1, 1970. The Jan. 1, 1970, deadline could not be met. The new date was announced following the mid-December 1969 meeting of EC Council of Ministers.

NEAFC BEGINS JOINT ENFORCEMENT PROGRAM

The Northeast Atlantic Fisheries Commission's (NEAFC) joint enforcement program began Jan. 1, 1970. Under this plan, both nets and catch of fishing vessels of member countries may be inspected on the high seas, within the NEAFC area, by recognized inspectors from a member country to see if Commission rules are being followed.

Area

The NEAFC area lies east and north of lines drawn south from Greenland and west from southern tip of Spain.

Regulations

NEAFC rules regulate mesh size, use of topside chafers, and minimum sizes for certain species.

Countries Affected

The plan affects: Belgium, Denmark, France, Iceland, Norway, Poland, Portugal, Spain, Sweden, U.K., and the USSR. In the case of the USSR, Poland, and Sweden, there will be no inspection of catch or gear below decks, and no inspection of the catch anywhere on board Soviet vessels. ('Fishing News,' Jan. 9, 1970.)

NETHERLANDS TO WITHDRAW FROM INTERNATIONAL WHALING COMM.

The Netherlands has announced that it will withdraw from the International Whaling Commission effective June 30, 1970. (U.S. Dept. of State, Dec. 31, 1969.)

FISH CAGED TO CONTROL BIRTH

Fishery scientists have found a birth-control method for Tilapia aurea, a species that tends to overpopulate in fish ponds, reports FAO. By enclosing these fish in cages suspended in ponds, scientists find they discourage spawning; also, any eggs produced by the females, who hatch them in their mouths, fall through bottom of cages and are lost.

Tilapia are edible fish found mainly in fresh water. They resemble the freshwater sunfish. Tilapia reproduce so prolifically in normal pond conditions that a stock of 7,000 to 15,000 in a hectare of water can explode to 350,000.

The cage-suspension method was devised by biologists at the agricultural station of Auburn University, Auburn, Alabama, U.S., after two years of experiments.

Other Projects

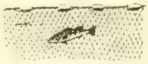
This and other developments are reported in latest issue of FAO Fish Culture Bulletin (Vol. 2, No. 1, Oct. 1969), a quarterly review of world fish-culture research and development.

In Czechoslovakia, warm water effluents from power plants were used to heat carp ponds at Brno. Breeding was speeded one month.

Grass carp were used to control weeds in rearing ponds at the National Fish Hatchery in Marion, Alabama, of the U.S. Bureau of Sport Fisheries and Wildlife. Extensive floating mats were eliminated in 30 days after ponds were stocked with grass carp fingerlings.

In Poland, production of young carp was doubled in fingerling ponds by using nitrogen-phosphorous fertilizers. A 4-fold increase was registered in ponds fertilized with ammonium sulphate and superphosphate in which fish received supplementary feeding. The 4-year study took place in Zabieniec.

Taiwan reports successful spawning of black carp accidentally introduced with grass carp imported from Hong Kong several years ago. Spawning was induced artificially through injections of pituitary extract, which stimulate reproduction.



NORDIC NATIONS SET MINIMUM PRICES FOR FROZEN FILLET EXPORTS

The Nordic countries have agreed on a minimum price system for frozen fish fillet exports to the United Kingdom and Sweden. In Oct. 1969, the U.K., Denmark, Iceland, Norway, and Sweden tentatively had agreed on a minimum price system in the U.K. Sweden had indicated a desire for a similar system in her domestic market. She feared it would become a dumping ground for excess production not sold in U.K.

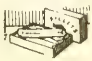
U.K. Agreement

The EFTA Council approved the U.K. market arrangement on Dec. 15, 1969. It was to take effect Jan. 1, 1970. Minimum price system is supposed to achieve price stability at a level satisfactory to both parties. Minimum prices are enforced by suppliers--Denmark, Finland, Norway, Sweden, and Iceland (after she attains EFTA membership).

Swedish Agreement

A similar agreement for the Swedish market has not yet been signed. However, this agreement has no direct connection with U.K. minimum price system and will not change frozen fish fillets' duty-free status in Sweden. (U.S. Embassy, Copenhagen, Dec. 5, 1969; Jan. 5, 1970.)

A list of affected products and their U.K. market prices is available from BCF, Office of Foreign Fisheries, Wash., D. C. 20240.



SOVIETS EXPLORE INDIAN OCEAN FISH STOCKS

The Azov-Black Sea Fisheries Research Institute (AZCHERNIRO) conducted a survey of one of the least known areas of the Indian Ocean from December 1966 to April 1967. Cruising on the shelf between 25° and 7° N. latitude, the R/V 'Lesnoi' explored Wadge Bank off Cape Comorin.

Prevailing Species

The waters were rich in ichthyofauna; demersal species prevailed. Large concentrations of *Cubiceps natalensis* and *Polinurichthus*, and *Chorophthalmus agassizi* were found at 250-400 meters. Chorophthalmus made up 47.5% of the catches. It is a commercially valuable food fish, 15-21 centimeters long, weighing 35-75 grams. Cubiceps and Polinurichthus are among the Indian Ocean's most valuable food fishes. They are 14-15.8 centimeters long; average weight is 76 grams. Sizeable concentrations of hairtail (*Trichiurus savala*) also were discovered; average length 24.5 centimeters; average weight 98 grams.

AZCHERNIRO scientists believe Wadge Bank is potentially good commercial fishery during winter months. ('Rybnoe Khoziaistvo,' Nov. 1969.)

DIRECTOR OF NEW FAO FISHERY DIVISION NAMED

Herman Watzinger, internationally known engineer, expert in fishery development, and member of the Kon-Tiki expedition in 1947 under Thor Heyerdal, has been named director of FAO's new Fisheries Industries Division.

The division has 3 branches: fishing vessels and engineering, fishing gear and methods, and fishery products and marketing.

New Director

Mr. Watzinger took up his duties in Rome on Feb. 1. He had been managing a Fishery Research and Development project (FAO/UNDP) in Peru. He is a former managing director of Compania Pesquera La Gaviota S.A., a major Peruvian fish meal firm. He also has been associated with one of the main fish-processing enterprises in the U.S.; he has served with British, Danish, Swedish, and Norwegian firms specializing in refrigeration and fish-preservation equipment.

Engineer

Mr. Watzinger is a graduate mechanical engineer, Norwegian Technical College, Trondheim. He has conducted research and written about freezing fish fillets and preserving other foods. He belongs to the American Society of Refrigerating Engineers and the Norwegian Society of Engineers.

He joins two other division directors in Fisheries Department: Dr. Mario Ruivo, Fishery Resources Division, and Dr. James A. Storer, Fishery Economics and Institutions Division.

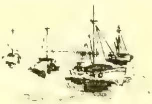
SOVIET VESSELS FIRE ON DANISH FISHING CUTTERS

On Dec. 8, 1969, Soviet naval vessels fired on 10 Danish cutters fishing in the Baltic Sea in international waters 60 miles off Klajpeda, Lithuania. There were no casualties; sails on one Danish cutter were damaged. The Danes fled, abandoning their fishing gear.

The cutters were fishing salmon on Hoburg Banks, a traditional Danish fishing area. The Soviet vessels were conducting naval exercises.

Danes Return

Two days later, when Soviet exercises ended, the Danes returned, recovered their gear and resumed fishing. The Soviets took 400 hooks belonging to one cutter, but returned them later. ('Berlingske Tidende,' 'Børsen,' Dec. 12, 1969; 'Fishing News,' Dec. 19-26, 1969.)



CANADA

LANDINGS IN MARITIME PROVINCES TOP BILLION POUNDS

On November 20, 1969, Canada's Department of Fisheries & Forestry announced that cumulative landings in the Maritime Provinces for the first 10 months 1969 were 1,102 million pounds worth $62.6 million. Landing in same period 1968 were 1,181 million pounds ($63.4 million) and, in 1967, 944 million pounds ($53.3 million).

* * *

EAST COAST SHRIMP FISHERY DEVELOPS

In 1965, exploratory fishing for pink shrimp (Pandalus borealis) was sponsored jointly by the Canadian Department of Fisheries and Forestry and the governments of New Brunswick and Nova Scotia. It was carried out to a limited extent off the Maritime Provinces. The results, plus 1966-67 explorations, led to the belief that it would be possible to take shrimp in commercial quantities in Chaleur Bay-Gulf of St. Lawrence and Passamaguoddy Bay-Bay of Fundy areas.

A few vessels were fitted out for shrimp fishing in the Gulf of St. Lawrence. These succeeded in landing fair quantities of shrimp in summer and autumn months. Winter ice curtailed their operations.

Fundy Fleet Grows

In Bay of Fundy area, 6 boats were fitted out for shrimp fishing in 1967. Results were so satisfactory that fleet increased rapidly to 30 boats. In 1968, it landed about 1.2 million pounds. The fleet has increased until it numbers over 40 boats landing about 2 million pounds a year.

Much of the catch is air-freighted to Scandinavia, where there is great demand for fresh, salt-cooked pink shrimp.

Some See 40 Million Lbs.

Some enterprising fishermen believe this fishery could yield up to 40 million pounds year. They are having shrimp trawlers specially designed and built for it. The fishery may soon rank among the world's important shrimp fisheries.

* * *

FISHING VESSEL INSURANCE PLAN IS RECAST

Low-cost insurance for most Canadian fishing vessels will begin in April 1970. Larger vessels--up to 100 feet registered length--will be covered for first time. New rate schedules will make the insurance plan financially self-supporting. Revenues should be sufficient to cover both insurance claims and administrative costs.

New Rates

The new rates are:

1% of appraised value of vessels appraised at C$5,000 or less; 2% if appraised value is $5,000 to $25,000; and 4% if appraised value is over $25,000.

Coverage

In the event of total loss: owners of vessels valued at $5,000 or less will receive 60% (70% in B.C.) indemnity of insured value; owners of vessels appraised from $5,000 to $35,000 can insure at 2% for a 60% (70% in B.C.) recovery of insured value, or they can insure for 95% recovery at the 4% rate; owners of vessels appraised at more than $25,000 (paying 4% premium) will receive 95% of insured value. There will be a 5% deductible for partial loss of vessels valued at more than $25,000. Boats valued at less than $25,000 will have a partial loss deductible of 15%.

The minimum insurable length of a vessel now is 18 feet. This limit will be removed and replaced by a minimum appraised value of $500.

7,500 Vessels Covered

Currently some 7,500 fishing vessels with an appraised value of $40 million are covered under the insurance plan. All are owned by individual fishermen and private companies. Public corporations operating large trawler fleets are not covered. ('Fisheries News,' Dec. 15, 1969.)

* * *

CANADA (Contd.):

SALT-COD DEFICIENCY PAYMENTS ANNOUNCED

On Nov. 10, 1969, Canada's Department of Fisheries and Forestry announced the amounts of 1969 deficiency payments to Atlantic coast salt-cod fishermen.

The payments are \$4 a quintal on large and medium Madeira and \$3.25 on Thirds (about 80% of the light salted cure). The payment on large and medium salt bulk is \$2.50 a quintal, or \$5 a draught. Payments will total about \$2 million.

How Payments Calculated

The level of payments was calculated from prices received by fishermen for the year's production. Payments amount to half the difference between average price fishermen actually received and the government's target prices announced in spring 1969.

* * *

SALTFISH CORPORATION RECOMMENDED

A bill to establish a Saltfish Corporation that would stabilize and improve earnings of Atlantic Provinces fishermen producing cured fish (mostly cod) was introduced in Canada's House of Commons on Dec. 16, 1969. The Department of Fisheries and Forestry explained on Dec. 19 that such an organization would maximize returns from exports--and minimize assembling, processing, and marketing costs. It also could put traditional cured fish production in reasonable order and, if justified by demand, replace old and inefficient methods with modern processes.

To Be Sole Buyer

The Corporation would become the sole buyer of cured fish and of fish for curing, controlling the movement of cured fish in both interprovincial and export trade. It would establish a buying price for salt fish before the fishing season and distribute any surplus earned by the close of the production year to the fishermen.

Other Operations

Its operations would include buying, assembling, grading, processing, packaging, storing, selling and market promotion of fish and cured fish products. Services of private individuals and firms would be used if they could contribute to greater efficiency in these operations. For certain services, such as purchasing, private traders might be appointed as Corporation agents, on a commission basis.

* * *

FISHERIES RESEARCH BOARD USES SUB AS LAB

Fisheries Research Board scientists first established the feasibility of using a submersible for underwater research in 1968. Now they are going to use a new submarine, the 'Shelf Diver', to study herring, scallops, and crab in the Bay of Fundy and Gulf of St. Lawrence.

Shelf Diver

The Shelf Diver is 23 feet long and can accommodate 3 observers or divers. Operating down to 800 feet, it has a built-in decompression chamber allowing divers to emerge at those depths.

Bay of Fundy Herring & Scallops

A decline in herring stocks in Maritime fishery has caused considerable concern in Canada. Unlike West Coast herring, eastern stocks spawn at 40 to 60 feet. Shore spawning is the rule on the Pacific coast. Thus, it is relatively easy to check the spawn and make reasonably accurate predictions of future harvests. In the Bay of Fundy, scientists must go beneath surface to make accurate surveys.

Studies on queen crab populations in the Gulf of St. Lawrence, begun in 1969, will continue with special emphasis on trapping gear. Divers from the submarine will watch the effectiveness of various baits at 600 feet.

The submarine also will help in studies of scallop stocks and their placement on the ocean floor in the Bay of Fundy.

THE YUGOSLAV FISHERY IN THE ADRIATIC SEA

Richard L. Major

Yugoslavia maintains a small commercial fishery of approximately 25,000-30,000 metric tons a year in the eastern Adriatic Sea (fig. 1). In 1966-1968, her marine fisheries become more important because of decreases in freshwater catch (see Table). However, their contribution to total catch is only slightly higher than in 1948 (64.6% in 1948; 66.6% in 1968). It is estimated that an additional 2,000-3,000 metric tons are taken by inhabitants of the coast for food and by sport fishermen.

This report examines the small but interesting fishery: the fishing methods and catch; utilization of catch and the social and economic factors that influence it; and the fishery's prospects. It is based on four articles (Basioli, 1968; Grubelić, 1963; Grubešić, 1968; Morović, 1968) and on information gathered firsthand in Yugoslavia from February to August 1969.

FISHING METHODS AND CATCH IN ADRIATIC

The Adriatic Sea is not a uniform fishing area in terms of the type of fishery conducted. Different types of gear are used in four areas--the area embracing the shoreline and offshore banks (various dragnets, set-nets, traps, etc.), the trawling area, the open-water area (seines), and the deep-water area (longlines). Each area is considered separately later.

Fig. 1 - Eastern shore of the Adriatic Sea showing locations important to this review. Inset shows the location of the Adriatic relative to the familiar land masses of Italy.

Yugoslavia's Fisheries Catch for Selected Years 1948-1968

Fishery	1968	1967	1966	1965	1960	1955	1948
	(In 1,000 Metric Tons)						
Marine	29.9	30.0	27.3	26.0	20.9	13.6	13.7
Freshwater	15.0	17.9	18.2	15.9	10.0	9.0	7.5
Total	44.9	47.9	45.5	41.9	30.9	22.6	21.2
Marine as % of Total	66.6	62.6	60.0	62.1	67.6	60.2	64.6

Source: FAO Yearbook of Fishery Statistics.

In 1968, 8,246 people were engaged in the fishing industry: 2,412 full-time fishermen, 5,456 part time, and 378 shore workers. Fishermen shared 25 to 40 percent of the net income. The fishery involved 6,349 boats, including 4,265 with motor and 2,084 without. Of the motorized craft, only 193 exceeded 10 gross registered tons. The 43,290 nets used included 40,264 set nets, 1,507 drag seines, 460 trawls of various types, 426 purse seines, and 633 nets of other types. Also used were 16,083 basket-traps and over 1.3 million longline hooks.

Fish make up about 96 percent of the catch; the rest are crustaceans (crabs and lobsters) and molluscs (oysters, mussels, octopus, and squid). The so-called blue or pelagic fish

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(such as sardine, sprat, anchovy, and mackerel) compose about three-fourths the commercial catch. About 85 percent of these blue fish are canned; the rest are salted or consumed fresh.

Shoreline and Bank Area

This area includes the waters adjacent to the mainland of Yugoslavia, the islands, and the reefs. It makes up only one-thirtieth of the eastern half of the Adriatic (the other half is adjacent to Italy) but yields one-fifth the catch. It is by far the most varied region in number of species caught. The dominant fishes are: picarel (Maena spp.), grey mullet (Mugil spp.), dentex (Dentex spp.), bream (Sparidae), pandora (Pagellus erythrinus), salema (Boops salpa), bogue (Boops boops), greater amberjack (Seriola dumerili), leer fish (Lichia amia), wrasse (Labridae), bass (Dicentrarchus labrax), scorpionfish (Scorpaena spp.), corb (Umbrina cirrosa), brown meagre (Corvina nigra), red mullet (Mullus barbatus), striped mullet (Mullus surmuletus), forkbeard (Phycis phycis), comber (Serranus spp.), grouper (Epinephelus guaza), moray (Muraena helena), conger eel (Conger conger), gar-fish (Belone belone), blue damsel fish (Chromis chromis), goby (Gobius spp.), and smelt (Atherine spp.). Also important are the following invertebrates: octopus (Octopus vulgaris), common squid (Loligo vulgaris), cuttlefish (Sepia officinalis), spiny lobster (Palinurus vulgaris), lobster (Homarus vulgaris), spider crab (Maja squinado), common prawn (Palaemon serratus), oyster (Ostrea edulis), mussel (Mytilus galloprovincialis), and date-shell (Lithophaga lithophaga).*

This area offers the most favorable conditions for effective year-round fishing: accessibility, shallow water, and high-quality fish. It is not surprising, therefore, that these grounds have been exploited for thousands of years.

The coastal fishery is a mosaic of different types of gear. Most numerous are nylon gillnets, various drag-nets (set from small boats, then retrieved by hand from the beach), and small beam trawls. In recent years, the use of drag-nets has been greatly curtailed because of the conviction that this gear takes too many immature fish. As drag-nets are phased out, gillnets tend to replace them.

Fig. 2 - Dalmatian fisherman preparing basket-traps. These traps are widely used in Yugoslavia for taking fish and shellfish.

Fishing with basket-traps (fig. 2) is done mostly by islanders, who also use hooks, spears, gillnets, drag-nets, and beam trawls in their subsistence fishery.

The subsistence fishery is the biggest single element of the coastal fishery today. It involves thousands of fishermen--at least a few from every community. Nearly every household has a few fish dinners weekly. Iz Veli, a typical island community, is shown in figure 3.

Sport Fishing

Sport fishing is increasing. In 1962, over 5,000 members were registered in 52 clubs. The number of unregistered sport fishermen was estimated to be twice that large. These fishermen used about 6,000 skiffs, 1,500 underwater spear-guns, 2,500 gillnets, and 300,000 longline hooks. One concerned scientist calculated, on the basis of 1962 statistical

*All scientific and most common names are from Bini (1965). Where common names familiar to U.S. and Canadian readers were needed, the names recommended by the American Fisheries Society (1960) were used.

Fig. 3 - The village of Iz Veli on the island of the same name--a typical island fishing village of Yugoslavia.

data, that each square kilometer in the coastal area had 11 fishermen (professional, subsistence, and sport), 4.6 boats, 12.7 nets, 5 basket-traps, and 1.5 longlines. These figures did not include large numbers of unregistered small nets--especially gillnets. The intensity of sport fishing has probably increased several fold since these calculations were made. Dynamite is now widely (but illegally) used to kill fish.

These data attest the heavy exploitation in the coastal zone. Catch statistics show, furthermore, that some of the most valuable species, red mullet, striped mullet, dentex, bass, bream, scorpionfish, and octopus, are far less abundant today than 100 or even 50 years ago. Less desirable species, such as bogue and other small fishes, make up an increasing percentage of the catch. The young of most important species have legal protection--a minimum body length regulation. The regulation is difficult to enforce, however, and seems largely ineffective.

Trawling Area

This area extending out to depths of 300 meters (the limit for standard Adriatic trawlers) ranks second in size and in the number of species taken. Important are hake (Merluccius merluccius), skate (Raja spp.), sole (Solea spp.), anglerfish (Lophius spp.), gurnard (Trigla spp.), whiting and poor cod (Gadus spp.), John Dory (Zeus faber), dogfish (Squalus spp., Scyliorhinus spp.), smoothhound (Mustelus spp.), angel shark (Squatina spp.), stingray (Dasyatis spp.), picarel, pandora, bream, weever (Trachinus spp.), argentine (Argentina sphyarena), squid, cuttlefish, Norway lobster (Nephrops norvegicus), and spider crab. There are large but as yet unmarketable populations of fan mussel (Pinna nobilis), sea urchin (Echinus spp.), starfish (Antedon mediterranea), and sponge (Geodia spp., Mycale spp.).

The history of exploitation in the trawling area dates to the third and fourth century B.C., when the Greeks had colonies on the present-day Yugoslav coast. Ancient Greek documents show that longlines were used to take fish (chiefly hake, dogfish, and skate) in water down to 100 meters. Trawling with two-boat combinations (pair trawling) in depths to 80 meters began about 200 years ago. Motorized vessels were first used in these pair trawling operations in 1908; modern trawling (with doors) began just after World War I. The number of boats in the trawl fishery has fallen in recent years (from 154 in 1961 to 117 in 1965).

Only about one of every six boats is a full-time trawler. The others divide their fishing time between trawling and other types of fishing--chiefly seining for pelagic fish. The full-time trawlers are smaller vessels (under 100 hp.) built between the two world wars. They operate in the canals between the larger islands but, even there, they are often blown into port by adverse winds and so average only about 150 fishing days per year. Of the larger boats (over 100 hp.) that divide their fishing time between trawling and other types of fishing, only every tenth boat fishes intensively in the open sea areas. The others fish either inside or outside, but not extensively. Crews range from seven to eight men for the larger vessels, upward from 25 m., but are five or less for the smaller boats working in the canals.

Trawlers now take 1,000-1,600 metric tons annually. The main trawling area is the Blitvenica grounds (fig. 1). By agreement, part of this area is allocated to Italian fishermen. The Yugoslavs are reexamining this agreement, however, in light of their own declining catches. (For details, see CFR, July 1969, page 47.)

Open-Water Area

Although this area is by far the largest in terms of sea surface, scarcely one-half of it contains significant fish populations. Furthermore, fish in that one-half are not uniformly distributed: they are fairly abundant on some grounds but scarce in others.

Of the about 200 commercially important species in the Adriatic, only about 14 are found in the open-water area. Yet this small number makes up three-quarters of the commercial catch. Important species are: sardine (Sardina pilchardus), sprat (Clupea sprattus), anchovy (Engraulis encrasicholus), Atlantic mackerel (Scomber scombrus), chub mackerel (Scomber japonicus colias), Atlantic saury (Scomberesox saurus), gar-fish, horse mackerel (Trachurus spp.), bluefin tuna (Thunnus thynnus), Atlantic bonito (Sarda sarda), frigate mackerel (Auxis bisus), little tuna (Euthynnus alletteratus), swordfish (Ziphias gladius), and bogue. These are all schooling fish--some dwell close and others far from shore. A catch of Atlantic mackerel, a popular fish cooked on a grill, is shown in figure 4.

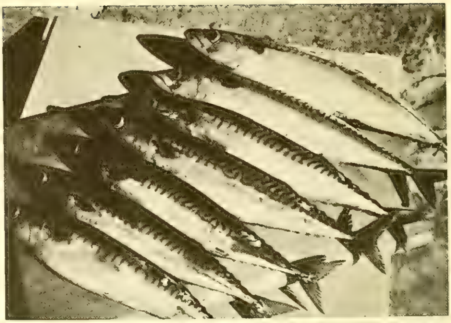

Fig. 4 - Atlantic mackerel, a popular fish, especially when cooked on a grill.

The exploitation of pelagic fish in the Adriatic Sea is centuries old and spans three distinct periods. During the first, before 1929, the fishery was limited to a narrow band near the shore and involved only drag-nets and set-nets. In 1929, the advent of purse seines enabled the fishermen to move farther offshore. The first use of modern fish-detection equipment and radio-telephones in 1953 marked a beginning of the third period--expansion into previously unexploited areas.

In 1968, 416 boats were engaged in seining. These were two basic types. The first, about 170 boats, operated by true professional fishermen, is typically 16-19 (occasionally 20-25) meters long with 80-150 (occasionally 150-240) hp. (fig. 5). Nylon nets used are on the average 350 m. long, 80 m. deep, and are lifted with a winch. The average crew is about nine; the average yearly catch 90-100 metric tons.

Another type of seiner (246 boats) fishes closer to shore, with cotton netting that requires much more maintenance than nylon nets. These boats often fish on stations in narrow local areas where fish are known to occur. Crews are made up of seasonal workers who otherwise work at agricultural jobs; the crews are often twice as large as those of true professional seiners. The average catch is 25-30 metric tons a year. Some beach seines are still used for catching pelagic fish but in decreasing numbers. Special skiffs, outfitted with lights to attract fish schools, are an important part of the pelagic fishing (fig. 6).

Fig. 5 - Three large purse seiners lying in port. The vessels are the backbone of the Yugoslav fishery for pelagic species.

Fig. 6 - A skiff outfitted with lights for attracting pelagic fishes. In 1968 about 4,000 of these units engaged in the Yugoslavia fishery for sardines, sprat, and anchovies, and the other open-water species.

The fishing season lasts 9 months and is confined to areas less than 120 meters deep. Beyond that depth only a rare school of Atlantic saury or tuna are found--never sardines. The catch of pelagic fish has increased steadily from about 9 thousand metric tons in 1955 to 23 thousand tons in 1968; sardines make up 54 percent, mackerel 13.5 percent, sprat 13 percent, anchovies 8 percent, and the others 11.5 percent.

Deep-Water Area

This area in the southern Adriatic is given a special classification because it is farther from shore and deeper than the open-water area. Depths range from 300 to 1,000 meters.

Of the 31 species of fish and shellfish in the deep water area, the most important are hake, stone bass (Polyprion cernium), roughshark (Centrophorus granulosus), sixgill shark (Hexanchus grisseus), blue shark (Carcharias glaucus), rockfish (Sebastes dactyloptera), congor eel, greater forkbeard (Phycis blenniodes), Norway lobster, and shrimp (Aristeomorpha foliacea).

Ninety-five percent of the catch is taken by longlines and the rest by trawls. Little is known about the status of the stocks except that hake are becoming scarcer. Although some marine scientists believe that this area could support a larger fishery, the rigors of conducting a longline fishery at considerable distances from shore have suppressed expansion thus far.

UTILIZATION OF CATCH

In round figures, the total marine catch has increased from 26,000 metric tons in 1965 to 27,000 in 1966 and 30,000 in 1967 and 1968. Most of this increase, however, is from the catch of pelagic fish. The catch of shellfish has increased only slightly, and that of the highly sought demersal or "white" fish (groundfish) has decreased. For the Yugoslav housewife who prefers the "white" fish, the situation is bleak.

First, even within the decreasing catch of groundfish, fewer prime species and more less-desirable species are being caught. Second, to meet skyrocketing demands of expanding Yugoslav tourist industry, hotels and restaurants are buying more and more available prime fish, even before they reach the dock. The result: fewer high-quality fish appear on the public market and these are expensive. Since 1963, in fact, frozen Japanese fish have been imported to meet the demand--a bitter situation, indeed, for coastal people with a great tradition of eating fresh groundfish.

The fish-canning industry has a long history. Even before World War II, Yugoslav sardines in oil and fillets of anchovies were well received on the world market. Immediately after 1945, the canning industry expanded its capacity to 30,000 metric tons annually. This proved to be overexpansion because catches of pelagic fish did not increase accordingly. Despite recent catch increases, from 18,000 metric tons in 1965 to 23,000 in 1968, and the purchase and canning of frozen tuna from Japan's Atlantic Ocean fleet, the industry continues to operate below capacity.

In giving reasons for this less-than-optimum operation, some experts contend that the stocks of pelagic fish already are fished to capacity and no significant reserves exist. Only anchovies, sprat, and saury, they maintain, can support increased fishing effort. Others contend that plenty of fish are available but that high operating costs (fuel, maintenance, and repair) compared to price received for fish simply make increased fishing unattractive. Still others cite difficulties in marketing the canned products on world market.

It is increasingly evident that the Adriatic's fish populations cannot support the vigorous canning industry, let along meet domestic demand for fresh fish. Moreover, skeptics say that to raise per-capita fish consumption to the average European's (15 kg. per year), the catch would have to increase 10 times. This, they feel, cannot be done because the fishery reserves are too limited.

THE FUTURE

The Adriatic Sea, deficient in nutrient salts, is not a productive body. Therefore it is difficult to envision significant expansion of the conventional fisheries. Yet the possibility of increasing production by farming the sea appears tremendous. The Yugoslav coastline is surprisingly extensive. The direct distance from the border with Italy southward to the border with Albania is only 628 km., but the total length of the shoreline of the mainland and islands is 6,106 km. Yugoslavia has one of the most richly indented coasts in Europe.

The possibilities for fish farming and shellfish culture are almost unlimited under such circumstances. Fish production could be increased by rearing high-quality fish (chiefly mullet) in enclosed or semi-enclosed bays, artificially fertilized. Initial studies by Yugoslav marine scientists have proved that such rearing can be successful. The main species of shellfish in the Mediterranean and Adriatic Seas are the mussel and the oyster; the mussel is much easier to rear. Fan mussels, which can be farmed on the sea floor, offer another possibility. From each hectare of suitable ocean floor, it is possible to harvest 50,000 fan mussels annually with more than 8,420 kg. of pure flesh. This yield is better than the amount of meat produced per hectare on much of Yugoslavia's grazing lands.

Through fish farming, the Yugoslavs would like to raise the consumption of fresh seafood from one-half kg. per year--among the lowest in Europe--to 4 kg. per person per year.

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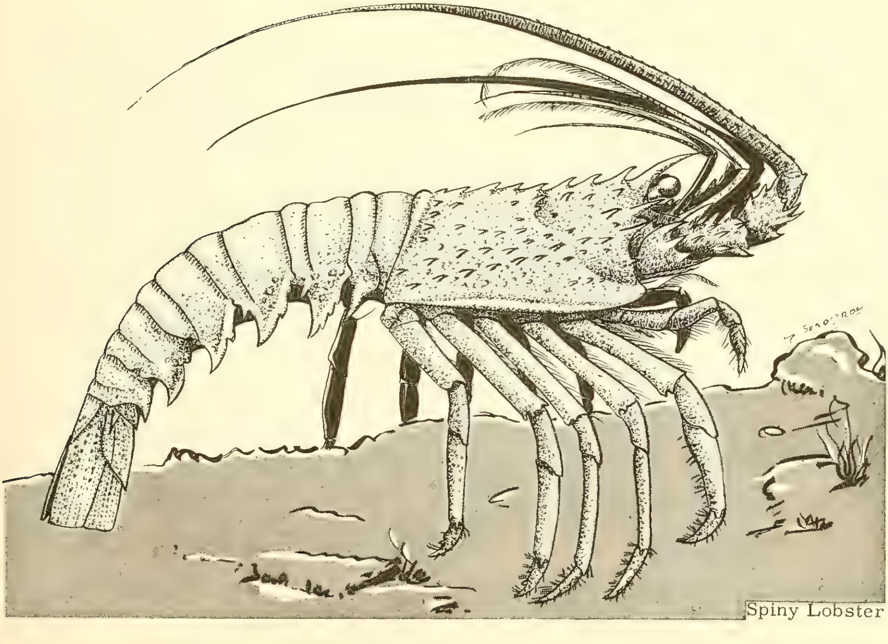

Spiny Lobster

USSR

KAMCHATKA HERRING CATCHES DECLINE

In 1959, Kamchatka's herring catches came from 4 major populations--3 in Bering Sea off Soviet shores, and one in northern Okhotsk Sea. By 1968, the Bering stocks had been completely depleted; only the Okhotsk herring remained. And even the most optimistic predictions give the Okhotsk stocks only 3 years at present fishing intensity. The stocks are fished by 200 vessels from the Kamchatka Fisheries Administration alone.

The Bering Sea fishery off Kamchatka's east coast has been discontinued temporarily, but local 'kolkhozes' reportedly are not equipped to catch other species.

Distant-Water Fleets Blamed

Depletion in the Bering has been blamed on the 'fishery in international waters,' where restrictions set by Soviet scientists are ineffective, and the fishery continues. A leading scientist has said that efforts to expand distant-water fisheries will be increased, although these are less efficient than traditional coastal fisheries.

Processing Plant Idle

Despite depleted stocks, one of the largest Soviet fish-processing plants in the Far East has been built in Kamchatka, on Lavrov Bay. The 12-million-ruble (US$13.2 million) plant has 17 salting shops, and 2,000-metric-ton refrigerated storage capacity. The plant, built contrary to the advice of fishery scientists, is now idle for lack of herring. It probably will not operate for 5 years or more.

Lacks Refrigerated Transports

The Kamchatka fleet also lacks refrigerated transports. In first-half 1969, 25 factory stern trawlers (BMRT) were idled for 217 days waiting to unload catches. ('Literaturnaia Gazeta,' No. 42, Oct. 15, 1969.)

* * *

FISHES SAURY IN NORTHERN BARENTS SEA

Four vessels of the Northern Fisheries Administration (Sevryba) sailed from Murmansk in late September 1969 for the northern Barents Sea. Their mission was to explore for saury around Novaia Zemlia, a large island off Siberia. Catches of 7 to 10 metric tons per vessel per day were reported. This is the farthest north the Soviets have explored for saury.

Pacific Saury Dwindles

According to U.S. scientists, none of the 4 species of saury (Cololabis saira, Scomberosox, and 2 dwarf species) occurs in the area of Novaia Zemlia. If the Soviet claim is true, the attempt to diversify their saury fisheries probably results from dwindling stocks of Pacific saury (Cololabis saira) between USSR's Siberian coasts and Japan. This was discussed recently in meetings of Japanese and Soviet scientists.

* * *

WHALING FLEET OFF HOKKAIDO

The Japanese whaling industry was concerned about a Soviet whaling fleet operating off Cape Erimo (Hokkaido) in Sept.-Oct. 1969. The total number of catcher boats was not known, but at least one mothership and 8 boats were in the area. At that time, sperm whaling was at its peak.

Area Barred to Japanese

The Japanese whaling industry was having a difficult time because the Soviet motherships were operating in an area (south of 20° N.) where Japan prohibits operations of her own whaling motherships. ('Shin Suisan Sokuho,' Nov. 6, 1969.)

* * *

CONSIDERS SQUID FISHERY OFF U.S. ATLANTIC COAST

The Atlantic Fisheries and Oceanography Research Institute (ATLANTNIRO) analyzed 3,420 hauls during 24 exploratory and research cruises between 1958 and 1968 from

USSR (Contd.):

Cape Hatteras, N.C., to Georges Bank. Squid was found distributed widely in the area. A year-round fishery appears possible with seasonal adjustments.

Largest Concentrations

The largest concentrations were found in June-November northeast of Blake Canyon in 50-160 meters. Catches on the southern slopes of Georges Bank averaged 0.5-1 metric ton an hour; peaks were 6 tons. Off Wilmington, Delaware, and Baltimore, Md., catches of 2.5 tons were made in 60-100 meters. In a 30-square-mile area off Wilmington, squid stocks were estimated at 6-7,000 tons.

In December-May, squid concentrate in troughs of the continental slope at 100-220 meters, in water temperatures of 9-12° C. ('Rybnoe Khoziaistvo,' No. 10, 1969.)

Soviet squid catches now are incidental to groundfish catches.

* * *

STUDIES VALUABLE FOOD FISH DISCOVERED OFF HAWAII IN 1967

The Soviets discovered large concentrations of boarfish (Pseudopentaceros richardsoni) northeast of Hawaii in 1967. The fish is 22-31 centimeters long, 7-12 centimeters high, 3-5 centimeters thick. Its weight ranges between 210 and 675 grams. The flesh contains 19-27% oil and 12-17% protein. At -18° C., boarfish can be kept for 1 year without deteriorating. The fillets are suitable for delicatessen items (canned, smoked, salted, etc.). ('Rybnoe Khoziaistvo,' No. 10, 1969.)

* * *

SCIENTISTS DISCOVER MAGNESIUM-METABOLISM REGULATOR IN SALMON

Soviet experiments with Pacific salmon have confirmed the existence of a substance that regulates magnesium metabolism in live organisms.

Any anadromous fish has a mechanism that enables it to withstand either a shortage or excess of magnesium salts. Salmon are known to be particularly sensitive to abrupt fluctuations of the magnesium salt level when migrating downstream to the ocean.

To Continue Experiments

By continuing the experiments with dogs, the scientists hope to identify the organ that produces the substance. Once it has been isolated, it could help prevent or cure disturbances of magnesium metabolism in live organisms. ('Tass,' Nov. 26, 1969.)

* * *

UNDERWATER HABITAT VEHICLE TESTED IN BLACK SEA

The Soviet habitat vehicle 'Sadko-3' was lowered off Sukhumi in the Black Sea to 25 meters in late 1969. The experiment included bio-acoustic research, and tests of activity and physiological condition of 3-man crew. Voices and sounds of marine fish were recorded to use in inducing artificial schooling of fish with similar manmade sounds. If successful, the technique may be introduced commercially.

The Vehicle

Sadko-3 was designed by the Leningrad Hydrometeorological Institute. Its 3 stories are divided into compartments: the first is the diver's compartment; the other 2 (spherical shape) are dwelling compartments. The laboratory, on the outside, has a cagelike structure. This is a metal frame covered with synthetic-fiber net of 300 cubic meters. Species of fish are observed in near-natural conditions.

The biological program is headed by the Chief, Acoustics Institute of USSR Academy of Sciences.

Test Site

The tests took place at marine scientific station of Laboratory for Underwater Research of Leningrad Hydrometeorological Institute at Sukhumi. Specialists from Academy of Sciences and Medicobiological Institute of Public Health Ministry participated. ('Pravda,' Nov. 29, 1969.)

ICELAND

FISHING INDUSTRY IN 1969

'Iceland Review,' No. 4, 1969, reports that 1969 was a good year for cod and other demersal species on Icelandic fishing banks. Both trawlers and smaller boats made good inshore catches. Vessels fishing baby lobsters off the south coast increased. Much of this catch was exported frozen to the U.S., Switzerland, Italy, and Britain. The Greenland turbot fishery off the north and east coasts also increased. The turbot was sold whole-frozen to Europe, and frozen in blocks to the U.S.

Exports

An important contract for canned and smoked saithe was signed with Czechoslovakia. Unusually large quantities of shrimp from the northwest will go to Norway, Sweden, and Denmark. A search for shrimp and shellfish, underway in Faxa Bay, will increase employment opportunities around Reykjavik.

All available salted-fish stocks were sold at fairly good prices, mainly to South Europe.

Whale Meat

The whaling season (late May-late Sept.) produced 423 whales from the Greenland Sea, about average. Much of the meat went to Britain for pet food.

Catch & Utilization

The U.S. Embassy, Reykjavik, reported on Jan. 13, 1970, that preliminary data on Iceland's 1969 fish catch showed 655,246 metric tons (9% over 1968). Value can only be estimated; probably it will be considerably less than in 1964-66, but at least 15% higher than in 1968. (Figures for first three quarters 1969 show an increase value of 25% over the same period 1968.)

The Embassy had reported on December 9, 1969, that institutional, retail, and fish 'n chips trade in the U.S. largely accounted for this greater value. These outlets have developed a booming market for individually packaged Icelandic fillets, primarily cod. Volume and prices of Icelandic cod fillets sold to U.S. are expected to continue increase through 1970.

More Whitefish

Total catch during 1969 improved markedly over 1968 but was comparatively small for the 60's. This is primarily because the huge quantities of herring caught in earlier years are no longer found around Iceland. However, record quantities of higher-valued fish have been caught. Whitefish, mainly cod, amounted to 424,000 metric tons, exceeding the previous record--415,000 tons in 1964. Similarly, the 1969 shrimp and lobster catch was a record 6,000 tons, surpassing the 1963 high of 5,800 tons.

Herring & Capelin

As expected, the 1969 herring catch was minimal--53,000 tons. It dropped about 90,000 tons from 1968. It was about 10% of the 1964 catch and represented an even smaller percentage of 1965 and 1966 catches. This decline was partly offset by an increased catch of relatively lower-valued capelin. This catch establishing a new record kept combined quantity of capelin and herring at the 220,000-ton level.

Table 1 - Fish Catch 1968 and 1969

	Preliminary 1969	1968
	(Metric Tons)	
Groundfish	424,228	373,018
Herring	53,220	142,820
Capelin	171,350	78,166
Shrimp	2,898	2,451
Lobster	3,550	2,489
Other	n.a.	2,416
Total	655,246	601,360

Table 2 - Utilization of Fish Catch 1968 and 1969

	Preliminary 1969	1968
	(Metric Tons)	
Groundfish:		
For freezing	249,227	202,237
For salting	83,335	115,178
For drying	45,562	15,174
Landed abroad on ice	35,681	28,812
Herring:		
For salting	19,400	28,834
For freezing	2,800	7,776
For reduction	5,800	55,712
Landed abroad on ice	25,220	49,204
Capelin:		
For reduction	168,950	76,919
For freezing	2,400	1,248
Lobster and Shrimp:		
For freezing	6,348	4,825

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ICELAND (Contd.):

FISHERMEN'S STRIKE AVERTED

Representatives of seamen's unions and fishing-vessel owners have agreed on the distribution of income from fish catches. This probably has averted a strike that could have crippled the country's economy. The fishermen had demanded a higher percentage. Final agreement was signed subject to two conditions: a change in the law on proportion for each party, and increased fish prices.

Under legislation passed in late 1968, 27% of the sales revenue from cod and other white fish catches had been reserved for vessel owner-operators (10% for escrow-type fund for new capital expenditures and debt repayments; 17% to defray an anticipated increase in operating costs due to the Nov. 1968 devaluation). This left only 73% of the white fish to be divided between labor and ship operators, usually 41% to 42% to the fishermen, and 58-59% to the owners-operators. Under the new agreement, the government must change the legislation, reducing initial amount given to owners from 27 to 21%. This will leave 79% to be divided among fishermen.

Increased Prices

The second condition was met when the Fisheries Price Board increased by 9.5% the fixed price of cod and other white fish to the processing plants. Boat owners and fishermen's representatives on the Fisheries Board voted in favor of the increase. Representatives of the processing plants voted against it.

Results of Agreement

According to the press, overall benefit to fishermen will be about a 15% increase in income over 1969, assuming comparable catches. The agreement must be approved by individual unions. An important fishermen's union in the Westmann Islands already has rejected contract. Union members said they would negotiate their own agreement.

Significance of Higher Prices

The 9.5% hike in white-fish price already in effect for 1970 is expected to be extended to herring and capelin. Because landed price is only a fraction of the price of processed fish sold abroad, this action probably will not affect the processing industry's foreign-market position. The effect of the 9.5% increase is similar to the effect of an increase in wheat prices on the consumer price for bread. In fact, the steady price rise in the U.S. during 1969 for frozen cod blocks (from 21 cents to 24 cents per lb.) may well have set the stage for the increase. Iceland's landed price for prime cod is to be raised from 3.25 U.S. cents to 3.56 cents a lb. (prime cod is 19 or more inches long, large, gutted with head, and class 1A quality).

Since the 9.5% increase was already overdue, it is not considered an impediment to the fish-processing industry. The fishermen are not obtaining higher wages; they are only recouping what they lost during 1967-68 when fish prices declined.

Domestic Supply Assured

Another perspective is the relationship of the Icelandic price to prices prevailing in other countries for unprocessed fish. Icelandic vessels tend to land their catch abroad to benefit from higher prices (mainly in Great Britain and West Germany) this became a real problem during second-half 1969. Although a higher price level will eat into the fish-processing industry, profits will, at the same time insure a continuing supply. (U.S. Embassy, Reykjavik, Jan. 9, 1970.)

NORWAY

PURSE-SEINE FLEET LOSING PROFIT

Norway's purse-seine fleet is caught in a profit squeeze despite its modernity and great mobility. Profit data for 1968 showed a loss for smaller seiners, balanced operations for middle-size vessels, and some surplus for large seiners. Incomplete 1969 data show no improvement.

Too Many Vessels

The fleet may be overbuilt, a development forecast previously, and a chronic problem in many of world's fisheries. The future appears bleak because the herring resource and some related fisheries are diminishing. Present fleet is 400 vessels worth US$150 million. Fisheries Department spokesman say 300 would be adequate. Pressure is being exerted on the government to prohibit fleet expansion.

NORWAY (Contd.):

As a result, the Government Fisheries Bank no longer issues loans to purse-seiners. (Reg. Fish. Attaché, Copenhagen, Dec. 1, 1969.)

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NORDIC GROUP TO ENTER MORE EXPORT MARKETS

During 1969, Nordic Group (Norwegian fillet export organization) doubled its frozen fish fillet exports to the U.S. The organization now plans to request rights to enter all other export markets for fish fillets.

Expanding Market

Nordic Group's chairman said that assertions of catastrophe, made when the group first began exporting to the U.S., have proved groundless. Experience showed the Group's exports did not interfere with other exporters. In fact, Frionor is said to have increased its exports 100% since Nordic Group obtained an export license. This showed the market can accommodate all--Nordic Group, Frionor, and Findus. The chairman also contended that more Norwegian products would only stimulate sales. Nordic Group forecast 1969 exports to the U.S. worth about US$5.7 million. ('Fiskaren,' Nov. 10, 1969.)

SWEDEN

GOVERNMENT AIDED FISHING INDUSTRY IN 1969

The Swedish Government aided the fishing industry in 1969 because of the adverse effects of price developments and rising imports. Over US$240,000 was spent for advertising and promoting fishery products, $2.8 million was made available for fishery loans, and $600,000 assisted fishermen transferring to other employment. ('Dansk Fiskeritidende,' Nov. 7, 1969.)

DENMARK

FIRM TO INVEST IN PERU FISH-MEAL FACTORY

Atlas A/S, Denmark, will invest US$2.7 million in a complete fish-meal plant in northern Peru. The plant will have pipelines running from floating pumping stations to the plant, storage pits, cooking equipment for sterilization and coagulation, double screw-presses, rotary drying ovens, mills and sacking machinery.

Marketing Areas

Atlas' most important markets are South and Central America, the USSR, and Japan. The firm also has begun market investigations in North Africa. Morocco, for example, is interested in increased fish-meal production. (Reg. Fish. Attaché, Copenhagen.)

UNITED KINGDOM

DECLINE OF FISH SUPPLIES FORECAST

Britain's White Fish Authority (WFA) has forecast a drop of 7 to 12 percent in 1970 fish landings at British ports from 1968 figures. Imports of fresh and frozen fish also are expected to fall. WFA estimates that 1970 landings of fresh fish from distant-water vessels will be down 20% from 1968. In 1968, this fleet provided about one-third the fish landed by British vessels.

Catch Rates

WFA says catch rates on fishing grounds exploited by Britain's major suppliers--Norway, Denmark and Iceland--will be at about 1968 level. But the fall in 1970 catch rates on most North Atlantic grounds will reduce overall level of supplies.

Imports

It is highly probable that total volume of 1970 imports will be lower than in 1968's. Their level will be determined to some extent by international prices.

Prices to Rise

WFA concluded that since total supplies of fish will be lower in 1970 than in 1968, prices are likely to rise. ('Fishing News,' Dec. 26, 1969.)

LATIN AMERICA

CUBA

THE FISHING INDUSTRY

The following information comes from "The Fishing Industry in Cuba," published by the National Institute of Fishing, Havana, in Nov. 1969.

Cuba's National Institute of Fishing directs and conducts fishing. It has 4 fleets: the Cuban, Caribbean Shrimp, Gulf, and Coastal (including former fishing cooperatives). It includes the Exportadora del Caribe export enterprise, Cuba-pesca enterprise for importing fishing equipment, Victoria de Girón docks, Fishing Research Center, Fishing Port of Havana, Fish Culture Department, and plants for processing fish and other seafoods.

In 1958, the last year before Castro, Cuban fishermen brought in 21,900 metric tons of fish. In 1968, 66,032 metric tons were caught. The Institute "envisages" almost 175,000 metric tons for 1970.

Before Revolution

In 1959, there were a few thousand fishermen with about 3,000 boats.[1/] More than 90% of these boats were less than 33 feet long. About 2,000 were 10 to 24 feet, usually sailed by one or two men using primitive fishing techniques. Fishermen, dependent on middlemen and shipbuilders, lived a hand-to-mouth existence. Most fishermen engaged in coastal fishing. Only a few boats fished the open sea--the Gulf of Mexico. None of these was over 80 feet long. Almost all were sailboats with auxiliary engines. All lacked modern equipment needed to increase their catches.

Today, Cuba's national fishing industry is equipped with "modern steel boats, trawlers, and tuna boats that sail distant seas. . . . Modern fishmeal plants, fishing ports, docks, dry docks and other installations are being built." So too are fishing schools to train thousands of young people in modern techniques.

High Fish Consumption

At present, per-capita fish consumption is more than double the pre-Revolution figure.[2/] Before Castro, most fish, except that for export, was sold in Havana where purchasing power was "disproportionally great." In interior cities, small towns, and villages, fish was never a staple because "the people there could not learn to consume a kind of food that was practically nonexistent as far as they were concerned."

Now, the catch of the Coastal Fleet fishing enterprises and cooperatives based in each province is distributed within that province. Also, thousands of tons are shipped every year from Havana, where new, steel-hulled fleets are based, to the interior. Towns and villages "receive proportionately more fish and fish products than before."

The Coastal Fleet

After the Revolution, the fishermen were grouped into cooperatives, granted credit, and provided with equipment, supplies, and technical aid. Modern towns were built for fishermen, who had been living in shacks, near seaport cities of Manzanillo, Caibarién, and Pilón. The price of fish was raised substantially and, "more important, stabilized." In 1966, the National Institute of Fishing created an agency to operate the Coastal Fleet. This was "foundation for a more adequate exploitation of the rich inshore fishing areas."

Today, the fishermen's standard of living has risen over 150%. Illiteracy has been eliminated. Many are pursuing technological and administrative studies at intermediate level.

In 1968, the Coastal Fleet caught 35,875 metric tons of fish and shellfish--54.3% of the total Cuban catch.

The Cuban Fishing Fleet

To conduct open-sea fishing, steel-hulled, deeper-draft vessels were added. Fishermen

1/The last official Cuban census in 1954 tallied 12,900 fishermen--one half in provinces of Havana and Las Villas. This number probably did not change appreciably by 1959. (Milan Kravanja, BCF, Office of Foreign Fisheries.)

2/Despite claims of doubling consumption of fishery products, the effect on food situation is negligible. Long lines still form in front of state-owned Havana restaurants, which have less to offer than even a few years ago, travelers report. The regular daily menu consists of macaroni or pizza with tomato sauce and some cheese. Only rarely are fish dishes available; shellfish never. The total absence of lobsters and shrimp on domestic markets is due mainly to heavy emphasis on shellfish exports to earn much-needed hard currency. Availability was severely reduced by a 50% decrease in sugar exports.
It is not known how the Cubans figure fishery product consumption. (Milan Kravanja)

CUBA (Contd.):

were trained to handle larger vessels and fishing equipment--the longline and trawl net. They were trained aboard vessels that were prototypes of the fishing fleet. Those young men have become the captains and officers of new, modern, far-ranging vessels.

The Cuban Fishing Fleet was born in 1962. In that year, it caught only 6.1% of total catch. In 1968, when total gross tonnage had reached 29,758 tons, its catch was 33% of total.

The Cuban Fishing Fleet now has 52 vessels: 3 motherships; 24 tuna boats; 11 side trawlers; 10 stern trawlers; and 4 Victoria-type Cuban-built vessels. It can also use several other Cuban-built steel-hulled vessels. It operates in international waters of North Atlantic, South and Central Atlantic, Caribbean, and Gulf of Mexico.

The Caribbean Shrimp Fleet

Created in 1968, the Fleet has 90 steel-hulled, 76-foot-long vessels with hold capacity of 30 metric tons. These were built in Spain in Bilbao, Santander, Gijon, and Vigo. Construction of 30 French-built refrigerator shrimp boats is scheduled for completion in first-quarter 1970. These are 82-foot-long steel-hulled vessels. They have capacity of 50 metric tons of frozen shrimp, can freeze 5 metric tons daily, and are equipped with cold-water tanks with capacity of 1.84 metric tons. Processing and packing aboard vessels will make it possible for finished product to reach ports "in top condition." The fleet also has several Cuban-built steel-hulled trawlers.

Operational plans for 1970 include 300 trawlers fishing on insular shelf, Gulf of Mexico, and near Honduras and Guyana. Cuba expects these modern trawlers to bring in 10,000 metric tons of shrimp in 1970--and 60,000 metric tons of fish will be caught along with shrimp and turned into fish meal. The boats will operate out of Cienfuegos Bay, "where docks, packing houses, machine shops, an ice plant, a fish meal plant and several warehouses will be built."

The Gulf Fleet

The Gulf Fleet has operated since 1963, mainly in Gulf of Mexico waters. In 1968, it brought in 11% of the total catch. It has Cuban-built wooden vessels 60 to 75 feet long, fitted with latest mechanical, electrical, and electronic equipment.

The fishing gear used most are longlines (for grouper) and trawl net (for shrimp). The Lambda-type grouper boats made in Cuba (most are this type) have up to 6 self-propelled auxiliary boats. The auxiliaries are lowered into sea and brought aboard by hydraulic cranes. Each boat is manned by 2 men. These boats fish the Yucatan Channel and Campeche Bank. The species most frequently caught are grouper, kingfish, and red snapper.

The Gulf Fleet also has 40 Lambda-type boats converted into shrimp trawlers. These operate on Continental Shelf and Gulf of Mexico.

The Fishing Port of Havana

The port processes fish caught by Cuban Fishing Fleet and services and repairs fishing vessels.

The 34-acre port, which cost 35 million pesos, was built by Soviet specialists under a 1962 technical assistance agreement. It has 8 refrigeration storerooms with total capacity of 11,500 tons of fish. An ice plant can produce 40 tons of ice a day. A floating dry dock can handle ships up to 2,500 tons displacement.

"Other installations include repair shops, supply storerooms, power substations, steam boiler rooms, air compressor rooms, more than 100 pieces of heavy equipment (gantry cranes, fork lifts, motorized warehouse trucks, etc.), a radio communications plant, a fish meal plant with a capacity of 90 metric tons of raw material per day and an oxygen plant."

The facilities are being expanded with new docks, boats, tugs, barges, and storage depot.

Experience in Ship Building

Prior to 1959, ship building was limited to a few boats for sponge fishing, dinghies and other small craft for fishing in Gulf of Mexico. There were no large shipyards on the island. The few boats were built in shipyards on river banks or beaches for easy launching.

By 1961, however, there were several shipyards building small fishing vessels for Cuban use. "This marked the birth of the Cardenas, CUBA (Contd.):

Victoria, Cayo Largo, Lambda, Sigma, Eta, Omicron, Ro and other types of small and medium-sized boats."

Over 500 wooden vessels between 27 and 122 feet long have been built in Cuban shipyards. Cayo Largo-type boats have been built for lobster, bonito, and sponge fishing; and Doce Leguas-type boats will be used for shrimp fishing on insular shelf.

Construction of steel-hulled vessels has begun. Several have displacement of over 600 tons and will be used to transport shrimp from boats to shore. Also under construction are all-steel shrimp boats, tugboats, and others.

Tests are being conducted on a 50-foot trawler-shrimp boat of reinforced concrete for coastal fishing; a second is being built for lobster fishing.

Fishery Research

The Fisheries Research Center (CIP), at Baracoa Beach in Havana Province, conducts fishery research. This Center has 5 work groups "that carry out research on trawling, tuna fishing, shrimp fishing, lobster fishing and the catching of other marine species (such as oyster, sponges and tortoises). The CIP conducts research in physical and chemical oceanography, plankton and fishing statistics."

Lobster studies include populations in the 4 zones of Cuban Continental Shelf.

Shrimp research also gets special attention: to discover new areas around Cuba and to obtain data on shrimp populations in the rest of the Caribbean and adjacent seas.

Oyster and sponge culture are studied in corrals built by CIP for experiments to increase national production without depleting these resources.

Taking Advantage of Inland Waters

In March 1967, the National Institute of Fishing established the Fish Culture Department with subsidiaries throughout Cuba. This stocks fish and exploits water resources of rivers, natural lakes, and those created by hundreds of dams and reservoirs.

The Fish Culture Department is trying to adapt and raise the *Ctenopharyn godon idellus* (white *amur*), *Hypophtalmichtys molitrix* (white tenca) and several species of carp, and raise bullfrogs, crawfish, and freshwater turtles. It is researching other native Cuban species and ornamental (tropical) fish.

Reservoirs have been stocked with some of these species. "Fingerlings of the so-called American trout have also been included, destined for sports fishing."

JAPANESE TANNER CRAB FISHERY IN EASTERN BERING SEA

Milstead C. Zahn

Japan's two eastern Bering Sea king crab fleets diversified into a full-scale pot fishery for tanner crab (Chionoecetes sp.) in the summer of 1969. This new tanner crab fishery is a timely example of a fishery shifting to meet new demands of economic survival.

The tanner crab resource is not a new discovery. It occupies the same range where king crab has been exploited commercially by the Japanese since 1930. Japanese king crab fleets in the eastern Bering Sea began processing small amounts of tanner crab in 1953. Their production remained at experimental levels, ranging from 170 to 3,457 cases annually until 1964. Early attempts, both foreign and domestic, to extract tanner crab meat from the shell were not competitive with king crab processing then riding the crest of a burgeoning market.

Interest Heightened After 1965

Japanese interest in tanner crab expanded considerably following the 1965 U.S.-Japan King Crab Agreement. That established a quota on the Japanese eastern Bering Sea king crab catch. Emphasis on tanner crab utilization intensified further as king crab catches declined and prices climbed to unacceptable levels in the Japanese market. Tanner crab are retailed primarily as frozen sections and frozen meat in Japan; they find a ready market there with demand and price expected to continue upward.

The response in the Japanese fishing industry to a developing domestic tanner crab market became particularly evident in 1968. Then, in addition to the king crab fleets, several relatively small tanner crab processing ships moved onto the central and eastern Bering Sea grounds. These ships had been fishing tanner crab in the traditional ground near Olyutorskiy Gulf off the Soviet coast. The vessels were diverted 700-800 miles to the southeast and became the first serious commercial effort on the eastern Bering Sea tanner crab stocks. Typically 500-1200 gross tons and employing 35-50 men, they fished exclusively with crab pots. The smaller vessels handled all phases--from pot handling through cooking and freezing. The larger ships were accompanied by pot-setting boats of 80 gross tons. Crab butchering and cooking was done on the weather deck of all these processing ships. These expeditions fished some large U.S.-type king crab pots, but emphasis centered on smaller conical pots rigged several to a groundline.

Mothership Fleets in 1967

During summer 1967, Japan's two mothership-based, king-crab tangle-net fleets began limited use of tanner crab pots though the traditional tangle gear takes five times more tanner than king crab in some areas. Use of pots by the mothership fleets further increased in 1968. By 1969, the two mothership fleets in Bristol Bay used tangle nets and conical pots in nearly equal ratio, and pot use is expected to increase next season. All tanner crab effort in 1969 was incorporated with the two traditional king-crab tangle-net fleet operations.

The Grounds

In general, Japan's expanding tanner crab fishery shares a common season and area with the traditional king crab operations. The eastern Bering Sea crab grounds encompass most of the Bristol Bay "flats" on the Continental Shelf area north of the Alaska Peninsula to Cape Newenham and west to about 175° W. longitude. The extensive Bering Sea Continental Shelf connects Alaska and the Soviet Union on the southern approaches to Bering Strait, and thence northward. It provides a remarkably uniform bottom at depths generally between 30 to 50 fathoms--extending from the Alaska Peninsula west and north to Siberia. Within about 50 miles of the Shelf edge, or 100-fathom curve, the ocean floor falls gradually through 70 and 80 fathoms.

Mr. Zahn is Fisheries Management Agent, BCF, Office of Enforcement and Surveillance, Kodiak, Alaska.

Tanner Processors Before 1969

Prior to 1969, the small tanner processors fished productively in 60-70 fathoms along the Shelf edge between Cape Olyutorskiy (Siberia) and the Pribilofs, as well as on the Shelf near the Pribilofs. The 1969 effort was limited to north of the Alaska Peninsula and near the Pribilof Islands (fig. 1). Fishing began in March with the fleets first working some 20-30 miles offshore north of Unimak Island to as far northeast as off Port Moller. About early May, the effort shifted west to near the Pribilofs. By mid-June, the fishery had returned to north of the Alaska Peninsula. Generally, quotas are filled and the fleets bound for Japan sometime in September or early October.

case of 48 half-pound cans. The Bristol Bay tanner crab have a higher market value, apparently because of larger size, than those caught on the western side of the Bering Sea. Reportedly, the Japanese industry considers crab of $3\frac{1}{2}$ inch carapace width to be commercially usable, though U.S. observers have noted that crab less than $4\frac{1}{2}$ inches are seldom used. Because females are small, they are not retained in commercial operations.

Factoryships in E. Bering

Current Japanese crab effort in the eastern Bering Sea is centered around two 7,500-ton factory ships, each carrying 4-6 forty-

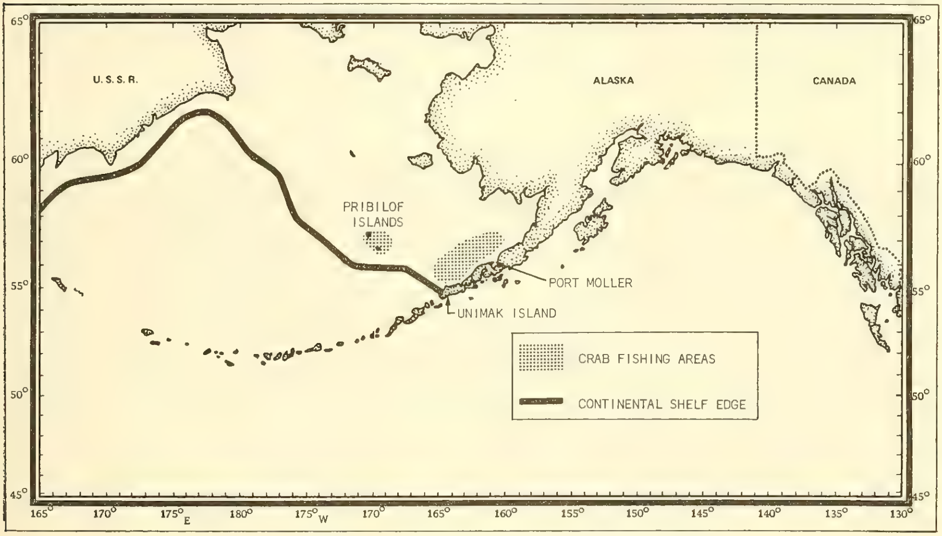


Fig. 1 - Japanese tanner and king crab fishing areas off Alaska, 1969.

Between 1966 and 1969, the Japanese tanner crab catch east of 175° W. longitude in the Bering Sea increased elevenfold--from 1.5 million crab in 1966 to 8.6 million in 1967, 12 million in 1968, and 17.6 million crab in 1969. The 1969 catch exceeded the anticipated 16 million crab by 1.6 million. Crab size varies between areas, but an average of 150 tanner crab is required for one

foot kawasaki boats. The kawasaki boats are used primarily for retrieving tangle nets; on occasion, they work pots. Other accompanying vessels, clippers or small trawlers in the 80- to 150-ton category, were increased from 6 per factory ship to 15 or more in 1969. These larger vessels are responsible for setting net fields and pot gear, and for retrieving pots and some tangle gear.

Fig. 2 - A tanner crab pot vessel, assigned to mothership 'Keiko Maru,' sets gear north of Unimak Island. A buoy and flag are visible going over stern. Stacks of nested pots are on well deck, and fully assembled pots are on fantail.

Fig. 3 - Aerial view of Japanese vessel handling tanner crab pots. Crab are visible stowed in sling loads on well deck. Longlines that carry the pots are coiled on fantail, with nested pots stored to one side.

Lightweight Pots on Longline

Since at least 1965, Japanese fishermen have experimented with pot fishing for king and tanner crab in the Bering Sea. Large king crab pots, patterned on U.S. models, have proved unacceptable thus far. Highly successful, however, are lightweight pots for tanner crab fished on a longline. They are designed to take tanner crab and are selective of that species. Basic design resembles a top-entry beehive shape. Framework is $\frac{3}{8}$-inch black iron rod, except the bottom frame of $\frac{1}{2}$-inch stock wrapped with rope to reduce chafing. The circular base is 45 inches in diameter and the circular top 28 inches across. Top, middle, and bottom frames are welded to straight rods to form a structure 22 inches high. This framework is covered with 6-inch, stretched measure, synthetic fiber web. Some variation in mesh size and frame size occurs. The web bottom of the pot opens for dumping crab. Then it is easily closed by puckering with a drawstring arrangement that secures by means of a hook and stout rubber band. The entry tunnel, hanging vertically from the web top, is a sheet of white plastic sewn into a tunnel 20 inches wide; this tapers to 14 inches diameter and 8 inches long. The complete pot weighs about 40 pounds.

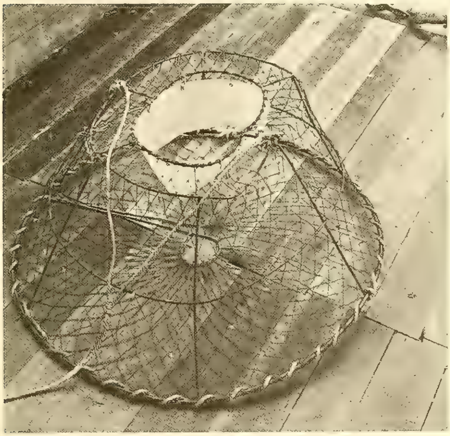


Fig. 4 - Tanner crab pot used by Japanese fleets in Bering Sea. Attached to anchored ground lines, about 1 mile long, these pots are highly selective for tanner crab.

Fishing The Pots

Each pot is rigged with bridle and a 4-fathom gangion ending in an eye splice. Bridles usually are knotted to the top frame in two places, so the pot hangs vertically. Some variation on this rigging incorporates a third piece in the bridle secured midway on the side of the pot. Most lines are synthetic fiber.

Due to ease of handling, pots can be stacked on deck in a ready-to-fish condition. Completely releasing the bottom drawstring, however, permits such efficient nesting that a stack of 30 pots is only 6 to $6\frac{1}{2}$ feet high. A common sight on the fishing grounds is a pot boat carrying hundreds of pots, stacked on all available deck space, so the original ship profile is unrecognizable.

A typical gear arrangement in the Bering Sea is 128 pots on a 3,200-meter groundline. Longlines are anchored and buoyed with glass floats and flagged poles similar to tangle net

Fig. 5 - Japanese crab factory ship 'Keiko Maru,' one of two motherships supporting crab fleets in eastern Bering Sea. Both king and tanner crab are processed on board.

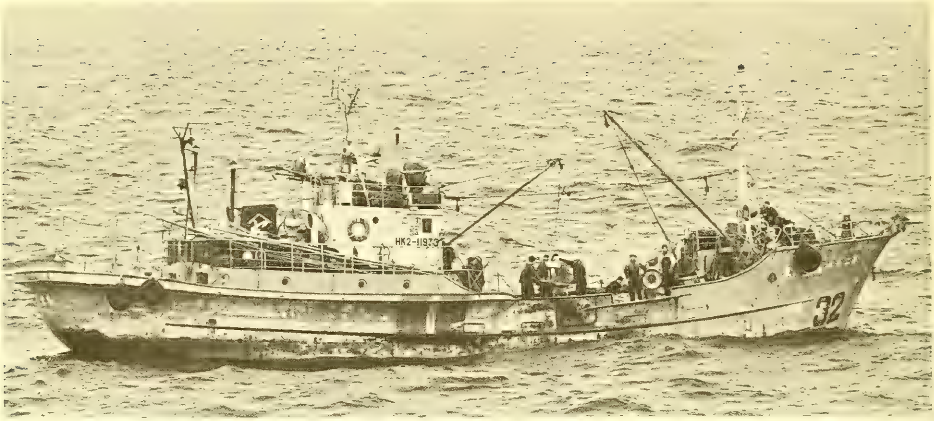


Fig. 6 - A Japanese ship, about 90 feet long, retrieves tanner crab pots. Groundline comes aboard over power roller at starboard rail. (Photos: M. C. Zahn)

gear. Flag code indicates either tangle net or pot string. Both types of gear are set parallel to each other, and as close as one-fourth mile. Gear strings in the eastern Bering Sea are set on a northwest/southeast direction. The longline is retrieved over a power roller at the starboard rail of the well deck, although some boats are rigged for port hauling. There is some variation in handling gear as it comes aboard. In one method, the pot is emptied on deck, and then is baited and reset without detaching from the longline. In other cases, the pots are hand carried to the fantail for stacking, and the longline passed aft and coiled in separate piles. Pots on the stern work areas usually are nested in tight groups on their sides rather than in vertical stacks, apparently for ease of handling during setting. A platform on the stern facilitates setting gear with strings of pots being set at about 5 knots. Crab on board pot boats are stored in sling loads on deck to facilitate delivery to the mothership, generally within 24 hours. Catches, frequently dead but in good condition, are unloaded day and night with delivery and turn-around taking less than one-half hour.

Herring Bait

The usual bait is herring and herring waste placed in small perforated plastic containers of about $\frac{1}{2}$-cup capacity. Three bait containers are placed in each pot. Another successful bait has been Pacific cod (*Gadus macrocephalus*) used as hanging bait. Pot strings, normally, are fished for 2- to 4-day soaks. Pot success, with seasonal and area variations, has ranged from 12 to 17 crab per pot.

The two species of tanner crab (*Chionoecetes* [*bairdi* and *opilio*]) in the Bering Sea pack are not differentiated in processing. They are marketed in Japan simply as "zuwaigani" (tanner crab). After cooking, most of the meat is frozen, and less than one-third of the pack is canned. The final frozen product varies from legs with shell on to flake meat and leg meat segments. By 1969, large tanner crab legs were retailing for as much as 14 cents each in Japanese markets. Recent use of clear plastic shrink packs, before freezing, has increased market value. It was being considered for larger use in 1970.

JAPAN

TUNA INDUSTRY BESET BY HIGH PRICES

In December 1969, Japanese packers were finding raw material costs rising faster than canned tuna prices. Export sales prices to the U.S. for canned tuna in brine had risen to record highs. So too had canned tuna in oil for export to Europe. But foreign market prices had not increased sufficiently to enable packers to keep up with rising raw material costs. For example, while foreign market prices for canned tuna had increased 10%, raw material costs to packers had increased around 30%; their sales prices rose about 20%.

Raw Material Prices

Dockside prices in Japan were averaging around US$580 a short ton for albacore, $365 a ton for skipjack, and $328 for small skipjack. Even at those prices, most albacore was bought by cold storage operators. The demand for skipjack, from 'katsuobushi' (dried skipjack loin) processors, was so strong that very little, if any, was available to packers. The sharp increases in raw material costs compelled packers to reduce production and sales.

Trading Firms Squeezed

Trading firms faced higher prices of the Sales Company and slower foreign price increases. In addition, the firms were caught in a cost-price squeeze. Since the strong demand abroad had sharply reduced the Sales Company's holding, the firms were forced to pay the packer's asking price to make shipments.

December Quotations

The Sales Company's December 1969 price quotations, 7-oz. 48's, per case: in brine--white meat solid, $12.31; light meat solid, $9.56; in oil: white meat solid, $12.08-12.22; light meat Grade A, $9.86-10.00; light meat Grade B, $9.44-9.58.1/

Exports Weakened

The high prices for oil-pack sharply cut purchases from foreign countries. Their buyers switched from Grade A to Grade B packs, and from skipjack to lower-priced big-eyed.

The major trading firms were not exerting their usual effort to promote canned tuna exports. Since production increase by packers did not look hopefu in view of the raw material situation, the trading firms were hopeful to hold on to their outlets without losing money. Thus, the price increase was weakening Japan's international competitiveness. Local opinion is that trading firms may profit in the long run by concentrating on domestic market, where food prices are rising. ('Suisan Tsushin,' Dec. 1, 1969.)

* * *

FINDS SAURY ABUNDANT OFF U.S. WEST COAST

Five vessels exploring for saury off U.S. and Canadian west coasts ended operations in late November 1969. The survey established a production potential.

Now the question is how the resource can be harvested most efficiently for the Japanese market. The exploratory vessels fished with stick-held dip nets, but volume production would require a mothership fleet with a freezership.

The Saury

The saury were medium size, averaging around 140 fish a 10-kilogram (22 pounds) container, and "characterized by the absence of fat."

Survey Area

The exploration began east of 170° E. worked east toward the U.S. coast, surveying the area between 52° N. and 39° S. latitudes.

The Vessels

In late July 1969, Taiyo's 'Azuma Maru No. 6' (238 gross tons) conducted a brief survey off California, then proceeded to tuna grounds off Mexico. Nihon Suisan's 'Shinano Maru' (539 gross tons) returned to Japan with about 150 metric tons of saury in late October.

Nichiro's 'Akebono Maru Nos. 17 & 21' (499 gross tons each), and No. 18 (492 gross tons), had taken over 300 tons by mid-November. They terminated operations at month's end.

1/Ex-warehouse, Shimizu, Japan.

JAPAN (Contd.):

Plans for 1970

Operations in 1970 and after will depend on the saury fishery off Japan. Japanese and Soviet scientists have predicted a good saury season off Japan in 1970. ('Suisancho Nippo,' Nov. 25, 1969.)

* * *

NEW SAURY NET TESTED

'Tenyu Maru No. 37' (499 gross tons) sailed for the eastern Pacific recently on a saury fishing expedition. She was equipped with a special rigging for distant-water operations.

Tests in Okhotsk & Pacific

She used the new gear, a 'light-using surrounding lift net,' successfully in the herring gillnet fishery in the Okhotsk Sea off Kamchatka. Now she is trying it out in the eastern Pacific. No details of the gear's construction or rigging have been disclosed. Reportedly, its design was based on saury-migration data in the eastern Pacific.

Portable Design

The vessel probably will use a surround net, encircle saury attracted by lights, and haul them aboard by pump. Its performance will be followed closely in Japan. ('Suisan Keizai Shimbun,' Dec. 2, 1969.)

* * *

INVESTIGATES CHILEAN FISHERY RESOURCES

The Japan Fisheries Association plans a 3-year cooperative fishery-resource investigation in Chile to develop a centolla crab fishery and a salmon hatchery program.

The Association will send 8 fishery specialists in the first year (fiscal 1969 ending March 1970). Four left Japan on Nov. 18, 1969, for a 70-day crab survey. Four others were slated to leave December 16 for a 4-month salmon hatchery study.

Financing

The Association's budget for the first 2 years is US\$63,000--\$48,000 for crab investigations, and \$14,400 for salmon. Half the cost will be subsidized by the Japanese government; the rest will be financed by major fishery firms and a fishermen's organization. The 3rd year budget will depend on findings in the first 2 years.

Resource Search

Japan proposed the survey on basis of available data--and on assumption that fishery resources were as abundant south of 40° S. latitude as in the Bering Sea and the North Atlantic. Chile was selected because of its geographic location and its favorable attitude toward Japan. ('Suisan Tsushin,' Dec. 12, 1969.)

* * *

SURVEYS SHRIMP FOR YEMEN

In cooperation with the Food and Agriculture Organization (FAO) program for developing countries, a Japanese company will conduct a 2-year survey of shrimp fishing off south Yemen. FAO has charted a vessel, 'Nisshin Maru No. 52' (100 gross tons), for the work.

The Japanese may increase the number of vessels in the future and establish a joint venture with Yemen. ('Shin Suisan Sokuho.')

* * *

FISH UTILIZATION IS CHANGING

Of Japan's total marine catch (excluding whales) of 7.85 million metric tons in 1967, 68% was utilized in producing processed products, and 32% was marketed fresh or frozen. Among processed products, kneaded 'kamaboko' (fish cake) and sausages took 24% of total catch; salted and dried, 23%; oil, meal, and inedible items, 13%; and canned, 8%.

In recent years usage of fishery products has changed greatly due to rising incomes and changing diet. ('Japan Fisheries Yearbook,' 1969.)

* * *

PLANS 1970 HERRING FISHERY OFF SOVIET COASTS

In 1969, the Japanese Fishery Agency accepted 232 applications for 1970 herring fishing licenses. They included 218 vessels that actually fished in 1969. The new licenses are to be issued in May 1970.

JAPAN (Contd.):

Fishery Poor in 1968

Because of the 1969 herring catch--about 26,000 metric tons off Cape Okhotsk (West Kamchatka) and poor yields in the Olyutorskii Cape area--the number of Japanese herring vessels allowed to fish the Olyutorskii area probably will be reduced considerably in 1970. ('Shin Suisan Sokuho,' Nov. 1, 1969.)

* * *

EXPORTS OF CANNED TUNA IN OIL FELL IN 1969

Jan.-Oct. 1969 exports of canned tuna in oil totaled 7,821,675 kilograms valued at US$7,528,000, down 3,926,865 kilograms and $2,127,000 from same period 1968. Most of the decline was due to sharply reduced exports to West Germany. The latter's purchases were 63% below the 1968 period, primarily because of increased prices. ('Katsuo-maguro Tsushin,' Dec. 3, 1969.)

* * *

CANNED MACKEREL EXPORTS AND PRICES RISE

December 1969 prices for canned mackerel exports to the U.S. were c. & f. US$6.30-6.50 a case for natural 1-lb. tall 48's, about 30 cents over November's high of $6.20. Prices for mackerel canned in tomato sauce rose about 55 cents a case. The price increases were attributed to active buying when production declined because of sharply reduced landings and rising dockside prices.

Stronger Export Market

Increased buying was due to a strengthening overseas market. The export market, dull during first-half 1969, began picking up in second half. Canned mackerel exports in 1969 should have exceeded 9 million cases; 7.85 million cases were sold in 1968. ('Suisan Tsushin,' Dec. 16, 1969.)

SOUTH KOREA

WILL EXPORT SAURY TO JAPAN

Songto Fishing Company plans to export Pacific saury to Japan. At 30 metric tons a shipment, price will be around 100 yen a kilogram (US$252 a short ton), duty included (destination Hakata or Shimonoseki, southwest Japan). Songto has a fleet of 6 trawlers (40-100 gross-ton class) and a refrigerated carrier vessel. ('Suisancho Nippo,' Nov. 28, 1969.)

* * *

SHRIMP FISHING IN CARIBBEAN BEGINS

A Mexican shipyard built 5 steel-hulled 380-hp. shrimp trawlers for a South Korean fishery firm during 1969. The 76-foot-long vessels cost US$96,000 each, excluding nets. Korean crews claimed the vessels in August 1969. They will fish shrimp off Guyana.

The shipyard was reported negotiating with the same firm for 10 more shrimp trawlers for spring 1970 delivery. (Reg. Fish. Attaché, Mexico City.)

* * *

TO ADD HUNDREDS OF LONGLINERS IN 1970

South Korea's Office of Fisheries plans to build 450 small longline vessels in 1970. Gross tonnage: 5,500 tons; cost: 1.7 billion won (US$54.7 million); average longliner: 12.2 tons. One hundred vessels will fish puffer; 350 sea eel.

Korean importers of Japanese vessels have been at a disadvantage with Japanese builders following devaluation of the won in Nov. 1969 (from 285 to 305.1 won for US$1). Difficulties in concluding a vessel-import contract for 1970 are expected.

47 Japanese Vessels

From Apr.-Oct. 1969, 47 Japanese-built vessels were licensed for export to S. Korea by Japanese Fisheries Agency: 30 trawlers, 3 purse seiners, 8 tuna longliners, 3 fish carriers, and 3 auxiliary vessels. ('Nihon Suisan Shimbun,' Dec. 10, 1969, and 'Shin Suisan Sokuho,' Oct. 24, 1969.)

SOUTH KOREA (Contd.):

About Puffers

Puffers (family Tetraodontidae) are called that because they react to being pulled from the water by swallowing air and blowing up like a balloon. Their internal organs (sometimes the meat) may contain a deadly poison--tetrodotoxin, which has important medical uses. Despite this, they are a much appreciated food fish, especially in Japan. There, dishes from puffer (fugu) are prepared by cooks required to have a certificate from a licensed "fugu" school. Dishes from improperly prepared puffer can results in acute food poisoning.

TAIWAN

RATIFIES CONTINENTAL SHELF CONVENTION

The Taiwanese Legislature ratified the Convention on the Continental Shelf at its last session in 1969. It was aimed at protecting possible petroleum resources in the Taiwan Straits. ('Minato Shimbun,' Nov. 9, 1969.)

* * *

PLANS 1970 FISHING VESSEL CONSTRUCTION

The Fisheries Bureau has set a target of 33,000 gross tons for 1970 fishing vessel construction. In the past, only tuna longliners have been built; now trawlers are to be included. The Bureau has planned forty 250-ton tuna longliners (financed by an Asian Development Bank loan); two 300-ton trawlers; 4 pairs of 2-boat 200-ton otter trawlers, and three 800-ton high-seas shrimping vessels. (The America-China Fund will provide US$1.5 million.) Several trawlers, or 2-boat otter trawlers, totaling 800 tons will be financed by Taiwan's Agriculture Rehabilitation Corporation.

Reconstruction

The Central Bank of Taiwan will provide US$7.5 million to rebuild a number of draggers (total 4,000 tons) and tuna longliners (4,000 tons). The money also will be used to expand freezing facilities both in Taiwan and at overseas foreign bases; and buy refrigerated trucks. Plans for the remaining 10,400 tons are to be worked out.

1968 Landings

Taiwan's 1968 landings were an all-time record--531,000 metric tons--15.9% over 1967. Growth rate, one of the highest in the world, doubled 1967's 7.7% in 1968. High-seas fishing provided almost one-half the total catch in 1968 compared with 20% in 1956. Total 1968 value of landed fishery products was US$130 million.

The Government's 5-year plan provides for a continuous expansion of fishery landings well into the 1970s. In 1968, the fishing industry came close to the planned 1969 catch (557,000 tons). The 800,000-ton catch planned for 1972 now seems feasible. ('Suisan Keizai,' Nov. 13, 1969.)

1969 Catch

The Fisheries Bureau has announced that during the first 6 months of 1969 the catch was 293,457 metric tons--18.5% higher than during the same period in 1968, and 52.7% of the catch planned for 1969. High-seas fisheries totaled 127,351 tons (up 3.7%), offshore fisheries totaled 132,642 tons (up 24.8%), coastal fisheries 13,588 tons (up 9.1%), and fish culture yielded 19,876 tons (up 17.6%). The tuna catch was 45,776 tons, worth about US$3.9 million (up 20.4%). ('Suisancho Nippo, Sept. 25, 1969.)

THE MARINE FISHERIES OF MOROCCO

Salvatore Di Palma

The waters off Morocco contain rich resources of sardines and other fishes. In 1968, landings totaled 212,920 metric tons--sardines comprised 167,623 tons. Most fish is canned or reduced into meal and oil for export; 1968 exports were 104,000 metric tons worth about $34,200,000. The need for upgrading and expanding the industry is generally recognized. The task has been assigned to the Office National des Pêches created in February 1969. Recent improvement in world market for canned sardines and fish meal augurs well for the near future.

THE RESOURCES

The waters off Morocco's Atlantic Coast from Cape Spartel to Cape Juby are rich in fishery resources. Strong upwellings and oceanic currents favorably influence the fisheries. Sardines (Sardina pilchardus) are the most important stock. Mackerels, anchovies, tuna and tunalike species, horse mackerels, and hake are abundant. Limited but fairly valuable resources of shrimp and lobsters are also present.

The Harbor of Agadir. (FAO/A. Defever)

Mr. DiPalma is Regional Fisheries Attaché for Western Africa, United States Embassy, Abidjan, Ivory Coast.

The Mediterranean waters off the northern coast have limited resources and supply less than 5% of landings.

Official nomenclature divides fishes into two groups: "poisson industriel," or industrial fish, and "poisson marée," fresh fish.

I. INDUSTRIAL FISH

In 1968, 188,780 metric tons of industrial fish were landed--89% of total landings. Industrial fish primarily are canned or reduced. They are sardines, anchovy (Engraulis encrasicholus), mackerel (Scomber scombrus), bluefin tuna (Thunnus tynnus), skipjack (Katsuwonus pelamis), frigate mackerel (Auxis thazard), black skipjack (Euthynnus alleteratus), bonito (Sarda sarda) and 'espadons' (Xiphiides). Much industrial fish is sold fresh: 17,961 tons in 1968, equal to about three-fourths the landings of fresh fish. Also, small quantities are salted.

Tuna and Tunalike Fishes

Landings have fallen slightly in recent years; in 1967, they were 6,447 metric tons. Tunas are taken mainly by sardine vessels and by "madragues" (fish traps). Sardine fishermen fish seasonally for bluefin, which appear in autumn off Safi-Agadir area; catches are limited by inadequate gear, short vessel range, and fishing technique. The number of madragues and their catches have declined. Occasionally, some tuna are taken by artisanal fishermen. Expansion of tuna industry has been considered in development plans over the years, but actual accomplishments have been minor.

An expensive research effort in 1964/65 involving a French vessel proved inconclusive. Attempts to use present vessels in Senegalese area showed their inadequacies for distant-water fishing. Nevertheless, expansion of tuna fishery is integral part of future plans; it includes fishing the resources of the Gulf of Guinea. The task, though not impossible, will be formidable. It will require high capital investment, considerable experience in tuna fishing, competing with foreign fishermen, and selling in highly competitive world market.

Mackerel

The 7,753 tons landed in 1968 were nearly 20% below 1967 figure. The decline was reflected too in figures of the Office de Commercialization et d'Exploration (OCE); these showed 1968-69 exports of 3,808 tons worth about $1,180,000, down 22% and 17% respectively from previous period. On the whole, however, mackerel offers potential for greater exploitation. Development waits better vessels, exploratory fishing, additional export markets, and diverting more of catch to reduction.

"POISSON MARÉE" (FRESH FISH)

"Poisson marée" are sold on fresh fish market; also, considerable quantities are frozen for local consumption and export. Horse mackerel, hake, sea bream, and blue fish are principal species; gurnard, mullet, sole, and shark are also landed in important quantities.

In 1968, Casablanca and Agadir accounted for 14,942 tons of the 23,827-ton catch. Tangier, Kenitra, Safi, and Larache also had annual landings of over 1,000 tons. Trawlers and line-fishing and gill-net craft, motorized and nonmotorized, participated.

The two main markets for "poisson marée" are the large urban centers, especially their foreign population, and France. Casablanca is the most important single market; besides its own trawler catch, it receives fish trucked from Agadir and other ports.

Efforts to promote greater domestic consumption of fish have had mixed success. Low purchasing power and the traditional preference for meat are reasons given for low consumption. The rapidly growing tourist trade is expected to absorb greater quantities of fish. With ample resources available, expansion of the fishing industry depends on expansion of the domestic and export markets.

CRUSTACEANS

Crustaceans follow sardines in potential for expansion. Shrimp, primarily Parapenaeus longirostris, are most important. Annual landings, however, have fluctuated during past 5 years from 250 to over 1,000 tons. Information on catches seems inadequate to plan growth. More information will be needed on areas fished, techniques, catches by foreign vessels, and requirements for Moroccan investors.

Lobster, spiny and northern, are another fishery where local fishermen might be diverted from sardine fishery. Official statistics show only a modest catch of 40 to 50 tons annually; some landings are unreported. Also, catches by foreign vessels off the coast are excluded.

THE SARDINE INDUSTRY

By far the dominant sector of the Moroccan fisheries is the sardine industry. During 1963-68, sardines accounted for 70 to 85% by weight of total landings. The 1968 landings were 167,623 metric tons; the record year was 1966 with 251,876 tons. More than half the catch goes to reduction plants; the remainder, the better-quality fish, goes primarily for canning and, to lesser extent, to fresh-fish market.

Over 90% of all sardine landings are made at Safi, Agadir, and Essaouira, centrally situated on Morocco's Atlantic coast.

Port of Safi

Because a larger proportion of its landings is canned, Safi leads the other two ports in income from catch. In 1968, nearly 33,000 metric tons of sardines (raw-fish weight) were canned in Safi. It has 38 canneries and 6 fish-meal plants.

Most cannery workers are hired on part-time basis. Women on canning lines receive about 14 U.S. cents per hour. Salaries for men are higher and depend on type of work and condition of employment. A social security tax of 15% is assessed; employe and employer each contribute half.

There are 117 sardine vessels working out of Safi: most are wood, 15 to 18 meters long, 20 to 40 GRT, and have 120 to 149 h.p. In Safi, vessels are contracted to fish for specific plants. Also, some plants have their own vessels. Many fishermen augment earnings by farm work during off season.

Agadir

The lead for volume of sardines landed alternates between Agadir and Safi. Agadir received 114,000 tons (of 251,876) in 1966's record catch.

The number of sardine vessels based at Agadir varies around 95 annually. The average vessel is about 16 to 17 meters long, nearly 5 meters wide, 29 to 30 GRT, and has a 160 to 170 h.p. engine. The vessels usually fish near port. Unlike the situation at Safi and Essaouira, vessels are all independently owned.

Sales are arranged through local fishery office. During peak season, when potential landings are higher than demand, each buyer submits his maximum daily need; the buyer must be ready to take this amount every day. During peak periods, sailings are rotated so landings do not exceed total orders. When landings are low, the available sardines are allocated among buyers in proportion to quantity taken during peak season. There are 18 canners and 8 fish-meal plants.

As in other ports, sardines are off-loaded at dock by the tedious technique of shoveling fish into small wicker baskets, which are hand-passed up to the dock. If slated for canning, the fish are salted and boxed before loading on trucks for transport to cannery several miles away. Reduction fish are dumped directly into open trucks; at weighing station, a dye is put on reduction fish.

Essaouira

Less important than Safi or Agadir, Essaouira (Mogador) is easily the most picturesque. The port has 7 canneries, 2 fish-meal plants, and one freezing plant. Only 10 vessels are permanently based here; however, up to 60 arrive from other areas during height of sardine run. Vessels fish under contract with the plants. In 1968, nearly 30,000 tons of sardines were landed.

Other Ports

Casablanca, Al Hoceima, and El Jadida account for major share of sardines landed at other ports. All but a limited quantity are sold on fresh-fish market.

Sardine Prices

Prices generally are set annually after discussions among processors, vessel owners, fishermen, and government officials; the prices are published in a government decree. In 1969, prices fixed for sale of sardines destined for canning, freezing, salting, and export were in 2 categories:

1) Quality fish for industrial use, 50 count per kg. or less: Agadir--US$76 per metric

ton; Essaouira and Safi--$80 per ton. Vessel owners received $8 per ton of purchase price to amortize cost of nets. Balance is shared 60-40 by crew and vessel owner.

2) Low-quality fish or fish not fit for human consumption: Agadir--$20 per ton; Essaouira--$12 per ton; Safi--$13 per ton. No net bonus paid out of purchase price for such fish.

At each port, there is a government fishery office. Each lot of sardines going to canners is sampled. The sample is sorted by an official who separates canning-quality fish from noncanning quality. Size, freshness, and appearance are criteria. Proportion between the two in sample is basis for payment of entire lot.

For sardines higher than 50 count per kg., prices are negotiated in each community.

Sardines for reduction were: Agadir--$14.50 per ton; Essaouira, $17; and Safi, $18. A net bonus of $1 per ton is paid out of purchase price at Agadir and Essaouira.

Some Observations

The strength and viability of the Moroccan fishing industry appears related to sardine industry. By far the greatest amount of capital investment is in sardine canneries, fishmeal and oil plants, and vessels: 75 canneries, 18 meal plants, and around 250 vessels (mostly wood, small, and overmanned). The industry also accounts for major part of fishery earnings.

At the same time, it is generally recognized that the sardine industry could benefit greatly from more efficient equipment and improved techniques. The government can help because it sets price for fish, level of wages, cost of cans and other canning needs, and has roles in marketing, and in licensing vessels and plants. A solution is being sought to problem of how to introduce new and more efficient equipment in fishing and canning without displacing workers. This and other problems including shortage of capital and credit are being faced.

Consolidating canneries and diversifying and upgrading sardine products are other measures being pursued. OCE and the canners are working harder to find more export markets.

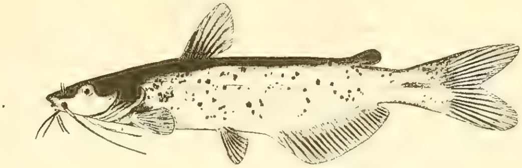
Fishing Changes Slower

In fishing, change has been slower. The question debated is how to innovate without harming owners and reducing jobs. One suggestion is licensing reduction plants around Ifni and to the south and drawing off excess vessels, fishermen, and plant workers from Agadir-Safi area. This probably would be effective if properly executed. Another suggestion would permit introduction of improved vessels to replace one or more old vessels, with possibly some type of work or earning guarantee to crews of replaced vessels.

Foreign investment in sardine and other fisheries is being encouraged by the government and could be helpful. Fiscal measures as an aid and incentive to modernize are another possibility being mentioned.

Considerable improvement is possible in the Moroccan sardine industry--but will require the cooperation of government agencies and the industry. Concerted effort is needed in sales, processing, production (vessel owners and fishermen), and in research to determine stocks and location of sardines.

FOOD FISH FACTS



CHANNEL CATFISH
(Ictalurus punctatus)

Catfish have been a popular and plentiful food fish through thousands of years. Folklore abounds with tales of catfish which sometimes grew to 6 feet in length and weighed over 100 pounds. There is a wide variety of catfish which includes the gafftopsail and sea catfish which live in the ocean. Some of the fresh-water catfish family includes the yellow, brown, black, and flat bullheads; the stonecat; the widemouth and toothless blindcats; more than 10 varieties of madtoms; and the white, blue, headwater, yaqui, and flathead as well as the channel catfish.

DESCRIPTION

All catfish have long barbels about the mouth used for locating food, are scaleless, and have heavy, sharp pectoral and dorsal spines. Channel catfish, considered by many to be the best eating, are easily distinguished from other catfish by their deeply forked tails, a relatively small head, and small irregular spots on the sides. The channel is the most active of all catfish and grows quite large, the world record is 57 pounds. A desirable fish to many sportsmen, it can be caught with a variety of baits and lures and provides considerably resistance at the end of a fishing line.

HABITAT

Most catfish inhabit warm, quiet, slow-moving waters. Channel catfish prefer large rivers and lowland lakes with clean bottoms of sandy gravel or boulders. They adapt readily to new environmental conditions and stocking this species in new waters is usually successful. Although catfish originally were found mainly in Mississippi basin waters, they now inhabit waters in many parts of the United States.

CATFISH FARMING

For many years the catfish market was adequately supplied by commercial fishermen who harvested wild catfish. In recent years the catfish population has decreased as has the number of men who harvest them. However, the demand for catfish has not declined and, because of this, more and more farmers have been changing their fields from agricultural activities into catfish ponds. In ten states, ranging west from Florida into Texas and extending as far north as Kansas and Missouri, approximately 26,000 acres were utilized in intensive catfish farming in 1968. The channel catfish is usually the species chosen for these ponds because of their choice flavor, adaptability, and faster growth. It is estimated that in a 210-day growing season, the channel catfish will attain a weight of $1\frac{1}{2}$ pounds, if not overcrowded. The recommended stocking per acre to attain this growth is considered to be 1,000 six-inch fingerlings. If more fingerlings are stocked per acre, the growth will be less in the same number of days.

The catfish farmer has a choice of procedures after his fields have been converted into ponds. He may buy fingerlings from other farmers and feed them to market size. Or he may breed the catfish, raise the fingerlings for sale, or use them to stock his own ponds and feed them to market size. Some farmers also dress and deliver the catfish to market or to processors.

(Continued following page.)

CATFISH FARMING (Contd.)

Raising catfish is not simply a formula of "have water, add fish, reap instant money." The initial investments run high and costly mistakes are easily made. Added to the cost of the land is the cost of pond construction. Ponds should be constructed in soils that hold water, the bottoms should be well graded and completely cleared to permit seining at harvest. Quality of the water is important and the water system must be adequate to get water to the ponds as well as draining water from the ponds before restocking. These are just a few of the problems that must be met by the successful catfish farmer. However, the future of catfish farming is bright and the market demand is increasing as more and more people are becoming aware of this fresh-water, pond-cultured delicacy.

CONSERVATION

The Bureau of Commercial Fisheries seeks and defines new and under-utilized fishery resources and develops improved harvesting methods and gear as part of its service to the United States fishing industry. To aid the increasingly important catfish industry, Bureau research personnel perfected a seining system with a mechanical haul and demonstrated its use in harvesting pond-cultured catfish. The mechanized seining and conveyor equipment reduced the time and labor required for harvest.

USES OF CATFISH

Catfish can be bought as steaks, fillets, whole dressed, and skinned dressed. The tender, white, nutritious flesh can be prepared in a variety of ways. It is good eating either baked, broiled, grilled, barbecued, smoked, sauteed, or stuffed. (Source: National Marketing Services Office, BCF, U.S. Dept. of the Interior, 100 East Ohio, Room 526, Chicago, Ill. 60611.)

The Bureau of Commercial Fisheries has published an exciting, full-color booklet that is chock-full of ideas using tasty catfish. It is called "Fancy Catfish," Fishery Market Development Series No. 6 (I 49.49/2:6). For your copy, send 256 to the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402.

(Recipe p. 67.)

CATFISH CANTONESE--PLEASE WITH EASE

Did you know that commercially-raised channel catfish are rapidly becoming one of the more popular fresh-water delicacies on the market today? Gourmets insist that pond-cultured catfish have a flavor superior to most wild catfish. Specialty restaurants and drive-ins featuring catfish are already being built and others are in the planning stages to take advantage of this new popularity. Why? Probably the reason is the quality of the fish. Today's increasing market demand is largely supplied by an ever-growing group of farmers who are changing their fields from agricultural activities into catfish ponds. Ranging west from Florida into Texas and extending as far north as Kansas and Missouri, there were approximately 26,000 acres in ten states which were utilized in intensive catfish farming in 1968.

Catfish Farmers of America, a new organization, hopes to control the marketing of its products and maintain high quality throughout the entire rearing, processing, and marketing pattern. In order to assure that pond-cultured catfish are top quality, catfish farmers are using scientifically-proven techniques and balanced food formulas. Also important is the construction of the ponds which must have sloping sides and a relatively constant water depth, a little deeper in winter than in summer. The cleanliness and temperature of the water, the amount of oxygen in the water, and the absence of predators are only a few of the many precautions followed to produce a quality product.

According to the Bureau of Commercial Fisheries, all catfish are good eating--especially the channel catfish. This fish may be identified by its deeply forked tail, an easy check for the Consumer. Pond-cultured catfish are usually harvested at about $1\frac{1}{2}$ years of age and weigh from $\frac{3}{4}$ to $1\frac{1}{4}$ pounds. The flesh of catfish is white, tender, and tasty, and is an excellent source of high-quality protein, vitamins, and minerals.

Catfish may be prepared in dozens of different ways, but broiling is one of the easiest. "Catfish Contonese," a Bureau of Commercial Fisheries tested recipe, is particularly good eating. The fish are broiled with a lemony-butter sauce until flaky, then served with a hot sweet-sour topping. This topping is distinctive because it has just a touch of soy sauce to bring an unusually appetizing taste to this catfish entree. Look for pond-cultured catfish in your market and try "Catfish Cantonese" soon.

CATFISH CANTONESE

- 3 pounds pan-dressed skinned catfish or other fish, fresh or frozen
- $\frac{1}{4}$ cup melted butter or margarine
- $\frac{1}{4}$ cup lemon juice
- $1\frac{1}{2}$ teaspoons salt
- $\frac{3}{4}$ teaspoon paprika
- Dash pepper
- Sweet-Sour Sauce
- Julienne cut strips of fresh carrots, celery, and green pepper

Thaw frozen fish. Remove fins and tails. Clean, wash, and dry fish. Place fish in a single layer on a well-greased baking pan, 15 x 10 x 1 inches. Combine remaining ingredients except Sweet-Sour Sauce and vegetables. Brush fish inside and out with sauce. Broil about 6 inches from source of heat for 8 to 10 minutes. Turn carefully and baste with remaining sauce. Broil 8 to 10 minutes longer or until fish flake easily when tested with a fork. Place fish on a warm serving platter. Pour hot Sweet-Sour Sauce over fish. Garnish with vegetables. Makes 6 servings.

SWEET-SOUR SAUCE

- $\frac{1}{2}$ cup water
- 3 tablespoons catsup
- 3 tablespoons soy sauce
- 3 tablespoons sugar
- $1\frac{1}{2}$ tablespoons vinegar
- 2 tablespoons cold water
- 1 tablespoon cornstarch

Combine water, catsup, soy sauce, sugar, and vinegar in a 1-quart sauce pan. Heat. Combine water and cornstarch. Add to sauce and cook until thick and smooth, stirring constantly. Makes approximately 1 cup sauce

(Source: National Marketing Services Office, BCF, U.S. Dept. of the Interior, 100 E. Ohio, Room 526, Chicago, Ill. 60611.)

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UNITED STATES DEPARTMENT OF THE INTERIOR
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Philip M. Roedel, Director, BUREAU OF COMMERCIAL FISHERIES

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States -- now and in the future.

BACK COVER: Lifting pound net to purse mostly alewife for unloading in lower Potomac River. (Photo: J. B. Rivers)

COMMERCIAL FISHERIES Review

VOL. 32, NO. 3 MARCH 1970

COVER: Loading oyster shells for planting as cultch.

COMMERCIAL FISHERIES

Review

A comprehensive view of United States and foreign fishing industries--including catch, processing, marketing, research, and legislation--prepared by the Bureau of Commercial Fisheries.

FISHERMEN'S MEMORIAL--GLOUCESTER, MASS.

Managing Editor: Edward Edelsberg
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The Bureau of Commercial Fisheries and The Bureau of Sport Fisheries and Wildlife make up The Fish and Wildlife Service of The United States Department of the Interior.

Throughout this book, the initials BCF stand for the Bureau of Commercial Fisheries.

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CONTENTS

Transferring king crab from weighing bucket to processing-plant cart. (BCF-Alaska photo: J. M. Olson)

THE U.S. FOOD SITUATION

The average American ate a record amount of food in 1969 and paid over 5% more for it. This year there likely will be slightly more food supplies per person, but retail prices will rise again--perhaps $3\frac{1}{2}$ to 4%. It will reflect continued strong demand. This is reported by the U.S. Department of Agriculture.

Food consumption per person in 1969 was a record 106% of 1957-59 average. It was slightly higher than 1968. The increase came primarily in chicken and turkey, vegetable oils, fresh and processed fruits, and processed potato products. Consumption of red meat per person was slightly less--more beef but less veal, lamb, and pork. Consumption of eggs, milk, and most manufactured dairy products declined. Cheese consumption increased.

Fishery-Product Consumption Steady

Although per-capita consumption of fishery products has remained constant, total consumption of fresh and frozen food-fish products has increased faster than domestic landings. The gap has been filled by imports of food-fish products.

Retail Prices Up

Despite continued high level of food availability, retail prices rose sharply in 1969. The year's average was 5.2% above 1968; prices in December 1969 were 7.2% above a year earlier.

Restaurant food prices moved up steadily throughout 1969. Red meats and eggs led in price advances for store-bought food. Most other food-store items also rose, but prices of fats and oils leveled, and prices of fresh fruit declined.

1970 Predictions

Per-capita food supplies are expected to gain slightly in 1970. Consumption of poultry and processed fruits likely will rise substantially; that of eggs and fish probably will rise moderately. Beef production and consumption will be up, but veal and lamb again will be down. Pork production will be down until later in 1970, then increase, so total red-meat per-capita consumption may be about 1969 level.

1970 Fish Consumption

In 1970, civilians will eat about 1,230 million pounds of fishery products (edible weight). One quarter will come from groundfish: such as cod, haddock, hake, Boston bluefish (pollock), and ocean perch; about 60% of this will be imported. Landings of flounders, cod, ocean perch, and Boston bluefish are expected to rise above a year ago, while haddock landings will drop to a record low. The decline in haddock landings may more than offset any gains in other groundfish.

NORTH ATLANTIC SHRIMP INDUSTRY EDGES SOUTH

On the U.S. Atlantic Coast, the northern shrimp fishery appears to be edging southward, reports BCF. The northern shrimp used to be harvested almost exclusively within 50 miles of Portland, Maine, and marketed as "Maine shrimp."

BCF has promoted frozen Maine shrimp at international food fairs. Introduced in London in 1966, it has been well received in France, Germany, Italy, Sweden, and the Netherlands. About 50% of Maine's shrimp production for the 1968-69 season was exported to Western Europe, mostly to Sweden.

Enter Non-Maine Fishermen

Biologists do not know where these deep-water shrimp mature, but they move shoreward to spawn and are caught then. Maine's commercial fishermen have harvested the small pink shrimp as a winter crop--from September or October into April or May.

However, BCF exploratory fishing has shown the shrimp within reach of other coastal states; also, that traditional shrimping season can be extended through summer. As a result, vessels from Massachusetts and New Hampshire moved into the fishery in 1969.

In 1969, Maine fishermen caught about 24.5 million pounds worth around $3 million; Massachusetts landed 4.5 million pounds worth about $500,000, and New Hampshire about 100,000 pounds valued at $12,000.

A new processing plant capable of handling up to 200,000 pounds of shrimp a day is being built on Gloucester (Mass.) State Fish Pier.

Northern & 4 Florida Species

As the northern shrimp fishery expands, BCF marketing specialists speculate that the shrimp may be marketed more widely under a more general name. In the Gloucester area, it is "just shrimp" because it is the only commercial shrimp species there.

In Florida, the picture is somewhat different. There, fishermen land 4 different species--the white shrimp, a somewhat larger brown shrimp, the southern pink (not the same species as the northern shrimp), and royal reds.

Despite this formidable competition, the delicate flavor of the northern shrimp, marketed frozen as a novelty, has won it considerable popularity among Florida gourmets.

Availability Fluctuated Sharply

Northern shrimp are too small and too delicate to be processed by conventional methods. Until the advent of special equipment and techniques, the shrimp either were peeled by hand or sold whole (unpeeled). Besides processing problems, industry development has been hampered by sharp fluctuations in availability. In the 1930s, the northern shrimp was abundant in the Gulf of Maine. By the 1950s, it had practically disappeared. Then, in the late 1950s, it became abundant again.

Mysteries About Shrimp's Environment

Little is known about environmental factors that control the young shrimp's chances of survival to adulthood. Biologists believe the life span is about 4 years. During the last year of life, the shrimp, which begins its adult life as a male, changes to female and moves in toward the shore to spawn.

INTERIOR DEPARTMENT INSPECTED VAST AMOUNT OF FISH IN 1969

During 1969, the inspection service of the U.S. Department of the Interior (USDI) inspected or graded over 328 million pounds (edible-weight basis) of fish and fishery products. About one million pounds of the total were rejected for noncompliance with USDI Grade Standards or product specifications.

The 1969 amount inspected was about 28.5% of the volume processed in the U.S. each year--and 12% of U.S. annual consumption.

GOOD DEMAND FOR PUGET SOUND PACIFIC HAKE

The demand for Puget Sound hake is good this year. Two factors have helped to stimulate it: 1) the formula for the Oregon moist pellet has been changed. Now hake and hake meal can be used in place of other ingredients; and 2) the increase in world price of fishmeal.

Peruvian fishmeal, for example, rose from \$172 per ton (f.o.b. New York and Gulf ports) in September 1969 to \$204 per ton in December 1969.

Fishermen are receiving \$15 to \$20 per ton for hake, compared to \$12 to \$20 last season.

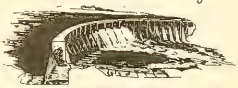
The Fishery

The seasonal fishery begins in September or October and extends through May or June. The catch for the 1969-70 season during September through January is 1,000,000 pounds; for the same period last season, it was 1,700,000 pounds. Generally, fishing improves significantly during the season's second half, when hake are more concentrated and available in the area of Port Susan. Last season's catch was 9,000,000 pounds.

NEW DEVICE PROTECTS SALMON AT LOW-HEAD DAMS

A prototype fish-guiding device has been installed in a turbine intake of Ice Harbor Dam (Snake River, Washington). It is a large traveling screen designed to divert salmon fingerlings from the turbine, where many die. After a week's trial, under maximum turbine load conditions, its mechanical operation has been successful. Its efficiency in diverting salmon fingerlings from the turbine will be measured this spring, when their seaward migration starts.

The device is a key part of a bypass system being developed to protect salmon fingerlings of the Upper Snake River in their migrations past seven dams on their way to the sea.



OYSTER STUDIES YIELD IMPORTANT INFORMATION

A Federal-state study of shellfish in Pacific coast bays revealed a relatively high mortality in native oysters and mussels from Yaquina Bay, Oregon. However, the Pacific oyster, more than 99% of the oysters marketed commercially, has not been affected. State fisheries agencies of Oregon, Washington, and California have cooperated with BCF, University of Washington, and the Pacific Coast Oysters Growers Association in investigating causes of oyster mortalities since 1965.

Lab Examination

Experimental planting of native oysters in Yaquina Bay suffered mortality rates from 18 to 30%, or more, per year. Samples of oysters from the trays examined microscopically by biologists at the BCF laboratory in Oxford, Maryland, and at the University of Washington showed a condition that appeared serious enough to cause the oyster deaths. Although similar conditions were observed in mussels taken from Yaquina Bay, it was not found in the Pacific oysters examined from the same area.

No Public Health Threat

No name has been given to the condition present in these native oysters and mussels.

The cause has not yet been identified. Scientists say the disorder could be caused by environmental factors, or by a virus. The Boards of Health in Oregon and Washington reviewed the problem and do not view the native oyster condition as a threat to public health.

In contrast to the high mortality rates of native oysters and mussels, Pacific oyster mortality in Yaquina Bay is the lowest observed on the Pacific coast. In fact, experimental plantings of Pacific oysters in Yaquina Bay, as part of the coastwide mortality study, were used as a "control" for comparison with plantings in other bays, where Pacific oysters have higher death rates.

OYSTER-MEAT QUALITY INDEX REPORTED

A plump, creamy-white oyster meat that generally fills its shell cavity is considered of high quality; a shrunken transparent oyster meat with a high water content that does not fill the shell cavity is considered of low quality. Using this basis, the Virginia Institute of Marine Science has been conducting surveys in the rivers of Virginia to determine the condition of oysters.

Survey's Results

As a result of these surveys, the Institute developed an acceptable measure of quality and relative yield--designated the "Oyster Meats Quality Index." It can be used to compare the actual size of an oyster meat with the space inside the shell cavity. The index's chief value is to provide industry with a useful tool for comparing the potential yield of oysters of the same size, different growing areas, and from one season to the next.

Where To Get Index

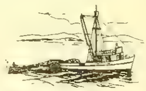
The index was reported in the Jan. 1970 issue of the Institute's "Marine Resources Information Bulletin." It may be obtained from the Institute at Gloucester Point, Virginia 23062.

FISHERIES SURVEY OF AMERICAN SAMOA SLATED

The research vessel 'Charles H. Gilbert' of the BCF Biological Laboratory, Honolulu, sailed for American Samoa to conduct the first systematic survey of the area's fishery resources. The Government of American Samoa is cooperating.

The islands are headquarters of a large fishing industry. The two U.S.-owned canneries there are supplied by about 100 vessels from Japan, Korea, and Taiwan. The bulk of the catch is albacore tuna. Much of the product is exported to mainland U.S.

The survey, however, will concern itself with skipjack tuna, for which there is growing demand in the fishing industry.



SCIENTISTS WARN AGAINST ADDING DDT TO ANTI-FOULING PAINT

The Virginia Institute of Marine Science (VIMS) is concerned about continuing reports of oyster-boat owners mixing DDT with copper anti-fouling paint. The mixture is used on boat bottoms to control scurf, borers (worms) and barnacles. This is an extremely dangerous practice "because DDT is one of the most toxic pollutants that can be put in water," VIMS scientists warn. They say its value in protecting boat bottoms has never been proved and it may, in fact, do more harm than good. DDT could change the paint and cause it to flake off--exposing bare wood to infestation.

Shellfish Concentrate DDT

Shellfish, especially oysters, concentrate DDT in their bodies to levels approximately 10,000 times those found in the water. One pound of DDT can contaminate a billion pounds of water. This would be sufficient to load over 100,000 bushels of oysters with enough DDT to justify seizure by health authorities.

Recommends Better Grade of Paint

If the usual 'soft' copper anti-fouling paints are not giving the required protection, VIMS recommends using a better grade of copper, rather than adding materials like DDT. Some paints now on the market were formulated for tropical areas, where fouling and worm problems are more severe than in Chesapeake Bay. Use of these paints on a properly prepared bottom should provide the necessary protection, without endangering the very seafood products the boats are meant to harvest.

DEALERS INTERESTED IN ALASKAN SEAFOOD

BCF marketing personnel report that seafood dealers in Central and Southwestern States have expressed interest in handling fresh and frozen Alaskan seafood products. Airlines flying between the Western States and Alaska are anxious to fill space. They are willing to discuss special freight rates to instal cold-storage facilities for emergency and temporary holdings. Also, they would facilitate transfer of Alaskan seafoods to eastbound transporters.

Alaskan fishery-product containers assembled on the beach near waters from which products came. (Photo: J. M. Olson)

BCF Coordinates These Interests

BCF personnel are working with Alaskan producers, transporters, and dealers to coordinate their interests in developing markets for these products in Central and Southwestern States.

INTERIOR HONORS BCF SCIENTISTS

Dr. Reuben Lasker, BCF Fishery-Oceanography Center, La Jolla, Calif., has been awarded Interior Department's Meritorious Service Award by Secretary Walter J. Hickel. The award recognizes his outstanding contributions in the physiology of marine organisms, both fish and invertebrates.

Secretary Hickel cited Dr. Lasker's accomplishments in the study of the energy exchange between fishes and their food supply. Dr. Lasker has studied 3 main organisms of the California Current food web, a euphausiid shrimp (a common food organism of pelagic fishes), the Pacific sardine, and the northern anchovy. He discovered that the efficiency of energy transfer of phytoplankton and small zooplankton to euphausiids is about 10% over the animal's life span. Similar studies on adult sardines and anchovy showed the relationship of food needs of these fishes to the energy available in the zooplankton. The studies can be used to predict how much food must be available in the sea to sustain fish populations. He is the author of more than 30 scientific publications in this specialized research.

Dr. Lasker, 40, joined BCF in 1958, after receiving his Ph.D. in Zoology from Stanford University.

Richard A. Barkley of BCF's Biological Laboratory in Honolulu won Interior Department's Meritorious Service Award for his contributions to oceanography.

Secretary Hickel cited Barkley's "Oceanographic Atlas of the Pacific Ocean" and his studies of the interaction of the Kuroshio and Oyashio currents off Japan. The atlas was published by University of Hawaii Press in 1968. It is an analysis of the physics and chemistry of the ocean's upper layers down to about 5,000 feet; it draws upon 50 years of oceanographic observations.

Barkley's investigations of the Kuroshio-Oyashio consisted of a theoretical treatment of what happens when the two streams of water--one warm, one cold--meet. They help explain heretofore-puzzling aspects of the ocean circulation. They offer clues to the physical processes that sustain Japan's immense fisheries.

Barkley, 40, joined the Honolulu Laboratory in 1960 shortly after receiving his Ph. D. in oceanography from the University of Washington.

'SQUOXIN' IS A SELECTIVE TOXIN FOR SQUAWFISH

A selective fish toxin that will turn squawfish belly-side up--and leave trout, salmon, steelhead, and other desirable species unharmed--is a management tool scientists have long been seeking. Squoxin, a nonchlorinated hydrocarbon that kills the highly predacious squawfish and leaves other fish swimming happily, is a big step in this direction.

Releases of young salmon and trout from fish hatcheries are especially vulnerable to squawfish. As many as 250 young salmon have been found in the digestive tracts of squawfish.

Squoxin Developed

The squawfish-killing chemical was developed by Dr. Craig MacPhee, professor of fisheries at the University of Idaho, after 4 years of research and testing. The search was sponsored by BCF's Columbia Fisheries Program Office.

The selective toxin, Squoxin, acts on the squawfish's nervous system as a vaso-constrictor; it prevents efficient use of oxygen and the proper function of the blood vessels. The chemical is applied to the stream or lake environment--.1 part per million--and kills squawfish, while not harming salmon and trout. The toxin also kills a very few dace and shiners--an indicator that the proper amount of toxin is being metered into stream. It has no effect on aquatic insects or other fish foods, humans, or land animals.

Slow-Working, Short-Lived

Squoxin is a relatively slow-working but short-lived toxin. It becomes ineffective within hours. The first dead squawfish are seen 3 hours after squoxin is applied, and more are dying 24 hours later. Because of squoxin's short life, it must be applied over a long period.

One amazing characteristic of the toxin is that squawfish apparently have no sense of danger, or are aware that they are being killed. With other fish-killing chemicals, such as rotenone, fish of all kinds try desperately to escape with the very first whiff. Squawfish have moved miles downstream to get out of rotenone's effective range.

Field Tests

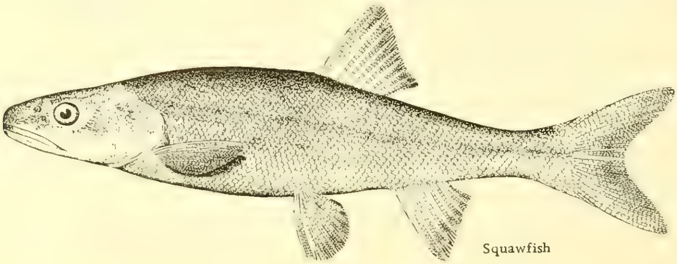
During experimental field tests, squawfish, trout, young salmon, steelhead, and other fish were observed swimming directly below the point where the squoxin was being put into the water. They appeared unaware of the chemical.

The first indication of squawfish distress is an apparent weakening, followed by a slow drift downstream, and then loss of equilibrium. Distress is noted 2 to 3 hours after the start of chemical application. Exact counts of dead squawfish are very difficult to make. But, in one test, it was estimated that about 200,000 squawfish were killed in an 8-mile section of stream.

Squoxin can be an exceptional fishery management tool to help control squawfish, especially in areas heavily populated by squawfish and salmon and trout.

Laboratory experiments on mammals have indicated that this selective chemical is perhaps five times less toxic than table salt when administered to experimental animals on a specific volume-per-unit weight basis.

A patent has been issued to the U.S. Government and the principal investigators by the U.S. Patent Office.



Squawfish

OCEANOGRAPHY

USC STUDIES SANTA BARBARA OIL SPILL EFFECTS

"Keep those (drift) cards coming in, folks," University of Southern California (USC) scientists have asked the public. The scientists are conducting a year-long study of the effects of the Santa Barbara Channel oil spillages.

The drift cards, brightly colored and encased in watertight polyethylene envelopes, are being used to trace ocean currents. They have been released periodically throughout the Santa Barbara Channel from USC's research vessels 'Velero IV' and the 'Golden West.'

Since March 1969, 12,500 drift cards have been released. The final drop was scheduled for Feb. 8-17, 1970.

Public Cooperation Asked

The cards wash up on beaches and other waterfront areas. Finders are asked to discard the plastic envelopes, indicate on the cards where and when they were found, and then mail them (postage-prepaid) to USC.

SURFACE SLICKS HAVE 10,000 MORE PESTICIDE THAN ENCIRCLING WATER

Concentrations of up to 13 parts per billion (ppb) of chlorinated pesticides were measured in natural surface slicks in Biscayne Bay, Florida, by Dr. Eugene F. Corcoran and Dr. Douglas B. Seba of the University of Miami Rosenstiel School of Marine and Atmospheric Sciences. The researchers also found that water surrounding the slicks generally contained less than 1 part per trillion--or less than 1/10,000--of the pesticides found in the slicks.

Dr. Corcoran said: "Natural surface slicks may explain the occurrence of pesticide residues in penguins in the Antarctic, or the disappearance of pelicans from nearly all of the U.S. seacoasts. In Biscayne Bay, for example, we have observed gulls and pelicans diving into surface waters to feed on the dense schools of small fish that feed on plankton concentrated in the slicks. Since these sea birds eat many times their weight in fish, they eventually have more pesticide concentrated in their tissues than the fish did."

"Surface slicks are natural oceanographic phenomena which appear as calm streaks or patches on the otherwise rippled surface of lakes, coastal waters, and open ocean areas," added Dr. Seba. "In our aerial surveys of Biscayne Bay, we have observed slicks varying from a few meters to over 100 meters in width and up to several miles in length. During the summer of 1968, aerial photographs revealed that about 10% of the bay was covered with these slicks"

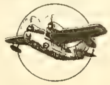
How Slicks Induced

The slicks may be wind-induced or may occur where two water masses converge. The converging water causes compaction of the film of dissolved organic and inorganic molecules normally found on the surface of biologically productive waters; this provides a tremendous supply of nutrients. Some nutrients are used directly by phytoplankton (microscopic floating plants); others combine into small particles and are used by filter-feeding animals.

Pesticides In Atmospheric Dust

The cycling of pesticides depends not only on food-web interactions, but on interaction between atmosphere, water, silt, and bottom deposits. Dr. Seba and Dr. Joseph M. Prospero found in a study that atmospheric dust collected at Barbados, West Indies, after it had crossed 4,000 miles of open ocean, contained appreciable amounts of chlorinated pesticides. The latter were similar to those found in Biscayne Bay surface slicks. The scientists believe this indicates that Atlantic tropical tradewinds are responsible for transporting significant quantities of pesticides from continents to the open-ocean ecosystem. They also found pesticides in the rainwater of tropical hurricanes.

The research was supported in part by Interior Department's Federal Water Pollution Control Administration, the National Science Foundation, and the Office of Naval Research.



ESSA VESSEL SEEKS EVIDENCE OF PACIFIC SEA-FLOOR SPREADING

U.S. oceanographers are investigating a little-known ocean area in the South Pacific south of Easter Island for evidence of sea-floor spreading. They are aboard the U.S. Coast and Geodetic Survey ship 'Oceanographer,' a "floating laboratory" manned by 95 officers, scientists, and crew.

Their investigation centers on the East Pacific Rise, a 3,000-foot underwater mountain range; the Chile Trench, a deep chasm in the seabed off South America; and the intervening area. The ocean there is about 15,000 feet deep.

Sea-Floor Spreading Theory

The study of sea-floor spreading is based on the theory that the ocean floor moves constantly and carries along the continents. The oceanographers are trying to determine the extent and rate of the spreading.

The oceanographers also are investigating the topography of the sea bottom. Little is known of sea-floor features in this area.

The ship will spend about seven weeks between Papeete, Tahiti, and Valparaiso, Chile.

DISCOVERIES SUPPORT A NEW THEORY OF SEA-FLOOR MOTION

Discoveries that support a new theory of sea-floor motion have been made by scientists in the Deep Sea Drilling Project. Geologist James D. Hays of Columbia University has reported "evidence that the major Pacific Ocean floor plate has moved at varying speed and direction during the past 35 million years." His findings support the theory that "the sea floor is being pulled away from the East Pacific Ridge by the force of gravity." It was believed before that the sea floor was "being pushed and dragged away by the force of convection currents" under it.

His conclusions are based on data gathered on the recently completed ninth leg of the Project, supported by the National Science Foundation. Dr. Hays was chief scientist during the 52-day voyage of the research vessel 'Glomar Challenger' across the equatorial Pacific from Tahiti to Panama.

BOTTLE DRIFTS 7 YEARS FROM GEORGIA TO FLORIDA'S GULF COAST

A bottle tossed into the Atlantic Ocean in June 1962 off Wassaw Island, near Savannah, Ga., by Explorer Scouts was found in the Gulf of Mexico off Ft. Myers Beach, Fla., 830 miles away, in July 1969.

The finder, Don B. Howard, of Ft. Myers, asked oceanographers of Commerce Department's Environmental Science Services Administration (ESSA) what route the bottle could have taken.

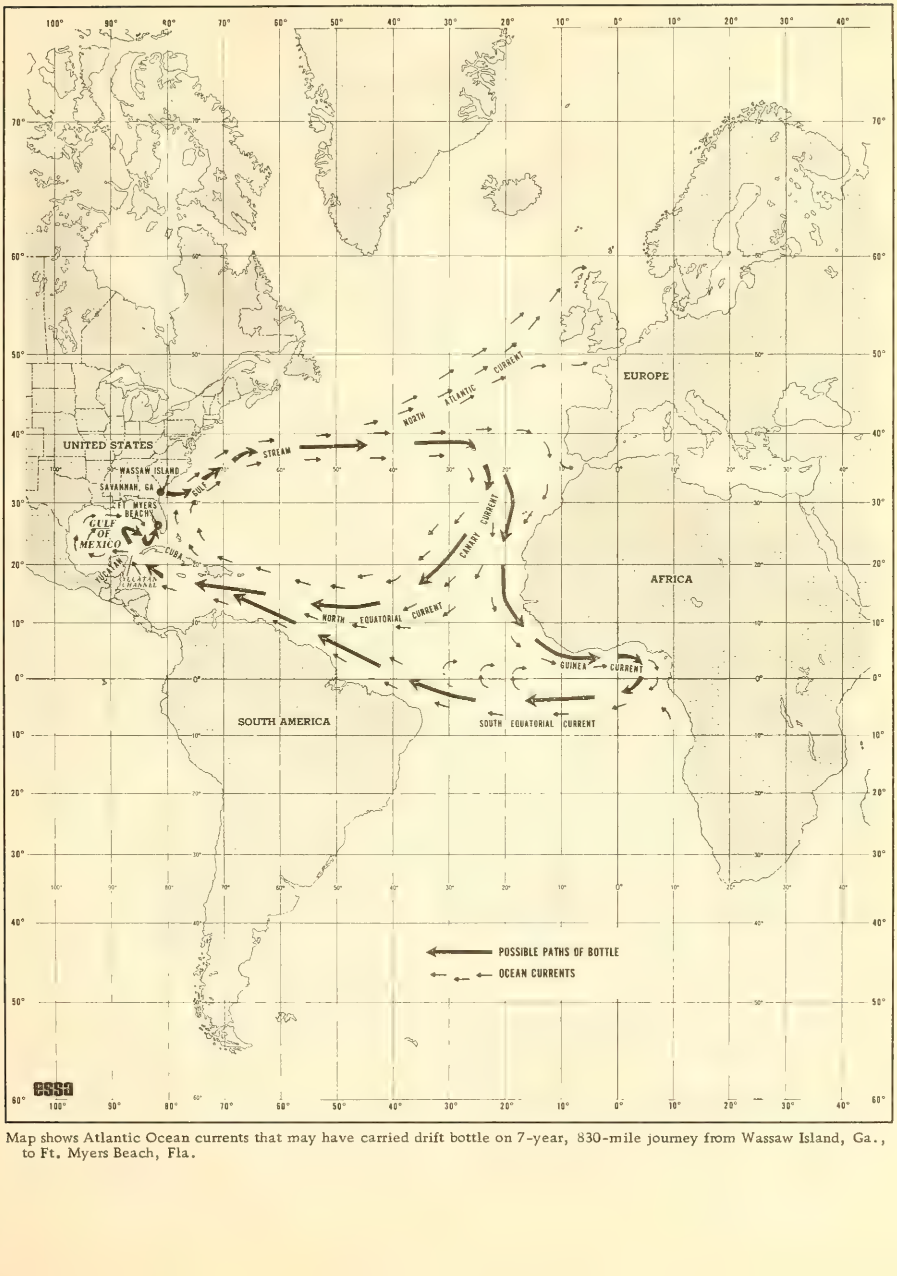
The oceanographers said it was impossible to track the route or estimate the miles traveled. Once the bottle was transported offshore at Savannah, it would have been picked up by the Gulf Stream and carried into the North Atlantic. From there to Ft. Myers Beach, it could have traveled several routes that would have taken it between Cuba and Mexico's Yucatan Peninsula into the Gulf.

The oceanographers said they could suggest probable routes, even though they could not pinpoint the actual route. The time and distance of the drift would vary with seasonal speed and location of ocean currents and local meteorological effects. They outlined these possibilities:

1. When the bottle was picked up by the Gulf Stream, it would have drifted at 2 to 4 miles per hour up the U.S. coast to vicinity of Cape Hatteras, N.C. There, it would move easterly across North Atlantic until caught by Canary Current. This current would carry the bottle southward, down Africa's bulge, and to North Equatorial Current, which would transport it westward across Atlantic into Caribbean. Then the Caribbean Current would transport it to the Yucatan Channel. From there it would pass into Gulf of Mexico and land on Ft. Myers Beach.

2. The bottle could have traveled a somewhat longer route. After drifting down North Africa's west coast, it could have been caught in the Guinea Current and carried south of African bulge to South Equatorial Current. This would have transported bottle across the Caribbean Sea, where it would follow the course outlined above.

In either case, it was considered probable that the bottle lay trapped in the rushes of the Georgia coastal swamps for a long time--until high tides and/or strong offshore winds freed it and caused it to drift far enough from shore to be picked up by the Gulf Stream.



Map shows Atlantic Ocean currents that may have carried drift bottle on 7-year, 830-mile journey from Wassaw Island, Ga., to Ft. Myers Beach, Fla.

SCHEDULE OF U.S. RESEARCH-VESSEL CRUISES PUBLISHED

The scheduled cruises and areas of operation of all U.S. owned or sponsored research vessels during March-September 1970 are included in the newest edition of "Oceanographic Ship Operating Schedules." The publication is the work of the Marine Sciences Affairs staff, Office of Oceanographer of the Navy, for the National Council on Marine Resources and Engineering Development.

What It Includes

The report includes expected cruise dates; area of operations; type of work--fisheries research, plankton studies, etc.

Scientists may apply for berth space to the agencies or institutions operating the ships.

Research data acquired during the cruises can be obtained from the National Oceanographic Data Center, Washington Navy Yard, Washington, D. C. 20390.

Free Copy

Single copies are free from: The Marine Sciences Affairs Staff, Office of Oceanographer of the Navy, Building 159E, Room 476, Washington Navy Yard, Washington, D. C. 20390.

NEW COAST PILOT PUBLISHED FOR SOUTHEASTERN ALASKA

The U.S. Coast and Geodetic Survey has published a new edition of "U.S. Coast Pilot 8," a 254-page nautical book describing the panhandle section of Alaska between the southern boundary and Cape Spencer. This area has a general ocean coastline of 250 miles and a tidal shoreline of 11,085 miles.

The last edition of Coast Pilot 8 was issued in 1962; the first in 1869.

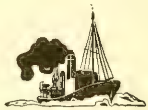
The new book costs $2.50. From: U.S. Coast and Geodetic Survey (C44), Washington, D. C. 20235. Annual Supplements are distributed free.

BCF COOPERATES WITH MAINE IN OCEANOGRAPHIC TRAINING

The Maine Maritime Academy and BCF conducted a cooperative oceanographic survey during the winter cruise of the Academy's training vessel "State of Maine'. Kenneth Honey, a plankton specialist at the BCF Biological Laboratory in Boothbay Harbor, supervised the collection of oceanographic data and instructed the midshipmen in survey techniques. Mr. Honey demonstrated the methods of sampling plankton. The midshipmen were told about new underway expendable surface and deep-water temperature-sensing system.

Collections Supplement Lab's Study

The collections were made periodically from Castine to Nassau. These will supplement the Boothbay Harbor Laboratory's ongoing investigation of oceanographic factors controlling the distribution of plankton. Information on composition and abundance of the eggs and young stages of fish in the samples will be used in studies of the commercial potential of underutilized fishes in the Atlantic's deeper waters. By participating in making the biological and hydrographic collection, the Academy's future merchant marine officers obtained firsthand experience with oceanographic sampling systems. An increasing number of these systems is being put on transoceanic cruises of commercial vessels used as "ships of opportunity" by oceanographers.



FOREIGN FISHING OFF U.S. JANUARY 1970

NORTHWEST ATLANTIC (Fig. 1)

Favorable weather in January permitted reasonably good surveillance of foreign fleets off New England and Middle Atlantic coasts; 88 foreign fishing and support vessels were sighted (80 in December 1969). No Soviet or Polish violations of 'no fishing' zone were observed.

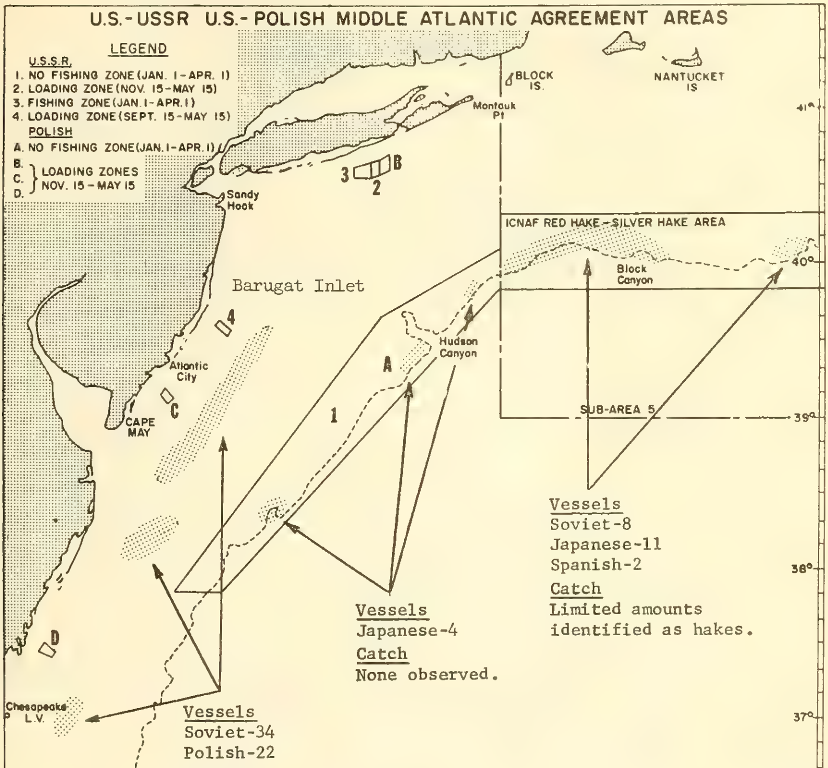


Fig. 1 - Foreign fishing vessels off southern New England and Georges Bank. Number of vessels, country of origin and species fished.

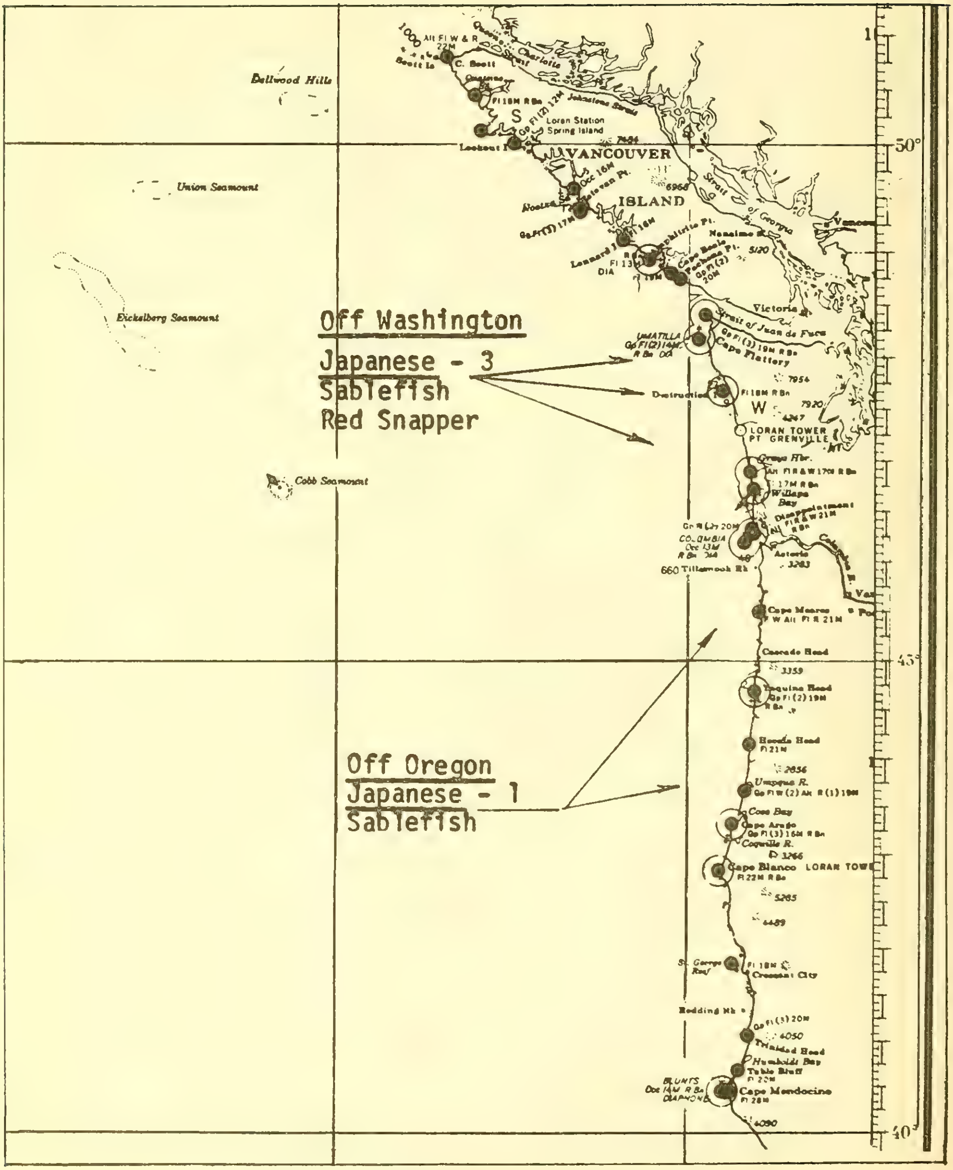


Fig. 2 - Foreign fisheries off U.S. Pacific Northwest.

Soviet: 34 medium side trawlers, 5 factory stern trawlers, 1 factory base ship, 2 refrigerated carriers.

Japanese: 15 freezer stern trawlers.

Polish: 14 large side trawlers, 7 freezer stern trawlers, 1 factory base ship.

East German: 3 stern and 4 side trawlers.

Spain: 2 side trawlers.

OFF CALIFORNIA

No foreign fishing vessels sighted.

On January 26, a BCF scientist boarded the Soviet research vessel 'Ogon' in Los Angeles Harbor. Ogon is participating in a joint U.S.-USSR survey of Pacific hake larvae off Baja California.

OFF PACIFIC NORTHWEST (Fig. 2)

Soviet: No vessels observed (none in Jan. 1969).

Japanese: 3 longliners--2 off Washington, 1 off Washington and Oregon (1 in Jan. 1969).

One longliner off Oregon caught sablefish with an estimated 75% success (percentage of hooks with fish attached). A longliner off Washington had only an estimated 15% success.

OFF ALASKA (Fig. 3)

Japanese: Between 40 and 45 vessels (10 fewer in December 1969; about same number in January 1969). Twenty-five stern trawlers and 2 refrigerated transports fished herring in central Bering Sea; 1 stern trawler fished ocean perch in Gulf of Alaska; 1 factoryship fleet took flatfish in eastern Bering; 2-4 longliners took sablefish in eastern Gulf; 5 stern trawlers fished groundfish in eastern Bering.

Soviet: Vessels increased in January for 3rd consecutive month, from 100 to nearly 190 (40% more than at end of January 1969).

Herring: 45 medium side trawlers, 40 stern trawlers, and 30 support vessels north of Pribilofs in central Bering. After midmonth, average daily catch per vessel was 25 to 30 metric tons. Some BMRTs took over 60 tons a day.

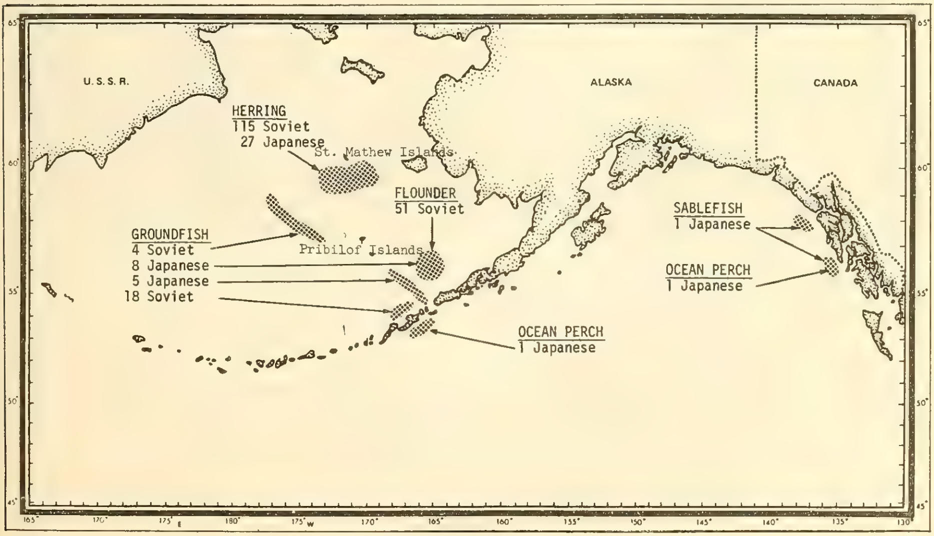


Fig. 3 - Soviet & Japanese fisheries off Alaska, January 1970.

Fig. 4 - Far removed from stormy seas, 7 Soviet vessels--from motherships to medium side trawlers--nest together to transfer fish and cargo while another side trawler approaches to make delivery. The vessels belong to the Soviet herring fleet operating near St. Matthew Island in the Bering Sea, and are anchored some 30 miles, or more, from the ice, but it is common practice for the ships to take shelter from seas and icing conditions by running inside the ice. All Soviet vessels in this winter fishery are reinforced for travel in pack ice. (Photo: M. C. Zahn; Date: December 31, 1969.)

Flounder: 30 medium side trawlers, 11 stern trawlers, and 10 support vessels in eastern Bering. Some set and hauled trawls over 10 times a day to fill required quotas

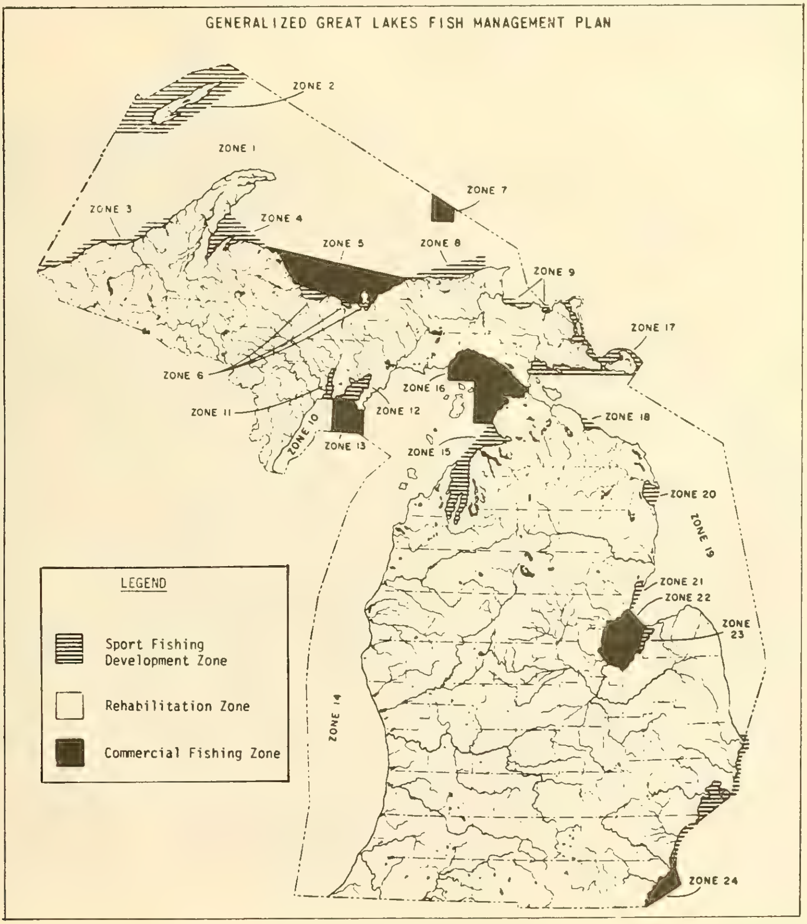
Groundfish: 17-22 trawlers along Shelf edge in Bering; 15 medium trawlers and 1 refrigerated transport north of Fox Islands in eastern Aleutians; 4 medium trawlers along Shelf edge in central Bering, northwest of Pribilofs.

MICHIGAN

GREAT LAKES WATERS ZONED FOR FISHERY MANAGEMENT

In Nov. 1969, the Michigan Natural Resources Commission adopted a zone management plan for its Great Lakes fishery. The plan aims to restore and further develop this resource. It establishes 3 distinct types of use areas in the state's Great Lakes waters for the purpose of managing the fishery in each according to its special problems and needs.

The accompanying map indicates the three types of zones and the sections in the lakes where each will apply. The zones are prescribed for: (1) Sport fishing development--inshore areas with either actual or potential high-quality sport fishery; generally will be



closed to commercial fishing. (2) Rehabilitation--open to sport and commercial fishing; the latter will be closely regulated, particularly the gill nets. (3) Commercial fishing--traditionally productive areas, which will be managed primarily for commercial species.

Number of Fishermen

The plan also regulates number of commercial fishermen. For 1970, it is expected that about 250 fishermen will qualify for licenses. The industry has declined: in 1950, Michigan had 1,460 licensed commercial fishermen; in 1969, only 350.

Species Decline

Species that have declined sharply in lakes Michigan and Huron are perch, walleyes, and herring.

MAINE

1969 PACK OF CANNED SARDINES DECLINED

The 1969 pack of canned Maine sardines has been estimated at 1,018,000 standard cases, worth $12.2 million. It was the smallest pack since 1964 and a drop of 681,302 cases from 1968's pack of 1,699,302 standard cases.

The Maine Sardine Council attributed the decline chiefly to (1) light landings caused by poor weather, (2) failure of late-fall run of fish, and (3) delayed packing at beginning of 1969 caused by large supply of imported and domestic packs.

OREGON

BCF HELPS FISHERMEN CONVERT TO SHRIMP SEPARATOR TRAWL

BCF's Seattle (Wash.) Exploratory Fishing and Gear Research Base and the Oregon State University Extension Service held a 2-day workshop, Jan. 28 and 29, 1970, to demonstrate to Newport, Oregon, fishermen the conversion of standard shrimp trawls to separator trawls. Twenty-two fishermen took part at some time during the workshop; 12 fishermen attended full time.

Two nets belonging to Newport fishermen were converted with all fishermen doing some of the actual work. This prepared them to work on their own.

More Sessions

Workshops were scheduled at Brookings and Astoria, Oregon, in February. These efforts have been received enthusiastically by the fishermen. It appeared that most of the Oregon shrimp fleet would be using separator trawls when the season opened March 1.

ALASKA

UNIQUE MARINE WEATHER FORECAST UNIT ESTABLISHED

BCF Juneau reports that the U.S. Weather Bureau, with Coast Guard and Navy cooperation, has established a forecast unit in Alaska reportedly the most sophisticated in the U.S. The unit is designed to supply weather information on a regular basis to mariners within 60 miles of the state's coastline.

Established in October 1969, the unit is the first of its kind in the U.S. It was a logical place to start the new program, says BCF Juneau, "because of the massive fishing and barging operations in Alaska--and because Alaska represents about 60 percent of the total U.S. coastline."

What Unit Does

The Weather Bureau provides information on "winds and general weather; issues a synopsis of the weather pattern; warns of any storms or other frontal activity which might be conducive to the formation of ice on vessels as the result of blowing spray; estimates visibility, particularly in fog, when it is expected to be reduced below three miles, and reports on sea ice where applicable."

Forecasts are issued for 6 areas:

- Southeast Alaska and North Gulf Coast
- Kodiak, Cook Inlet, and Alaska Peninsula, including Bristol Bay
- Pribilof Islands and southwest coast
- St. Lawrence Island, Norton Sound, Seward Peninsula, and Kotzebue Sound
- North Coast from Point Hope to Canadian Border
- Aleutian Islands

The unit is manned 24 hours a day by a 3-man staff.

* * *

'OREGON' STUDIES TANNER CRAB GEAR

A tanner crab gear research cruise was conducted from BCF's 'Oregon' near Kodiak Island by staff of BCF's Exploratory Fishing and Gear Research Base, Juneau, Alaska.

Principal objectives were: (1) to test relative efficiency of four pot types for capturing male tanner crab, and (2) to test relative effectiveness of different baits. A conical pot modeled after Japanese tanner crab pot was among types tested.

1 Pot Twice As Efficient

A 6' by 6' by 30" model of a modified king crab pot averaged 47.9 pounds of male tanner crab per pot catch; it was almost twice as efficient as the other types tested.

Bait Effectiveness

The combination of fresh Pacific cod and ground frozen herring averaged 74.9 pounds of male tanner crab per pot catch; it was over twice as effective as the other baits. Fresh Pacific cod was second most effective bait. It was followed by ground frozen herring and the BCF Seattle Technological Laboratory's emulsified experimental bait.

Kodiak, Alaska. (Photo: J. M. Olson)

A drift gillnetter and oil rig vie for space in Cook Inlet, Alaska. (BCF-Alaska photo: J. M. Olson)

WORLD DEMAND FOR SHRIMP & PRAWNS MAY OUTSTRIP SUPPLY DURING NEXT DECADE

Donald P. Cleary

Rising incomes in the United States have been an import determinant of sharp increases in the demand for shrimp. This same force--and associated improvements in distribution and use of frozen foods--is now creating a greater demand for shrimp throughout the world. The U.S. will have to compete increasingly with other countries for limited shrimp and prawn resources. Assuming demand in other countries increases at least as rapidly as U.S. demand, the world's estimated harvest potential of shrimp and prawns from known populations may be reached by 1980.

Rapid Growth in U.S. Shrimp Consumption

Since 1950, shrimp consumption in the United States has increased nearly 6% annually, on the average; it rose from 118.3 million pounds (heads-off weight) to 336.8 million pounds in 1968. On a per-capita basis, shrimp consumption increased from .78 pound to 1.68 pounds in that period. This is more than a 115% gain. In comparison, during 1950-1968, per-capita consumption of meat, poultry, and fish combined increased 19%--from 177 pounds to 210 pounds retail weight. Similarly, shrimp gained in popularity while per-capita consumption of all seafoods has remained relatively constant at 10 to 11 pounds.

Determinants of Shrimp Consumption

Past increases in the consumption of shrimp in the U.S. have been quite spectacular. What does the future hold? The answer to this question lies in an understanding of the determinants of shrimp consumption and how those determinants influence the level of consumption. Major determinants are price of shrimp relative to the general price level for consumer goods, price of competing foods, and income levels.

Statistical techniques make it possible to isolate and measure with some degree of precision the importance of these determinants of shrimp consumption. An application of these techniques indicates that income and price of shrimp are very influential determinants. These two factors, according to the analysis, accounted for 90% of the change in per-capita consumption since 1950. In the analysis, per-capita consumption was expressed as a mathematical function of per-capita personal disposable income and the retail price of shrimp adjusted by the consumer price index. Two important observations can be made from this equation:

(1) Each 1% gain in per-capita real income tends to be accompanied by a 1.77% increase in per-capita shrimp consumption.

(2) Each 1% increase (relative to general price level) in the retail price of shrimp tends to be accompanied by a 0.46% decline in per-capita consumption.

Knowing these relationships, we can predict with some reliability what consumption is likely to be--given changes in income and in price of shrimp.

Figure 1 shows actual per-capita shrimp consumption and estimated consumption for the period. Note how closely the equation is able to estimate per-capita consumption when price and income are known.

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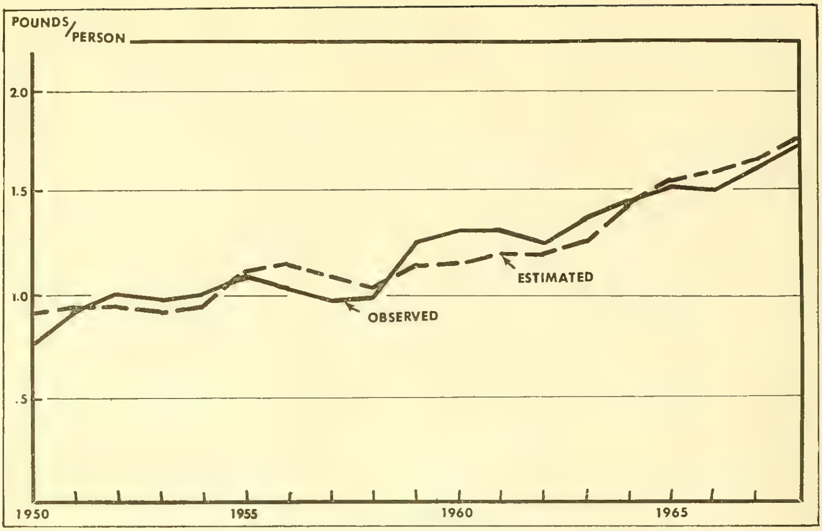

Fig. 1 - Actual and estimated per-capita shrimp consumption, 1950-1968.

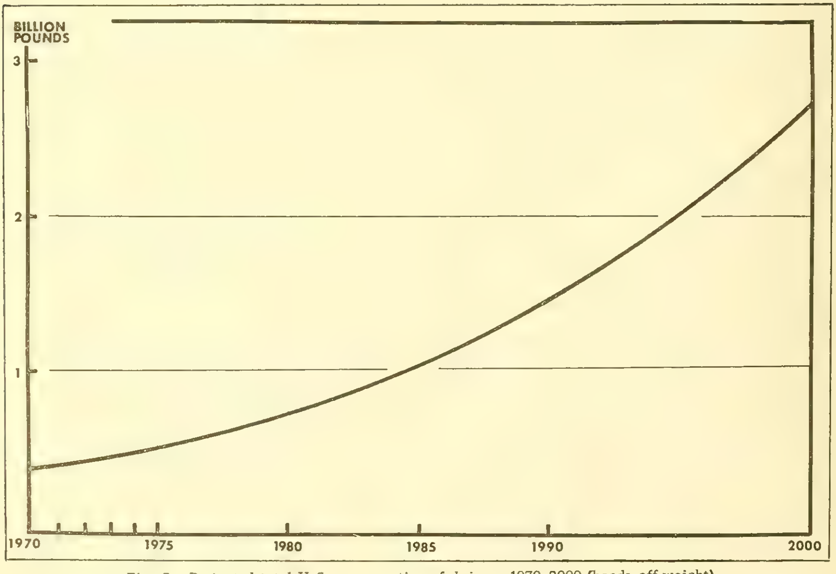

Fig. 2 - Projected total U.S. consumption of shrimp, 1970-2000 (heads-off weight).

During 1950 through 1968, "real" per-capita personal disposable income (adjusted for changes in general price level as measured by consumer price index) has risen relatively faster than retail shrimp prices; thus the rapid increase in per-capita consumption. Increases in the "real" price of shrimp have been moderated by world ability to develop new shrimp fisheries and to increase exports of shrimp to the United States. In 1950, shrimp imports were only 40% of domestic landings; by 1968, imports were 17% greater than total domestic landings.

World Demand for Shrimp and Prawns May Outstrip Supply by 1980

Using the consumption equation explained above, per-capita shrimp consumption was projected into the future by assuming 2 things: 1) "real" price of shrimp will not increase, and 2) a series of changes in income will occur as projected by the National Planning Association. Projected total consumption of shrimp in the United States is shown through the year 2000 in figure 2.

Based on the results of the analysis, per-capita shrimp consumption in the United States could reach 2.56 pounds, heads-off weight, by 1975, and 3.39 pounds by 1980. If we assume the world supply of shrimp is essentially unlimited--and if we can assume no change in past relation between income and demand for shrimp--then the analysis indicates that per-capita consumption would reach 5.30 pounds by 1990, and 8.80 pounds by 2000. Estimated per-capita consumption, multiplied by Census Bureau projected population, shows total U.S. consumption of shrimp can be expected to reach 562 million pounds (heads-off weight) in 1975, 797 million pounds in 1980 and, if supply is unlimited, 1.4 billion pounds in 1990, and 2.7 billion pounds in 2000.

It is a risky business to make projections far into the future on the basis of past and current relationships. Whereas per-capita real income most likely will continue to increase over the next 30 years, demand for shrimp may reach a saturation point. Even if supplies were sufficient to satisfy demand at a constant price, there is a probability that consumer tastes would change, or the influence of income and other forces on demand will change, and demand for shrimp would be altered.

As noted, much of the increase in per-capita consumption of shrimp in the U.S. can be associated with increasing affluence. Another factor has been advancement in the distribution and marketing system. Western Europe and Japan are experiencing rapidly increasing demands for shrimp for much the same reason as the U.S. And, similarly, these markets are supplying their increasing needs from imports. It is very likely that growth in world demand will grow more rapidly than expansion of shrimp and prawn harvesting.

A maximum estimate is that the world harvest of shrimp and prawns can be expected to increase only 88%. Such an estimate is based on known natural stocks and does not include the still-undetermined potential from aquaculture. Total world harvest potential is estimated to be 1.9 billion pounds, heads off. Estimated present world production of shrimp and prawns is slightly more than one billion pounds. This figure is an average for the mid-1960s, thus will understate present total world harvest.

United States consumption of shrimp in 1968 was 337 million pounds, or about one-third total world shrimp and prawn production. If the U.S. continues to consume one-third of world harvest, and if U.S. consumption increases as anticipated, then total world production must reach maximum potential of 1.9 billion pounds by late 1970s.

Excess Demand Will Be Moderated By Price Increases

Real personal disposable income is expected to increase at about 3% per year during the 1970s and 1980s. Since per-capita consumption increases 1.77 times as fast as per-capita personal disposable income, we can anticipate an increase in per-capita demand of over 5% per year. Also, population is expected to increase slightly more than 1% per year through the 1970s and 1980s. The combined effect of increasing real income and increasing population should result in a 6-7% growth per year in total demand. To offset increasing demand--and to hold total consumption constant after maximum harvest potential is reached--real price will have to increase by about 15% per year.

Certainly price increases will be strong when production is no longer able to keep pace with increases in demand. Price increases should be expected to accelerate considerably before potential harvest is realized. With current technology, and at current prices, not all the world's shrimp resources will be profitable to harvest. Only with increasing prices will there be sufficient stimulus to develop new grounds and to harvest high-cost areas.

The possibility of shrimp and prawn harvests leveling off in the next decade while demand continues to climb is quite real. Shortages in natural supplies will force increasing attention to aquaculture. As prices increase, the development and use of higher cost methods will be stimulated. This illustrates the importance of considering future returns to aquaculture in planning development of U.S. and world estuarine areas.

"Clean" catch consisting predominantly of pink shrimp.

EXPLORING FOR SCHOOLING PELAGIC FISHES IN MIDDLE ATLANTIC BIGHT

Jackson Davis

An exploration for schooling pelagic fishes was conducted by the Virginia Institute of Marine Science (VIMS), Gloucester Point, Virginia, in the waters of the continental shelf between Cape Hatteras, North Carolina, and Block Island, Rhode Island, during Feb. 9-May 14, 1969. It was done under research grant sponsored by the Bureau of Commercial Fisheries, Washington, D.C.

Fish schools detected by sonar were small and transitory. Rough seas, especially in February and March, make two-boat purse seining of doubtful practicality.

The exploration was conducted from the menhaden vessel 'W. T. James Jr.' under charter to VIMS. The 187-foot, 500-ton James was equipped with a Simrad SK3 sonar and CK2 scope. A skiff, powered by an outboard motor, was equipped with a Simrad Basdic. Fishing gear was a purse seine 250 fathoms long and 1500 meshes, 1.5 inch stretched, deep rigged as is usual for menhaden purse seines. The net was fished by the technique standard in the menhaden industry: half the net is set from each of 2 purse boats traveling in a semicircle around a school. The purse boats were 37 feet long overall and 10 feet wide, powered by diesel engines--and equipped with hydraulic masts and booms, and Marco model 29A power blocks to handle the net.

Area Explored

Different portions of the Mid-Atlantic Bight were explored in 7 cruises about 10 days each. Cruise tracks were developed in response to the prevailing weather as each cruise progressed. To the extent allowed by weather, the entire shelf was examined, but little time was spent in water deeper than 40 fathoms.

In February and early March, the major concentration of fish was in 15 to 30 fathoms between Cape Hatteras and Cape Henry, Virginia. A secondary concentration was in 10 to 15 fathoms between Parramore Banks ($37^{o}30'$ N) and Jack's Spot ($38^{o}10'$ N). Fish were detected by sonar but usually not caught--because they were not schooled, or because rough seas precluded setting the net. However, both fish behavior and scanty observations of the catches by foreign trawlers indicated they were mostly herring and mackerel.

A fleet of 75 to 125 or more Soviet and Polish trawlers fished these concentrations and followed the migrating herring and mackerel during March, April, and May as they moved northeasterly along the 30-fathom curve. The foreign fleet apparently had good information concerning the whereabouts of fish. We found by steaming through and around the fleet that the distribution of trawlers on the surface very closely approximated the distribution of fish beneath the surface. Usually the fish were in a band 5 to 10 miles wide and 30 to 50 miles long in 25 to 35 fathoms.

Fish Behavior & Purse Seining

Purse seining was practical only twice each day when fish were schooled briefly. At other times, they were too dispersed to be caught in a purse seine. For an hour or a little more before dawn, fish were schooled and the schools were in suitable position to be caught by seining. However, with the first light of dawn, the schools broke up and the fish settled to the bottom individually and in small groups. In late afternoon, fish regrouped into schools which stayed deep in the water until sunset, when they rose rapidly to the surface and dispersed. Thus fish were schooled and in suitable position to be caught in purse seines for two periods, each of two hours or less, in each 24 hours. During the 20 or more hours that fish were not available to a purse seine, they appeared to be suitably positioned for capture with a universal trawl.

Mr. Davis is associated with the Virginia Institute of Marine Science, Gloucester Point, Virginia 23062.
Virginia Institute of Marine Science Contribution No. 337.
Note: Mention of equipment does not constitute endorsement by the Federal Government.

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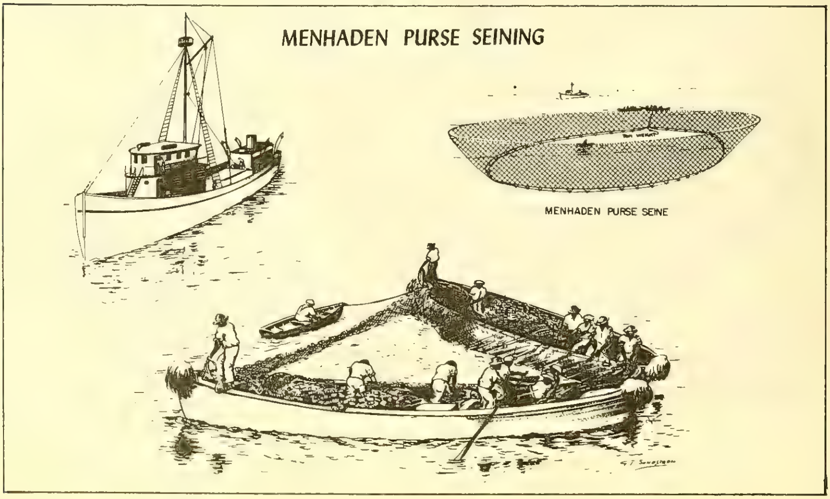
Fish remained schooled only briefly, so it was necessary to set the net quickly. Our technique was first to locate a school with the sonar. Then we sent the basdic-equipped skiff to relocate the school and stay above it. The skiff served as a target for the purse boats to set the net around. Unfortunately, relocating the school by basdic operator in the skiff was time-consuming, despite radio communication between the ship's pilot house and the skiff's basdic operator. It seems that setting the seine from purse boats would be more efficient. On several occasions, schooled fish dispersed while the basdic operator was attempting to position the skiff over them. Dispersal seemed to be in response to changing light intensity, rather than to the presence of the skiff. We believe this is so because we also observed dispersal of schools at dawn and dusk when the skiff was not overboard.

Perhaps schooling behavior would be somewhat different if a large trawler fleet were not present. Schools might be larger and they might maintain their integrity better. The largest school detected in 1969 was about 60 yards wide. But, in 1966 and 1967, when only 25 or fewer foreign trawlers were working, we detected several schools larger than 50 yards and one at least 6.5 miles.

1969 Program's Aim

The field program in 1969 was aimed at finding resources that could be harvested by the menhaden fleet during its off-season. Therefore, it was terminated in mid-May when menhaden fishing usually begins. Information acquired from various sources, mostly Coast Guard-BCF surveillance flights, suggests that herring become more vulnerable to purse seines in May and June. An observer sighted schools of fish, probably herring, south of Long Island in mid-May. Near June, the USSR added to its fleet about 40 purse seiners that fished on Georges Bank.

Sea conditions are important to the success of a purse-seining operation. Purse boats are not suited to winter's rough seas. The number of days at sea were: February-15; March-23; April-17; and May-10. In February, seas were calm enough to operate purse boats only 20% of the days at sea. In March, 40% of the days were suitable. As spring progressed, conditions improved. In April, 60% of the days were suitable and, in May, 70%. These percentages reflect the fact that it was often possible to work near shore when seas were too rough in deeper water. Working conditions were less favorable along the 30-fathom curve where fish were most abundant.



PACIFIC OCEAN PERCH & HAKE STUDIED OFF WEST COAST

Thomas A. Dark, Herbert H. Shippen, & Kenneth D. Waldron

From January through March 1969, BCF's 'Miller Freeman' conducted fishery research off Washington, Oregon, and California (Cruise No. F69-01). Her major objectives were to obtain data on: (1) distribution, age, size, sex composition, and relative abundance of Pacific ocean perch (Sebastodes alutus) off Washington and Oregon; (2) distribution and relative abundance of eggs and larvae of commercially important fish, particularly Pacific hake (Merluccius productus), off California; and (3) distribution and relative abundance of juvenile Pacific hake off southern California.

RESEARCH ON PACIFIC OCEAN PERCH

Historically, the Pacific ocean perch has been one of the most important rockfishes in the Pacific Northwest trawl fishery. Perch grounds off Washington and Oregon are not as extensive as those off Alaska; nevertheless, until recently, the former supported a fishery important to the economies of both states. During the past several years, increased local demand and foreign exploitation of Pacific Northwest groundfish resources have reduced perch stocks to where few U.S. fishermen find it profitable to continue fishing these grounds.

BCF Seattle, Wash., responded to this serious problem by initiating a field program in 1968 to study facets of the Pacific ocean perch: its distribution and abundance, growth and mortality, relation to the environment, size of its standing stock, and the response of the stocks to various rates of fishing. Ultimately, such information will allow estimates of the level of fishing that will maximize the harvest on a sustained basis. These estimates are required before a sound management program can be implemented.

This research cruise was the first in a series to assess Pacific ocean perch stocks off Washington and Oregon and to monitor changes in response to varying fishing rates.

Sampling for Pacific ocean perch began Jan. 8, 1969, and ended on the 24th. Weather was poor at times--but never severe enough to restrict operations. Fishing was conducted in statistical areas designated by the Pacific Marine Fisheries Commission and the U.S.-USSR fishery agreement of 1967 (fig. 1). In areas 12 to 15, drags were started at about 125, 150, 175, and 200 fathoms; in areas 10, 11, this sampling scheme had to be modified because suitable trawling grounds were limited.

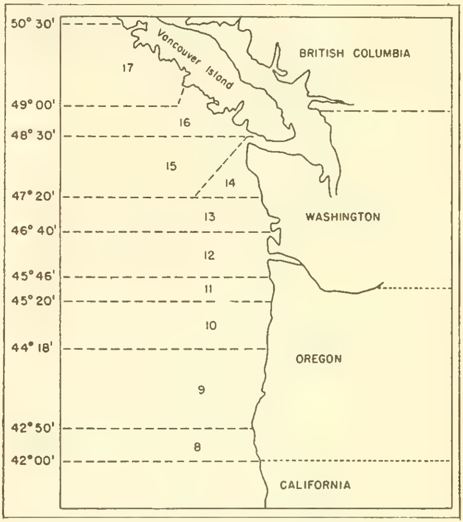


Fig. 1 - Locations of statistical areas based on Pacific Marine Fisheries Commission areas and areas designated in the U.S.-USSR fishery agreement of 1967. The Miller Freeman trawled in areas 10 to 15 on cruise F69-01.

Fishing Gear and Sampling Procedures

The vessel fished with a BCF Mark I Universal Trawl of $2\frac{1}{2}$-inch mesh (stretched

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measure included one knot) in the body and 3-inch mesh in the cod end; the cod end was lined with $1\frac{1}{8}$-inch mesh. The trawl was fitted with 7 by 12-ft. V-doors; during fishing, the nominal dimensions of the trawl mouth were 45 ft. wide by 23 ft. high. Rollers (bobbins) attached to the groundline permitted fishing on rough bottom; a depth-sensing system measured the depth the net was fished. The relative abundance of fish, as well as bottom depth, was determined with a newly installed 800-fathom depth sounder. Tows were made at $1\frac{1}{2}$ to $2\frac{1}{2}$ knots for 30 minutes.

Catches were sorted by species, and total weight of each type of fish determined. Samples of Pacific ocean perch were taken from the catch and examined for size and sex composition; otoliths were removed for age determination at the BCF Seattle Biological Laboratory. Random samples of female perch were collected from hauls 4 and 13 to determine the stage of sexual maturity.

Catches

Total catches ranged from 0 to 5,946 lbs. per tow; Pacific ocean perch ranged from 0 to 1,764 lbs. per tow (fig. 2). Largest catches occurred in areas 13, 14, and 15 at depths of about 145 to 185 fathoms. Although 17 species

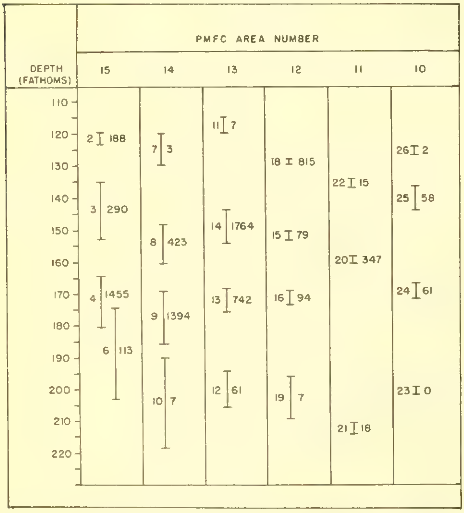

Fig. 2 - Catches of Pacific ocean perch in January 1969, by depth of trawl and statistical area. Number to left of depth range designates haul number; number to right is weight (lbs.) of catch.

of rockfish were caught, only Pacific ocean perch were taken in large numbers. Other large catches included: (1) 5,300 lbs. of Dover sole (Microstomus pacificus) taken at 200 fathoms in area 15, (2) about 2,000 lbs. of spiny dogfish (Squalus acanthias) at 125 fathoms in area 14, and (3) 2,500 lbs. of spiny dogfish at 160 fathoms in area 11.

An estimated 68 percent of the female Pacific ocean perch were sexually mature; most had eggs in advanced stages of development, but evidently none had spawned in 1969. Some fish were preserved for racial studies.

Fulfillment of objectives must await comparison of present data with similar information that will be gathered on future cruises.

PACIFIC HAKE--EGGS AND LARVAE

Only recently has the Pacific hake become the object of an important fishery. Since 1966 it has been caught by U.S. and Soviet vessels fishing along the Pacific Northwest coast. Hake catches have been processed for fish meal, but they will be used as a primary source of fish protein concentrate (FPC) when an FPC pilot plant at Aberdeen, Washington, becomes operational in the near future. Foreseeing the need for management of this fast-growing fishery, BCF began an intensive research program. One phase is collection of information concerning the hake's early life history, the eggs and larvae, particularly their distribution and abundance.

Knowledge of the distribution and abundance of hake eggs and larvae is important in three ways: (1) it enables determination of the distributional characteristics of the spawning population; (2) it allows for estimates of the size of the spawning population; and (3) it provides a basis for prediction of the contribution of present broods to the fishery several years hence.

The first benefit: Information on distribution and schooling habits might allow exploitation of the spawning population. All current evidence indicates that hake spawn at considerable depths and are dispersed over a large area; therefore, commercial exploitation during the winter spawning season does not appear feasible. Also, by gathering information on spawning, we may gain insight into the racial composition of the fishable population, which is important in establishing a management program.

Second benefit: An estimate of the spawning population size would provide a preliminary measure of the size of the fishable population because most fish available to the present fishery are adults. Stock size is another type of information important in computing the maximum sustainable harvest.

Third benefit: The adult Pacific hake population is composed of relatively few age groups. So a particularly large or small age group entering the fishable population has great significance in terms of the abundance of hake available to fishermen. There is considerable evidence that age groups vary greatly in size. Therefore, it would be valuable to fishermen, processors, and fishery managers to have advance information on expected stock size. Sampling the early life stages (eggs, larvae, and juveniles) may provide reliable forecasts of age group strength.

From Jan. 25 to Feb. 17, a cooperative U.S.-USSR survey of Pacific hake eggs and larvae was conducted off California, at plankton stations of CalCOFI (California Coopertive Oceanic Fisheries Investigations). Other organizations participating were the BCF Fishery-Oceanography Center and the Scripps Institution of Oceanography at La Jolla, Calif., and TINRO (Pacific Scientific Research Institute of Marine Fisheries and Oceanography) at Vladivostok, USSR. Sampling was begun off Pt. St. George. It was interrupted by a 2-day port call to San Francisco (Feb. 10-11) for supplies and change of scientific personnel. It was completed just north of Pt. Conception (fig. 3).

The plankton sampling gear used off California, of CalCOFI design, consisted of two nets mounted on a single frame. One net of 505-micron mesh had a mouth diameter of 3.3 ft. (1 m.); the other, of 333-micron mesh, had a mouth diameter of 1.6 ft. ($\frac{1}{2}$ m.). Each net was equipped with a flow meter; on most tows, a bathykymograph recorded the depth-time path of the net. Oblique tows were carefully controlled to about 656 ft. (water depth permitting). Plankton samples were preserved in formalin, buffered with sodium borate, and sent for processing to the Fishery-Oceanography Center at La Jolla.

Oceanographic data were gathered to determine relations between fish and their environment. Salinity and temperature were measured by an STD probe to 1,986 feet (600 m.). Surface isohalines, surface isotherms, and 10-meter isotherms are given in figures 4, 5, and 6, respectively. Water samples for nutrient determinations were collected at about 30-ft. (10-m.) depth and frozen for later analysis.

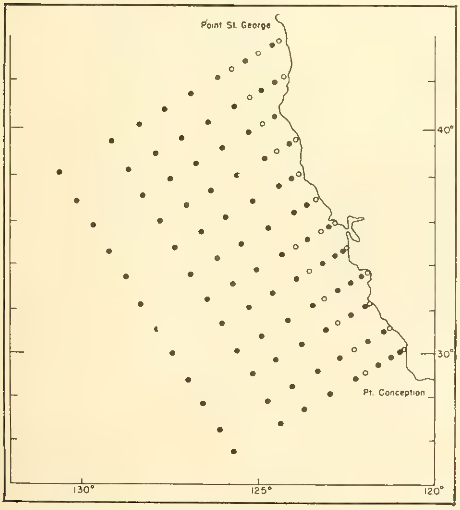

Fig. 3 - Stations fished off California in January and February 1969 to study the distribution and abundance of eggs and larvae of fish. Open circles- plankton tow stations, solid circles plankton tow and STD stations.

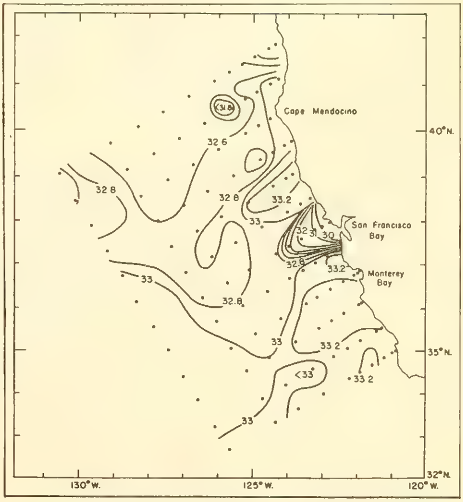

Fig. 4 - Surface salinity (‰) of water off California during the study of fish eggs and larvae in January and February 1969.

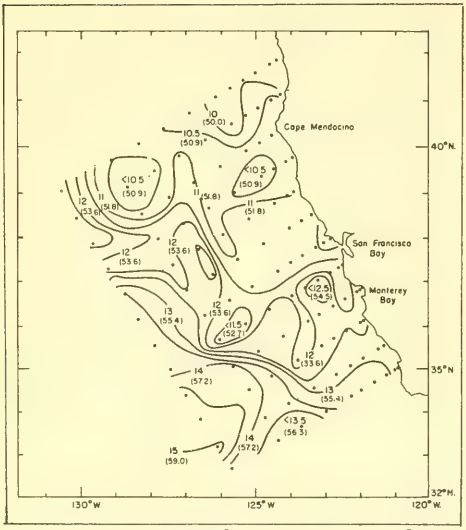

Fig. 5 - Surface temperature (°C. and, in parentheses, °F.) of water off California during the study of fish eggs and larvae in January and February 1969.

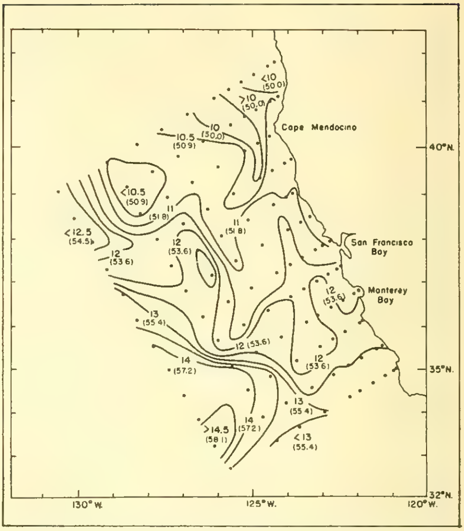

Fig. 6 - Water temperature (°C. and, in parentheses, °F.) at a depth of 33 feet off California during the study of fish eggs and larvae in January and February 1969.

PACIFIC HAKE--JUVENILES

The abundance of juvenile hake (post-larva stages) might also be used to forecast recruitment to the fishable population. The first requirement for sampling is to define the distribution of juvenile hake. A portion of this cruise was devoted to examining the distribution of juvenile hake along the southern California coast.

On Feb. 19, the Miller Freeman began an acoustic search for juvenile Pacific hake, extending from Morro Bay to La Jolla, Calif. (fig. 7). Water 30 to 200 fathoms deep was examined at vessel speeds of 6 to 10 knots. Large concentrations of fish were seldom detected on the sounder. Individuals and small schools were detected frequently, but it was difficult and sometimes impossible to relocate the schools for trawling. As soon as a school was detected, the vessel continued through it until contact was lost; then the ship reversed its course. Upon relocation of the school, the vessel was run on varying courses to determine roughly the size and shape of the school. When a school was sufficiently large, the trawl (BCF Universal Mark I without rollers, equipped with a 1 -inch mesh liner the full length of the cod end) was

Table 1 - Locations, Dates, and Trawling Information for Drags for Juvenile Pacific Hake Off California, February 1969

Haul No.	Location		Date	Bottom Depth	Haul Depth	Haul Duration
	Lat. N.	Long. W.	February	Fathom	Fathom	Minute
1	$34^{\circ}05'$	$119^{\circ}37'$	19	80-100	60-70	59
2	$35^{\circ}15.7$	$120^{\circ}57$	21	35	28-32	70
3	$35^{\circ}00.2$	$120^{\circ}46$	22	40	30	99
4	$34^{\circ}10.8$	$119^{\circ}21.2$	23	44	20-36	71
5	$33^{\circ}33.5$	$117^{\circ}52.7$	25	160-200	16-34	78
6	$33^{\circ}31.5$	$117^{\circ}58.4$	25	120-180	4-30	106

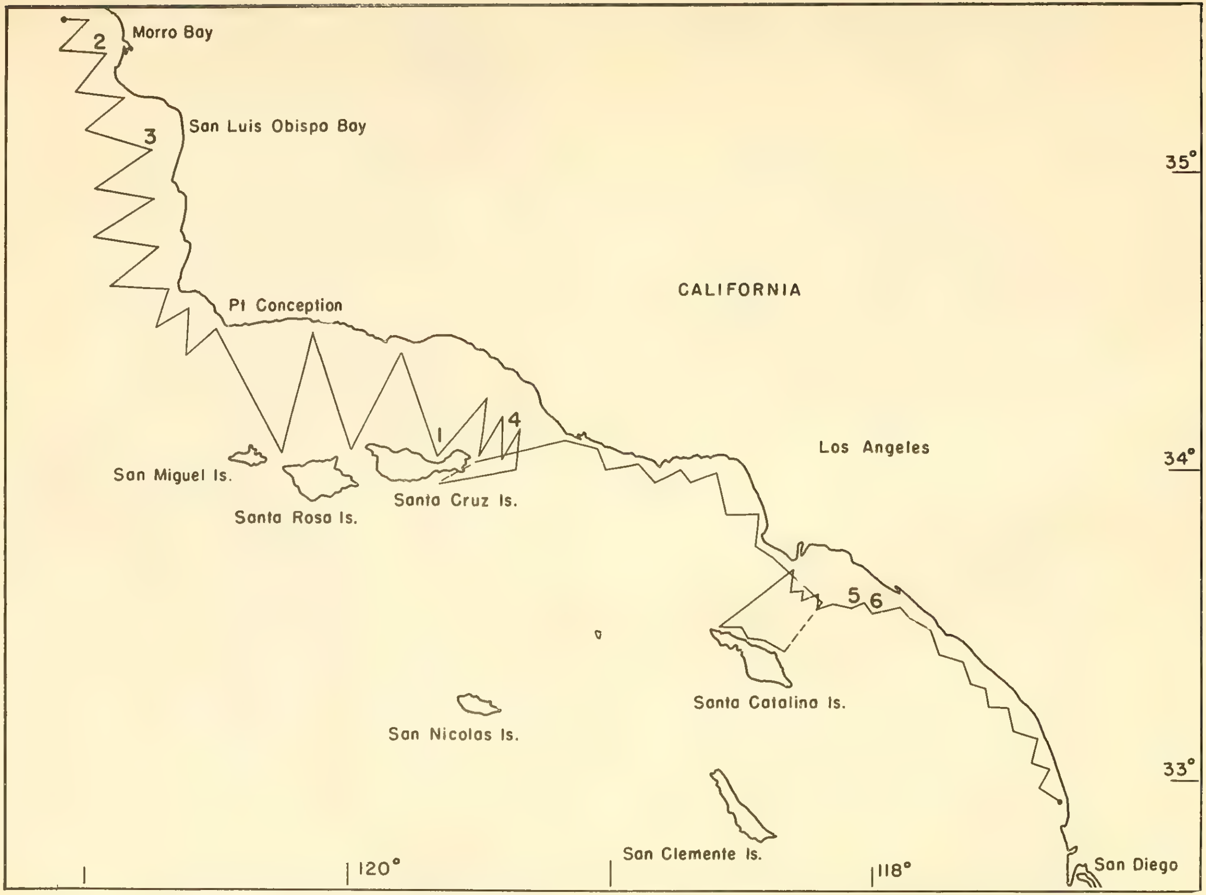

Fig. 7 - Search pattern used for juvenile Pacific hake off California in February. Numbers along the cruise tract designate fishing (trawl) sites.

Table 2 - Species Composition of Trawl Catches Off California, February 1969

Species	Haul Number 1		2		3		4 1/		5		6	
	Lb.	Fish	Lb.	Fish	Lb.	Fish	Lb.	Fish	Lb.	Fish	Lb.	Fish
Bocaccio (Sebastodes paucispinis)	-	-	-	-	-	3	-	-	-	-	-	-
California lizardfish (Synodus lucioceps)	-	-	-	-	-	-	-	6	-	-	-	-
Chinook salmon (Oncorhynchus tshawytscha)	-	-	-	-	-	-	23	1	-	-	-	-
King-of-the-salmon (Trachipterus trachypterus)	-	-	-	-	-	1	-	-	-	-	-	-
Midshipmen (genus Porichthys)	36	-	-	-	1	-	-	-	-	-	-	-
Northern anchovy (Engraulis mordax)	469	-	-	-	-	-	659	-	20	-	195	-
Pacific bonito (Sarda chiliensis)	-	-	-	-	-	-	-	3	-	8	-	9
Pacific electric ray (Torpedo californica)	-	-	-	-	-	1	-	3	-	-	-	-
Pacific hake (Merluccius productus)	28	-	-	-	.5	-	21	-	-	-	6	-
Pacific pompano (Palometa simillima)	-	-	9	-	26	-	-	-	12	-	7	-
Queenfish (Seriphus politus)	-	-	-	1	-	-	-	-	-	-	-	-
Rockfish (genus Sebastodes mostly S. jordani)	38	-	2	-	-	-	-	-	-	-	-	-
Scabbardfish (Lepidopus xantusi)	-	-	-	-	-	-	-	-	-	-	-	3
Spiny dogfish (Squalus acanthias)	-	-	-	-	-	1	-	-	-	-	-	-
Thresher shark (Alopias vulpinus)	-	-	-	-	-	-	-	1	-	1	-	-

1/About half of the catch was lost in hauling of the cod end of the trawl up the stern ramp of the vessel.

lowered to depth and fished for 1 to $1\frac{1}{2}$ hours. Catches were sorted by species, and the most numerous were weighed to determine relative abundance.

Because large concentrations of fish were lacking, only six drags were made (table 1); sizes and composition of catches varied (table 2). Of the areas surveyed, the most productive were the eastern Santa Barbara Channel and San Pedro Bay; these were the only areas where large schools were discovered, and where significant quantities of juvenile Pacific hake were taken.

All Pacific hake were measured (fork length ranged from $5\frac{1}{2}$ to $15\frac{1}{2}$ inches [14 to 39 cm.], and an otolith was collected for age determination. Except for the four Pacific hake in haul No. 4 (ages 2, 4, 6, and 7 years), all were in, or had just completed, their first year of life. More often than not, juvenile Pacific hake were taken with large catches of northern anchovy (Engraulis mordax). The anchovies predominated: their total weight exceeded total weight of hake by a factor of 24. These young hake were similar in size to the anchovy and could have schooled with them. In the areas searched, juvenile Pacific hake apparently do not occur in widely distributed pure schools--and are dispersed throughout the region and are associated with anchovy schools.

PUERTO RICO'S COMMERCIAL MARINE FISHERIES

A Statistical Picture

José A. Suarez-Caabro

Puerto Rico's fishing industry presents a great contrast: it has a modern, productive, and highly capitalized tuna fleet--and an inshore fishery that has not changed substantially in several generations.

We began to evaluate the inshore marine fisheries, using statistical information, in June 1967. It was part of the Fisheries Research and Development Program cosponsored by the U.S. Department of the Interior and the Department of Agriculture, Commonwealth of Puerto Rico. The University of Miami's School of Marine and Atmospheric Sciences was technical adviser from July 1967 through June 1969. The program was authorized under Commercial Fisheries Research and Development Act of 1964 (PL 88-309).

The main objective is to establish a system for obtaining data on landings and sales of fish and shellfish in Puerto Rico's inshore fisheries. The system will assist the local fishing industry--and fill the statistical needs of the Bureau of Commercial Fisheries and other interested agencies. Statistical data include number and types of fishing craft and gear, and number of fishermen.

This article presents the results of our work in 1968-1969.

FISH & SHELLFISH LANDINGS, 1968-1969

Currently, the information gathered through the sale tickets system is coming directly or indirectly from many fishermen. In my opinion, at least 70% of total landings are

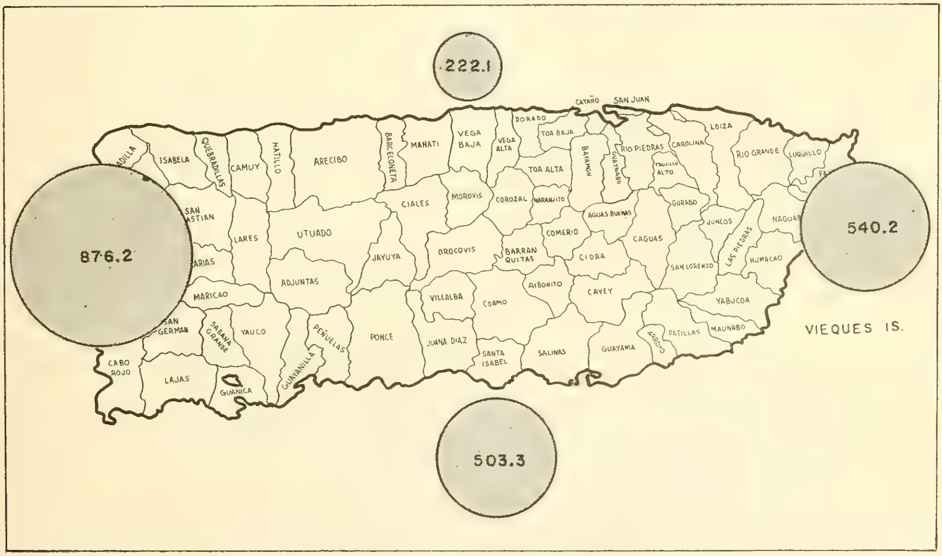

Fig. 1 - Reported landings from inshore commercial fisheries (in 1,000 lbs.) by coastal regions, Oct. 1967-Oct. 1969.

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being collected by this method. However, a very important goal of our project is to determine this percentage with greater accuracy.

Distribution of Landings

Production is highest on the west coast of island and lowest on the north coast (Figs. 1 & 2). Since statistical program was started in October 1967, Cabo Rojo alone has produced consistently nearly 30% of the island's reported landings of fish and shellfish--and about 23% of exvessel value.

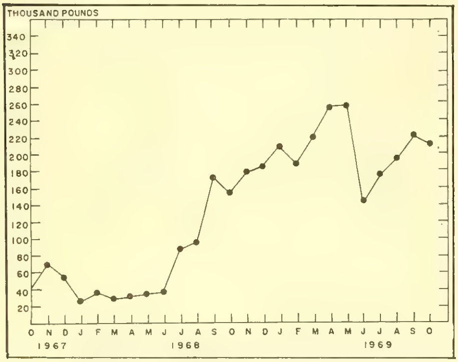

Fig. 2 - Reported landings of fish and shellfish from coastal waters, Oct. 1967 through Oct. 1969.

After Cabo Rojo, the more productive fishing centers were Vieques Island and Fajardo (east coast), Guanica and Lajas (south west coast), Aguadilla and Mayaquez (west coast), and Naguabo and Humacao (east coast). Cabo Rojo and the above areas together produce 66% of Puerto Rico's total reported production.

The average price paid to fishermen, for fish and shellfish combined, July 1968-June 1969, was 28 cents. The lowest (23 cents) was recorded on the west coast; the highest (38 cents) on north coast.

Fish represent 87.6% of the weight (Fig. 3) and 73% of the exvessel value of the landings. Of the shellfish, spiny lobster (including some sand lobsters) was most abundant--8.4% by weight and 22% by value. It also brings the highest exvessel price per pound (74 cents) of any fish and shellfish; land crab is close behind at 64 cents per pound. The remaining 4% of landings were other shellfish and turtle. These values represent averages for the island, but price per pound varies regionally.

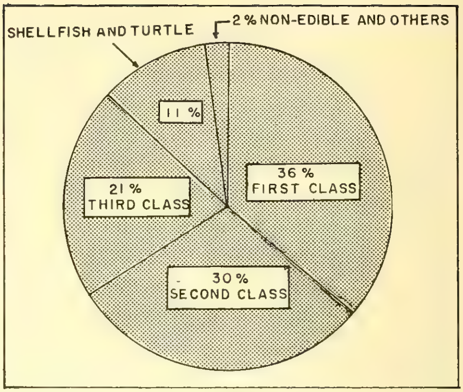

Fig. 3 - Distribution of marketing classes of fish and shellfish reported from coastal waters, July 1968-June 1969.

Information is available for the past two years, but reliable data are not. It is difficult and premature to try to make accurate estimates of annual production and seasonal variation. If magnitude of reported landings of previous years is compared with July 1968-May 1969 data, it can be concluded that figures have increased steadily since July 1968 (Fig. 2). However, it is still questionable whether this increase represents part of a seasonal cycle of availability of fish and shellfish--or simply an improvement in data acquisition, or both.

Composition of Catch

Accurate information on catch composition is extremely difficult to obtain because of the diversity of species in the catches and the lack of fish-landing records kept by fish dealers and fishermen. The author has seen 15 to 20 species in one catch. However, during 1969, the statistical agents gathered much information on composition by species.

In Puerto Rico's coastal waters, there are roughly 130 species of commercially important fish, including all market classes. About 30 are first class, but the most common are: hogfish, Lachnolaimus maximus; king mackerel, Scomberomorus cavalla; trunk-fishes, Lactophrys spp.; Nassau grouper, Epinephelus striatus; silk snapper, Lutjanus vivanus; yellowtail snapper, Ocyurus chrysurus; dolphin, Coryphaena hippurus; yellowfin grouper, Mycteroperca venenosa; mysty grouper, Epinephelus mystacinus; blackfin snapper, Lutjanus buccanella; wahoo, Acanthocybium solandri; barracuda, Sphyraena barracuda; snook, Centropomus undecimalis, and mutton snapper, Lutjanus analis.

The most common classified fish are: snapper (35%), mackerels (28%), and groupers (12%).

Shellfish are represented mainly by 74% spiny lobster, Panulirus argus; 11% conch, Strombus gigas; 8% sea turtles, Eretmochelys imbricata, Caretta caretta, Chelonia mydas and Dermochelys coriacea; 5% octopus, Octopus vulgaris; and 2% land crab, Cardisoma quanhumi.

FISHERMEN, CRAFT, AND GEAR

At every fishing center, the number of fishermen, craft, and gear was surveyed during April-Sept. 1969.

The total number of fishermen was determined on the basis of information in 2,131 fishing license applications for fiscal year 1968-1969. Interviews were based on three main questions: fisherman's status (regular, casual, deckhand), type of boat (name, registration number, propulsion, dimensions), and type of gear (number, quantity).

There were 991 fishermen: regular, casual, and deckhand (regular or casual). A regular fisherman receives at least 50% of income from fishing, or spends half his working time at it. There were 787 fishing boats (motor and other).

On the entire island, 38% of the fishermen were regular, 62% casual. Most fishermen were boat owners: 80% of regular, and 69% of casual.

The distribution of regular fishermen by region is significant. The west coast, most productive area, had highest number (34%). The lowest number (15%) was on north coast, lowest production area.

Of fishing craft, 76% are boat-motor, and 24% boat-other (sail, row, motor and sail). The highest number of motor boats are on the south coast (33%), followed by east (25%), north (23%), and west coast (19%).

A few fishing boats are driven by sail or motor and sail (Fig. 4). Sail boats are 3% of

Fig. 4 - Twenty-seven-foot motor and sail fishing boat at El Combate, Cabo Rojo.

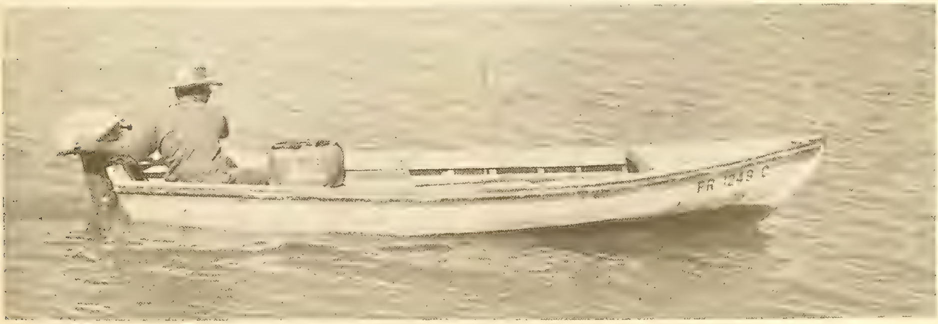

Fig. 5 - Sixteen-foot outboard motor fishing boat called "yola" is the most popular fishing craft.

boat-other, and motor and sail only 11%. Row boats are about 85%: the highest number in the north coast (38%), followed by west (30%), east (18%), and south (14%) coasts.

The most popular commercial fishing boat is the "yola" (Fig. 5). It is largely a flat-bottom skiff of the dory type, small, roughly constructed, and with a restricted cruising range. About 57% of all fishing boats are 16 to 18 feet long. The most common mode of propulsion is the outboard motor, 6 to 10 horsepower (38%).

In Sept. 1969, inshore fishing gear of all types totaled 12,125 units, divided as follows:

Fish pot (62.8%): most common. It is generally arrow-head shaped, with one downward curving entry funnel at apex. This funnel is tapered to prevent escape of the catch (fig. 6). The pot is about 5 feet long, 5 feet wide, and 1.5 feet high; it is constructed of mangrove pole frames and galvanized chicken wire. It is fished as single unit with a separate buoy line or several buoys attached to one main line.

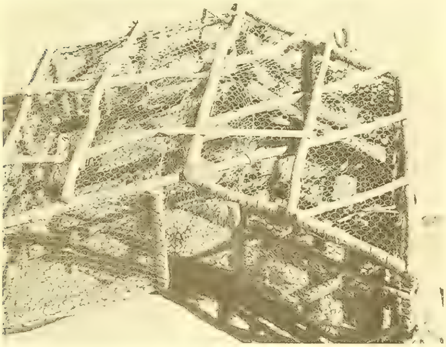

Fig. 6 - Conventional fishing pot at El Combate, Cabo Rojo.

Troll line (9%): a long single line, with one or more barbed hooks at free end of line, baited with either natural or artificial lure, and towed behind moving boat (fig. 7).

Hand line (6.2%): a single line with one or more hooks held or attended by one fisherman. At end of line, 4, 6, or 8 hooks are hung from a hard frame of galvanized wire ("ballestilla"), with 3- to 5-lb. lead attached to center (fig. 8).

Fig. 7 - Troll line with spoon used at La Puntilla, Cataño.

Fig. 8 - Hand line for fishing silk snapper at El Combate, Cabo Rojo.

Spiny lobster pot ("cajon," 5.3%): restricted to a few fishing centers. Various designs and dimensions resembling fish pots described before (fig. 9). One type is made of galvanized chicken wire and mangrove poles. Typical Florida-type wooden lobster pots have been introduced in recent years. About 32 inches long, 25 inches wide, 16 inches high, they are constructed of precut cypress slats and 1 x 1 inch strips of pine or spruce (fig. 10).

Cast net (4.7%): Almost every fisherman has one cast net ("Atarraya") for catching small bait fish. It is a circular, cone-shaped, 6-15-foot diameter net thrown by hand to trap fish. The leads on net's outer edge sink rapidly to bottom, entrapping fish. The net is then recovered by slowly pulling the recovery line attached to its center.

Turtle net (4.6%): a special type of gill net ("volante" or "chinchorro de carey") for catching sea turtles. A single wall of net 4 to 6 yards deep by 20 to 80 yards long; mesh is 20 to 24 inches, stretched measure.

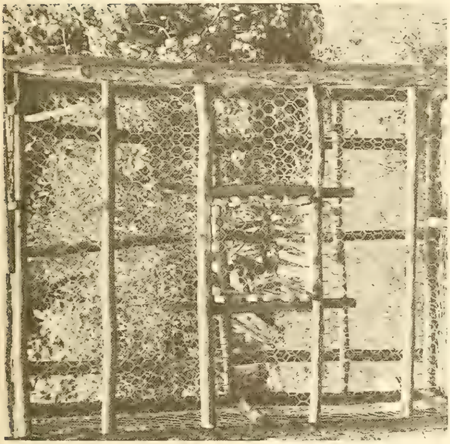

Fig. 9 - Spiny lobster fishing pot at Las Croabas, Fajardo.

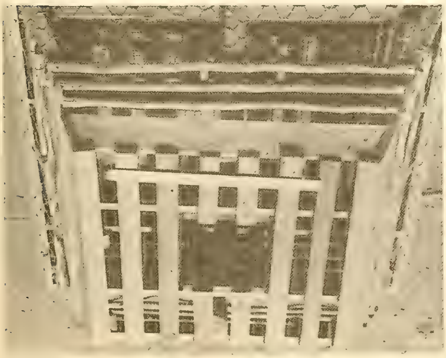

Fig. 10 - Florida-type spiny lobster fishing pot used at Camino Nuevo, Yabucoa.

Gill net (3%): common on north coast. It is a fence of fiber webbing (fig. 11) in which fish are caught (gilled) in net's meshes. Sizes of mesh depend on species and size of fish sought. Its height and length are also variable. Several types used, such as bottom and surface gill net ("trasmallo" or "filete"), and trammel net ("mallorquin").

Fig. 11 - Six hundred yards length by four yards length by four yards depth gill net used by fishermen at Puerto Real, Fajardo.

Trot line (1.4%): this type ("palangre") is a long fishing line with series of baited hooks on short, separate, branch lines (fig. 12). It can be anchored or left drifting, and requires only periodic attention.

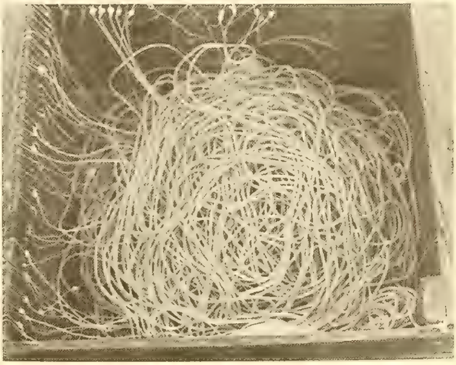

Fig. 12 - One hundred hooks trot line gear for bottom fishing at Puerto Real, Cabo Rojo.

Spear (1%): has limited use in inshore commercial fisheries. Generally, the spear ("fisga") is used by fishermen with a diving outfit. They catch mainly lobster or big fish.

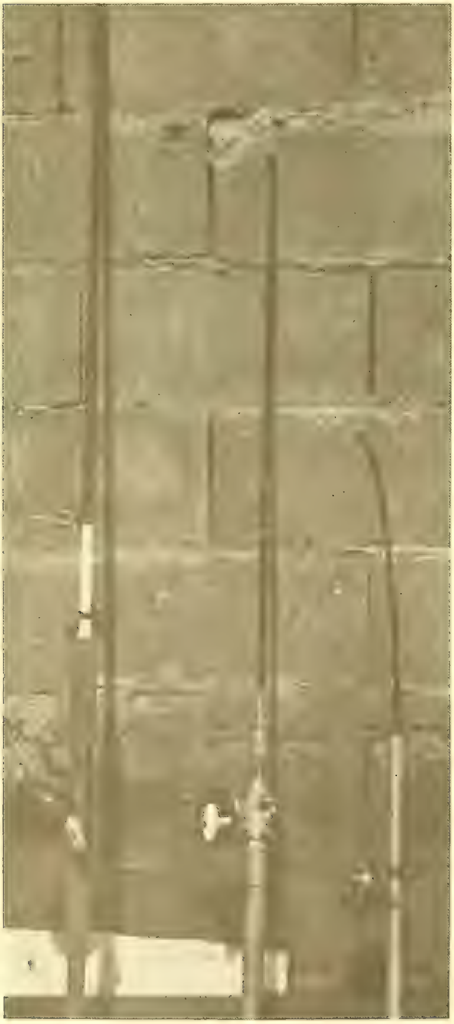

Fig. 13 - Different types of pole and lines used at La Puntilla, Cataño.

Haul seine (0.9%): an encircling type of net made of mesh webbing and with two wings and a bag. Top line has floats to keep it at surface, while bottom or foot line is weighted. Bag is flanked by wings, to which auxiliary lines are attached. A haul seine ("chinchorro") generally is set from row boat and hauled to the shore line, or to beach, by 8 to 10 auxiliary fishermen.

Pole and line (0.5%): utilized principally by sport fishermen. A few commercial fishermen use it occasionally (fig. 13).

'Others,' the hand reel (0.2%): It holds about 1,500 feet of $\frac{3}{64}$ stainless steel stranded cable; 4 to 6 circle hooks sizes 7, 8, and 9 are fished from each line. Hand reels have been reported only from Salinas and Vieques Island. Deep-water fishes--snappers and groupers--are caught with it. Sometimes a homemade imitation of conventional hand reel (fig. 14) is used.

Fig. 14 - Hand made hand reel for deep fishing at La Puntilla, Cataño.

ACKNOWLEDGMENTS

I am grateful to Mr. Rolf Juhl, Coordinator of the Fisheries Development Program (PL 88-309) in Puerto Rico, who reviewed the manuscript and made useful suggestions. Also, to Mr. Félix Iñigo, Chief, Division of Fish and Wildlife, Department of Agriculture, and his staff, for access to files and for sharing his long experience in Puerto Rican fisheries. Mr. Donald S. Erdman, above Division, read manuscript and made useful observations.

Bag of fish taken during bottomfish explorations by BCF research vessel 'Oregon'. (Photo: J. B. Rivers)

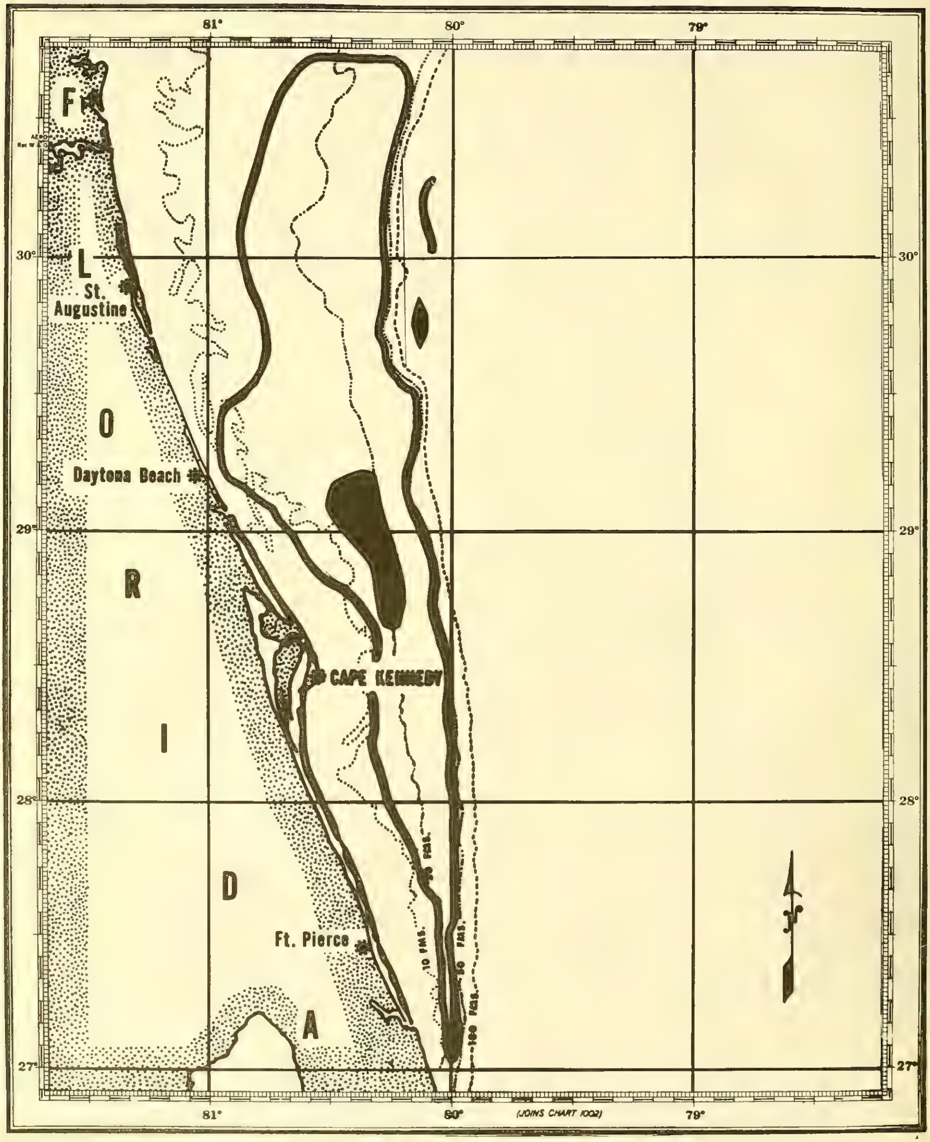

Fig. 1 - Area of calico scallop explorations by BCF research vessels 'Silver Bay' and 'Oregon,' 1960-1968, and area of major effort by commercial calico scallop fishing fleet, 1969.

CALICO SCALLOP FISHERY OF SOUTHEASTERN U. S.

A Photo Review of Latest Developments

Robert Cummins Jr. and Joaquim B. Rivers

Numerous sporadic attempts to develop automated processing equipment for calico scallops have culminated in the construction of four factory-type scallop vessels. These are equipped with processing machinery that automatically sorts the catch and shucks and eviscerates live scallops at sea. The vessels began fishing in early 1969. The equipment had been used successfully only for shore-based processing in North Carolina, so initial operations consisted primarily of modification and refinement of the system for use aboard ship at sea.

Cape Kennedy Grounds

The vessels have operated on the Cape Kennedy grounds out of the Florida east coast ports of Ft. Pierce, Port Canaveral, and St. Augustine (Fig. 1). The largest of the four vessels, 'Kon Tiki No. 1', recently was diverted to fishing in Central America because of domestic labor problems. The other vessels, 'Ruth M', (Fig. 2), 'Sheela L.', and 'Venture', have been operating with variable successes.

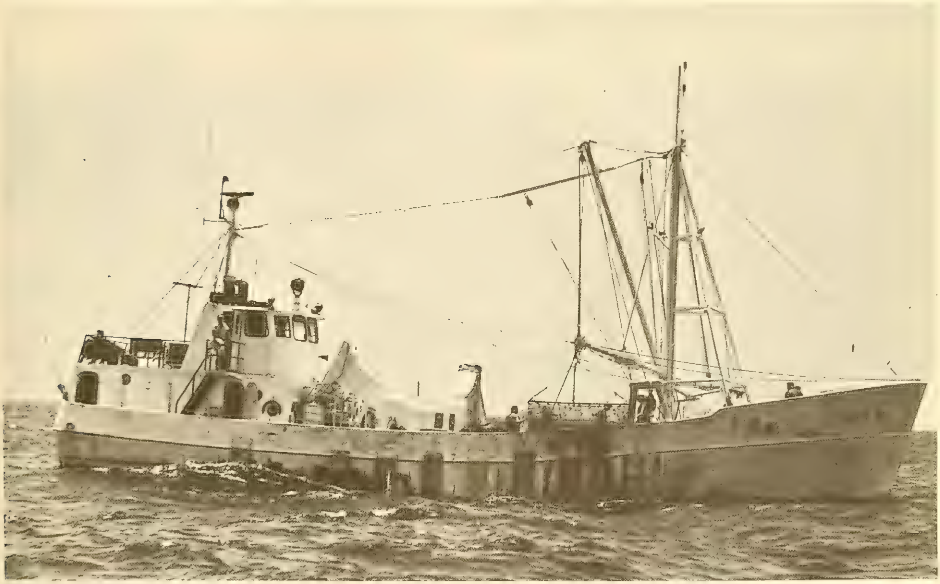

Fig. 2 - Factory scalloper Ruth M., 86-foot steel hull, fully automated to process calico scallops at sea, operating on Cape Kennedy grounds.

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Contribution No. 182 Exploratory Fishing and Gear Research Base, Pascagoula, Miss. 39567.

U.S. DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service
Reprint (Sep.) No. 867

By September 1969, production rates had gradually increased to a maximum of about 4,000 pounds of processed scallop meats per 24 hours of fishing. Increased production at that time was limited by the processing equipment rather than the catch rate. During the period, wholesale prices for scallop meats averaged $1.50 per pound. The vessels are "ice" boats that land the processed scallop meats in 10-pound containers packed in ice; about 12,000 pounds are their maximum holding capacity. When landed, the meats are frozen in liquid nitrogen or sold as "fresh."

Under 10-Minute Processing

Although equipment modifications continue to be made, the accompanying photographs by Joaquim B. Rivers show the equipment now used for processing calico scallops. The processing time from "on deck" (Fig. 3) to "ready for packing" is less than 10 minutes.

Fig. 3 - A 10-foot "tumbler dredge" with about 1,400 pounds of calico scallops coming aboard after 15-minute drag.

Five sequential processing steps are shown: 1) sorting the catch (Figs. 4, 5, 6, and 7); 2) shucking (Figs. 8 and 9); 3) cleaning (Figs. 10 and 11); 4) eviscerating (Figs. 12, 13, and 14); and 5) chilling/packing (Figs. 15 and 16).

Fig. 4 - Overall view of main deck processing equipment. Includes conveyor "separator" with trash overboard trough, "shucker" with shell overboard trough, and salt-water "cleaning trough" to below-deck eviscerator.

Fig. 5 - Feeding the bucket conveyor leading to "separator."

Fig. 6 - Inside view of rotating screw-type squirrel cage "separator."

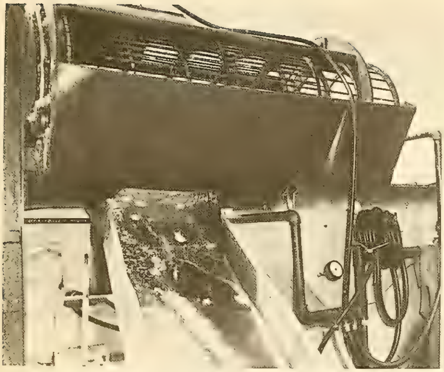

Fig. 7 - Side view of "separator" with trough where dead shell and debris go overboard.

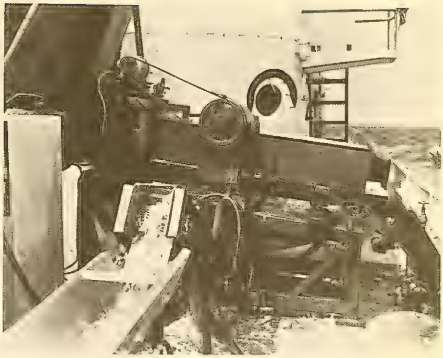

Fig. 8 - Shaker screen or exit portion of "shucker" where shucked meats and shells are separated. Shown are overboard trough for shells, and salt-water cleaning trough for shucked meats with viscera attached.

Fig. 9 - Vibrating shaker screen separating shells from shucked scallop meats. The meats drop through perforations in the screen.

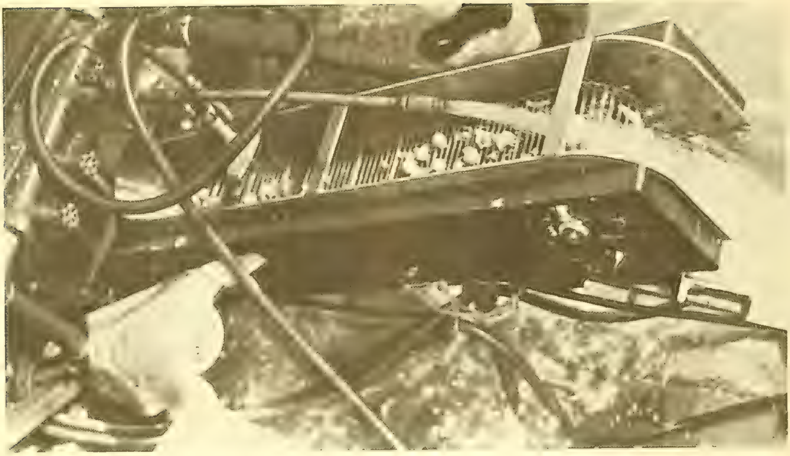

Fig. 10 - "Hamburger machine," a washer conveyor for shucked meats between shaker screen and salt-water floatation cleaning trough.

Fig. 11 - Salt-water floatation cleaning trough and conveyor trough leading to below-deck eviscerator.

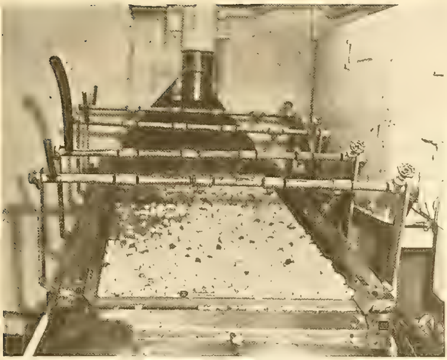

Fig. 12 - Rotating roller-type "eviscerator," below deck, separates viscera from edible adductor muscle.

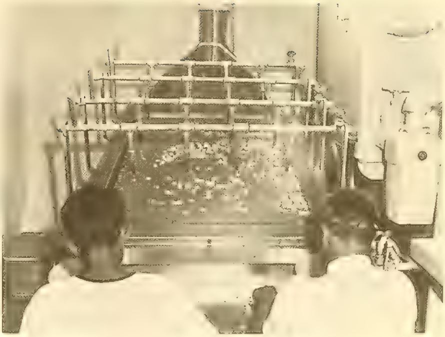

Fig. 13 - Inspecting eviscerated scallop meats coming off "eviscerator" prior to brine chilling.

Fig. 15 - Packing brine-chilled scallop meats in 10-pound plastic buckets.

Fig. 14 - Freshly eviscerated calico scallop meats.

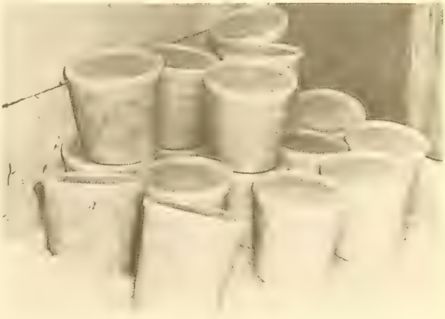

Fig. 16 - Ten-pound buckets of processed scallop meats packed in ice.

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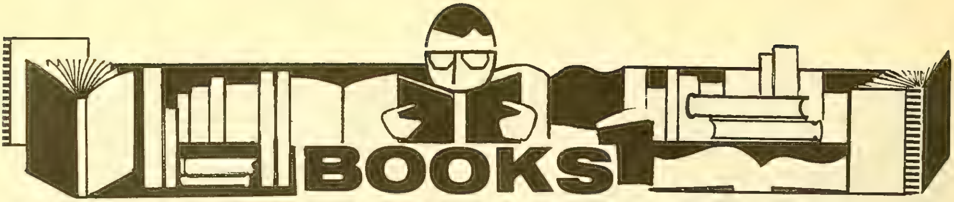

EUTROPHICATION

"Pollution and Eutrophication Problems of Great South Bay, Long Island, New York," by Jack Foehrenbach, article, 'Journal of the Water Pollution Control Federation,' Vol. 41, No. 8, Part 1, August 1969, pp. 1456-1466, illus. Water Pollution Control Federation, 3900 Wisconsin Ave. NW., Washington, D.C. 20016. Single issue $2.

The population increase is causing serious problems of pollution and eutrophication in many of our natural waterways. Homes and high-rise apartments built on the banks of estuaries, lakes, and streams tend to become centers of densely populated urban areas.

This paper describes the problems of Long Island's Great South Bay--a body of water unique in several ways. One is its valuable commercial fishery. In 1966, it yielded 4,792 million pounds of shellfish worth $4,250,000, and 53,400 pounds of finfish valued at $12,000.

Mr. Foehrenbach discusses the bay, its hydrography, the sources of pollution and their potentially adverse effects on the bay's ecology.

FISH-KILLS

"A Kinetic Model of Fish Toxicity Threshold," by Car W. Chen and Robert E. Selleck, article, 'Journal of the Water Pollution Control Federation,' Vol. 41, No. 8, Part 2, pp. R294-R308, illus., $2.

Hundreds of fish-kills resulting from the discharge of toxic waste waters into natural waterways are reported in the U.S. every year. Criteria governing discharge regulations are based on 'threshold concentrations' of toxic substances. Threshold concentration usually is defined as the lowest toxicant concentration that can kill a fish.

This article describes a method that can be used to determine the threshold concentrations of various mixtures of toxicants--and to evaluate the proportional amounts of toxicity contributed by individual components.

FISHERY LITERATURE

"Commercial Fisheries Abstracts, Author Index 1954-1969," edited by Frances Spigai, $15. Order from Oregon State University Computer Center, Corvallis, Oregon 97331.

Over 24,000 author entries cover 16 years of articles in Commercial Fisheries Abstracts. The index is presented in a simple format, including author, date, page, code and subject for each entry.

PROCESSING

"Freezes Catfish with Liquid Nitrogen," article, 'Food Engineering,' Vol. 41, No. 12, Dec. 1969, pp. 66-7, illus. Food Engineering, Chilton Co., Chestnut and 56th Sts., Philadelphia, Pa. 19139. Single copy $1.

Mississippi catfish processor states that using a conventional air-blast freezer, it takes 12-18 hours to process and freeze his product and shrinkage loss is 3-5%. This article describes a liquid-nitrogen freezing unit that reportedly can do the job in less than 15 minutes--$3\frac{1}{2}$ for processing and 10 for freezing--with no loss from shrinkage. The nitrogen-frozen catfish also seemed to have better color, flavor, and texture than this processor's air-blast frozen product.

"A New Midwater Trawl for Sampling Discrete Depth Horizons," by Malcolm R. Clarke, 'Journal of the Marine Biological Association of the United Kingdom,' Vol. 69, No. 4, Nov. 1969, pp. 945-960, illus.

To study the vertical distribution of animals effectively and economically, towed sampling devices that can be opened and closed are essential. To be effective, such gear must: catch the size range of animals selected for study; have an opening-closing mechanism that retains the catch made at a chosen level; and sample at no other levels--or keep such samples separate. The gear also must have a depth-metering device, and be able to register the period and/or depth when the net is open.

Mr. Clarke describes a new trawl designed to these specifications. He details its opening and closing equipment, acoustic release gear, depth-telemetering pinger, and the method to operate the trawl from a research vessel.

RESOURCE MANAGEMENT

"Largemouth Bass and Other Fishes in Ridge Lake, Illinois, 1941-1963," by G.W. Bennett, H. Wickliffe Adkins and W.R. Childers, Illinois Natural History Survey Bulletin, Vol. 30, Article 1, Sept. 1969, 67 pp., illus. Illinois Natural History Survey, Natural Resources Building, Urbana, Illinois 61801.

The study of the management of the fishes of Ridge Lake is possibly the longest continuous investigation ever made of a warmwater fish population in a small artificial lake. The lake was drained completely and the fish population tallied nine times in 23 years.

One of the more important aspects of the long-term study is that it demonstrated the variability of a fairly simple population of common fishes, not only in numbers and total weight, but also in the yield obtainable. These variations are partly related to the application of various management techniques. They are related even more importantly to the incomplete ecosystem represented by the habitat and its plant and animal association. It is incomplete because certain components are absent. This situation is more or less the case with all artificial lakes and reservoirs, and many natural lakes.

The report examines the data on, and the effects of, the fish censuses, competition, size distribution, survival rates, mortality factors, and management techniques.

SALMON

"Growth Rate and Body Composition of Fingerling Sockeye Salmon, Oncorhynchus nerka, in Relation to Temperature and Ration Size," by J.R. Brett, J.E. Shelbourn, and C.T. Shoop, article, 'Journal of the Fisheries Research Board of Canada,' Vol. 26, No. 9, Sept. 1969, pp. 2363-2394. Queen's Printer, Ottawa, Ontario. Single issue $1.

This paper describes the materials, methods, and results of a study determining how temperature affects the growth and efficiency of food conversion of young sockeye salmon at various levels of feeding intensity. It also describes a test of the authors' hypothesis that the optimum temperature for growth would shift to a lower temperature with a decrease in ration.

SENSE OF SMELL IN FISHES

"Olfaction in Fishes," by Herman Kleerekoper, Indiana University Press, 1969, 222 pp., illus.

Dr. Kleerekoper reviews recent progress in the study of the significance of olfaction in fish behavior to acquaint the serious student with this important and fascinating area of biological research. He covers the role of olfaction in procuring food, in parental and social behavior, and in defense mechanisms and homing orientation. He includes sections on the electrophysiology of the olfactory apparatus, neural pathways, nares, cells, blood, enzymes, pigments, and circulation of water in the olfactory organ.

SHRIMP

"The Ocean Shrimp, Sergestes similis, off the Oregon Coast," by W.G. Rearcy and Carl A. Forss, 'Journal of Limnology and Oceanography,' Vol. 14, No. 5, Sept. 1969, pp. 755-765.

Sergestes similis is important in the oceanic food web. It preys on euphausiids and copepods and, in turn, is preyed upon by large carnivores such as albacore and rockfish. It is also the most abundant pelagic shrimp in modified subarctic waters off the northwest Pacific coast.

This is a study of its inshore-offshore and seasonal distribution, sexual maturity and egg size, breeding seasonality, size structure, recruitment and growth in the northeastern Pacific off Oregon.

THERMAL POLLUTION

"Biological Aspects of Thermal Pollution," Vol. I, xx + 407 pp., illus.; 'Engineering Aspects of Thermal Pollution,' Vol. II, xx + 351 pp., illus. Order from Vanderbilt University Press, Nashville, Tennessee 37203. $7.95 each volume.

Thermal pollution is usually caused by the discharge of hot condenser cooling water into the surrounding waters. Fisheries biologists, water resources managers, and others are gravely concerned by the threat it poses to water quality. Very few chemical, physical, or biological processes in water are unaffected by a temperature rise. Aquatic life responds with increased metabolic activity, lowered resistance to toxic substances, and greater need for oxygen.

Waste-heat discharges from electric power generating plants already have raised water temperatures in many U.S. streams. The national demand for electricity is growing so enormously that, by 1985, waste-heat discharge from such plants is expected to quadruple. Despite this immediate and serious threat, little is known about the facts of thermal pollution.

In summer 1968, in an attempt to determine the state of current knowledge and the most urgent research needs, the Federal Water Pollution Control Administration and Vanderbilt University cosponsored two symposia to bring together engineers, scientists, and government officials in the field. These two books are the symposia proceedings.

THE FOLLOWING PUBLICATIONS OF THE DEPARTMENT OF INTERIOR, FISH & WILDLIFE SERVICE, ARE AVAILABLE FROM DIVISION OF PUBLICATIONS, BCF, 1801 N. MOORE ST., ARLINGTON, VIRGINIA 22209.

AQUARIA

"Experimental Sea-Water Aquarium," by Reuben Lasker and Lillian Vlymen, Circular 334, Nov. 1969, 14 pp., illus.

Among other facilities at BCF's Fishery-Oceanography Center, La Jolla, Calif., is a 9,300 sq. ft. experimental sea-water aquarium. It incorporates some innovations not usually designed into other sea-water systems that make it invaluable in fishery and marine biological research. This paper describes the aquarium, the sea-water supply, temperature regulation, maintenance, environment rooms, and other special features.

MENHADEN

"Synopsis of Biological Data on the Atlantic Menhaden, Brevoortia tyrannus," by John W. Reintjes, Circular 320, Nov. 1969, 30 pp., illus.

This is a review of the taxonomy, morphology, distribution, reproduction, life history, growth, behavior, and abundance of Atlantic menhaden. Mr. Reintjes includes data on the size, age, and sex composition of the commercial catch, estimates of its relative abundance, and a description of fishing methods and equipment.

PROCESSING

"Guidelines for the Processing of Hot-Smoked Chub," by H.L. Seagran, J.T. Graikoski and J.A. Emerson, Circular 331, January 1970, 23 pp., illus.

The production of hot-smoked fish must be carried out under strict processing regimens and in a sanitary environment. Failure to observe such precautions may result in a product of inferior quality that even could be hazardous to public health.

The raw fish is processed by handling, preparing, brining, heating, and smoking. The smoking colors, flavors, and cooks the flesh. With proper processing and careful sanitation of plant and raw material, the product will be safe, wholesome and of acceptable quality. When adequately refrigerated, it will resist microbial spoilage.

This pamphlet provides descriptive guidelines for preparing hot-smoked chub. They should meet both the requirements of the regulatory agencies concerned and the economic demands of the industry. The guidelines cover plant sanitation, raw material quality (both frozen and nonfrozen stocks), processing--brining, smoking, and monitoring equipment--and packaging and handling. Charts for calculating brine strengths and a method of determining salt concentrations in fresh and smoked chub are included.

TUNA

"Review of Studies of Tuna Food in the Atlantic Ocean," by Alexander Dragovich, SSR-F No. 593, Dec. 1969, 21 pp.

A thorough knowledge of the food and feeding of tunas is requisite to an understanding of their regional and local aggregations and behavior.

Mr. Dragovich has reviewed 57 published and unpublished reports on the food of tunas in the Atlantic. Rather than summarize each paper, he has chosen to discuss the points of most interest to a fishery biologist: food organisms; tuna feeding habits; seasonal and diurnal variation in food and feeding habits; food in relation to tuna species and sizes; and tunas as collectors of marine organisms.

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The following articles are in 'Fishery Industrial Research,' Vol. 5, No. 5, Dec. 1969:

QUALITY CONTROL

"Recommendations for Improving the Quality of Vessel-Caught Groundfish," by J. Perry Lane, pp. 203-213, illus.

Newly caught fish can suffer changes, with varying degrees of rapidity, that leave them soft in texture, dull in appearance, and high in odor-producing compounds. Unfortunately, this loss of quality is both cumulative and irreversible.

The changes are primarily chemical, bacterial, and enzymatic. They cannot be stopped, but they can be slowed. Dr. Lane suggests guidelines and practices for both vessel and catch that should ensure delivery of fish as near its quality peak as possible.

SHRIMP PROCESSING

"Alaska Pink Shrimp, Pandalus borealis: Effects of Heat Treatment on Color and Machine Peelability," by Jeff Collins and Carol Kelley, pp. 181-189.

Fresh Alaska shrimp are difficult to peel on machines. To precondition them for peeling, they commonly are held on ice for at least 2 days. Holding shrimp not only increases costs, but results in lower yield because of physical damage and leaching. Quality also suffers because off-flavors and odors develop.

This paper reports on a precooking process that can be substituted for holding on ice or in refrigerated sea-water. The precook method also results in a canned product with more color and better texture than shrimp held on ice before peeling.

TUNA PURSE SEINES

"Depth-Time Sequential Analyses of the Operations of Two California Tuna Purse Seines," by Roger E. Green, pp. 191-201, illus.

Purse-seine fishermen often see tuna disappear from well-set nets for no apparent reason. Long after purse seines became the major U.S. gear for tuna fishing, the proportion of successful sets averaged only about 50-60%.

Timing of setting and pursing is very important in successful fishing, but little information is available on the depth of a purse seine at different times during setting. This paper attempts to fill the information gap with time and space analyses of 2 California tuna purse seines. Both are near the mode of the size range used by the California fleet for tropical tunas.

Thirty-two sets were made with 2 purse seines equipped with depth-time recorders and bathykymographs. The equipment provided data to prepare composite sequence analyses and underwater net profiles for 4 basic stages of the setting and pursing operations: 1) halfway through setting, 2) end of setting, 3) start of pursing, and 4) halfway through pursing.

--Barbara Lundy

INTERNATIONAL

THREE NATIONS OWN HALF WORLD'S FISHING VESSELS

Eighty-seven countries own trawlers and other fishing vessels over 100 gross tons. More than half these ships and their total tonnage are concentrated in 3 fleets: Soviet, Japanese, and Spanish. This was reported in 'Fishing News', Nov. 21, 1969.

Lloyd's Register of Shipping Statistical Tables for 1969 shows 11,535 commercial fishing vessels in world merchant fleet of 52,276. There are also 414 fish carriers and factoryships.

USSR Leader in Larger Vessels

The Soviet Union is the leading owner of the larger fishing vessels. Her fleet of trawlers and other catchers totals 2,604; 382 of these are above 2,000 tons. She owns 304 carriers and factory vessels--66 of these above 10,000 tons, and 80 between 4,000 and 10,000 tons. The Soviet larger-ship fleet aggregates 3,405,148 tons, just short of half the 87-nation total.

Japan No. 2

Japan is in second place with 2,067 trawlers and fishing vessels (719,097 tons) and 58 fish carriers and factories (169,374 tons). She has 44 fishing craft over 2,000 tons; in this category, she is not far ahead of Poland's 34 ships.

Spain has the third largest fleet--1,289 ships, 398,755 tons--but only 9 of these are above 2,000 tons. She also has one factory ship of 10,413 tons.

The United Kingdom has only 2 ships above 2,000 tons (the presently laid-up Fairtry trawlers). However, she is in fourth place with 578 fishing vessels (240,212 tons) above 100 tons.

Smaller Fleets

Then follow: France 663 (192,876 tons) fifth, Norway 623 (178,156 tons), Poland 168 (176,275 tons), West Germany 215 (161,886 tons), Canada 458 (124,134 tons), East Germany 161 (107,111 tons), Portugal 154 (105,523 tons), Italy 158 (71,617 tons), and Iceland 228 (62,310 tons).

Small Craft Important Too

Lloyd's Tables also show the extent to which some major fish-catching countries depend on smaller coastal fishing craft. Peru has a yearly harvest of around 10 million tons of anchoveta--but she is well down in the big-ship league with 294 vessels (44,643 tons) between 100 and 500 tons. South and West Africa have 100 ships (31,818 tons). The Philippines, with a catch of 750,000 tons, has 32 vessels 100 to 500 tons; and Thailand, 850,000 tons, has only 2 vessels above 100 tons. Indonesia, more than one million tons, has 4 vessels.

ICELAND HOSTS CONFERENCE ON FISH HARVESTING

Recent developments in commercial fishing technology--locating fish concentrations, purse seining, and trawling on the bottom and in midwater--will be principal topics of an international conference in Reykjavik, Iceland, May 24-30, 1970.

Dr. Leslie L. Glasgow, Assistant Secretary, U.S. Department of the Interior, said the conference is open to private individuals and representatives of companies, Federal and state agencies, and academic institutions.

Reykjavik will be the third FAO-sponsored meeting dealing with fish-harvesting technology in recent years. The first was in Hamburg in 1957, the second in London in 1963.

Advances in Technology

In recent years, much has been learned about the distribution, abundance, and movements of fish--and their reaction to fishing gear. Methods of finding and identifying fish also have improved considerably through more efficient echo sounders, sonar, and net-sounding equipment. These developments have led to spectacular advances in gear and operational methods used in purse seining and trawling, and in vessel design. Purse seining and trawling, adaptable to small and large vessels, now account for two-thirds the world fish catch.

BCF Liaison

Those attending conference must pay all costs involved. U.S. residents should contact U.S. Liaison Officer: William H. Stevenson, Chief, Division of Exploratory Fishing, Bureau of Commercial Fisheries, U.S. Department of the Interior, Washington, D. C. 20240. Telephone: Area Code 202, 343-6643.

COMMON MARKET RAISES TUNA AND COD QUOTAS

The Common Market tariff quota for tuna--fresh, chilled or frozen, whole, headless or in pieces intended for processing--has been raised from 50,000 metric tons to 65,000 tons. This was done at the Dec. 8-9, 1969, meeting of the European Communities (Common Market) Council.

The Council also increased from 34,000 tons to 39,500 tons the Community tariff quota for cod, including stockfish and klippfish, whole, headless or in pieces, salted, in brine or dried. (U.S. Mission, Brussels, Dec. 15, 1969.)

JAPANESE-BRITISH TUNA-PACKING VENTURE SLATED FOR MAURITIUS

The Japanese Overseas Fisheries Co. and Bryce Bros., a British firm, are planning a joint tuna-packing venture in Port Louis, Mauritius. Mauritius Tuna Enterprise will start with about US$181,000, half from each firm.

Plant Capacity

A two-line packing plant with a yearly 300,000-case (48 7-oz. cans) production capacity is scheduled to start in March 1970. The pack will be primarily tuna-in-brine for export to the U.S., but tuna also will be packed in oil.

Supplies from Foreign Longliners

Foreign longliners working out of Port Louis will supply the raw tuna. About 50 Taiwanese, 6 Okinawan, and 15 Japanese vessels now serve the Overseas Fisheries Company. Annual landings are around 30,000 metric tons. The cans will come from Japan.

Government Backing

Mauritius has little industry other than sugar. To develop more, the Government is making loans to Bryce Bros. ('Suisancho Nippo,' Jan. 8, 1970.)

INTERNATIONAL PACIFIC HALIBUT COMMISSION SETS 1970 REGULATIONS

In January 1970, the International Pacific Halibut Commission met for the 46th time, at Prince Rupert, British Columbia. The Commission is responsible to Canada and the U.S. for developing halibut stocks to levels that will permit maximum sustainable yield. Its regulations must be based on scientific investigations.

Benefits of Management

Before regulation began in 1931, annual catch had declined to 44,000,000 pounds. Under management, halibut stocks steadily increased, and annual yield rose to record catch of 75,000,000 pounds in 1968. The yield has diminished since then. The 1969 catch was considerably below record, but its value was second highest. In British Columbia, halibut was most valuable species in 1969, worth a record C$12,000,000 exvessel, a record high.

The Commission, concerned about the resource, recommended reducing Area 2 catch limit by one million pounds to 20 million pounds, a reduction in Area 3A by one million pounds to 30 million, and Area 3B by 500,000 pounds to 3 million. The Commission also will study the desirability of licensing all vessels landing halibut.

The Commission recommended the following regulations for 1970:

1) Area 2--all convention waters south of Cape Spencer, Alaska--shall open April 25 and close when 20,000,000 pound catch limit is attained, or Oct. 15, whichever is earlier.

2) Area 3A--between Cape Spencer and Shumagin Islands--shall open on April 25 and

close when 30,000,000 pound catch limit is attained, or Oct. 15, whichever is earlier.

3) Area3B--Shumagin Islands to Atka Island, not including Bering Sea--shall open first on April 1 for 5 days, then reopen April 25, and close when catch limit of 3,000,000 pounds is attained (including poundage taken during first season of 5 days), or on Nov. 15, whichever is earlier.

4) Area 3C--west of Atka Island, not including Bering Sea--open March 17-Nov. 15.

5) Area 4A--the Bering Sea edge-Unimak Pass to Pribilofs--open for 12 days, March 22-April 4.

6) Area 4B--Fox Islands grounds, Bering Sea--open for two 12-day periods, March 22-April 4, and Sept. 1-14.

7) Area 4C--edge grounds and Bering Sea side of Aleutians between 170° W. and 175° W.--open March 17-April 11.

8) Area 4D--east of 175° W. and north of line between St. Paul Island and Cape Newenham and waters of Bering Sea west of 175° W.--open March 17-Nov. 15.

Nursery Area

The flats in southeastern Bering Sea east of Area 4A, and south of line between Pribilofs and Cape Newenham, have been declared a nursery area and are closed to all halibut fishing.

Hours

Opening hour of Areas 2, 3A, and 3B will be 1500 hours Pacific Standard Time (PST). Closing time will be 0600 PST. Areas 3C, 4A, 4B, 4C, and 4D will open and close at 1800 and 0600 hours PST.

Closure Notices

The Commission will provide 10 days' notice of closure of Area 2; 18 days' notice of closure of Area 3A; and at least 18 days' notice of closure of Area 3B.

The next annual meeting will be held at the Commission's office and laboratory in Marine Sciences No. 2, University of Washington, Seattle, Washington 98105. Mr. Haakon M. Selvar of Bainbridge Island, Wash., was elected Chairman, and Dr. William Sprules of Ottawa, Ontario, Vice Chairman for the ensuing year. (IPHC, Jan. 30, 1970.)

CANADA AND U.S. AGREE ON RECIPROCAL FISHING PRIVILEGES

Representatives of the United States and Canada met at Ottawa Feb. 10-13, 1970, and negotiated a draft agreement on reciprocal fishing privileges in certain areas off the coasts of the two nations. In recent years, each had established exclusive fishing zones. The draft agreement is subject to Governmental approval.

The Canadian Delegation was led by Dr. A.W.H. Needler, Deputy Minister of Fisheries and Forestry. Ambassador Donald L. McKernan led the U.S. Delegation. Their advisors included state, provincial, federal, and fishing industry representatives from both coasts.

The areas covered by the draft agreement include east and west coasts of Canada and the U.S. including Alaska. The species involve all commercial fisheries affecting both nations. The 2-year draft agreement applies only to commercial fisheries and to the areas named.

Fisheries of the two nations will continue much as before in the areas designated as reciprocal fishing areas: (a) Salmon trolling by Canadians will continue to be permitted only in a 3-to 12-mile area off the U.S. U.S. salmon trollers will be permitted to continue off Canada's Vancouver Island. (b) Pacific halibut fishing in each nation's reciprocal fishing area will continue. (c) Trawl fisheries conducted in each nation's reciprocal fishing area by vessels of the other nation will continue. (d) The longstanding practice of transferring herring on the east coasts of the U.S. and Canada will continue; but neither will fish herring in the other's reciprocal fishing area. (e) Fishing for any species of clam, scallop, crab, shrimp, or lobster will not be permitted in the other nation's reciprocal fishing area. (f) The initiation of a new fishery by vessels of one nation within the other's reciprocal fishing areas will require prior consultation and agreement.

Fishing regulations in the reciprocal fishing areas are to apply equally to the fishermen of both nations.

CANADA

1969 LANDINGS IN MARITIME PROVINCES WERE RECORD VALUE

Landings in Canada's Maritime Provinces--Nova Scotia, New Brunswick, and Prince Edward Island--totaled 1,233 million pounds worth a record C$76.9 million in 1969. This compared with 1,374 million pounds worth C$74 million in 1968, and 1,090 million pounds worth C$63.2 million in 1967.

Quantity Declined

The decrease in quantity from 1968 was due largely to smaller herring landings. Record quantities and values of ocean perch (redfish) and crabs were landed in 1969. The value of 1969 lobster landings was a record C$25.4 million, 33% of value of all landings. (Canadian Dept. of Fisheries and Forestry, Jan. 28, 1970.)

* * *

PREDICT IMPROVED BRITISH COLUMBIA SALMON RUN

After the very poor salmon runs in 1969, the industry is expecting better luck this year. Predictions are that 1970's total pack will be on the high side of the 1,400,000-case, 5-year average.

Canadian Salmon Pack, 1965-69[1]

Species	1969	1968	1967	1966	1965
			(48 Lb. Cases)		
Sockeye	358,505	611,011	558,892	407,949	245,798
Spring	5,300	7,416	14,679	14,585	18,891
Steelhead	584	933	1,296	2,480	843
Blueback	2,146	10,389	7,799	21,087	21,300
Coho	55,566	177,205	138,878	260,536	273,984
Pink	153,386	669,347	650,142	951,794	287,925
Chum	46,369	270,688	94,022	160,784	65,216
Total	621,856	1,746,989	1,465,708	1,819,215	913,957

1/Includes salmon canned from U.S. imports. (British Columbia Canned Salmon Pack Bulletin, Dec. 17, 1969.)

Northern Areas

Sockeye forecasts for the north are disappointing. A run of 1,000,000 fish, and a catch of only 320,000, has been predicted for the Skeena. The Nass run, expected to be average, could provide a catch of 224,000 sockeye.

Rivers Inlet Run Small

Only 500,000 sockeye are expected in the Rivers Inlet run; all could be used on the spawning grounds. The Fisheries Department, concerned about the effect of the efficient Rivers Inlet fleet on such a small run, is considering very drastic closures. Smith Inlet also is expected to be below average.

Fraser River Outlook Good

The Fraser River is a bright spot. The International Pacific Salmon Fisheries Commission has placed total run in Convention waters at 6,300,000 sockeye, and total catch at 4,500,000 (2,250,000 each for Canada and U.S.). The Fraser does not produce significant number of pinks in even-numbered years, but prospects for pinks in the north are most encouraging.

The Fisheries Dept. expects above-average returns in all areas from Cape Caution north, including Queen Charlotte Islands. Local stocks from Johnstone Strait also are expected to be above average. Coho and chum returns should be average; chinook possibly below. ('Facts on Fish')

* * *

NEWFOUNDLAND FISH-MEAL PLANT OPENS

A $2,750,000 herring reduction plant opened in Newfoundland in late January 1970. It is a joint project of Spencer Lake and the Clyde Lake Group of fishing industries (Nfld.), and National Sea Products Ltd. (Nova Scotia).

1,000 Tons Daily

The plant can process 1,000 tons of herring a day into meal and oil. Ten to 20 seiners will supply the fish. (U.S. Consul, St. John's, Jan. 30, 1970.)

* * *

FOREIGN FLEETS CAUSE CONCERN

Canada's Fisheries Department has disclosed that 744 foreign vessels, including 111 Soviet, fished off Canada in 1959; 211 Canadian vessels fished. In 1968, 1,815 foreign vessels (553 Soviet) and 558 Canadian vessels fished.

CANADA (Contd.):

In 1968, the Soviets caught 460,000 metric tons off Canada, compared with Canada's 1,160,500 short tons.

Fisheries Minister Criticizes Soviets

The Canadian Fisheries Minister has said that, in the Atlantic, "the haddock catch has been reduced in 10 years from 100 million pounds to 20 million. . . . the Soviet trawlers zero in on a school of fish and by the time they have finished they have virtually wiped out the entire school, there is nothing left . . . Major grounds off Canada's Atlantic coast were found to be critically overfished and in 1968 many Newfoundland fishermen had their catch cut in half."

* * *

TRIES ELECTRONIC TRACKING OF SALMON

Canada is tracking salmon electronically in the Miramichi River to discover how pollution affects salmon movements. The Miramichi is one of the world's greatest salmon-producing streams.

Tags & Sonar Capsules

Forty-eight salmon have been tagged. Sonar capsules (2" long and $1\frac{1}{2}$" in diameter) also have been inserted in their stomachs. Each capsule contains an electronic package powered by 4 mercury batteries. These have a life span of 30 days and can be tracked from as far as $1\frac{1}{2}$ miles.

* * *

HIKES SALMON-LICENSE FEES

New rulings in the salmon-licensing program, including a sharp increase in category A commercial salmon-license fees, have been announced. The increases will fund a buy-back program to reduce British Columbia's salmon fleet. The regulations will go into effect April 1, 1970. Category A includes vessels producing 10,000 pounds or more of pink or chum salmon or the equivalent. Category B vessels are those producing less than 10,000 pounds.

Beginning this year, category A vessels under 10 registered tons will pay a $100 salmon license fee, and those 10 tons and over will pay $200. There will be no increase in the $10 license for category B boats. Under the new rulings, a category B salmon license will terminate in 10 years. The B boat will not have its salmon license renewed, but after that will be allowed to fish any other species.

Categories of Boats

Owners of category A vessels will be allowed to drop to B category. They can make this choice at any time, but can never move back to category A. The 10-year terminal clause applies whenever they decide. Category B boats have the same fishing privileges as 'A,' can have the same earning power, and can be sold as producing 'B' salmon fishing vessels during their life span. Category B boats cannot be replaced to bring a new boat into the fleet. Only a category A boat can be replaced.

Company Boats 12% of Total

In April 1969, company-owned boats were frozen at 800, about 12% of the total commercial salmon fleet. They will be reduced at the same rate as the fleet when the buy-back program gets underway.

Another change will allow category A vessels to retain their salmon fishing privileges even though they do not fish for salmon. But they must take out a salmon license each year. (Canadian Dept. of Fisheries and Forestry, Jan. 16, 1970.)

EUROPE

USSR

DESIGN NEW BOTTOM AND PELAGIC TRAWLS

A new 50.8-meter universal trawl that can be used for bottom and pelagic trawling was designed and manufactured aboard the factory stern trawler (BMRT) 'Novaia Era.' Its vertical opening is 17.5 meters; horizontal 17.5-18 meters; each otter board is 6.2 sq. meters.

Tested Off U.S. West Coast

In Sept. 1968, the trawl was tested for Pacific hake at 250-400 meters between 43° and 49° N. latitudes off Oregon and Washington. In Nov. 1968, off Vancouver Island, 95 hauls yielded 1,000 metric tons of hake; average haul was 10.5 tons. In Dec. 1968, Novaia Era used the trawl in the Bering Sea for bottom and pelagic trawling for herring. Total catch was 4,300 tons, average haul 10.3 tons (usually 5.1 tons with conventional trawls), with peaks of 20-40 tons. The tests proved the trawl successful at various depths and bottoms.

New Pelagic Trawl

A 50-meter pelagic trawl also has been designed for 'Natalia Kovshova' class (8,500 gross tons) fish-canning stern trawlers. The horizontal opening is 25 meters. The vertical opening is 20, 18, 17, 16, and 15 meters at trawling speeds of 4, 4.5, 5, 5.5, and 5.8 knots, respectively. The otter boards are 8 sq. meters each. The wings and the first two bag sections are 3.1 millimeter diameter synthetic fiber line. The other trawl parts are made of lighter line.

Tests

Tested for 500 hours, the trawl caught 2,000 tons, with no hang-ups. It was 30% more efficient than the 38.5-meter trawls used by 'Atlantik'-class stern trawlers. ('Rybnoe Khoziaistvo,' Nov. 1969.)

* * *

SALMON IN PONDS RAISED UNDER NEAR-NATURAL CONDITIONS

In April 1965, scientists of the Sakhalin Branch, Soviet Pacific Fisheries Research Institute (TINRO), placed 1,680,000 chum fry in a 620-square-meter pond with a maximum pond depth of 50 centimeters. Its bottom, gravel, sand, and silt, was much like the bottom of natural spawning grounds. Water flow was regulated. Benthos for feed, reproducing naturally, had increased from 960 to 4,118 units per square meter. By the end of July 1965, it prevailed over nonfeed benthos. Walleye pollock eggs were placed on underwater feeding tables 2-3 times daily. The fry's average daily weight increase was 11.3 milligrams. After 37 days, their stomachs were 3 times as full as those of chum in a conventional nursery or in Sakhalin's Iasnomorka River. ('Rybnoe Khoziaistvo,' Nov. 1969.)

* * *

SALMON BRED ON SAKHALIN

The Sakhalin salmon hatcheries have succeeded in crossbreeding Siberian and humpback salmon. The crossbreed has the Siberian's weight and taste, and the humpback's quick growth. The hybrid fry will be released in the Pacific in spring 1970.

USSR's Largest Salmon Hatchery

The Sakhalin salmon hatcheries are the USSR's largest. They produced over 600 million fry in 1969, and the hatchery directors hope for as many this year. Great amounts of Siberian and humpback eggs are air-shipped to other salmon hatcheries, particularly in the Caucasus and on the Kola Peninsula.

New Installations

A new Sakhalin laboratory has been set up to increase salmon resources. It will coordinate the activities of both existing hatcheries and ones that will be built in the next few years.

To preserve the salmon, timber floating has been stopped on all rivers with natural spawning grounds. (TASS, Jan. 4, 1970.)

* * *

RECORD SOUNDS MADE BY KING CRAB AND SALMON

Soviet scientists have succeeded in recording the sounds made by king crab and Pacific salmon. They have made experimental tape recordings in the Pacific, the Sea of Okhotsk,

USSR (Contd.):

and Kuril Lake. Salmon make sounds like a buzzer or the ticking of a clock. King crab emit crackling sounds that grow into a noise like breaking waves.

Sound recording appears most successful with non-schooling fish such as salmon, tuna, and sharks. It also is effective with crustaceans like crab and shrimp.

The scientists claim it is possible to determine the species of the fish and even its size and migration patterns through its sounds. (TASS, Jan. 4, 1970.)

* * *

COMPILE MEDICO-GEOGRAPHICAL MAP OF PACIFIC

A medico-geographical map of the Pacific has been authored by 2 Soviet scientists, Artur Keller and Innokentii Krasnoreev. (TASS, Nov. 18, 1969.) The map supplies navigators and researchers with information on diseases. It details areas inhabitated by fauna dangerous to man: sharks, snakes, poisonous fish, echinodermata, jellyfish, etc.

TASS claims that it is the world's first medico-geographical map of the Pacific. It reflects the Soviets' increasing concern with the Pacific where their fisheries are expanding continuously.

* * *

SOVIET-BLOC COUNTRIES DISCUSS FISHERY PROBLEMS

COMECON (also known as CEMA or Council for Economic Mutual Assistance) countries met in Leningrad in early Nov. 1969 to discuss the Tri-Partite Agreement (USSR, Poland, and East Germany) on cooperation in Marine Fishing. The agreement was signed on June 28, 1962; Bulgaria and Romania joined later.

Bulgaria & Romania Progress

In 1969, the Joint Commission noted that Bulgaria and Romania had achieved considerable success in diversifying their coastal fisheries into high-seas operations. This was made possible by joint studies of fish stocks in potential fishing areas, a coordinated plan to deploy research vessels, and exchange of information. One practical result of joint research is an "electric trawl which increases catches by 40 percent." The gear was designed by Poles, Soviets, and East Germans.

What They Discussed

The delegates of 5 countries discussed increasing their cooperation, unifying their "scientific potential" (for marine research), and relations with "other international fishery bodies."

The Commission's next (8th) annual meeting will be held in Rostock, East Germany, Sept. 21, 1970.

* * *

FAR EASTERN FISHERMEN PROTEST INEFFICIENT ADMINISTRATION

On November 20, 1969, the leading Soviet newspaper, 'Izvestiia,' printed unusual 'letters to the editor' from Far Eastern fishermen. They complained of the lack of refrigerated fish carriers, insufficient moorage in Vladivostok and Nakhodka, and poor at-sea servicing for factory stern trawlers (BMRTs).

Refrigerated Carriers Lacking

The writers claimed that 20-25 BMRTs of Kamchatka's High Seas Fishery Administration were idle a total of 394 days in 1968, and 390 in first 8 months 1969, while waiting to transfer catches to carriers. This represented a catch loss of 18,000 metric tons, or about 23 tons a day.

Kamchatka's Trawler and Refrigerator Fleet vessels were idle for 1,500 days in 19 months (Jan. 1968-July 1969) for the same reason. They could have caught and delivered 10,000 tons of fish in this time. The combined loss was equivalent to about 4% of Kamchatka's total annual catch.

Excessive Demurrage

There is a striking imbalance between the fleet's fishing and processing, and carrying capacity. Fishing vessels are demurred for weeks waiting for fish carriers to unload. The carriers, in turn, may have waited weeks, or even months, to unload in port. Demurrage time of all Kamchatka's fishing fleets amounted to 72.2% of their total operating

USSR (Contd.):

time in 1967, 69.1% in 1968, and 73.1% in first-half 1969.

One letter accused the Soviet Far Eastern Fisheries Administration (DAL'RYBA) of operating Nakhodka and Vladivostok fishing harbors inefficiently. Some vessels have had to wait 40-60 days in the roadstead before mooring in port. The 'Donbass' class vessel 'Kadievka' was demurred 67 days in 9 months because of this. Demurrage of a 'Pervomaiski' or 'Donbass' class vessel costs 2,000 rubles (US$2,200) a day.

Poor Servicing At Sea

Another letter complained of disorganized at-sea servicing of BMRTs. In summer 1969, the 'Khingan' ('Maiakovskii' class) lost 5 days in June, 6 in July, and 10 in August waiting for refrigerated carriers to transship her catch. She could have caught 700 tons of fish and produced 500,000 rubles (US$550,000) worth of fishery products in that time. The Khingan fished off Hawaii in August 1969. (U.S. Embassy, Moscow, Nov. 22, 1969.)

The First Deputy Minister of Fisheries admitted late Jan. 1970 in 'Pravda' that the protests were justified. He said the following measures would be taken to improve the situation: (a) equip the entire Soviet fishing fleet in 1970 with lighter large-mesh trawls permitting 20% increase in towing speed and 10-15% in catches; (b) attach one mothership to a group of fishing vessels to streamline fishing and catch-transfer operations (experiments successfully conducted in N. Atlantic with 'Trudovaia Slava' and fleet of 37 fishing vessels); (c) construct improved factory stern trawlers with mechanized production lines. (U.S. Embassy, Moscow, Jan. 24, 1970.)

* * *

STAGE TV FILM FESTIVAL ON FISHING & FISHERMEN

In September 1969, the 4th TV Film Festival on seamen and fishermen was held in Riga, Latvia. East Germany, Czechoslovakia, Poland, Bulgaria, Finland, and USSR entered films dealing with the life, labor, and adventures of seamen and fishermen.

Czech Film Wins

The first prize went to a Czech film, second to a Finnish film, and third prize was awarded to a Soviet film on tuna fishing in the Atlantic. A Polish TV film on a Polish journalist (Leonid Telig) who sailed around the world on a sailing yacht received a citation. ('Rybnoe Khoziaistvo,' Dec. 1969.)

* * *

SCIENTISTS STUDY LUMINESCENCE OF MARINE ANIMALS

Bioluminescence studies in the Soviet Union are described by biologist A. Kovalev in an article translated by the Novosti Press Agency.

Many marine animals, including fish, possess luminescence. Sometimes its intensity is so great that one can read a newspaper near a glass jar containing 5-6 euphausiidae crawfishes (krill) about 27 millimeters long. Oceanographers in bathyscaphes and bathyspheres deeper than a kilometer photographed some fish and other animals without using spotlights.

When & Where Organisms Shine

Most marine surface organisms do not shine in calm weather. They produce a flare only when irritated mechanically. So along a ship's side--or in wake-stream with very high concentration of shining organisms--a light strip appears that often disappears just a few dozen meters behind ship's stern.

What is biochemistry of live light? Luciferin and luciferase were found in the special organs of many shining organisms. With aid of luciferase, oxygen oxidizes luciferin; the reaction is attended by luminescence and secretion of very little heat. Bioluminescence interests scientists because they can't obtain light without a great expenditure of heat.

The commercial fish of the oceans' surface layers do not shine themselves. But they concentrate and move quickly--and cause small organisms to shine. This allows fishermen to locate shoals.

Research at Sevastopol

Soviet scientists have turned from describing bioluminescence to studying it quantitatively. The Sevastopol Institute of the Biology

USSR (Contd.):

of Southern Seas, using photoelectronic equipment, showed that the shining intensity of Black Sea noctiluca varies seasonally. Maximum intensity occurs in June and October. The Institute also measured the intensity of luminescence in the Mediterranean and the north Atlantic.

One scientist hypothesizes why fish concentrate around light sources. He assumes that in the process of evolution, they have developed a positive reaction to the bioluminescent field. The reaction appears when they move and is caused by excitation of small, shining, plankton animals.

When catching fish using light, the lamps immersed into water to attract fish must conform to spectral characteristics of the bioluminscent field.

UNITED KINGDOM

MOVES TOWARDS SMALL STERN TRAWLERS

The British deep-sea trawling industry now widely accepts the stern trawler for distant-water fishing. However, this attitude has not extended to vessels under 140 ft. In the near-water fleet--189 vessels 80 to 110 ft.--there were no stern trawlers at the end of 1968; there were only 3 in the 177-vessel middle-water fleet.

New Stern Trawler

But there have been recent signs of a change in attitude. A Hull-based firm will try a prototype $82\frac{1}{2}$ ft. stern trawler. It will operate from Fleetwood on the west coast.

Boston Fleet

Boston Deep Sea Fisheries Ltd. has announced a more ambitious project. The firm, Britain's second largest trawler group, has vessels based at Hull, Grimsby, Fleetwood, and Lowestoft. The Boston fleet is like other vessels working in the North Sea from the Suffolk port of Lowestoft. It consists of 100-120 ft. diesel-powered side trawlers. The Lowestoft industry has long believed that stern fishing is not suited to North Sea conditions. Some efficient new vessels have been built for Lowestoft in recent years, all side trawlers.

Protoype for Boston Fleet

Now the Boston group has concluded that the time has come to introduce a stern trawler to the port. The vessel, about 100 ft. long, incorporates many interesting new features. It may set the pattern for future trawlers in near-water fleet. It will be followed by at least 5 more. (It is believed the new trawlers will use the net drum.) ('Fishing News International,' Dec. 1969.)

FRANCE

INCREASES SUBSIDIES FOR DEEP-SEA FLEET

To encourage modernization of long-range fishing vessels, France recently announced a 15-25% increase in subsidies to owners of such vessels. The Fund for Economic and Social Development also is providing credit to owners building new vessels. Few vessels have been added to the distant-water fleet in recent years, although several trawlers for middle-water fishing have been built in Poland. One reason for the lack of new vessels is the hake scarcity on Irish and Scottish grounds. The scarcity also has sent some vessels venturing off the coasts of Iceland.

Buys Vessels From Poland

From 1952 to 1969, French companies were authorized to purchase 26 vessels from Poland. Deliveries were made to 7 different French ports, but most went to St. Malo. An order for one freezer-trawler, to be delivered in 1971, was placed with Gdynia shipyards recently. To operate in the North Atlantic, it will be the largest and best equipped in the French fleet. The vessel, homeported in St. Malo, will be 89.9 meters long overall, 1,350 gross tons, and have a 2,061 cubic meter total hold capacity.

The French fleet has about 706 vessels over 100 gross tons each, and totals 194,200 gross tons. ('Fishing News,' Jan. 9, 1970, and 'Polish Maritime News,' Oct. 1969.)

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THE FRENCH TUNA INDUSTRY

David K. Sabock

Tuna canning is an old French industry. It started at La Rochelle and Les Sables d'Olonne in 1850. By 1869, the island of Croix had become the tuna center, but it wasn't until 1891 that the first major tuna-fishing campaign was organized in Concarneau.

Today, French tuna vessels fish the nearby Atlantic and Mediterranean waters--and range to the distant fisheries in the Gulf of Guinea off W. Africa, and in the Indian Ocean. Despite the fleet's wide range, the industry is oriented domestically. However, with its fleet expanding, France sees herself becoming a more important factor in the international tuna market.

A significant amount of production takes place in several African countries tied to France by cooperation agreements. The French fishing fleet is responsible for most of this production, which is processed in African canneries with large shares of French ownership.

Catch Doubled in 10 Years

Tuna landings almost doubled from 1958 to 1968: from 34,000 metric tons (live weight) to 65,600 tons. Estimated landings for 1969 are 67,000 to 70,000 tons. This increase corresponds to increased French activity off the W. African coast, a fishery France entered in 1955-56. Since then, yellowfin has become the dominant species, accounting for 49,100 tons in 1968--75% of the total catch.[1] Albacore, formerly the main species, accounts for most of the remainder. Albacore catches were steady from 1958 to 1964, but then declined 30% to 14,600 tons. Small amounts of bluefin, skipjack, and bigeye also are caught. Tuna account for 8% of total fish and shellfish landings--and 12% of total value.

In the last decade, world tuna landings rose from 990,000 tons to 1.4 million tons. The French catch has increased more rapidly. France now accounts for almost 5% of the world catch, compared to 3.5% in 1958. It is now the world's 4th largest tuna harvester, behind Japan, the U.S., and Taiwan.

Some confusion exists over the French names for tuna. The French equivalents of English names are given here in parentheses: Albacore (Thon blanc, Germon), bluefin (Thon rouge), and yellowfin (Thon albacore). In English translations, albacore may also be called white tuna; bluefin, red tuna.

Fishing in European & W. African Waters

Albacore and bluefin are caught almost exclusively in European waters including the Mediterranean. Yellowfin, bigeye and skipjack, but primarily yellowfin, are caught in W. African waters (Gulf of Guinea).

Albacore and bluefin are fished in nearby French waters from July to October by about 450 vessels berthed at nearly every important Atlantic port. Primary ports include Douarnenez, Concarneau, St. Geunole, Lorient, Les Sables d'Olone, l'Ile d'Yeu, and St. Jean de Luz. Concarneau and St. Jean de Luz are the leading ports.

Early in the African fishing season, effort is concentrated between Libreville, Gabon, and Point Noire, Congo. As a warm-water oceanographic front moves southward during that hemisphere's summer months, the yellowfin also move southward. The fishing area then spreads from Libreville to Luanda, Angola, in the fall--and from Point Noire to south of Luanda in the winter. French fishermen have fished as far north as Port Etienne in Mauritania. July to December is the peak season for the African fishery.

Search for Other Fishing Areas

The expanding industry has looked elsewhere for tuna. In 1968, 20 vessels explored in the Mediterranean's Gulf of Genoa. Results were satisfactory. Vessels sailed from Port-Vendres, Agde, Marseilles, and other southern ports. Observations indicated two migrations of tuna, one in spring and one in summer.

In July 1969, the French CIAP Corporation placed a US$556,000 order with a Japanese fish net and gear manufacturer for a

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1/Landings data for yellowfin include small amounts of skipjack and bigeye.

modern 400-GRT double-deck longliner. The vessel will work in the Indian Ocean from the tuna base at Reunion Island, a French possession about 400 miles east of Madagascar and near Japanese base at Port Louis, Mauritius.

CIAP is a semigovernment corporation established in St. Denis, Reunion. It was formed to develop a tuna base in the Indian Ocean in line with the EC (European Communities) common fishery policy of promoting tuna fisheries. Plans call for initially conducting exploratory fishing with a longliner and, eventually, increasing the fleet to 10 vessels. Catches will be delivered to tuna packers in France.

Reports circulated in 1969 that France's (and Europe's) largest tuna seiner, the 'Biscaya' (1,082 GRT), would be fishing tuna in the Eastern Pacific. More recent information indicates the ship is working W. African grounds.

Fleet Develops

Only 20 years ago, most of the fleet was sailing boats. Since then, vessels were developed for longlining and purse seining. Vessels also grew larger. Orders for 155- and 165-foot vessels have been placed within the last few years for St. Jean de Luz and Concarneau, mostly the latter. The success of large seiners off W. Africa has stirred considerable interest among French companies; more "super-seiners" similar to the Biscaya are being built or planned.

Two Fleets for African Fishery

There are two fleets operating in African waters: one supplies fresh tuna to local canneries, the other ships frozen round tuna via refrigerated carriers to France. Vessels include bait boats, seiners, and combination seiner-bait boats. Emphasis is swinging to the seiners because their catch rates have been higher.

Considering the rapid development in the Gulf of Guinea, total catches there should continue to increase over 1968's 50,000 tons (live weight). The 1969 fishery may not have fulfilled expectations.

Although the U.S., Japan, Taiwan, South Korea, Spain, Italy, and Portugal fish tuna off W. Africa, the French fleet is dominant. About 42 French vessels fished in 1969, including 31 freezers and 11 bait boats. Operations are controlled by the Societe de Vente de Thon Congele (SOVETCO), an association of vessel owners headquarted at Concarneau, with representatives at African transshipping ports.

Canned Pack Rises--45,000 Tons in 1970?

Canned tuna production increased 53% from 19,600 metric tons (product weight) in 1958 to 30,000 tons in 1968. An output (preliminary figure) of 37,500 tons was attained in 1969. A pack of 45,000 tons is forecast for 1970. Since 1958, total canned fish production rose from 57,000 tons to 92,700 tons in 1967. It fell to 83,400 tons in 1968 as output of canned sardines dropped drastically. Tuna now dominates the canned fish pack with close to 40% of total output in 1968. Sardines (28%) and mackerel (24%) represent most of the remainder.

France ranks as the world's 4th largest tuna packer, behind the U.S., Japan, and Italy. It produced 8% of the world's 1968 tuna pack.

Firms Concentrate

Output has increased with reduction in number of firms and plants in the canning industry, and an increase in productivity of existing canneries. The number of firms dropped from 159 in 1956 to about 107 now. These firms operated 207 plants in 1956, 130 now. Average production per plant is about 600 tons, but average capacity is 1,000 tons. Eighteen plants produced more than 2,000 tons, 16 between 1,000-2,000, 16 between 500-1,000, and 47 under 500.

Processing techniques vary, depending on how tuna are to be packed. An oil pack is most common, although much is canned in brine. Other ingredients are used, mainly tomato sauce.

Imports High, Exports Low

France is a net importer of canned fish. It purchased 39,000 tons in 1968, while exporting only 2,100 tons. In recent years, both imports and exports have been relatively steady. About 11,700 tons of canned tuna were imported in 1968, a 30% increase over 1967. Principal suppliers were Senegal (8,050 tons) and the Ivory Coast (1,800 tons). Preliminary 1969 data indicate a 15,000-ton import level with a proposed 20,000-ton purchase in 1970.

Fresh and frozen tuna also are imported, though fresh tuna purchases are only 90 tons, almost all from Italy. Frozen tuna imports were 2,400 tons, up 33% from the 1,800 tons shipped in 1967. Japan supplied 40% of the total.

Special Arrangements with African Countries

Most tuna imports originate from Senegal, Ivory Coast, Congo-Brazzaville, Malagasy, Cameroon, Dahomey, and Mauritania. Their association with EC gives them the right to sell duty free on the French market, but quota limitations are in force. Quotas are assigned annually, with added provision that the tuna canned must have been caught by French fishermen. About 70% of the quota is assigned to Senegal, most of the remainder to the Ivory Coast.

The domestic fleets of these African countries are improving, with resulting increases in catches. It is becoming increasingly difficult for France to absorb this expanding output. The French quota is considerably below the capacity of African canneries, output is rising, so attempts will be made to export to the U.S., Italy, and West Germany. To assist in this effort, a guaranteed minimum price system for tuna exported is being considered.

Besides quota arrangement, Senegal also controls the supply of fish to various canneries. Senegal has 4 canneries with a total annual capacity of 35,000 tons (1968/69 quota was only 12,500). The canneries--SAPAL, Conserverie du Senegal, SCAF, and SOSAP--are in the Dakar-Rufisque area. Local tuna consumption is very low.

The Ivory Coast's quota in recent years, has been assigned to one firm, the Societe des Conserveries de Cote d'Ivoire (SCODI). Its daily capacity is about 35 tons of tuna and sardines.

Consumption Rising

Although French consumption of all types of canned fish is rising, this form accounts for only 20% of total fish consumption. Canned tuna consumption has more than doubled in ten years. Much of the increase is attributable to large nationwide advertising campaigns. Consumption is widespread, except for poorest people. Most tuna is consumed as cold hors d'oeuvres. In 1970, consumption is expected to approach 47,500 tons, 32% more than in 1968. The supply will be fulfilled easily from domestic production, plus imports from Africa.

Government Control and Assistance

Financial support given to the industry is the same as that for all French fisheries. Aid is provided for shipbuilding, interest rebates are granted to induce owners to build new vessels or modernize existing units, and the Credit Maritime Mutuel makes loans to fishermen and cooperatives to promote ownership of vessels and foster cooperation in small-scale fisheries.

The Comite Interprofessionnel du Thon (Interprofessional Tuna Committee) controls the industry by establishing or assisting in establishing exvessel prices, quotas, special trade arrangements, allocating supplies, and planning and setting the length of each season. It also assists the industry by supporting exploratory fishing, technological development, marketing, and other programs.

Fixed Price Systems

Most fish sales are by auction, but tuna for canning, along with sardines and salted cod, are exceptions. Prices of tuna used in canning are fixed for a 3-year period by agreement within the trade and approved by government authorities. There is provision for amendment, if necessary. A minimum price system does not exist.

The system requires that a single price be set for each species. The Comite Interprofessionnel du Thon operates the system, which includes setting quantities and allocating supplies. Pressure to adopt this type of pricing arrangement came in the early 1960s when canners could not obtain adequate supplies of raw tuna, and fluctuating catches made the existing seasonal price system inadequate. A 3-year fixed price system was adopted in 1963.

In fixing quantities, priority is given to French production. Quotas for sales in the French market are assigned to African countries in October of each year based on their tonnage caught, and the capacity of the French market to absorb output. African production for 1970 may reach 20,000 tons, about double 1968's.

Supplies are allocated to canners based on firm orders accompanied by an irrevocable payment with a partial bank guarantee. Canners are held to prices as long as economic conditions remain unchanged during the life of the contract. There is a levy on value of catches to finance a partial price-equilibrium fund and a countrywide advertising campaign.

The Future

Two items are particularly interesting in considering the future of the French tuna industry: (1) the results of their preliminary attempts at establishing a tuna base in the Indian Ocean, and (2) plans for marketing tuna from francophile West African countries.

Increasing worldwide interest is being shown in the fisheries potential of the Indian Ocean. France is entering that tuna fishery in its early stages. Also, the capacity of the West African canneries is far above their quota for the French market, and the output is increasing yearly. Where will they attempt to market their production? To what extent? And how will ability to sell elsewhere affect their efforts in France?

Main sources for this article were reports in 'La Pêche Maritime,' 'France Pêche,' and U. S. Embassy dispatches. A 35-entry bibliography is available on request from BCF Office of Foreign Fisheries.

WEST GERMANY

HERRING SHORTAGE GROWS

A growing shortage of herring has left the German canning industry unable to fill the strong domestic demand. German fishermen supply only about two-fifths of the canners. Foreign suppliers face the same difficulty as German fishermen--a declining herring catch from traditional fishing grounds. For the past three years, German fishermen have been increasing their herring fishery off the U.S. Atlantic Coast, especially on Georges Bank. However, they are still unable to satisfy the canners' demands. The canners are considering importing frozen herring from Canada.

They also are thinking about shifting to other types of fish.

Opportunity for U.S.

This situation has created a real opportunity for the U.S. fishing industry. If need be, the industry could exploit Georges Bank herring stocks. The German market would not be a stop-gap business. The annual sales potential for U.S. frozen herring there has been estimated at well over one million dollars.

Detailed Report Available

German importers and canners would welcome U.S. offers. (U.S. Consul, Bremen, Jan. 27, 1970.)

A detailed report, FFL-181, is available from Office of Foreign Fisheries, BCF, Department of the Interior, Washington, D. C. 20402.

NORWAY

FISH MEAL QUALITY IS UPGRADED

Installation of 4 solvent-extraction plants has greatly increased Norway's supply of upgraded fish meal. This was reported by the University of Rhode Island's Commercial Fisheries News Letter in Jan. 1970.

Solvent extraction is used to upgrade regular fish meal. Defatted Norwegian herring meal contains over 80% of highly digestible protein and has a pleasant malty flavor.

Pet Foods & Animal Feeds

Used in pet foods and animal feeds, defatted fish meal partially replaces dried skim milk as a source of high-quality protein. Commercial quantities are being exported to the U.S.

DENMARK

GREENLAND TO BUY 2 NEW TRAWLERS

Greenland's first stern trawler, 'Nuk,' began operations in mid-May 1969. She landed good catches despite technical difficulties and 3 wrecks during the summer. Experience indicated that raw material for fish fillet factories must be obtained on the banks far outside Greenland's coasts.

New Trawlers Planned

Now, funds have been set aside for 2 more trawlers to operate in 1971. The design, worked out with a Norwegian firm, calls for a 58-meter-long, 11.2-meter-wide, modern trawler with a load capacity of about 550 cubic meters. Nuk has a load capacity of 280 cubic meters, is 50 meters long, and 9.45 meters wide.

Equipment

The new trawlers will have a double trawl way, reinforced hulls, and 16-cylinder 1,960-hp. diesel engines. Reduction gear will allow a speed of about 14.5 knots. Crew's quarters will include 24 one-man cabins.

Ready in 1971

The two vessels are expected to enter Greenland fisheries in summer 1971. They will be based at Sukkertoppen and Frederikshaab. (Regional Fisheries Attaché, Copenhagen, Jan. 5, 1970.)

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THE FISHING FLEET

Denmark's fishing fleet (including Greenland and the Faroes) totals 4,634 vessels; gross registered tonnage is 156,000, and total horsepower is 571,467. About 13% are over 50 years old, and 25% less than 10. The bulk of this fleet--4,136 vessels, 106,000 gross tons--operate from Denmark proper. Of the Denmark-based fleet, 982 (24%) were built in the last 10 years. Most of the vessels are 5-50 GRT size.

Faroese Fleet

There are 274 vessels in the Faroese fleet, 31% over 50 years old, and about 100 less than 10. This fleet also 'boasts' the oldest vessel, 'Fimm Systrar,' 99 years old.

Greenland

In Greenland, no vessels are older than 50 years, and 84% of the 224 were built in the 1960s. (Reg. Fish. Att., Copenhagen, Jan. 27, 1970.)

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OCEANOGRAPHY COUNCIL SEEKS $13.3 MILLION FOR RESEARCH

Denmark's National Council for Oceanography has requested $13.3 (US) million in government grants for a 10-year ocean research program. Projects in Danish, Greenlandic, and Faroese waters will include studies of fisheries, pollution, and the ocean bottom. The studies are part of an international project under UNESCO and the Ocean Decade. (Reg. Fish. Att., Copenhagen, Jan. 27, 1970.)

ICELAND

FISHERY CATCH ROSE IN 1969

Iceland's 1969 catch was 665,246 metric tons. It jumped 9% in quantity and about 15% in value over 1968.

Although better than 1968, it was a relatively small improvement over other years during the 1960s. Primarily, this was because the huge quantities of herring caught in early 1960's are no longer found near Iceland.

Higher-Valued Fish Caught

However, record quantities of higher-valued fish were caught in 1969. The 424,000 tons of white fish (mainly cod catch) exceeded 1964's 415,000-ton record. The combined catch of shrimp and lobster set a new record, slightly over 6,000 tons. The herring catch was a minimal 53,000 tons, less than 10% of the mid-60's level, but the catch of capelin was a record. The combined quantity of capelin and herring remained near 1968's 220,000 tons. (U.S. Embassy, Reykjavik, Jan. 13, 1970.)

Unloading frozen tunny in Penang, Malaysia. (Photo: ILO)

ASIA

JAPAN

U.S. CANNED TUNA MARKET SURVEYED

The Tokyo Canned Tuna Sales Company's director spent 3 weeks in January 1970 surveying the U.S. canned tuna market. He wanted to determine U.S. reaction to Japanese exports of chunk-style, light meat tuna in brine. Japanese packers would like to increase chunk-style exports because this pack uses mostly skipjack tuna.

Skipjack More Available

Skipjack are more available than other species and would considerably ease difficulties in obtaining raw material. Japan's 1969 skipjack landings were mostly small fish unsuitable for solid pack, but usable for chunk style. ('Kanzume Nippo,' Jan. 10, 1970.)

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FROZEN TUNA IMPORTS INCREASE AS EXPORTS DECLINE

Japan imported 31,600 metric tons of frozen tuna, valued at about US$12 million, during Jan.-Nov. 1969, a 25% jump in quantity over same period 1968. In 1969, South Korea and Taiwan, the major suppliers, doubled their 1968 exports to Japan. The imported tuna are marketed fresh or frozen, or are used for canning. Japanese tuna imports climb yearly; in 1970 they are expected to reach 40,000-45,000 tons

Exports

Japan's exports of frozen tuna are steadily declining. Jan.-Nov. 1969 exports to the U.S. and Canada totaled 38,972 short tons valued at $16,155,203, compared with 70,854 tons worth $27,454,545 for same period 1968; exports to other countries totaled 17,262 metric tons valued at $7,107,108, compared with 29,007 tons and $11,620,650 for same period 1968.

To Change Fishing Method

The Japanese feel that present method of long-line tuna fishing cannot adequately meet the needs for exports. They feel the only solution is to increase production by using large seiners like the U.S. A joint company to operate a fleet of purse seiners belonging to different fishing firms has been proposed, but little progress has been made. There are too many differences of opinion, selection of officers, investment ratios, profit distribution, and other matters. ('Katsuo-maguro Tsushin,' Jan. 1, 1970.)

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FROZEN TUNA EXPORTS TO U.S. & CANADA DROPPED IN 1969

Japan exported 42,527 short tons of frozen tuna to the U.S. and Canada in 1969, and 18,505 metric tons to European and other countries, including Mexico and Ghana--a total of about 57,000 metric tons. This was sharply below the 100,000 metric tons exported in 1968. ('Suisancho Nippo,' Jan. 12, 1970.)

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U.S. EXPORTS TO ITALY CUT JAPANESE SALES

U.S. frozen-tuna exports to Italy are cutting into Japan's market. In 1969, the U.S. exported 4,650 metric tons of Atlantic-caught tuna in Sept. and Oct. alone. Japan exported 12,088 metric tons of frozen tuna to Italy in 1969 (9,989 tons Atlantic transshipments and 2,099 tons direct shipments from Japan). This is 39.3% less than the 19,893 tons delivered in 1968 and 56.9% below 1967's 28,026 tons. The decline in Japanese exports was due to sharply reduced fishing effort in the Atlantic owing to reduced profits and the transfer of vessels to other oceans to supply the domestic market in Japan where tuna consumption is rising.

Commission Sales

In order to retain their share of the Italian market, Japanese fishery and trading firms are selling tuna taken by South Korea, Taiwan, Malaysia, and Panama to Italy. In 1968, such commissioned sales probably reached 15,000 tons. In 1969, total Japanese tuna sales to Italy will be around 30,000 tons--15,000 tons from Japanese vessels including those in the Indian Ocean. The Italian market annually requires 47,000 metric tons of tuna and this means that Japan will retain barely a 63.8% share. ('Shin Suisan Shimbun Sokuho,' Jan. 7, 1970.)

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JAPAN (Contd.):

ITALIANS REJECT JAPANESE FROZEN TUNA

The representative of the Japan External Trade Organization (JETRO) in Venice, Italy, reported that Italian packers are expanding production despite their complete dependence on imported raw material.

Why Tuna Rejected

He urged Japan to solve the problem of continuing Italian rejection of Japanese tuna. In 1969, he inspected about 26,752 metric tons. About 3,590 tons, 13.4%, of 29 shipments were rejected for greeness, sponginess, or orange color in the meat when cooked.

U.S. Tuna Well Received

The U.S.-supplied tuna are said to retain good quality after cooking and therefore are well received by Italian packers. ('Suisancho Nippo,' Jan. 10, 1970.)

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YAIZU LANDINGS DROPPED IN 1969

In 1969, landings at Yaizu totaled 142,597 metric tons worth about US$71,971,000. Landings were down 3,844 tons from 1968, close to 3% in quantity, but up $6,790,000 (10%) in value. ('Suisancho Nippo,' Jan. 7, 1970.)

Yaizu Landings, 1968-69

Species	1969		1968	
	Quantity	Value	Quantity	Value
	Metric Ton	$1,000	Metric Ton	$1,000
Tuna:				
Bluefin[1/]	50,461	42,904	53,710	40,040
Albacore	19,139	10,165	16,295	7,876
Skipjack	45,928	14,550	48,085	12,526
Mackerel	20,166	1,803	21,341	2,284
Others	6,903	2,549	7,010	2,455
Total	142,597	71,971	146,441	65,181

1/Includes yellowfin and big-eyed tuna.

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WINTER ALBACORE FISHERY WAS GOOD, PRICES HIGH

In January 1969, Japanese pole-and-line fishermen were taking large, good-quality, winter albacore off the home islands. Ex-vessel prices were as high as US$541 a short ton, the same price as ship-frozen albacore bought by cold-storage operators for export. Japanese packers could not buy much at that price. To operate profitably, they could pay no more than about $504 a short ton. ('Shin Suisan Shimbun Sokuho,' Jan. 13, 1970.)

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TRAWL OFF U.S. EAST COAST

Fourteen Japanese trawlers belonging to 5 owners fished squid off the U.S. east coast near New York in January 1970. The 2,500-gross-ton trawlers were landing 17-18 metric tons a day when fishing was good. Most catches were exported to Italy, France, Spain, and Greece; some were shipped to Japan. The export price averaged US$550 a metric ton, cost, insurance, and freight (c.i.f.).

Butterfish in March & April

In March and April, the trawlers were scheduled to concentrate on butterfish and smelt. However, seas off New York became rough in March and hampered operations. Another problem is that fish with high fat content are preferred and bring a better price, but butterfish are small and lean in March.

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LIVE SEA BREAM SHIPPED BY AIR

The Nagasaki Prefectural Fishery Public Corporation started air-shipping live cultured sea bream from Kyushu, southern Japan, in December 1969, to Tokyo-Yokohama area, where they are very popular in 'sashimi' (sliced raw fish) restaurants.

They are shipped in a specially built tank with a holding capacity of 170-180 kilograms (374-396 pounds), or about 200 fish. They are sold for about US$1.52 at Kyushu, and about $3.16-3.79 at the Tokyo Wholesale Market. Air transport costs about 57 cents a pound.

Vessel Shipments

The corporation previously had made 2 shipments by vessel. This method enables delivery of large quantities at low freight cost, but it also produces high fish losses and higher storage costs after unloading. While air freight is more expensive, shipments can be adjusted to consumer requirements, and very little die-off occurs in transit. Three fish died in the first air shipment; only one in the third. ('Suisan Keizai Shimbun,' Jan. 7, 1970.)

NORTH KOREA

FISHING INDUSTRY EXPANDS

North Korea has launched a new 3,500-gross-ton refrigerated fish carrier, according to a report in the 'Pyongyang Times.' The 'Daebosan' is the sistership of one completed in 1968. Designed to process and freeze fish, she also will serve as a mothership to repair and replenish the growing North Korean catcher fleet.

Fleet Modernization Successful

Fishing industry modernization, started 12 years ago, is apparently successful. In the first year, fish landings rose 7.5 times; by 1959 they were up 12 times.

Government Aid

The trend is continuing due to substantial government expenditures on building and educational programs. Construction of a large, new fishing port on the west coast was begun in 1957. This was followed by an attempt to motorize existing fishing vessels--most of them primitive and small. Ten modern trawlers were added. Fishermen also were encouraged to exploit distant waters, and to fish throughout the year, regardless of season. ('Fishing News International,' Oct. 1969.)

Comment by Milan Kravanja, BCF Office of Foreign Fisheries: Catch data reported are obviously incorrect. According to FAO statistical yearbooks, North Koreans caught in 1953 only about 122,000 metric tons. This was less than one-eighth of 1938 fishery landings. The decline was caused by disappearance of sardines, and ravages of World War II (1941-1945) and Korean War (1950-1953). Considerable progress was made in immediate postwar years. By 1954, North Korea landed 315,000 metric tons of fish and shellfish. Mismanagement and unfavorable natural conditions reduced this figure to 291,000 tons by 1957. After "modernization drive" began in 1957, the North Koreans discontinued reporting their fishery catches.

Had such catches increased in 1959 by 12 times, as Pyongyang Times claimed, over those of "the first year of the project" (1957), the North Koreans would have landed in 1959 about 3.5 million metric tons of fish and shellfish. Had this trend "continued to date," North Korea would have become the world's largest fishing nation several years ago.

Instead, available information indicates that North Korean catches in recent years barely exceeded 600,000 metric tons. This was considerably below the 1969 record catch of 860,000 tons landed by fishermen of the Republic of Korea (S. Korea).

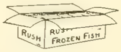
SOUTH KOREA

SALMON EXPORTS TO JAPAN ROSE IN 1969

The Republic of Korea (South Korea) exported about 324 metric tons of Pacific salmon to Japan in 1969. About 310 tons, mostly red salmon caught in Bristol Bay, off Alaska, were exported in August and September.

According to the Japan Tariff Association, salmon were exported (probably gilled and gutted) either fresh, chilled, or frozen. Some may have been exported after processing (salting), but such figures are not available from customs records.

Salmon exported in the early months of each year probably were caught off Korean coast. (U.S. Reg. Fish. Attaché, Tokyo, Jan. 27, 1970.)



INDONESIA

SUSPENDS FOREIGN INVESTMENTS IN SHRIMP FISHING

Indonesia has suspended further foreign investments in her shrimp fishery. On Nov. 20, 1969, the Minister of Agriculture said the action was necessary to survey effect of fishing by foreign companies on efforts to build up the shrimp beds, and on native shrimp fishing. He exempted domestic shrimp fishing and 7 foreign firms that previously had received permission to survey and fish shrimp.

Survey To Be Made

The Director-General of Fishing explained that the shrimp resources have never been surveyed--nor is the effect of present shrimping known. A survey is required before any increase in foreign activities could be allowed. He said no restrictions on other types of fishing are being considered.

INDONESIA (Contd.):

Data Collection

The Director-General also explained that a survey report will be compiled from data collected by the seven foreign companies (and Indonesian officials working aboard the companies' boats), the UNDP, and by his own staff.

The survey will last until end of 1971. The Directorate General then will be able to make recommendations regarding further foreign investments. He said most survey data probably would be made public. (U.S. Embassy, Djakarta, Jan. 7, 1970.)

TAIWAN

LEASES JAPANESE PURSE SEINERS

The recently formed Tayu Fishing Co. of Taiwan has employed a team of Japanese fishery technicians to work in Taiwan. It also has obtained a 1-year lease of 7 large purse-seine fleets from Okura Fishing Co., Japan.

Operations will be based at Keelung, Suao, and Kaohsiung ports. ('China Aquatic Products')

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NEW PROFIT-SHARING PLAN SUGGESTED

The Taiwan Fisheries Bureau has suggested to the Kaohsiung Municipal Fishermen's Association new standards for profit-sharing on deep-sea tuna longliners.

Its suggestions include:

1) The balance from total sales of the catch, minus direct costs and a 10% management overhead, be shared equally by management and labor.

2) A guaranteed minimum salary of NT$1,500 (US$37.50) a month.

3) A foreign-base subsidy for vessels 50 tons and over: US$30 in Pacific and Indian Oceans; US$40 in Atlantic.

4) Life insurance: NT$50,000 (US$1,250) for each crew member; NT$100,000 (US$2,500) for each apprentice-crewman. Payment of premiums are to be considered a direct cost. ('China Aquatic Products')

SOUTH PACIFIC

AUSTRALIA

ITALY TO FINANCE AUSTRALIAN TUNA INDUSTRY

Western Australia may have an Italian-financed tuna fishing industry in 1970. Two vessels, and up to 200 men, would start operations from Onslow, Broome, or Port Hedland. Vessels would be supplied by Italy and manned by Australians. The tuna would be frozen for processing at a modern cannery at Bari, Italy.

The joint venture follows months of negotiations between the Italian government-controlled organization, E.F.I.M., and the Australian Fremantle Fishermen's Cooperation Society Ltd. Similar Italian moves to set up a tuna industry on the East Coast in 1968 seem to have failed.

Italian Requirements

E.F.I.M. requires at least 10,000 tons of tuna a year and has been buying from Japan. The Japanese, however, cannot continue to supply this amount.

Australian Survey

The Fremantle Society, interested in a Western Australia tuna fishery, made a North-West survey several months ago. The main grounds appeared to be between North-West Cape and Port Hedland, out to the edge of the Continental Shelf, and from Broome to Cape Leveque, out for about 60 miles. ('Fish Trades Review,' Dec. 1969.)

* * *

TRY NEW METHOD FOR CATCHING SPINY LOBSTERS

The builders of an experimental 25-ft. submarine are testing a new method of catching tropical spiny lobsters. An electric current is passed through the sand where the lobsters settle, shocking them and making them jump out. A device then sucks them into the submarine.

Dominant Species

Tropical lobster, 'Panulurus polyphagus,' is found in muddy sea bottoms in northern Western Australia. This species is dominant on the west coast of India. There, it is caught in hoop nets, or by trawling at 35 fathoms or below. ('Australian Fisheries')

LATIN AMERICA

PERU

FISHING INDUSTRY DEVELOPMENTS

The 1969/70 anchovy fishing season started very poorly. There was a nationwide fishermen's strike in Nov. 1969. Warm water drove fish below normal depths, and the 'peladilla,' or immature anchoveta, appeared early. However, near-record catches in Dec. 1969 and good fishing in first weeks of Jan. 1970 revived industry optimism.

Production, Exports, Prices

About 1,840,000 metric tons of anchovy were caught in December; fish-meal production was about 330,000 tons. End-of-year stocks were about 300,000 tons, but heavy exports in first weeks of 1970 reduced stocks on hand to an even-lower level. Future prices for fish meal dropped from close to US$200/metric ton to $140-150, still a relatively high price.

'Peladilla'

To cope with 'peladilla' (small fish), the government chose to close fishing ports selectively rather than declare a general closed fishing season or 'veda' as in the past. Because fishing was so poor early in the season, the government chose this half-measure to meet industry needs and still protect the anchovy resource. However, industry sources reported that up to 80% of the December catch on some vessels was 'peladilla.' Callao, Ilo, Pisco, and Chimbote were closed on and off for short periods.

Tax On Industrial Use

On Jan. 1, 1970, taxes were increased on fish and whale meal, and crude and semirefined fish-oil exports. Industry did not object too loudly. The taxes include a 'Fishing Canon' of 1.5% of f.o.b. value of all exported fish and whale meal and oil in payment for industrial use of national resources. There is a similar 'canon' on exploitation of mineral resources.

Advance Payments on Income Tax

Exporters will pay customs an advance on income taxes at rate of: 5% of f.o.b. value on fish-meal exports; 2.5% of f.o.b. value on whale-meal exports; 6% of f.o.b. value on crude fish oil; 2% of f.o.b. value on semirefined fish oil. These charges will have the effect of a tax only when a firm's income taxes are less than advance payments.

New Vessels

Despite poor fishing, industry sources reported that Peruvian shipyards produced 75 large, modern fishing vessels in 1969 (many up to 350 tons). An even larger production is expected in 1970. This activity contrasts sharply with lack of active expansion of fishmeal plants or other sectors of economy. It may be that the need to renovate the fishing fleet has become so acute that industry can no longer delay.

New Minister Discusses Policies

At a press conference in Lima, Feb. 5, the new Fisheries Minister, General Javier Tantalean Vanino, discussed policies to be followed by the new Ministry. It had begun operations on Feb. 2.

He said fishing industry is pillar of Peru's economy. He recommended that fish-meal plants use their stickwater, that obsolete 100-ton vessels be replaced by 300-ton vessels, and that Peru develop an edible-fish industry. He would welcome foreign capital and technology to effect these changes. And he believes Peru should "occupy all 200 miles of littoral seas to insure sovereignty."

The Minister made two other significant comments: (1) No new fishery law is being planned; any necessary changes in fishery management will be made under existing procedures. (2) No fishing companies will be nationalized, but the government plans to control fish-meal marketing 'from beginning to end.'

He announced a closed fishing season from Feb. 11 to March 17. (U.S. Embassy, Lima, Jan. 20 and Feb. 6.)

EL SALVADOR

JAPANESE WILL SURVEY
EL SALVADOR FISHERIES

Taito Seiko, a net-manufacturing subsidiary of Taiyo Gyogyo, Japan, will conduct a 1-year feasibility study of El Salvador's fisheries.

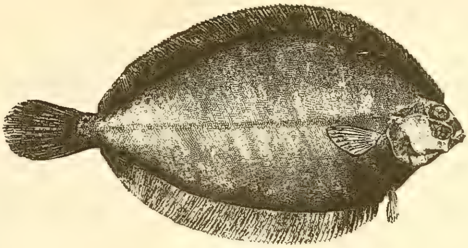
Five domestic firms, interested in a joint venture and believing FAO data inadequate, had asked Taito Seiko to carry out the survey. The 5 want information on the abundance and kinds of fish available. If survey results are favorable, Taito Seiko may join the 5.

S. Korean Survey

S. Korea sent experts to El Salvador for a similar survey in March-April 1969. They made recommendations, but so far no action has been taken. (Reg. Fish. Att., U.S. Emb., Tokyo, Jan. 30, 1970.)

Workers at the Puerto El Triunfo plant in El Salvador unload a catch of fresh shrimp. (Photo: FAO, Y. Hagata)

FOOD FISH FACTS



Gray Sole
(Glyptocephalus cynoglossus)

Soles are delightful-to-eat members of one of the most clearly defined and distinctive orders of fish (Heterosomata). This order also includes other flatfish such as halibut, turbot, flukes, and flounders; and all of them share a very unusual characteristic. All flatfish begin life swimming about in a normal manner but very soon their behavior patterns change. Their skulls begin to twist and one eye begins to move toward the other side. At the same time, the fish begins to tilt. Very soon both eyes peer from the same side and the fish swims with the eyeless side down. Some twist to the left and some to the right; however, all share the same flying saucer appearance. This change involves a complex modification of the head bones as well as of the nervous and muscle tissues. The underside of these fish is usually white, blending with the light filtering down through the water. The top side is pigmented, resembling the bottom on which the flatfish lives. An interesting fact is that the eyes of these fish can be raised slightly and moved independently, thus increasing vision. In size and other characteristics, flatfish vary greatly.

DESCRIPTION

Atlantic coast soles include two main species. The gray sole (Glyptocephalus cynoglossus) is also called witch flounder. This sole, which grows up to 25 inches in length, is noted for its fine flavor and is rapidly growing in commercial importance. Approximately 4.9 million pounds of gray sole were caught in 1968.

The lemon sole (Pseudopleuronectes americanus) is called a winter flounder or blackback when it weights less than 3½ pounds. Its usual length when caught inshore is around 18 inches. These two Atlantic soles share characteristic small mouths, straight lateral lines on bodies, and eyes on the right sides.

Pacific coast soles include the two following species: The petrale sole (Eopsetta jordani) is also known as brill sole. It averages about 17 inches in length and around 2½ pounds round weight. It has a wide body, small scales, large mouth, slightly curved lateral line, and is olive-brown in color.

The English sole (Parophrys vetulus) is also known as the lemon sole but as an entirely different species than the Atlantic lemon sole. It is noted for its fine flavor. Smaller than the petrale, the English sole averages about 15 inches in length and slightly over ¾ pound in weight. It is distinguished by a small mouth, a slender shape, and a pointed head.

Other soles of the Pacific include the rex, Dover, and rock.

(Continued following page.)

HABITAT

Most sole and flounders live along the Continental shelf and slope. Some come into shoal waters and are found in bays and close inshore along the coast.

The lemon soles of the Atlantic range from as far north as Labrador and as far south as Georgia with the greatest abundance off the coast of New England. They live from 1 to 20 fathoms deep and prefer soft muddy to moderately hard bottoms.

The gray soles of the Atlantic live in moderately deep water from the Gulf of St. Lawrence, the southern Grand Banks, and as far south as Cape Hatteras.

The Pacific petrale or brill and the English or lemon soles range from Southern California to Alaska.

SOLE FISHING

Sole are considered fine sport fish and are taken by hook and line, spears, nets, and seines. The otter trawl is used most extensively in commercial fishing.

CONSERVATION

The life history, migrations, and habits of many flatfish are not well understood by fishery scientists. To maintain fishery resources at a high level of production for both the fishing industry and the consumer, cooperative State-Federal research and development efforts are needed. In recognition of these needs Congress passed the Commercial Fisheries Research and Development Act of 1964. This act authorizes the Secretary of the Interior to enter into cost-sharing cooperative agreement with the States and other non-Federal interests. This program is administered by the Bureau of Commercial Fisheries. Many projects, designed to better understand fish and their environments, have since been undertaken. Some of these projects, particularly along the Pacific coast, have been specifically designed to learn more about our flatfish resources.

All fishery research, whether State or Federal, has a basic goal to ensure the wise use of renewable resource.

USES OF SOLE

Sole are fine eating fish. The flesh is firm, white, and delicate in flavor. Most sole are filleted and may be purchased either fresh or frozen. Fillets vary in weight from 2 to 4 ounces and occasionally up to 8 ounces. Some sole are dressed and sold whole for stuffing. Sole adapts readily to a wide variety of preparation methods. (Source: National Marketing Services Office, BCF, U.S. Department of the Interior, 100 East Ohio Street, Rm. 526, Chicago, Illinois 60611.

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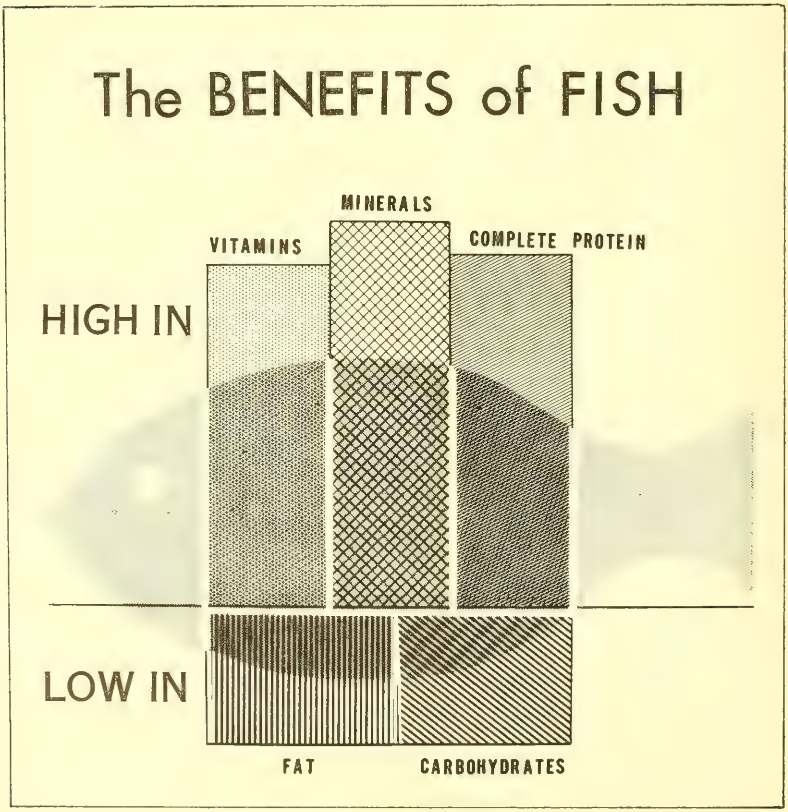

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UNITED STATES DEPARTMENT OF THE INTERIOR
Walter J. Hickel, *Secretary*
Leslie L. Glasgow, *Assistant Secretary*
for Fish and Wildlife, Parks, and Marine Resources
Charles H. Meacham, *Commissioner*, U.S. FISH AND WILDLIFE SERVICE
Philip M. Roedel, *Director*, BUREAU OF COMMERCIAL FISHERIES

BACK COVER: Mackerel.
(Photo: G. M. Mattson)

COMMERCIAL FISHERIES *Review*

VOL. 32, NO. 4

APRIL 1970

COVER: Eskimo child playing at cockpit of skin-covered kayak, on Nunivak Island, Alaska. Bubble gum is great prize to him. (Photo: E. P. Haddon)

COMMERCIAL FISHERIES

Review

A comprehensive view of United States and foreign fishing industries--including catch, processing, marketing, research, and legislation--prepared by the Bureau of Commercial Fisheries.

FISHERMEN'S MEMORIAL--GLOUCESTER, MASS.

Managing Editor: Edward Edelsberg

Production: Jean Zalevsky
Alma Greene

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Throughout this book, the initials BCF stand for the Bureau of Commercial Fisheries.

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CONTENTS

Halibut are stacked like cordwood in this Juneau, Alaska, cold-storage plant. (BCF-Alaska photo: J. M. Olson)

U.S. FISHERMEN EARNED RECORD $518 MILLION IN 1969

U.S. fishermen caught 4,292 million pounds of fish and shellfish in 1969. The catch sold for $518 million--the highest dollar value ever. The value was $47 million above 1968, and 31% above previous 10-year average. The catch was 176.4 million pounds, or about 4%, more than in 1968, and the largest catch since 1966. These data were reported by BCF's Division of Statistics and Market News.

There were record landings of Gulf menhaden, Pacific anchovies, yellowfin tuna, shrimp, spiny lobsters, tanner crabs, Dungeness crabs, and surf clam meats in 1969; and sharp increases in the catches of Atlantic cod, Pacific halibut, and blue crabs. Landings of Atlantic flounders, pollock, and soft clams were higher than in 1968.

Offsetting any real large gain in overall productivity of domestic fisheries were serious declines in landings of haddock, Atlantic sea herring, Pacific salmon, whiting, otter-trawl-caught industrial fish, sea scallop meats, and king crab. Production of jack mackerel, Atlantic ocean perch, and oyster meats also was below 1968 levels.

Record 12.08¢ A Lb.

Fishermen were paid a record average of 12.08 cents per pound for the larger 1969 catch; in 1968, the average was 11.46 cents; in 1967, 10.84 cents. The average price for many fishery items increased substantially in 1969, while other prices were somewhat higher, or at least held steady.

The smaller 1969 whiting catch (down 41%) actually gave fishermen as much money as the larger 1968 catch. Average prices paid for most other failing fisheries also increased to where total exvessel value paid was nearly equal to that received for the larger 1968 catches. Average prices paid to fishermen, measured by indexes of exvessel prices received, rose 13% from 1968 and 40% above 1957-59 average.

The index for all finfish prices rose 14% in 1969 because of sharp increases in prices for New England finfish, salmon, tuna, and industrial fish. Prices paid for all shellfish increased 14%. Prices for shrimp increased 9%, while other shellfish prices increased 17%.

PROCESSED FISHERY PRODUCTS

The 1969 value of processed fishery products produced in the U.S. from domestic and imported raw material was $1.5 billion--about 6% above 1968. The canned pack of 40.3

million standard cases was worth $580.8 million--slightly below 1968's record $583.9 million.

Canned tuna was produced at about 1968 level; packs of crab meat, shrimp, and clam products were larger.

Industrial products increased $14.5 million.

The remarkable fish stick and portion industry continued to set new volume and value records: Production was 329.8 million pounds valued at $134.7 million.

Breaded shrimp processors turned out 104.6 million pounds (just short of breaking 1966's record 104.9 million pounds). It was worth a record $110.5 million.

Domestic production of groundfish fillets and steaks continued to decline as expected, but output of other fillets and steaks increased. Total production of these items increased in volume and value in 1969.

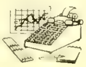
Processors of fish and shellfish specialty dinners, and other packaged fish and shellfish products, continued production increases. Their products were worth over $438 million--8% above 1968.

Exports of U.S.-produced fishery products were worth a record $104.5 million--a gain of $36.8 million--while imports also reached a new high of $844.3 million

AT YEAR'S END

At the end of 1969, some segments of the industry were facing declines in resource availability due to natural causes and heavy fishing; other segments remained highly competitive with foreign fleets and production. With only few exceptions, prices for fishery products generally increased at all levels: exvessel, wholesale, and retail. Fishermen received a high dollar exvessel value in 1969. The processing industry generally made excellent production gains. Many canned items, fish sticks and portions, fillets and steaks, shellfish (lobsters, crab, shrimp) products, and other fish and shellfish products were in good demand throughout 1969; many of these items made new inroads into foreign markets.

Civilian per-capita consumption of edible fishery products increased from 11 pounds of edible meat in 1968 to 11.1 pounds in 1969--the highest since 1954.



U.S. REGAINS 5TH PLACE IN WORLD FISHING

U.S. commercial fishermen caught about 5.5 billion pounds (live weight) in 1969, an increase of about 1 million pounds over 1968. This catch regained for the U.S. fifth place among the world's fishing nations. The catch figure includes the shell weight of mollusks, as is done by foreign nations. Shell weight is excluded in U.S. data on catch value.

Preliminary statistics indicate that Norway, formerly No. 5, dropped to sixth, the U.S. position in 1968. Norway's 1969 catch of 4.9 billion pounds was down 800 million pounds from 1968.

Japan Regains No. 1

Japan has regained the number one position she had held for many years. Her 1969 catch of 20.3 billion pounds was 1.2 billion greater than the 1968 figure.

Peru Falls to No. 2

Peru, which had led the world for several years, dropped to second place. Her catch was estimated at 19.5 billion pounds, a decline of more than $2\frac{1}{2}$ billion pounds. Peru's fishery is primarily anchovies. These are converted into fishmeal, and most of it exported.

USSR No. 3

Preliminary data show the USSR No. 3 with 16.1 billion pounds, up 1.4 billion from 14.7 in 1968.

Mainland China is believed to rank fourth. However, reliable statistics have not been available since 1960.

BCF IN COOPERATIVE SURVEY FOR INDUSTRIAL FISH IN ATLANTIC

BCF is using advanced electronic equipment and fishing gear in a cooperative Government-industry survey of herring and herringlike fish underway along the Atlantic Coast. The 3-month study began March 15 and will extend from New Jersey to Florida.

The midwater schooling fish are not used much by U. S. fishermen. These fish might supplement the declining Atlantic Coast menhaden, the most important "industrial" fish, which is used primarily for fishmeal.

Fishmeal Demand 800,000 Tons

The annual U. S. demand for fishmeal fluctuates around 800,000 tons: 200,000 tons are supplied by U. S. fishery, the remainder by imports. Annual imports are worth about $108 million. Use of the many species of herringlike fish by U. S. processors could significantly strengthen the fishing industry.

4 Survey Vessels

Four vessels will be used in the survey: the new stern trawler 'Delaware II' from BCF's North Atlantic Region, the 'Oregon II' from BCF's Gulf and South Atlantic Region, North Carolina's 'Dan Moore', and a menhaden industry vessel.

Commercial Scale Fishing

The Oregon II, equipped with sophisticated acoustical devices, will locate fish schools. The Delaware II, with modern acoustical fish-detection gear, will conduct commercial-scale fishing with pelagic (mid-water) and bottom-trawl fishing gear.

Catches will be transferred from Delaware II to the industry vessel and taken to shore. There, their suitability for fishmeal and oil will be evaluated.

Preliminary reports of findings are scheduled to be distributed by June 30.

SKIPJACK & YELLOWFIN TUNA SCHOOLS FOUND NEAR AMERICAN SAMOA

Scientists of the BCF Biological Laboratory in Honolulu have located numerous schools of skipjack tuna in the waters surrounding American Samoa, reports Richard S. Shomura, Acting Area Director, BCF, Hawaii.

In addition to skipjack, some mixed schools of skipjack and yellowfin were found.

American Samoa lies below the Equator, about 2,500 miles south and a little west of Hawaii. The Laboratory's research vessel 'Charles H. Gilbert' completed the first systematic survey of the area's fishery resources and returned to Honolulu in mid-April.

American Samoa is the site of two canneries. These depend for their raw materials not on surface-swimming fish caught near the islands--but on deep-swimming tunas from a broad belt of the open sea reaching almost to the South American coast.

The Government of American Samoa seeks to broaden the islands' economic base by harvesting surface-swimming tunas and other fisheries in the surrounding area.

Gilbert's Findings

The Gilbert's findings substantiate previous fragmentary reports that there are many schools of surface-swimming tunas in the area during the Southern Hemisphere summer. Sightings of fish schools approached five a day, about the average attained during the height of the Hawaiian summer season. The fishery for the skipjack tuna, the largest in Hawaii, reaches its peak in July.

Most of the skipjack caught were 10 to 14 pounds, smaller than the "season" fish in Hawaii. Fish were taken for tagging so scientists may follow their migrations. More than 500 fish have been tagged to date. These include yellowfin tuna, bigeye tuna, and skipjack. Blood samples were also taken. The samples will be analyzed later at the Laboratory in an attempt to trace the relation of the tunas of Samoa with those of other Pacific Ocean areas.

The Gilbert sighted skipjack tuna schools as far as 200 miles south of the Samoa Islands. To the north and northwest, beyond the independent nation of Western Samoa, the limits were much closer to shore; most sightings were within 40 or 50 miles of land.

The Gilbert carried a supply of live bait--threadfin shad--from Hawaii. She also was able to locate local bait supplies in Pago Pago Harbor.

SQUID SLURP IS TESTED SUCCESSFULLY

The Squid Slurp, a new pumping system, promises to eliminate much of the hard work in the San Pedro, Calif., squid fishery, reports Dr. Alan R. Longhurst, BCF La Jolla Laboratory director. The system was developed by Matt May and Bob Payne, operators of the 68-foot commercial fishing vessel, ERM-TOO, and Susumu Kato, fishery biologist at La Jolla.

During one day's fishing in February, May and Payne landed 30 tons of squid (now selling for $27.50 a ton dockside) at Port Hueneme. This was not unusual for them because they have been fishing squid for many years. But these squid were caught with a pump--without any net or brail. It was a cooperative experiment in which BCF provided most of the gear, while May and Payne contributed their vessel and fishing experience.

Traditional Squid Fishing

The traditional way to fish squid, explained Dr. Longhurst, is to anchor the vessel and turn on attracting lights at dusk. Brailing begins when enough squid gather under the lights. Usually, one fisherman holds on to the handle and purse line of the brail, while second pulls the brail through the concentration of squid. A third man operates a winch, which lifts the brail out of the water, and dumps the squid into the ship's hold.

With the Squid Slurp, the lighting arrangement remains unchanged, but the basic fishing unit is a pump with an 8-inch-diameter inlet that sucks in water at the rate of 1,600 gallons per minute to the pump inlet. A flanged elbow and 10-foot section of steel tubing is attached to a funnel with an opening measuring 3 feet by $1\frac{1}{2}$ feet. Inside this funnel is placed a waterproofed light, and the entire unit is submerged. An 8-inch fish hose carries the squid to a dewatering screen on board, which leads to either of two fish holds by means of an adjustable chute.

On the night of February 25, squid rose abundantly under the lights. The pump on the ERM-TOO was started at 8 p.m. The squid were pumped slowly and steadily into the well but, during one 15-minute period when they swam directly toward the funnel, about 10 tons were taken aboard. After 4 to 5 hours of pumping, 61,350 pounds of squid were taken aboard.

Pump's Advantages

Dr. Longhurst noted that the pump will reduce the crew to two and eliminate brailing. When squid are running directly into the funnel, pumping is faster than brailing. Only one man is required to stay on deck to watch over the pumping operation and to chase away the birds, sharks, pilot whales, and sea lions that prey on the squid and cause them to dive. Meanwhile, the second man can sleep and be ready for the long run to the processing plant.

Chief Disadvantage

The chief disadvantage of the pump, at least with the present setup, is that operations are difficult in rough seas. Pumping is also slower than brailing when squid are "dead" under the lights, or when they swim away from the entrance to the funnel.

Encouraged by their early success, May and Payne later decided to enlarge the funnel entrance to 6 X 4 feet. With this modification, they have landed up to 160,600 pounds (80.3 tons) of squid with the pump in one night's fishing. This is a record for a two-man crew.

Dr. Longhurst concluded: "With further improvements in the equipment and perhaps in the lighting system, pumping may eventually outfish brailing under all condtions."

SAN PEDRO FLEET'S FINANCIAL CONDITION STUDIED

BCF's Pacific Southwest Region reports that, in 1968, researchers at the BCF Fishery-Oceanography Center, La Jolla, Calif., began to investigate the financial condition of the San Pedro "wetfish" boat fleet. The fleet is composed of small (40 to 86 feet) purse seiners that operate within 100 miles of port. Its boat owners and fishermen have been financially hard-pressed for years. They complain of static prices for fish and rising costs. Between 1958 and 1968, the fleet dwindled from 48 to 25 vessels. Its newest vessel was built in 1947; half of the fleet was built before World War II.

1967 Landings

In 1967, the fleet landed about 82 million pounds. It accounted for 77% of jack mackerel, 54% of Pacific mackerel, 58% of bonito, 12% of bluefin tuna, and 54% of anchovies landed in California. Mackerel, bonito, and tuna are canned; anchovies become fish meal and oil.

Poor Financial Shape

The researchers' first objective was to describe and document the fleet's financial condition. With vessel owners' permission, financial data were gathered from bookkeeping firms. Analysis showed the fleet in poor financial shape. During 1963-68, annual revenue ranged from $45,000 to $120,000, profits from $1,400 to $34,000, and losses $200 to $10,000. The average gross revenue of $70,000 produced a profit of about $4,000; this corresponded to break-even point. Crew earnings stayed constant and averaged $4,000; crew size decreased from 380 to 240; number of vessels from 48 to 25.

Costs-and-Earnings Model

The second objective was to construct a costs-and-earnings model for wetfish operations. This would permit examination of the economic feasibility of new-vessel construction for vessel replacement or fleet expansion. The model took account of operating costs, taxes, depreciation, and arbitrary levels of gross revenue corresponding to those in the fishery in recent years. Their profit return on investment and crew earnings were predicted for vessels of various sizes--newly constructed or existing--for various conditions of catch.

Other Fisheries' Surplus Vessels

The researchers concluded that, with proper market conditions, fleet expansion through recruitment of suitable surplus vessels from other fisheries would be economically feasible. The outlook for new-vessel construction was found unfavorable. Even with a 50% construction subsidy, a vessel would need $225,000 gross revenue, an amount well above present peak levels, to attain the 1967 profit level. However, the picture would change if vessel efficiency could be increased through technological improvements in fishing and handling procedures. BCF and the industry are examining these possibilities.

GATE DESIGNED TO RELEASE PORPOISE FROM PURSE SEINES

After talking to fishermen, gear technologists, and behavorists, William Perrin of BCF LaJolla, Calif., developed a tentative design for a rescue gate for porpoise caught in purse seines. A triangular piece of webbing will be cut from the net to leave a gap about 4 fathoms long and 1 fathom deep at the center. Then, a large triangle of webbing will be sewn into the opening. The corkline for this section will consist of several inflatable sections, perhaps constructed of large diameter firehose. A system of independent air conduits will lead to a single connector at the end of the gate area. A skiff equipped with a gasoline-powered vacuum pump and compressed air tanks will connect to the air system after the net is set; the skiff will remain stationed at or near the gate during the rescue operation, which will be coordinated from the mast.

Opening and Raising Gate

The gate will be opened by evacuation of the corkline--and raised by rapid injection of air from the tanks. A prime requisite is that it be possible to raise the gate in a second or two when fish are seen heading toward it. It is hoped the extra webbing will reduce downward pull of the sunken corkline.

Modeling experiments using a miniature purse seine are being carried out. Construction of a prototype will begin immediately thereafter. If all goes well, the gate should be ready for testing under actual fishing conditions in late summer 1970.

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FISHERIES FEATURED AT MARINE TECHNOLOGY SOC. EXPO.

On Monday, June 29, 1970, the Marine Technology Society Conference and Technical Session will open at the Sheraton Park Hotel in Washington, D.C., and run through July 1. The Nation's suppliers of oceanographic equipment will meet "to discuss past, present, and future problems and hopes of the ocean environment."

One entire afternoon session will be devoted to Marine Biological Resources--fish, oysters, and lobsters. It will include three papers by BCF speakers: "Recent Developments in the Economic Theory of Commercial Fishery Management," E.W. Carlson and A.A. Sokoloski; "The Determinants of Actual and Subsidized Competitive Strengths and Weaknesses of the U.S. and Canadian Groundfish Fisheries," Donald P. Cleary and A.A. Sokoloski; "Economic Benefits to Fisherman, Vessels and Society from Limited Entry to the U.S. Northern Lobster Fishery," F.W. Bell. Also, "Computerized Modeling of an Acoustic Fish Abundance Estimation System," John B. Suomala Jr. and William Vachon, MIT; "Optimal Conditions for Oysters Grown in Closed Environments," George Claus and Cyrus Adler, Offshore/Sea Development Corp.

At another session, BCF's Edward F. Klima will talk about the development of an advanced-technology high-seas fishery and processing system.

Several other sessions among the 26 should interest CFR readers: buoys, undersea vehicles, marine geodesy, seagoing computers, cables and connectors, power systems for undersea habitats, oceanographic instrumentation, underwater optics, waste management and coastal zone, ocean mining, economic considerations in coastal zone management, critical legal issues, risks and opportunities in ocean industry, and corrosion of equipment at sea.

General Chairman of the MTS Conference is Donald L. McKernan, Special Ambassador for Fisheries and Wildlife to the Secretary of State, president-elect of MTS, and former head of BCF.

For more information, contact MTS, 1730 M Street NW., Washington, D.C. 20036

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INTERNATIONAL FISHERIES SURVEY CONTINUES OFF U.S. WEST COAST

The Soviet research vessel 'Ogon' left San Pedro, Calif., on March 13 to continue an international fisheries survey of the population of Pacific hake off Oregon and Washington. The vessel is operated by the Far Eastern Seas Fisheries Research Institute in Vladivostok.

Dr. Alan R. Longhurst, director of the BCF laboratory at La Jolla, reported that Ogon had just completed an egg-and-larva survey of spawning hake off California and Mexico with the assistance and advice of U.S. fishery biologists.

The Pacific hake spawns off California and Mexico each winter. The abundance of adult hake is estimated from the number of their eggs and larvae taken in plankton samples.

2nd Year of Cooperation

This is the second year of cooperative research on U.S. hake fisheries. The hake is a favorite food of Soviet citizens. It is fished heavily by the Soviet fleet in international waters off the Pacific Coast; in the U.S., hake is an important raw material in producing fish protein concentrate (FPC). The data from the cooperative surveys are necessary to provide a scientific basis for agreements to protect and conserve the species off North America.

San Francisco to Vancouver Island

Ogon is under the scientific leadership of Dr. Nikolai S. Fadeev of Vladivostok. The Soviet vessel rendezvoused on March 18 with a U.S. Coast Guard cutter to take aboard an observer, Eugene S. Maltzeff of BCF's Seattle laboratory. With him aboard, Ogon began using her acoustic echo-sounders to survey hake and rockfish stocks from San Francisco to Vancouver Island. The survey will end at the island by the end of May. The vessel will fish only to check the results of the acoustic survey.

Already, BCF scientists at La Jolla are working on samples and data from Ogon's plankton survey. They have found that hake, in response to warm ocean conditions, have spawned this year considerably farther north than last year.

As in previous years, the data from the acoustic surveys will be received from the Soviets at a scientific meeting in Moscow this fall.

Mary Kalin, BCF biological technician, sorts plankton samples for presence of hake eggs and larvae aboard Soviet research vessel Ogon--in presence of Dr. Nikolai S. Fadeev, vessel's chief scientist.

U.S. VISITORS WELCOMED ABOARD SOVIET FISHERY VESSEL

A 9-man U.S. team visited a Soviet factory ship on March 6, about 15 miles off Norfolk, Va., during the vessel's 6-hour stay. The team was permitted full freedom of the vessel.

A similar visit took place in April 1969. Both were made under a 1968 U.S.-USSR agreement on fisheries of the U.S. Middle Atlantic Coast. The two-year agreement, which extends and modifies one in effect since November 1967, provides that both nations will work together in developing information to conserve certain species: red hake, silver hake, scup, and fluke. These concentrate offshore in large schools during winter before moving inshore, where they are caught by U.S. fishermen.

The Soviet Union has agreed not to fish between Jan. 1 and March 30 in a 3,000-square-mile protected zone extending from Rhode Island to Virginia. This area is believed to be the prime spawning grounds of these species.

'Chopin' & the Fleet

The Soviet fleet fishing in the Atlantic from Rhode Island to Virginia is commanded by Viktor Zakharov, Western Fisheries Administration, with headquarters in Riga. His flagship is the 'Frederik Chopin,' a 5-year-old, 543-foot vessel built in Poland's Gdansk shipyards. The U.S. visitors described her as "clean and well kept with up-to-date fish processing equipment."

Zakharov commands a fleet of about 100 fishing vessels, including 5 or 6 additional factory ships and refrigerated transports. Most of the fleet comes from the Estonian, Latvian, and Lithuanian Republics.

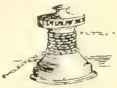
What They're Fishing

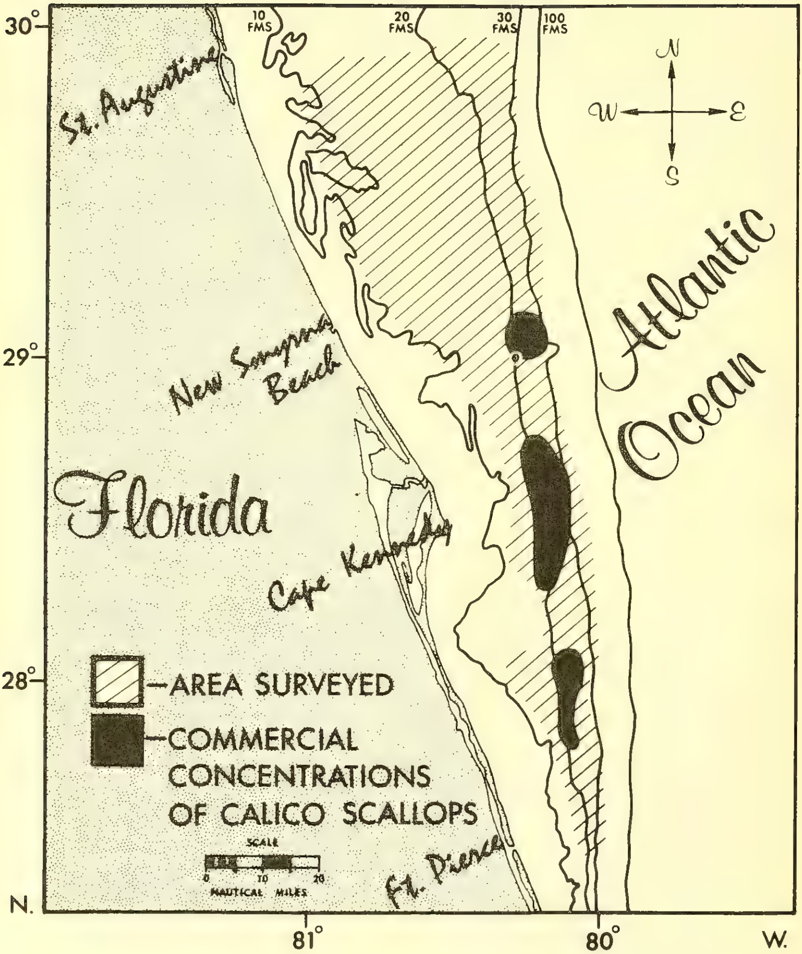
The fleet is fishing only for mackerel, sea herring, and river herring. Most fish is salted in barrels or frozen in freezing trays. The Chopin is equipped to produce canned fishery products as well as fish meal and oil, but these lines were not in operation during the visit. The vessel has a capacity of 13,600 gross tons.

Because stocks of Norway and North Sea herring are dwindling, Zakharov said, the Soviets had become interested in herring fisheries off the U.S. coast, which are not fished by Americans. He said herring from mid-Atlantic is less desirable than Norway or North Sea herring because of a lower fat content, but larger catches compensate for this. The demand for herring is good in the Soviet Union.

No Menhaden

The U.S. team also reported the Soviet claim that they have caught no menhaden. The Soviets believe this species stays close to the U.S. shore, where the 12-mile limit prevents foreign fishing. The Soviet Commander explained that his vessel conducts no specialized fishery for scup or fluke. He doubted his fishermen would be interested in these species because the Soviet Western Fisheries Administration does not rate them commercially exploitable. He said the Soviets help enforce the mid-Atlantic agreement with the U.S. by refusing to pay for scup. This did not insure that in bottom trawling by large stern factory trawlers for other fish, there would be some incidental scup.





30°
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AREA SURVEYED
COMMERCIAL CONCENTRATIONS OF CALICO SCALLOPS
SCALE
0
10
20
NAUTICAL MILES

BCF MIAMI SCIENTISTS STUDY FLORIDA CALICO SCALLOPS

Ann Weeks

Scientists of BCF's Tropical Atlantic Biological Laboratory (TABL), Miami, Fla., conducted their tenth cruise to calico scallop grounds off Cape Kennedy from March 28 to April 3 aboard the 83-foot research vessel 'Bowers' of BCF Pascagoula, Miss.

The 5-man team was directed by Thomas J. Costello, chief of the calico scallop program; it consisted of 3 biologists and 2 technicians, much of whose research was done underwater.

What They Did

They positioned a second diving buoy near one that has been in place 6 months as a marker for an ocean-floor research station. They installed new sensing devices on the bottom, obtained scallops for age-growth and tissue study at TABL, marked and released more scallops for later study, and installed special devices on the bottom and in the water column to collect infant scallops.

Stepped-Up BCF Program

Dr. Carl J. Sindermann, TABL director, said the intensive investigation of calico scallop stocks is part of a heightened BCF effort to help U.S. commercial fishermen land satisfactory catches of profitable seafood species.

He added: "Ordinarily we in the field of marine biology do not indulge in superlatives, but the calico scallop beds--which cover 1,200 square miles just off the north Florida coast--seem nothing short of fabulous." Estimates by BCF and the fishing industry, barring catastrophes, predict an eventual annual catch, perhaps as early as 1975, of 15-20 million pounds. The figure breaks down to an expected annual catch of about a half-million pounds by each of 30 vessels.

Sindermann said: "In view of the wholesale price of about $1.35 per pound paid for calico scallops last year, it's easy to see that this exciting new fishery could be immensely valuable to our fishermen."

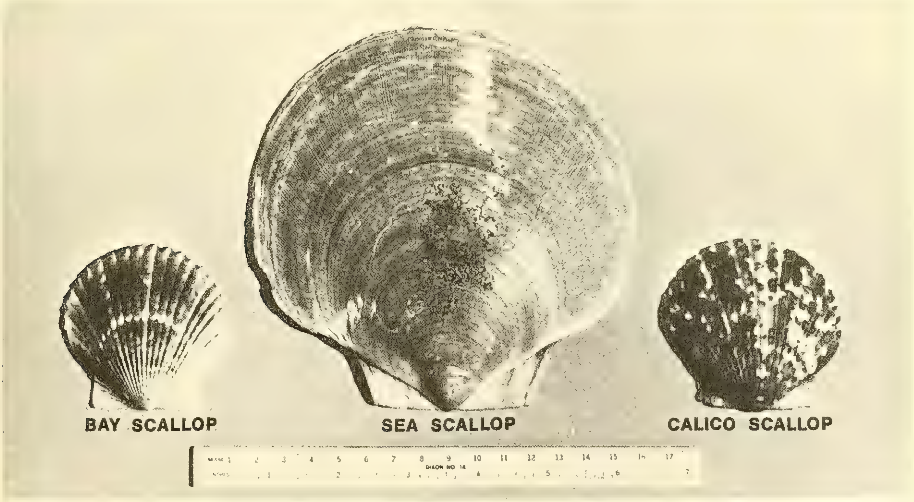


Fig. 1 - Gourmets prize the small, delicately flavored, and expensive bay scallop; most homes and restaurants buy and serve the larger sea scallop; those who have sampled the calico scallop claim that its flavor and delicacy match those of the bay scallop. The calico's edible meat is considerably larger than that of the bay scallop. Scallop fishermen are presently catching more calicos in one day than bay scallops in one year.

Field party chief Costello said that Florida landings of calico scallops in 1969 amounted to 160,300 pounds of shucked meats. He warned, however, that the shellfish were not yet available for home consumption. "Most of the catch is now sold directly to restaurant corporations. Later--when the fishery emerges from its present experimental stage--supplies will probably be abundant enough for at least limited distribution to food markets."

Much Work at Bed Sites

TABL marine scientists seek a better biological understanding of the life history of the bottom-dwelling mollusc. As a new fishery develops, it becomes increasingly important to know everything possible about growth and reproduction cycles, stock sizes, longevity, diseases to which the animal may fall prey, effects of fishing on the stocks, and the marine environment in which a species lives. Much of the scientific work involving calico scallops is done at the site of the beds. Specimens are marked, returned to their habitat, and retrieved later to ascertain just how far they may move in a given period; "spat" (infant stages) are planted in certain locations so survival and growth rates can be defined; specimens are examined periodically for evidence of damage by disease or predators; population rates are closely and frequently monitored; and oceanographic conditions are studied and charted.

Controlled Lab Experiments

In controlled experiments at TABL, thousands of calico-scallop eggs have been reared from moment of fertilization through several larval stages. These successful rearings are important to fishery biologists, who rely on written descriptions of the physical characteristics of myriad numbers of marine organisms, many of which change drastically as they pass from larval into adult stages. Because larval calico scallops have never before been described in the scientific literature, a marine biologist who found such larvae in a sample of seawater would be unable to do more than guess its identity.

Gear & Vessel Research

Gear and vessel research related to the calico scallop is carried out by other BCF laboratories, primarily the Exploratory Fishing and Gear Research Base at Pascagoula, Miss. One scallop-locating device that has yielded excellent results is the RUFAS (remote underwater fisheries assessment system), invented through joint efforts of BCF and the electronics industry. The RUFAS is a sled-like vehicle that can be towed over the

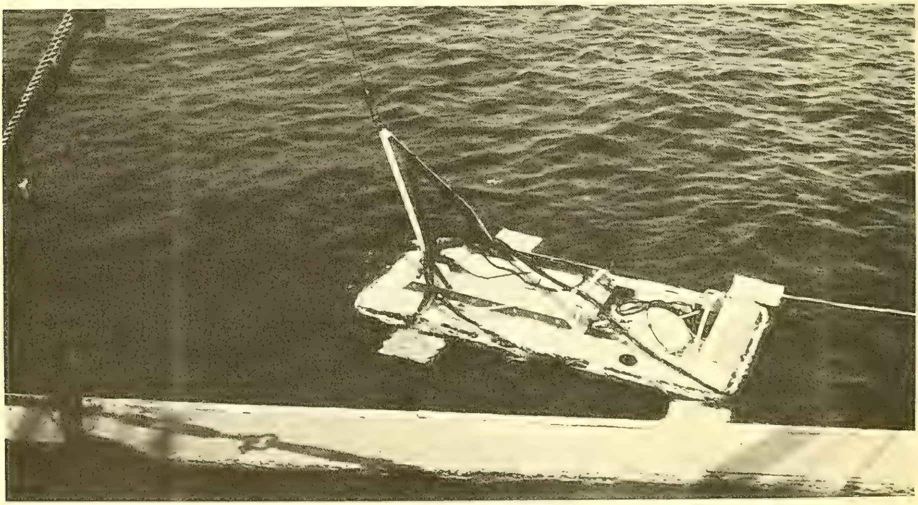


Fig. 2 - RUFAS (remote underwater fisheries assessment system). (Photo: J. B. Rivers.)

scallop beds by a surface vessel. Operated by remote control, the instrument contains a closed-circuit color television, video and audio tape recording equipment, and a high-quality movie camera.

In one recent survey, RUFAS took clear pictures of scallop beds covering 70 miles at 15 to 25 fathoms. The results pinpointed for fishermen the precise location of light, medium, and heavy concentrations of scallops. This reduced appreciably the time ordinarily spent trying to locate productive grounds.

Last year, BCF hired a Perry "Cubmobile" (a 3-passenger, deep-diving submarine) for close study of the seabed off Cape Kennedy. Several skippers of scallop vessels accompanied BCF scientists in exploratory tours of the ocean bottom.

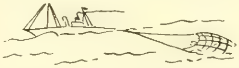
Fishing the Scallops

In 1969, major catches of calico scallops off north Florida were made from 4 vessels designed specifically for scallop fishing and processing. Two were factory vessels capable of dredging catch, then culling, shucking, eviscerating, freezing, and packaging the scallops while at sea. The vessels generally stay out 5 to 8 days (steaming to and from scallop grounds takes only a few hours), and process as much as 200 pounds of scallop meats per hour. Fishing is continuous, night and day, with a 14-man crew working 12-hour shifts. As processing methods improve, a 1-week trip is expected to yield about 15,000 pounds of calico scallop meats. The specially equipped vessels have been so successful that their manufacturers are thinking of producing 15 more ships for the highly promising calico scallop fishery off northern Florida.

Mrs. Weeks is TABL Writer-Editor.

SHRIMP-SORTING TRAWL IN GULF OF MEXICO SO FAR INEFFECTIVE

Tests aboard the 'George M. Bowers' recently revealed that the west-coast-type shrimp-separator trawls of current design were not effective in the Gulf of Mexico. Because the fish associated with shrimp in the Gulf are small, separator trawls using vertical panels have been ineffective in sorting fish from shrimp as small fish pass through separator panel in significant amounts. Sixty-five percent of shrimp went into side bags, and 80-90% of trash fish went into fish bag or trash chute.



LONGLINER IN GULF OF MEXICO LANDS 22,000 LBS. OF SWORDFISH

The east coast longliner, 'Gulf Stream', landed 22,000 pounds of swordfish at Pascagoula, Mississippi. It was her second trip.

The catch was made during 11 days, including travel to and from grounds; 10 longline sets were made.

The first trip's landings were 18,600 pounds during 9 days; 8 sets were made.

BCF Aid Asked

As a result of Gulf Stream's landings, BCF's Exploratory Fishing and Gear Research Base in Pascagoula, Mississippi, is receiving many requests for information and assistance.

'DELAWARE II' FINDS OCEAN QUAHOGS OFF SOUTHERN NEW ENGLAND

Extensive, commercially usable, concentrations of ocean quahogs (Arctica islandica) were located by BCF's Delaware II in January and February off southern New England (Cruise 70-1). More surveys are planned.

During the cruise between Nantucket Shoals and Amagansett, Long Island, New York, 382 survey stations were fished. This includes the eastern section of ocean quahog survey area 7 and western section of ocean quahog survey area 8 (see chart). The dredge was fished routinely for 4 minutes during each tow; one tow was made at each station.

Fig. 1 - Ocean quahogs. Size varies from 3 to 4 inches in length, 2.5 to 3.5 inches in height, and 1 to 1.5 inches in width. The colors range from dark mahogany to mottled black and white.

In area 7, 139 tows were made in 10 to 35 fathoms. Catches varied from a few individual ocean quahogs and surf clams to 5.2 bushels of ocean quahogs.

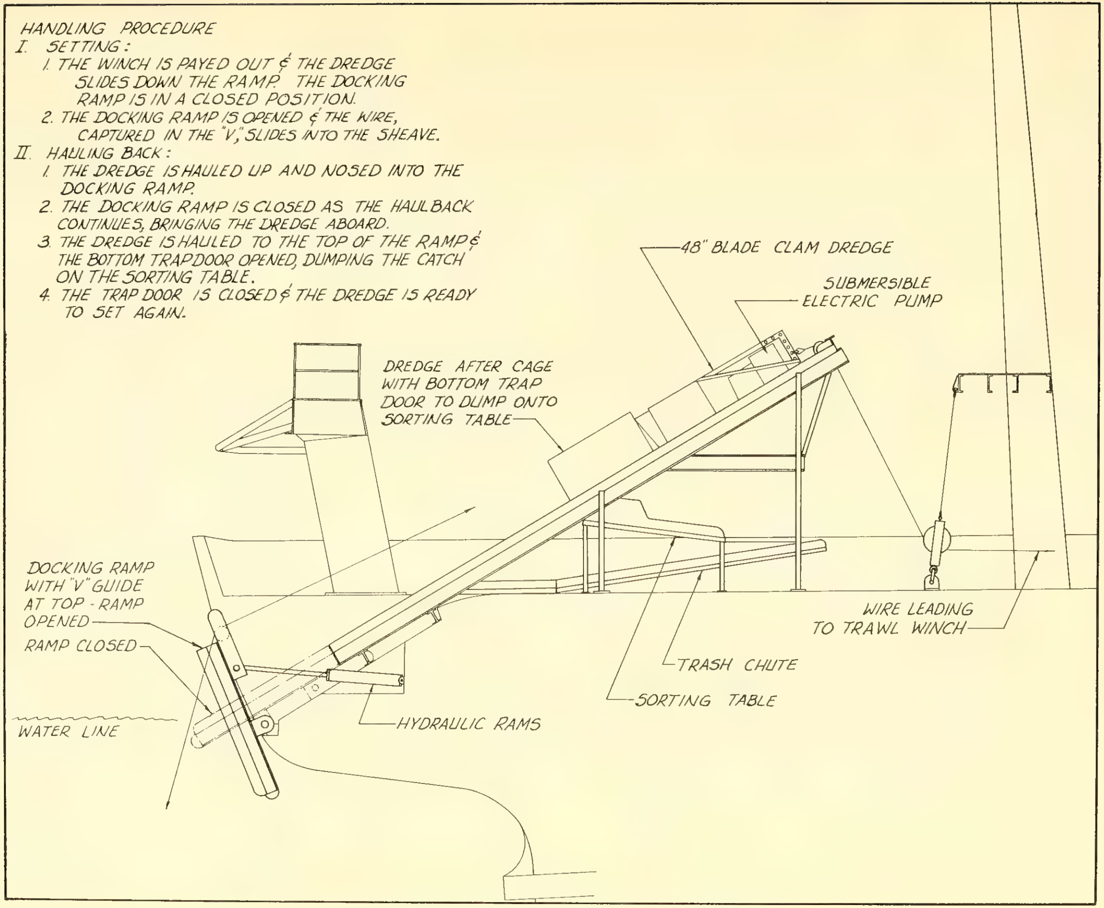
Of the 243 tows in area 8, in 20 to 35 fathoms, catches varied from 0 to 11.5 bushels of ocean quahogs. No live surf clams were found, although shells were taken.

Gear Development

The Delaware II has a high freeboard, so conventional dredge handling methods (hoisting dredge from vessel's side with a boom) were not practical. A new dredge handling system had to be designed.

A recent survey of the New Jersey clamming industry uncovered a method of setting and hauling the dredge from a vessel's stern. It was concluded that this method might be adapted to the stern trawler Delaware II. The current installation is a modified stern-haul system devised originally by Captain Eric Kirkeberg of Wildwood, New Jersey.

Figure 2 is a profile of the deck equipment. It identifies the major components. To set the dredge, the trawl warp is payed out--permitting dredge to slide down ramp and off vessel's stern. To haul dredge back, the docking ramp is first opened by hydraulic rams, and the wire is captured in the deep "V". Then hauling is started. Just as the dredge breaks the surface, the docking ramp begins closing as the haulback continues. The dredge is hauled to a point on ramp where bottom trap door can be opened to dump catch on sorting table. After dumping catch, the trap door is closed, and the dredge immediately set again. Sorting is done at tabletop level as trash,



, Fig. 2 - Stern chute clam dredge ramp used aboard Delaware II.

sand, and mud are washed out the stern through trash chute.

Difficulties were encountered in developing this system. The dredge had to be balanced along its centerline, in respect to port and starboard, and suspended with a relatively low center of gravity in relation to haulback attachment points. This was required to insure proper orientation and alignment at point of docking. A week's handling trials were necessary to develop the proper timing, coordination, and teamwork necessary to accomplish consistently a satisfactory docking maneuver. Installation of several additional small refinements to the system will be installed before the next cruise.

This system is expected to prove safer, less fatiguing, and generally more efficient than conventional system. During this initial clam-dredging cruise, the Delaware II was able to equal the number of tows per day averaged by Delaware I (BCF Gloucester's previous vessel) using conventional methods.

Survey Procedure

At the intersection of 2-mile spaced grid lines, samples were obtained by dredging along bottom for 4 minutes with a 48-inch (knife width) modified hydraulic dredge. At completion of each tow, the dredge was taken aboard, and the size and composition of catch determined. Ocean quahogs and surf clams were measured. Other species were noted for future reference.

Jetting water was furnished to dredge manifold by a dredge-mounted, 65 hp., submersible, electrical pump powered through a 4-conductor electrical cable by one of Delaware II's 150 kw. generators. Ample water volume and pressure were supplied by this pump.

Ocean Quahog Catches

About half the dredge tows produced ocean quahog catches large enough to be of some commercial interest. Catches were divided into 4 categories: (1) no ocean quahogs. (2) none to 1 bushel, (3) 1 to 2 bushels, and (4) 2 bushels or more. All catches in (4) are classified arbitrarily as commercial-size catches. However, many catches in 1 to 2-bushel category were just under 2 bushels; these would also be commercially valuable.

Of 382 survey dredge stations fished, 340 produced ocean quahogs, and 42 produced none. All fruitless tows were in area 8, in sections where bottom sediments were primarily soft mud. However, some ocean quahogs occasionally were found in this type of bottom.

Of the productive 340 tows, 94 were 2 bushels or more, 79 one to 2 bushels; the remaining 167 tows produced less than 1 bushel.

The maximum catch of 11.5 bushels was made in area 8 at 30 fathoms. Sixteen tows produced 5 or more bushels (14 from area 8, and 2 from area 7); 48 yielded 3 or more bushels (38 from area 8, and 10 from area 7).

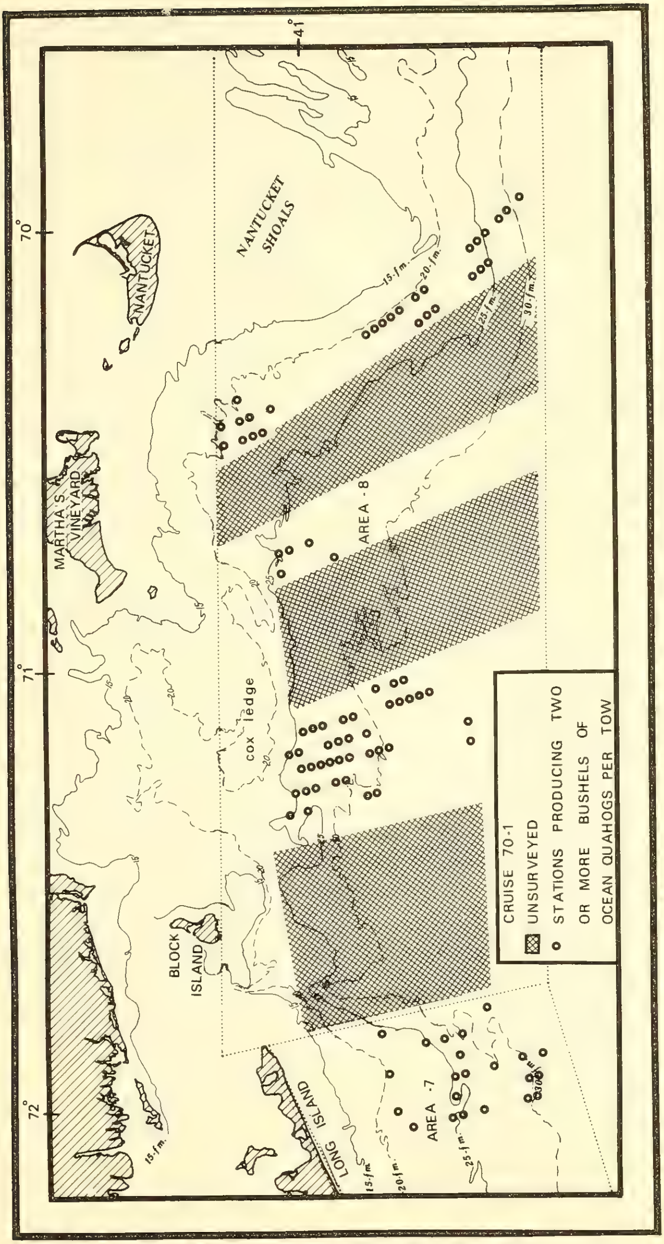
Catches of ocean quahogs generally were taken throughout both areas and in all depths surveyed (10 to 35 fathoms). However, in area 8, no tows were made in less than 20 fathoms; south of Cox Ledge, no tows have been made to date in less than 24 fathoms. This is because bottom in shoal water of these areas is very hard. Their investigation will wait until all other areas have been surveyed.

The shallow waters off Long Island (area 7) produced ocean quahogs and surf clams, but neither in abundance. Commercial-size catches were not made at less than 21 fathoms. Bottom sediments primarily were sandy and hard.

Ocean quahogs may occur in an almost continuous belt from one end of areas surveyed to the other. This assumes that future explorations will find that beds in unsurveyed intervening sections will be as numerous and dense.

Size of Ocean Quahogs

Samples from each ocean quahog and surf clam catch were measured. The range of length for ocean quahogs was between 1.3 and 4.4 inches. However, the greatest number of ocean quahogs measured were 2.8 to 3.8 inches long. Generally, the larger quahogs were found in area 7 off Long Island; there, although individual clams were larger, average catch size was somewhat smaller than in area 8. Few ocean quahogs over 4 inches long were taken; the same was true for those less than 2 inches long. The smallest size clams found probably do not reflect significantly either the occurrence or abundance of small



CRUISE 70-1
UNSURVEYED
STATIONS PRODUCING TWO OR MORE BUSHELS OF OCEAN QUAHOGS PER TOW
NANTUCKET SHOALS
NANTUCKET
MARTHA'S VINEYARD
BLOCK ISLAND
LONG ISLAND
AREA - 8
AREA - 7
cox ledge
70°
71°
72°
41°
15 f m.
20 f m.
25 f m.
30 f m.

clams because the dredge was not designed to retain the smaller quahogs. The scarcity of larger quahogs probably was due to fact that very few quahogs attain a size of over 4 inches during their life cycle in areas surveyed.

Many shells of the ocean quahog and other shellfish species were taken; abundance varied from station to station. In one section of area 8, bored shells were quite prevalent; these probably reflect a heavy infestation of predators.

The very few surf clams taken came from inshore depths of area 7. This is compatible with previously collected data from shallower waters of area 8. Other shellfish were taken from time to time, along with various finfish. It is of special interest that several specimens of the common razor clam were taken from some of the deepwater stations.

Samples of ocean quahogs were provided to interested industry members--and to BCF's Technological Laboratory at Gloucester, Mass.

For more information, contact Keith A. Smith, Base Director, or Phillip S. Parker, Fishery Biologist, EF&GR Base, State Fish Pier, Gloucester, Mass. 01930. Telephone: 617-283-6554.

CRABS ARE SERIOUS PREDATORS OF CLAMS

Studies by BCF's Milford (Conn.) laboratory of the predation rate of rock crabs and mud crabs on juvenile clams show these crabs to be serious clam predators.

A single rock crab can destroy as many as 25 10 mm-long clams per hour; a single mud crab up to 14 small clams (5 mm long) within one hour.

Rock & Mud Crabs Numerous

Rock crabs (Cancer irroratus) may be as numerous as 4 per square meter; mud crabs (Neopanope texana) up to 20 per square meter on shellfish beds.

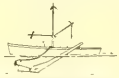
"It seems probable, therefore, that these two species of crab could almost destroy a good commercial set of clams."

KING-SIZED CLAMS MAY BE MARKETED

The geoduck, a king-sized clam (2 to 3 pounds) of the Puget Sound area, is a prize catch of sport clam fishermen on low tides. Currently, reports BCF Seattle, the Washington Department of Fisheries is investigating the commercial feasibility of marketing geoducks for the first time from an untouched deep-water resource (30 to 40 feet).

Large Clam Population

Previous studies showed the State has about 9,000 acres of this subtidal land with an estimated clam population of over 40 million. The biologists say the average clam is 12 years old, so only a small part of this reserve should be opened for commercial exploitation. These clams are taken by SCUBA divers with a suction device. Small trials are being made for harvesting geoducks on a 500-acre area. However, it is estimated that several hundred thousand pounds can be harvested yearly on a sustained-yield basis.



COLUMBIA RIVER SMELT PROMOTED IN MIDWEST

Each February and March, the lower Columbia River produces large quantities of smelt, reports BCF Seattle. With improved harvesting techniques developed by BCF's Exploratory Fishing and Gear Research Base, an above-normal surplus is expected this year.

BCF marketing personnel discussed with Washington firms the possibility of expanding their markets for fresh and frozen Columbia River smelt.

Midwest Sales

Samples of dressed and round smelt were shipped to Minneapolis for distribution to retail chains by BCF marketing personnel. Some 72,500 pounds were sold to retail chains in Houston, Dallas, Milwaukee, and Minneapolis. BCF Seattle hopes this is just a start in proving that Columbia River smelt can be sold outside the traditional Washington-Oregon area.

10-YEAR PLAN TO DEVELOP WILLAMETTE R. SYSTEM UNDERWAY

A program to speed development of the Willamette River system's potential for increased production of salmon and steelhead is being promoted by Oregon's Fish Commission, Game Commission, and BCF. One goal is to develop a natural, self-sustaining spawning run of 55,000 coho adults by 1978.

To achieve this, the Fish Commission has begun a program to plant 1.2 million juvenile coho salmon into the system each year for 9 years. The planting of small coho in 27 streams supplying 9 principal tributaries of the Willamette was completed around April 1. These fish will return as mature adults in fall 1971.

"Wild" Population Expected

During the last 5 years, an average of 6,600 coho adults passed above Willamette Falls each year.

It is expected that development of a "wild" population that will use completely, for the first time, the potential of the Willamette watershed will result from: completion of the new Willamette Falls fishway in 1971, improved water quality in Portland Harbor, and the heavy yearly planting program.

Enhance Anadromous Fish Runs

The development area embraces most of the breadth of the Willamette Valley, from the uppermost reaches of the tributaries northward to Oregon City. The Oregon Fish Commission believes development of the Willamette and its tributaries will be a major step in increasing Oregon's anadromous fish runs.

SOLUTION SOUGHT TO SALMON "SHAKER" PROBLEM

The Oregon Fish Commission, the California Department of Fish and Game, and west coast troll fishermen are working together to solve the coho "shaker" problem. The name "shaker" has been given to small coho salmon often shaken off the hook. The agencies and fishermen are concerting their efforts this season to gather information on the losses of sublegal size and out-of-season coho in northern California and southern Oregon ocean-troll fisheries.

The large number of these illegal coho killed while trolling for legal salmon during May and June concerns fishery agencies and fishermen. Biologists estimate the "shaker" mortality rate in this area is about 50 percent. Based on the estimated incidental catch of sublegal coho, it could mean a loss of up to 250,000 or more coho a year.

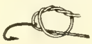
More Information Needed

The need for more information is apparent. Jim Bolin, manager of West Coast Trollers Association, offered the trollers' services in collecting the needed information during the 1970 season. Selected trollers will keep detailed logbooks, noting number, size, area, and time salmon were caught.

At end of 1970 troll-salmon season, the logbook information will be summarized and evaluated by Oregon, California, and Washington fishery agencies. The results will be reviewed with troll fishermen before any regulatory changes are recommended. Solutions could consider changes in seasons, minimum size limits, types of gear used, or a combination of these.

No Action Before 1971

No regulatory action will become effective before the 1971 season. If this is found necessary, legislative action would be required in California. The Oregon Fish Commission has authority to adopt regulations.



NEW MESH RESTRICTION FOR STEELHEAD IS EFFECTIVE

The $7\frac{1}{4}$-inch stretch-mesh size restriction placed on gill nets during the Columbia River commercial winter season by Oregon and Washington fishery agencies has effectively reduced the incidental catch of steelhead. So said Edw. G. Huffschmidt, chairman of Oregon Fish Commission, on March 16. This statement is supported by reduced steelhead landings--and results of a special experiment conducted during the 14-day winter season that ended March 5. The steelhead run appears smaller than average, but the study showed the fish were present and could be caught in good numbers with a "steelhead net" of 6-inch mesh.

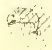
2 Nets Compared

The study compared the effectiveness of the mesh restriction. It used two identical diver nets--except that one was a legal $7\frac{1}{4}$-inch taut mesh, while the other was the 6-inch taut mesh. Diver nets are gill nets with trammels, which are drifted near the bottom during the winter season. Under Oregon Fish Commission supervision, the two nets were fished alternately over the same drift by equally experienced and proficient commercial fishermen. The test fisherman using the 6-inch mesh caught 36 steelhead in 8 drifts over a 40-hour test period; the fisherman using the legal gill net managed only 6 steelhead. Both nets caught 8 chinook, indicating the larger $7\frac{1}{4}$-inch mesh net was as effective as the smaller net for chinook.

At the same time, the smaller steelhead are escaping the more restrictive gear: just 1 of 36 steelhead caught in the 6-inch mesh net exceeded 30 inches. In the more restrictive $7\frac{1}{4}$-inch net, 2 of 6 steelhead caught exceeded 30 inches. In the recent season, 61% of the steelhead exceeded 30 inches.

Mesh Restriction Effective

Figures on the recent winter season gill-net landings also bear out the effectiveness of the mesh restriction. Only 3,600 steelhead were taken, while 13,300 chinook were landed. Over the last 10 years, the average winter-season catch during seasons, varying from 14 to 19 days, has been about 5,600 chinook and 8,000 steelhead.



REPORTS ON SHRIMP SEPARATOR TRAWL IN OREGON ARE GOOD

The Oregon shrimp fishery has reported encouraging results from use of shrimp-separator trawls. Commercial vessels using separator trawls continue to make almost pure catches of shrimp; those using standard shrimp trawls are plagued with a high concentration of smelt and other contaminants.

4 Such Trawls Ordered

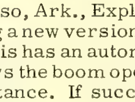
As a result of the early success of vessels using sorter trawls, fishermen converted another standard net to a sorter trawl recently, and ordered 4 new sorter trawls from netting companies.

ADVANCES IN CATFISH HARVESTING

The BCF Kelso, Ark., Exploratory Fishing Station is testing a new version of a haul seine brailing bag. This has an automatic triggering device that allows the boom operator to empty it without assistance. If successful, this new device will eliminate time loss and manpower during loading.

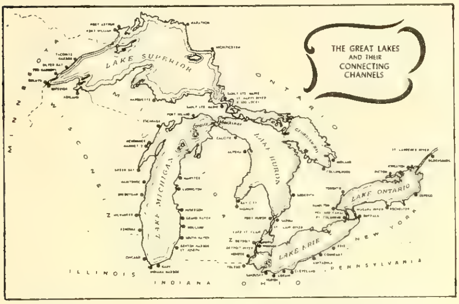
Slightly modified live cars also are being constructed. These have openings at each end for testing feasibility of using two or more live cars in tandem--while attached to the seine during hauling.

An experimental catfish grader has been completed and will be field tested. The reaction of catfish to wire mesh boxes with various openings is being observed in a test flume. Also, the reaction of catfish in ponds to changes in climatic conditions is being studied.



HEAVY ALEWIFE DIE-OFFS POSSIBLE IN LAKE MICHIGAN THIS YEAR

Severe winter weather and the predominance of alewives at critical age levels could result in heavy die-offs in parts of Lake Michigan this year, said Assistant Secretary of the Interior Leslie L. Glasgow.



Because the alewife population is much below the 1967 level, when millions of dead fish washed ashore, especially near Chicago, a die-off of that magnitude is unlikely. The Illinois and Indiana shores are the areas most likely to be affected by localized 1970 die-offs.

Water Temperatures Important

The 1969 annual alewife survey by BCF's biological laboratory at Ann Arbor, Mich., showed a 60% increase over the 1968 population. A severe die-off would not be expected this year under normal conditions; however, the Lake Michigan area had below-normal winter temperatures. Research shows that alewives cannot tolerate excessively cold water, although they may not die immediately. If water temperatures warm rapidly this spring, the added stress of adjusting to it could trigger severe alewife mortalities.

A Small, Short-Lived Fish

The Great Lakes alewife is small. Adults average about $6\frac{1}{2}$ inches and weigh about 2 ounces. It is used principally for fishmeal and pet food locally. Although alewives are live food for larger fish, including Coho and Chinook salmon and lake trout, they compete with other fish for space and food.

Lake Michigan alewife stocks are now largely older fish; over half the adults are in their fourth and fifth years. Alewives are short-lived in the Great Lakes. Only about 30% of Great Lakes alewives can be expected to survive their fifth year.

It is believed that alewives migrated from their native habitat along the Atlantic coast into the Great Lakes via the St. Lawrence River and canals. They are in all 5 Great Lakes; they are the most abundant fish in Lakes Ontario, Huron, and Michigan.

Advance information on die-offs is important to vacationers and operators of resort areas, beaches, hotels, restaurants, and other businesses.

The annual survey will continue when the Ann Arbor laboratory's role is changed to give greater emphasis to recreational fishing and environment quality.

On The Death of Lakes

On March 3, 1970, Carl L. Klein, Assistant Secretary of the Interior for Water Quality and Research, addressed a meeting in Washington, D. C., on lake restoration.

This is what he said:

Lake pollution is perhaps the most crucial and most difficult of water pollution problems. This should come as no great surprise to anyone. Lakes generally do not benefit from the same cleansing action as a strong river current which might help flush away contaminants or dissolve them in a powerful flow of clean water.

Even without the contribution of man-made pollutants, lakes tend to develop eutrophication problems because of the nutrients that accumulate in them. But man can and must do much more to prevent the process from speeding up and causing the premature aging—and dying—of our fresh-water lakes.

Like the living thing that it is, a lake is born, grows—even breathes—and slowly dies. The life cycle may last many thousands of years—or it could be a lot less. Much depends on the habitation that surrounds it. Man and his technology have become perhaps the gravest threat of all to the survival of lakes and of the other natural waterways which provide us with so many needs and enjoyment.

Death comes as a result of a lake slowly filling with silt and sediment. This is a natural process which manifests itself in reeds and water plant beginning to accumulate in shallow waters. The natural flow of streams through a lake may drain out the water, turning it into a swamp. The swamp plants then may give way to sturdier plants of a drier soil, and eventually, the one-time lake becomes dry land. In this manner, the United States has lost about half the lakes which existed on this continent some 12,000 years ago.

Where human habitation around a lake is relatively sparse, its waters can endure the minor damage contained in the wastes and debris thrown into it. The waters can assimilate a certain amount of wastes by decomposing them into harmless chemicals and dispersing them. But there is a limit to what a lake can absorb.

As ever-greater numbers of people and industry congregate around a lake and pour increasing amounts of waste into the water, the lake may become saturated and unable to purify itself. Man often does not realize the damage he has done until the lake begins to smell and the physical characteristics of pollution become obvious. By then, the pollution problem is already well past the stage of an easy solution.

Lake Erie is one of the most flagrant and frequently cited examples of lake pollution and eutrophication in this country. A look at its history and development is needed to help us understand the problem—and to prevent its recurrence elsewhere.

Lake Erie is the oldest, the Southernmost and the warmest of the five Great Lakes. It is only 241 miles long and has the smallest volume of water, with almost a 10,000-square mile surface area. The lake is very shallow, with an average water depth of only some 58 feet, and at its deepest point is only about 210 feet.

But Lake Erie also happens to be in the heart of one of America's greatest residential and industrial areas. It provides a resource to 11½ million people in the United States and Canada in terms of water supply, recreation, commercial fishing and shipping. And the annual value added by manufacturing in the Erie Basin stands at more than $17 billion.

By the year 2000—and, remember, that's only 30 years from now—the population of the Lake Erie area is expected to double, and so is the volume of industry in the Basin. These people and industries will depend on Lake Erie—a lake whose water quality must be maintained and enhanced so it can be passed on in a condition of unlimited usefulness.

As it now stands, Lake Erie is close to being strangled by the pollutants which pour daily into its waters. Municipal wastewater is the principal cause of pollution in the lake and its tributaries, with industrial wastes also occupying a major role, particularly in tributaries and harbors.

Among the most harmful discharges are untreated flows, combined sewer overflows and treatment plant effluents. Agricultural runoffs also leave their marks, as do wastes from commercial and pleasure craft, harbor dredging, urban runoff and soil erosion.

The wastes most destructive to lake Erie come from three major geographic areas. These are Detroit, Michigan, and the Cleveland-Cuyahoga and Maumee River basins in Ohio. Waste inputs from the Buffalo area affect the Niagara River more than Lake Erie, but a number of other areas have local problems which add up to significant pollution for the lake.

The three major sources of pollution in Lake Erie together discharge about 74 per cent of the phosphorous flowing into the lake, 87 per cent of the biological oxygen demand and 66 per cent of the chlorides.

The total BOD discharged to municipal sewage treatment plants in the Lake Erie Basin is equivalent to the raw sewage produced by 9.4 million people. After treatment, this volume is reduced to a load on the receiving waters equal to the raw sewage of 4.7 million people. In effect, this means basin-wide sewage treatment has an efficiency of about 50 percent.

Only about half of the 360 known sources of industrial wastes in Lake Erie and its tributaries can be classified as providing adequate treatment for their wastes. Yet together these industries account for 87 per cent of the total waste flow discharged into the lake or its tributaries.

The total industrial flow amounts to 9.6 billion gallons daily, with electric power production account for 72 percent and steel production 19 percent of the total. The steel, chemical, oil and paper industries discharge about 86 percent of the total industrial wastewater in the basin, excluding the electric power installations.

There are so many sources of pollution to Lake Erie that it is almost impossible to make an accurate record of all of them. However, the combined sewer systems of the cities of Detroit, Cleveland and Toledo are among the worst offenders, and just their overflows alone annually contribute wastes equivalent to the BOD of raw sewage from approximately 600,000 people. These combined sewer overflows are expected to represent a high percentage of future phosphorous contributions to the lake.

As you know, phosphorous is a major contributor to the process of eutrophication because of its stimulation to the growth of algae.

It only takes a small amount of phosphorous to create the conditions which precipitate algal growth. As little as 0.01 milligrams per liter at the beginning of the growing season in some lakes or an annual inflow of 0.2 to 0.5 grams per square meter of lake surface in others is all that is necessary.

And unlike nitrogen—which also contributes to this problem—phosphorous does not enter into the type of biochemical reactions that permit it to escape from water as a

Fig. 1 - Algae on shore and in lake, near Washington, D.C., indicate water is aging.

gas, nor is it easily removed from the system by organisms or sediments.

With present technology, the preferred way to control eutrophication is to impede plant production by making phosphorous less available for growth. And one important step in this direction is to reduce the amount of phosphorous-bearing effluents.

A certain amount of phosphorous is contained in the Earth's crust and enters surface waters from many natural sources. These include surface water runoff, soil erosion, waste from, and decay of, plants and animals, and dissolved and suspended materials in rain and snow.

Thus, over the course of hundreds and thousands of years, these small, but continuing inputs of phosphorous can by themselves bring lakes to an end through eutrophication and sedimentation—without man entering into it. The Green River oil shales of Colorado, Wyoming and Utah are a good example of lake deposits formed by natural euthrophication and sedimentation over a long period of time.

But man also produces significant amounts of phosphorous, and because of the tremendous population rise in recent years, and even greater increases predicted for the immediate future, his contribution to the eutrophication process is becoming a major challenge.

Municipal sewage contains considerable concentrations of phosphorous. It comes principally from phosphorous-bearing detergents and from human wastes. On the average, adult humans contribute about 1.4 pounds of phosphorous a year, while the use of detergents adds another 1½ to 2 pounds of phosphorous per capita annually, While some of the phosphorous is removed by conventional waste treatment processes, substantial amounts are discharged with no treatment at all.

The phosphorous used in detergents currently makes up some 50 to 60 percent of the total amount of phosphorous in municipal sewage. Obviously, this constitutes a major source of nutrient pollution which must be abated.

Our primary thrust on controlling this problem has been the development and demonstration of phosphorous removal technology for application at municipal waste treatment plants. This approach has been given priority because it attacks all of the sources of phosphorous in municipal wastes, regardless of its origin. We want to emphasize the fact that we are not out to throttle the detergent industry. Phosphate removal technology would have to be applied to municipal waste waters even if phosphates in detergents were to be completely eliminated from use.

The only roadblock that stands in the way of requiring the reduction or elimination of phosphorous from detergents at this time is that a substitute material has not yet been adequately tested which performs the same function as phosphorous. Until it can be proven that such a product will not cause some problem equally harmful to the environment, a substitute probably will not be placed on the market.

The Interior Department effort to clean up our lakes and other waterways is a continuing one, which we hope to expand, in order to demonstrate the restoration possibilities for all our water resources.

In Lake Erie, the existing backlog of unmet restoration needs includes the upgrading of sewage treatment by no fewer than 287 municipalities. The Lake Erie Basin should actually be served now by treatment sufficient to provide a minimum of 85 percent BOD removal, the almost complete removal of suspended solids and 92 percent removal of total phosphorus. It is to be anticipated that by 1990 the removal of over 95 percent of organic pollutants will be required throughout the Basin.

At present, there are some 189 industries which still have not installed treatment facilities sufficient to meet water quality standards. This situation is hardly excusable, and it shows we still have a long way to go just to conform to the pollution control regulations that are already on the books.

Our primary consideration must be to stop putting nutrients into our lakes. We must slow down the eutrophication process or we may discover our water resources becoming unusuable. We must also devise ways and means to reverse the entire eutrophication process to assure future generations of lasting sources of water.

In the Interior Department, our strategy is twofold: it consists of prevention and restoration. By prevention, we mean slowing

Fig. 2 - Scum and plant growth on Island Grove Pond, Abington, Mass. Overgrowth of algae spells death to other life, especially fish, in slow-moving water.

down eutrophication by removing key nutrients from wastewater before it enters a lake. At the same time, research and development must be carried on to find even more effective methods of nutrient removal.

Restoration means removing or inactivating nutrients after they have reached a lake. Restoration techniques must be carefully researched to find an economically acceptable method that is likely to succeed.

The mechanical harvesting of algae, the harvesting of organisms which eat algae and eliminating the effects of algae by chemical means are among the techniques being studied intensively by the National Eutrophication Research Program of Interior's Federal Water Pollution Control Administration. This work is being done in government and university laboratories, as well by private industry, and often uses small lakes in various parts of the country as field laboratories.

It is altogether doubtful whether Lake Erie could ever be returned to the condition which existed prior to man's appearance, or even to the condition which existed at the turn of the century. It can, however, be returned to some intermediate stage of aging, and we can expect a major improvement and protection of water quality.

Lake Erie and others threatened by eutrophication can be saved, but it can be done only with the continued and determined support of the public and its political representatives.

President Nixon set the tone for our efforts to control pollution in his State of the Union Message last January and in programs he launched in February to carry them through.

The President said, "The great question of the seventies is, shall we surrender to our surroundings, or shall we make our peace with nature and begin to make reparations for the damage we have done to our air, our land and our water?"

While, "The price tag on pollution control is high . . ." the price will be even higher if we fail to act. That is why we at the Interior Department are determined to act now while there is still time.

Fig. 3 - An Arkansas creek.

Fig. 4 - A surface blanket of filamentous green algae covers a large area of this river near Washington, D.C. These algae could be Spirogyra, Zygnema, Oedogonium, or Cladophora. (Photos: FWPCA)

'COMMERCIAL FISHERIES ABSTRACTS'

Commercial Fisheries Abstracts, a monthly journal, contains summaries of selected articles from about 350 trade, engineering, and scientific journals dealing with the entire spectrum of our fishery industries. These journals cover the biological, physical, and social sciences and the engineering, technological, and legal aspects of the aquatic resource supply, harvesting, processing, use, and distribution. The abstracter classifies each abstract into one of 10 main fields and further into basic subject groups in accordance with a classification system designed by BCF. Whenever possible, the abstracter includes sufficient information in each abstract to enable the reader to understand and use the results of the research described in the original article. In addition, he gives pertinent bibliographic information so that the reader can obtain the original article from a library or the author.

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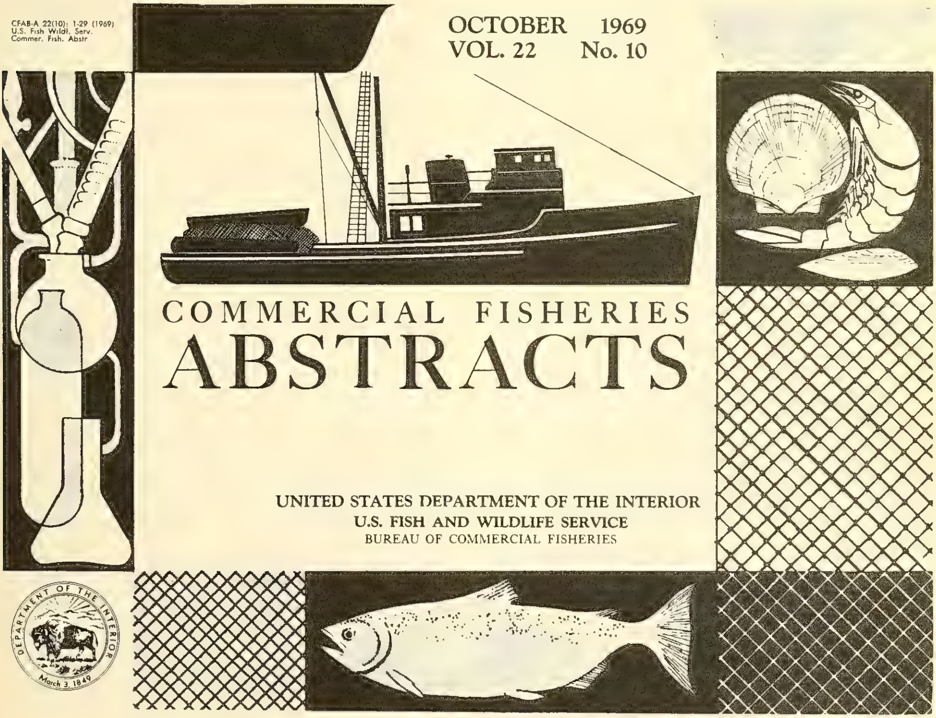
Frank T. Piskur, Editor



OCEANOGRAPHY

SEA TEMPERATURES MEASURED BY SATELLITE

The results of an oceanographic survey called "Little Window," conducted March 17-22, may show that ITOS, a new meteorological satellite, can measure the temperature of water at the sea surface as well as watch the weather. This was reported by Dr. A. R. Longhurst, director of the BCF laboratory in La Jolla, Calif.

"Little Window" was an oceanographic survey of a 60 by 30 mile square, or window, in the Gulf of California to test the ability of infrared sensors on ITOS to measure sea-surface temperatures from space. It was a cooperative effort of BCF, ESSA, NASA, Inter-American Tropical Tuna Commission, U.S. Naval Oceanographic Office (NOO), and the Mexican Navy and Weather Office.

Oceanographic Survey Lines

U.S. Government scientists working from BCF's research vessel 'David Starr Jordan' and a Mexican Navy corvette spent March 17-22 running a series of oceanographic survey lines across the mouth of the Gulf of California. The temperature information collected from Jordan will be compared to infrared readings simultaneously collected by the satellite during its twice daily pass over the area. A single track requiring more than 30 hours by ship can be seen in seconds by the satellite.

The project was coordinated by NOO oceanographer Paul E. LaViolette from the BCF laboratory. He said: "We can use infrared data collected by these polar-orbited satellites for just about any ocean in the world. The biggest limitation is cloud cover, but with the satellite's ability to look repeatedly at an area, we can 'see' the ocean, if we wait long enough."

Results May Be Valuable

The results of the "Little Window" survey may show that satellites can furnish a continual source of sea-surface temperature for any ocean of the world. Such information would have many practical applications: for the fishery scientist, who would use it to predict distribution of temperature-oriented fish, such as the tunas; for the meteorologist, who studies warm and cold ocean fronts and their relationships to short-period meteorological changes, and who is looking towards reliable long-range weather forecasts; for the oceanographer, who has been searching for a quick way to look at temperature conditions at the sea's surface.

The oceanographic ability of a second satellite, NIMBUS III, was also evaluated. The infrared sensor aboard NIMBUS III differs from those of ITOS because it operates at a different frequency and can measure the ocean's temperature only at night.

ORGANISMS THAT FOUL VESSELS CAN ALSO DETECT POLLUTION

Major problems facing ships everywhere are the marine plants and animals, such as barnacles, that attach themselves permanently to marine hardware. This problem costs the U.S. Navy alone \$50-\$100,000,000 a year.

Two biologists of the U.S. Naval Oceanographic Office (NOO)--John DePalma and Ed Long--use these "biofoulers" for useful purposes: to warn of encroaching water pollution.

They have found that in populated marine areas, particularly near naval bases, local species of marine biofoulers may serve as indicators of the amount of pollution in the area waters.

Biologists' Explanation

Long explained: "For instance, by examining the different species of biofouling plants and animals that attach themselves to test panels in the Wakiki-Pearl Harbor area, we would be able to tell how pollution from the Navy base in Pearl Harbor may be affecting the beaches at Wakiki."

DePalma added: "This is possible because we know that species diversity is lowered in direct relation to the amount of pollution in the area. By keeping track of species that we know from previous testing to occur only in, say, the Wakiki area, we can study the mean sizes of certain indicator species which vary directly with the distance from the source of pollution. Regular studies of the fouling in areas near naval bases could provide a sort of warning system for the Navy. Now is when we should be getting data, while the situation in places like Wakiki is not yet troublesome."

SCIENTISTS SEE RARE MARINE ANIMAL WITH SPECIAL CAMERA

"In the photograph, it looks like an exotic flower growing alone on a moonlit desert, but it isn't," explains Water Jahn, the U.S. Naval Oceanographic Office scientist who used a deep-sea strobe camera to take the photo. "It's actually a very primitive animal."

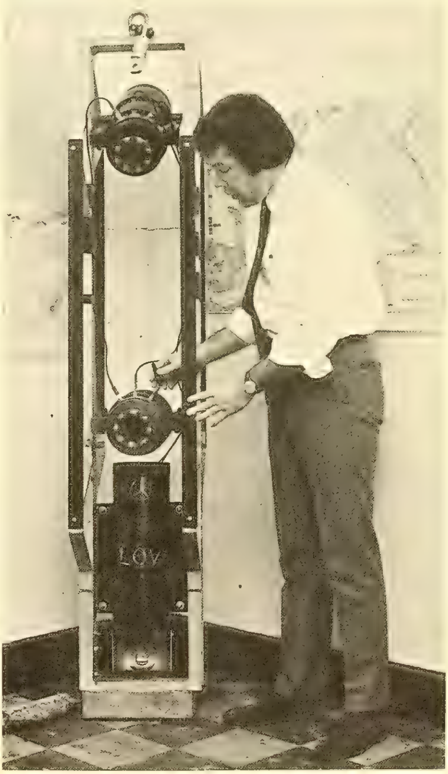
The creature was photographed on the sea floor 15,900 feet below the USNS 'Kane' when the NOO-controlled oceanographic survey ship stopped at a survey point about 350 miles west of the African coast.

"Umbellula"

Long-Stemmed Polyp

To determine "what type of animal," Jahn sent his photo to marine biologists, who identified it as a member of Phylum Cnideria (Ceolenterate), class Anthozoa, subclass Alcyonaria, Order Pennatulacea, family Umbellulidae. That means it is a long-stemmed polyp--a multicelled animal akin to hybroids, sea anemones, and living coral.

The biologists told Jahn it was the first time they had seen this variety actually living on the ocean bottom, although they knew it existed.



Mr. Jahn and his camera.
(Photos: U.S. Naval Oceanographic Office)

Study Origin of Oceans

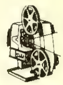
NOO officials said this probe was designed "to test theories that are relevant to the origin and history of all the world's oceans--theories that will help the Office interpret existing geologic structure and trends." Such understanding could become a scientific base for diagnosing the meaning of soundings and other survey data. NOO uses this information to chart the lands lying beneath the world's oceans and seas.

Like all deep-ocean regions, the sea floor beneath the open Atlantic is largely unexplored--at least as far as photographing it is concerned. So, Jahn recalled, "we lowered the camera to the bottom at 77 different Atlantic stations to get random shots--to see what could be found, and the 'Umbellula' (his name for it) appeared on Station 59."

The 'Umbellula'

The photo shows the Umbellula as a tentacled animal atop a slender stalk, which Jahn estimates to be about three feet long. The tentacles end in clusters of large flower-like polyps, or "feet," said to be deep red, shading toward orange-red or purplish red.

"These agile tentacles," Jan reports, "capture food floating by the Umbellula and pass their catch to the creature's center mouth. The tentacles also may serve as a defense against enemies. The Umbellula supports itself on the bottom by imbedding a long, hollow muscular bulb at the end of its stem into the soft sea floor mud."



NEW-TYPE DRIFTING BUOY SET ADRIFT ON GEORGES BANK

BCF's 'Albatross IV' set adrift a buoy on Georges Bank in March. On command of the NIMBUS satellite, the buoy radios its position and the water temperature to the satellite. The latter radios the data to a ground station. A series of such positions traces the surface current.

The Woods Hole (Mass.) Oceanographic Institution is responsible for U.S. Navy-developed buoys. The Institution requested BCF's Woods Hole Laboratory to select the location for the buoy. It did--in an area over the haddock spawning grounds.

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ANTARCTICA ONCE JOINED TO S.E. AFRICA, SCIENTISTS SAY

Two ESSA scientists, Dr. Robert S. Dietz and Walter Sproll, report they have established with a computer's help, that Antarctica once was attached to Africa's southeast coast. The continents now are 2,000 miles apart.

About 200 million years ago, they estimate, there was only a single universal land mass called Pangaea, 80 million square miles in area. Then, for still-unclear reasons, Pangaea started to rift apart, like an ice floe breaking up. The fragments--today's continents--were dispersed to their present positions. The split between Africa and Antarctica apparently was one of the first events to occur.

Support Continental Drift Theory

Dietz and Sproll support the continental drift theory. This postulates that the continents are drifting at rates of about an inch a year in the earth's mantle. The mantle is that part of the earth's interior lying between the molten central core and the crust.

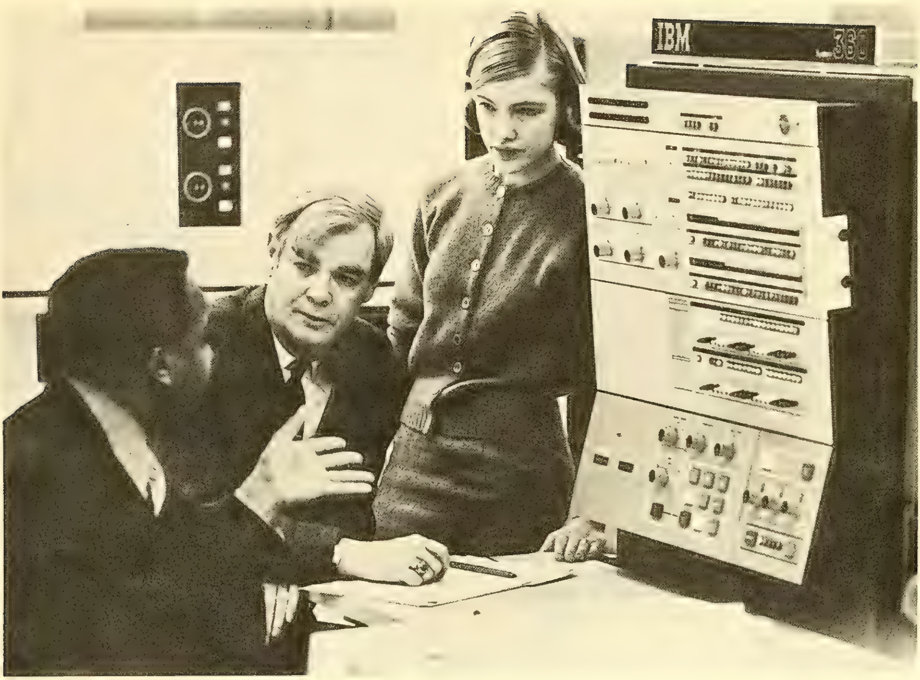
COMPUTER USED TO STUDY WORLD'S OCEANS

Scientists are using a computer at the National Oceanographic Data Center (NODC), Washington (D.C.) Navy Yard, "to unravel many of the mysteries locked in the cold and silent depths of the seas." Its electronic files contain an estimated 85% of world's known oceanographic station data, and are the largest collection of such information in the U.S.

The computer helps "chart the paths of 'rivers' that flow through the sea, measure the closely related effects of the world's oceans on global weather, even track the life cycle of a single drop of sea water."

Many Requests for Data

"A few months ago," said Dr. Thomas S. Austin, Director of the Center, "a scientist asked for all our data on a triangular section of the Atlantic from Gibraltar to the Azores to the coast of Scotland. He wanted readings from the surface down to 10,000 feet.



Dr. Thomas S. Austin (center), Director, National Oceanographic Data Center, James Pugh, computer operator, and Mrs. Charlotte Sparks, a programmer, with IBM System/360 Model 40. Its electronic files contain the largest U. S. collection of oceanographic station data.

"With this kind of information, he plotted the two-way flow of water into and out of the Mediterranean--eastbound for the upper layers of the water and westbound as the water gets deeper."

In another case, the Center's information on the effects of polar icecaps was needed. The freezing action in Arctic and Antarctic areas removes salt from water and makes it heavier. Then, the colder, heavier water flows along layers of equal density. It results in the creation of 'rivers' of colder water coursing along the ocean bottom.

Dr. Austin points out: "A drop of seawater has a life cycle that can be traced with information stored in the IBM computer."

The cycle can take thousands of years. It starts with the chemical combination of hydrogen and oxygen in the atmosphere as precipitation. "Precipitation enters the seas directly as rain, fog, or mist, or through runoff from rivers. It completes the cycle through evaporation by the sun."

NODC's Many Sources

NODC's information comes from many sources: world's navies, private shipping, scientists, oceanographic vessels, government agencies, and oil companies.

According to Dr. Austin, the data's completeness, currency, and availability are the system's key elements.

Nansen Bottles & Other Devices

Until recently, water samples were gathered mostly in Nansen bottles lowered by cable over the side of a ship. The bottles also have thermometers to take temperatures at various depths. The analysis of the contents of these samples yields information on the amounts of nutrients and chemical elements, the presence of plankton and other small marine life, and the subsurface currents' direction and speed.

In the past few years, the use of sophisticated continuous-recording devices on ships, buoys, and satellites has increased. Also, more computers aboard oceanographic vessels have increased information supplied to NODC.

The National Oceanographic Data Center, founded 9 years ago, is sponsored by 10 government agencies and administered by the U.S. Naval Oceanographic Office.

EXTRA-HOT PANAMA BASIN OF PACIFIC IS STUDIED

Oceanographers of ESSA's Coast and Geodetic Survey, aboard the 'Oceanographer', this month are seeking "answers to one of the earth's most puzzling riddles."

They are studying the welling up of heat from within the earth's bowels. This heat warms the water below the sea as it moves northward from the frigid Antarctic.

Scientists know little about the process by which this thermal energy moves upward after it escapes the earth's crust. But the basin ESSA's oceanographers are probing provides an unusual laboratory.

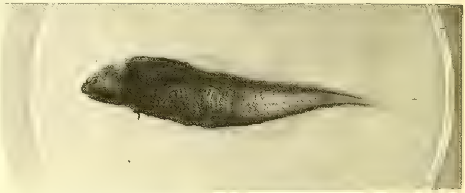
The Panama Basin

It is a 600-by-600 mile, 9,000-foot-deep, basin at the bottom of the Pacific, hemmed in by undersea mountains, and known as the Panama Basin. ESSA says: "The heat that rises in it from within the earth is estimated to be three times greater than the average rate elsewhere in the world's oceans. Furthermore, the basin floor is marked by abrupt pit-like deeps, ridges and escarpments which provide a wide range of conditions for examining the circulation phenomena."

The Panama Basin lies between the coasts of Central and South America and the Galapagos Islands. The islands are on the equator, about 600 miles west of Ecuador.

DEEP-SEA EXPEDITION CATCHES RECORD FISH

A depth record for collecting a vertebrate from the deep sea has been claimed by the crew of the 'John Elliot Pillsbury'. A fish of the genus Bassogigas was trawled from 26,132 feet, nearly 5 miles down, in the Puerto Rico Trench. The Pillsbury expedition was part of the National Geographic Society/University of Miami Deep-Sea Biological Program directed by Dr. Gilbert L. Voss and Dr. Frederick M. Bayer of Miami's Rosenstiel School of Marine and Atmospheric Sciences.



Bassogigas--trawled from 26,132 feet by R/V Pillsbury. (Photo: Don Heuer)

Dr. Voss, expedition's chief scientist said: "Only three or four specimens of Bassogigas are known in world biological collections, and our specimen is in the best condition of any that have been collected, as well as having been taken from the deepest water." The fish is about $6\frac{1}{2}$ inches long and, though it inhabited an area of total darkness, has two small eyes.

The remains of a squid which probably had reached 15 to 18 feet also were collected from the Puerto Rico Trench. The scientists say it is the first-known record of the carcass of a large animal taken from the ocean deeps.

The scientists say the Pillsbury is the only vessel in the U.S. oceanographic fleet fully equipped for trawling at these depths. Her main winch has two reels of $\frac{9}{16}$-inch wire; each reel contains 42,000 feet. As much as 35,840 feet were used to make the tows.

Pollution $4\frac{1}{2}$ Miles Down

The Pillsbury's scientists reported: "Man's efforts to pollute the earth were evidenced by some of the other items brought up when tows were made in water $4\frac{1}{2}$ miles deep. From the ocean bottom came empty paint cans, fruit juice cans, flip-top lids of beer cans, clinkers from steamship firerooms, pieces of old aluminum, empty bottles, and flashlight batteries."

Puerto Rico Trench

The level floor of the Puerto Rico Trench consists of soft, blue, extremely sticky clay. "The clay is covered with the largest amount of land plant material yet reported from any trench in the world. Pillsbury tows brought up coconut husks, tree seeds, fronds, tree branches, mangrove roots, and turtle grass remnants."

The Trench probably has "the most uniform, unchanging environment known in the Atlantic Ocean." At $4\frac{1}{2}$ to 5 miles down, there is no light from the sun, temperature is slightly below 2° C., and pressure is 800 times greater than on earth's surface. The Trench is over 200 miles long; at its widest point, it is almost 40 miles. At its deepest, the Milwaukee Deep, it is about 28,700 feet (4,780 fathoms).

The National Geographic Society/University of Miami Deep-Sea Biological Program investigates "the kinds, distribution, and concentration of marine life in the tropical waters of the Atlantic Ocean from West Africa to the coast of South America and the Caribbean Sea."

DR. J. L. McHUGH APPOINTED IDOE COORDINATOR

Dr. J. L. McHugh, the former deputy director of BCF, has been appointed head of the new Office for the International Decade of Ocean Exploration (IDOE) by Dr. William D. McElroy, director of the National Science Foundation.

The IDOE is an international effort to expand the uses of the oceans--and to design ways to protect the marine environment from degradation.

IDOE's first year will concentrate on three areas: identification of factors that will help man predict modifications in the oceans caused by nature or by man; investigation of specific oceanic areas with special attention to food chains and pollutants; and studies of selected areas of the ocean bottom to improve man's knowledge of it, and to facilitate location of natural resources.

Dr. J. L. McHugh

FOREIGN FISHING OFF U.S. IN FEBRUARY 1970

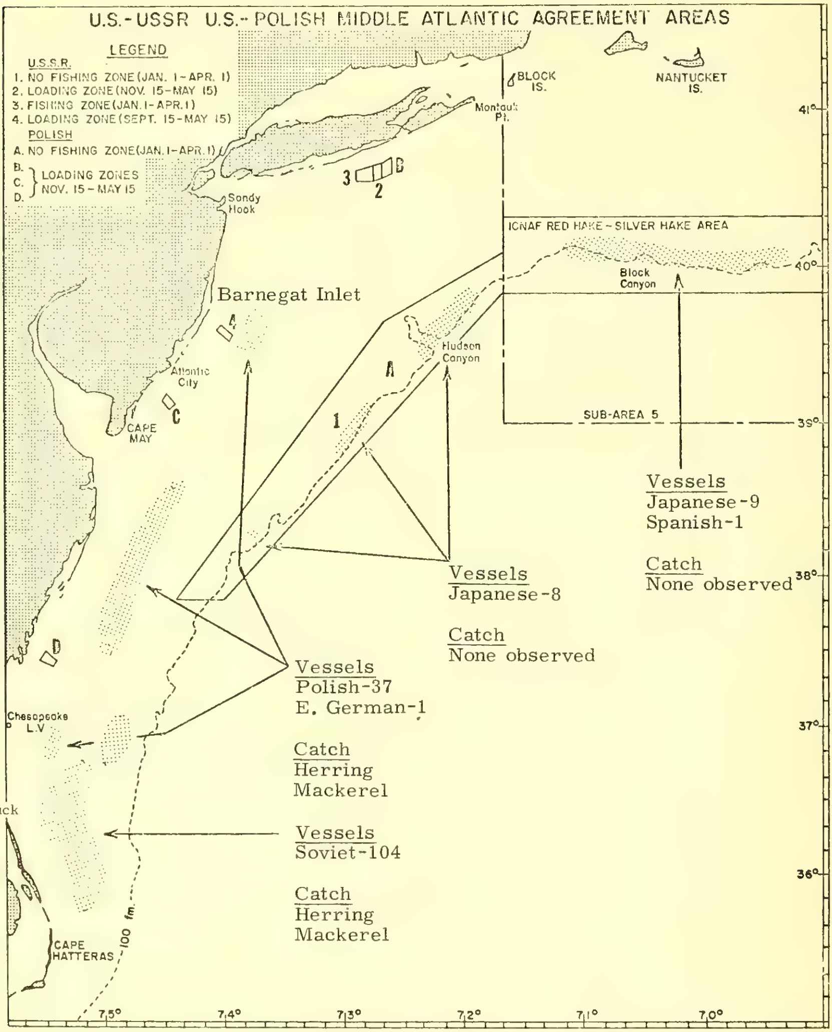


Fig. 1 - Foreign-flag vessels fishing off southern New England and Georges Bank, Feb. 1970 (shows no. of vessels and species fished).

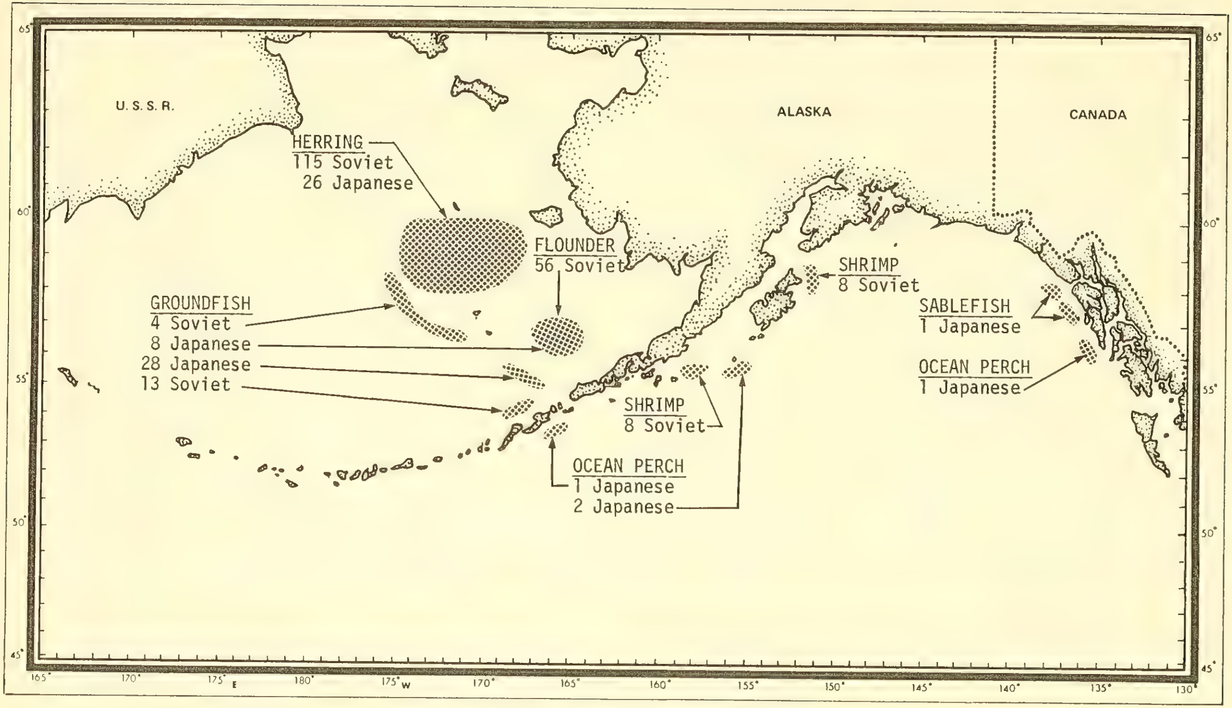


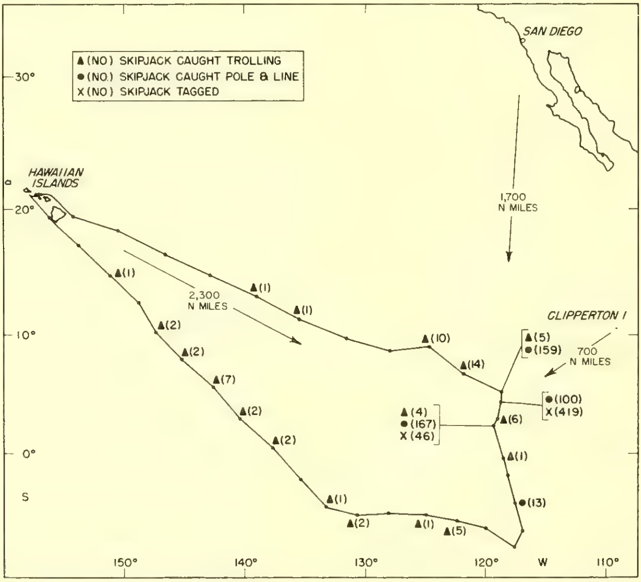
Fig. 2 - Foreign fisheries off Alaska, February 1970.

SURFACE TUNA SCHOOLS LOCATED & FISHED IN EQUATORIAL EASTERN PACIFIC

Thomas S. Hida

Large bird flocks, breezing schools of skipjack tuna, and mixed schools that included yellowfin and bigeye tunas were encountered about 700 miles southwest of Clipperton Island by the BCF research vessel 'Charles H. Gilbert' in October 1969. The vessel returned to Honolulu on November 7 after completing a 5-week voyage. Her primary mission was to collect samples of surface-swimming skipjack and yellowfin tunas for a subpopulation study. Detailed accounts of the schools fished are presented here because there are very few reports of schools in the area surveyed.

On a cruise to the equatorial waters of the eastern Pacific, Oct. 1-Nov. 7, 1969 (fig.), the research vessel Charles H. Gilbert of the BCF Biological Laboratory, Honolulu, encountered numerous schools of surface-swimming tunas far from land. The primary mission of the cruise was to collect surface-swimming skipjack tuna (Katsuwonus pelamis) and yellowfin tuna (Thunnus albacares) for subpopulation analysis. Although the 259



Track of Charles H. Gilbert Cruise 116, Oct. 1- Nov. 7, 1969, showing numbers of skipjack tuna caught, and number tagged, at different localities.

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Table 1. - Noon Positions, Dates, and Number and Kinds of Schools Sighted During Cruise 116 of the Charles H. Gilbert

Noon position		Date	Number of schools sighted						
Lat.	Long.	1969	Skipjack tuna	Unidentified	Mixed	Porpoise	Bigeye tuna	Mahimahi	Yellowfin tuna
On run to main area									
19°28' N.	156°10' W.	10/3	3	1	-	1	-	-	-
17°05' N.	153°45' W.	10/4	-	-	-	-	-	-	-
14°42' N.	151°04' W.	10/5	-	-	-	-	-	-	-
12°37' N.	148°45' W.	10/6	-	1	-	-	-	-	-
10°04' N.	147°26' W.	10/7	-	2	-	-	-	-	-
07°47' N.	145°09' W.	10/8	-	-	-	-	-	-	-
05°39' N.	142°44' W.	10/9	5	7	-	-	-	-	-
02°52' N.	140°26' W.	10/10	-	3	-	-	-	-	-
00°30' N.	137°44' W.	10/11	-	3	-	-	-	-	-
02°05' S.	135°26' W.	10/12	-	2	-	-	-	-	-
Subarea									
04°27' S.	133°22' W.	10/13	1	1	-	-	-	1	-
05°03' S.	130°53' W.	10/14	1	2	-	-	-	-	-
05°00' S.	128°10' W.	10/15	2	-	-	-	-	-	-
05°09' S.	125°08' W.	10/16	2	2	-	-	-	2	-
05°36' S.	122°35' W.	10/17	2	1	-	-	-	2	-
Main area									
06°12' S.	120°02' W.	10/18	1	3	-	-	-	1	-
07°43' S.	117°58' W.	10/19	1	1	-	-	-	-	-
06°25' S.	117°05' W.	10/20	-	3	-	-	-	1	-
04°09' S.	117°47' W.	10/21	1	7	1/1	-	-	-	-
01°52' S.	118°21' W.	10/22	-	1	-	-	-	-	-
00°28' S.	118°43' W.	10/23	2	1	-	1	-	-	-
02°14' N.	119°29' W.	10/24	1	2	-	-	-	-	-
02°46' N.	119°10' W.	10/25	2	-	-	1	-	-	1
04°12' N.	118°58' W.	10/26	-	1	2/1	2	1	-	-
05°04' N.	118°56' W.	10/27	2	3	-	-	-	-	-
On return run									
06°37' N.	121°54' W.	10/28	1	3	-	-	-	-	-
08°54' N.	124°48' W.	10/29	-	1	-	-	-	-	-
08°36' N.	128°00' W.	10/30	-	6	-	-	-	-	-
09°33' N.	131°47' W.	10/31	-	4	-	1	-	-	-
11°16' N.	135°32' W.	11/1	-	-	-	-	-	-	-
13°03' N.	139°07' W.	11/2	-	1	-	-	-	-	-
14°52' N.	142°55' W.	11/3	-	-	-	-	-	-	-
16°26' N.	146°40' W.	11/4	-	-	-	-	-	-	-
18°13' N.	150°32' W.	11/5	-	-	-	-	-	-	-
19°33' N.	154°20' W.	11/6	-	1	-	-	-	-	-
Off Kewalo Basin		11/7	-	2	-	-	-	-	-
		Totals	27	65	2	6	1	7	1

1/Skipjack, yellowfin, and bigeye tunas.
2/Skipjack, yellowfin, and bigeye tunas and mahimahi and rainbow runner.

skipjack tuna and 42 yellowfin tuna collected will be invaluable in the subpopulation study, the cruise was also noteworthy for a different reason: Numerous surface schools of tuna were sighted far at sea, and skipjack tuna apparently were abundant. There are very few previous reports of tuna schools that have come from the area surveyed.

The Gilbert departed from Honolulu on Oct. 2, 1969, with 143 buckets of 2- to 3-inch-long threadfin shad (Dorosoma petenense) which were to be used as live bait in pole-and-line fishing. Fifty baskets of longline gear were also taken aboard. The longline gear was to be fished in the event bird flocks or fish schools could not be located, or the threadfin shad died before the vessel reached the fishing area.

The longline gear was never used. We saw bird flocks and schools of tuna daily in the area of operation, and the threadfin shad held up well. One hundred and nine schools were seen on the cruise (table 1). Most schools were accompanied by flocks of up to 300 birds (table 2), largely shearwaters and terns.

Although numerous schools were seen, pursued, and chummed when the vessel first entered the fishing area on October 13, none responded to chumming during the first 8 days of fishing. Before October 21, this was the usual sequence of developments after a bird flock was sighted: (1) change vessel course and pursue, (2) number of birds diminishes upon approach, (3) jig strike, (4) reduce vessel speed and start chumming, (5) abandon school--either fish were not skipjack tuna or no response, and flock dispersed. The schools sighted from October 13 to October 21 were moving fast and were probably small.

The Catch

The first school successfully fished by pole and line was encountered on October 21 at lat. 4° S., long. 119° W. This was a poor-biting school; the average weight of the 13 skipjack, 8 yellowfin, and 2 bigeye (Thunnus obesus) tunas caught was about 3 pounds.

Fishing improved as the Gilbert proceeded northward to about lat. 2° N. along long. 119° W. On October 24, 213 large (17-pound average) skipjack tuna were caught by pole and line; 46 were tagged and released. Since sample requirements for subpopulation studies were fulfilled, the school was abandoned, although the catch rate was still good.

Two schools were fished on October 26 at lat. 4° N., long. 119° W. The first was a large breezing school of small fish. ("Breezer" refers to a school that can be detected by a

Table 2. - Frequency Distribution of Bird Flock Sizes Seen on Cruise 116 of the Charles H. Gilbert

Number of birds in flock	Average number of flocks observed per day		
	In main area: lat. 5° N.-10° S. and long. 115°-120° W.	In subarea: lat. 5° S. between long. 120° and 135° W.	On runs to and from fishing areas
1-5	0.1	0.6	0
6-10	0.7	1.0	0.1
11-25	1.0	0.8	0.6
26-50	1.0	0.2	1.1
51-100	0.7	0.4	0.3
101-500	0.6	0.2	0.2
Total per day	4.1	3.2	2.3

light-to-heavy rippling of the water surface, similar to that caused by local wind disturbance or a rip current; see Scott 1969.) Pole-and-line fishing yielded the following species and average weights: 519 skipjack tuna, 5 pounds; 13 bigeye tuna, 4 pounds; 28 yellowfin tuna, 4 pounds; 6 mahimahi (Coryphaena hippurus), 16 pounds; and 1 rainbow runner (Elagatis bipinnulatus), 13 pounds. A total of 419 skipjack tuna was tagged and released. Many more bigeye and yellowfin tunas could have been caught had they not been shaken off the hooks by the fishermen during the 1 hour of skipjack-tuna tagging. This large school was still breezing and following the vessel when last seen at 1500, although fishing had stopped at 1230. The vessel was scouting at a reduced speed of about 3 knots after fishing the school to enable the field party to complete sampling of the catch.

The second school of the day to be fished was a large one of bigeye tuna (10-25 pounds) which was "boiling" the surface when approached. ("Boiler," a very active, feeding school that can be detected by the "boiling" white water caused by jumping fish in pursuit of their prey; see Scott 1969.) Ninety-seven were landed in a few minutes, and the fish were still biting fast when fishing was stopped. Representative samples of the stomach contents were preserved when it was found that the fish had been feeding on a small anchovy, not yet identified, that closely resembles the Hawaiian nehu (Stolephorus purpureus).

Two schools of skipjack tuna were fished on October 27 at about lat. 5° N., long. 119° W. The first was a school of medium-sized (10-pound average) fish that breezed frequently but bit poorly. This school was abandoned soon after the 10th pass when an adequate sample (49 fish) had been caught by pole-and-line.

The second school was a large breezing school of medium-sized (8-pound average) skipjack tuna. Although the bait supply was depleted in a few minutes, five fishermen in the racks landed 110 skipjack tuna; this was more than the sample size required for subpopulation studies. After exhausting the live-bait supply on this school, the Gilbert curtailed pole-and-line fishing and returned to Honolulu.

Surface Trolling

Surface trolling with two to six lines was conducted throughout the cruise on all daylight runs. The catch from about 400 hours of trolling (see fig. for areas) consisted of 67 skipjack tuna (1-25 pounds), 9 yellowfin tuna (2-4 pounds), 9 bigeye tuna (2-10 pounds), 22 mahimahi (1-30 pounds), and one 8-lb. wahoo (Acanthocybium solandri). Skipjack tuna seemed to be plentiful on 3 days during runs to and from the fishing areas, judging by the many strikes on the trolling lines. Twelve schools were sighted on October 9 while the vessel was en route to the fishing area, at about lat. 5° N., long. 143° W. During the return trip, seven skipjack tuna were caught on October 28, and 14 on October 29, between lat. 6° N., long. 122° W. and lat. 9° N., long. 125° W. Many more came off the hooks and were lost while being retrieved. The strikes on the trolling lines were spread throughout the day. Unless a tuna school followed the vessel during this period--a situation unlikely in view of the vessel speed of about 9 knots--the area appears to represent rich grounds for skipjack tuna. There was little doubt that pole-and-line fishing would have been very fruitful in these areas.

Although bird flocks and schools were seen throughout the fishing area, the best fishing was in the latitudes a few degrees north of the Equator, where surface temperatures were about 25°-28° C. The water was clear and blue in the fishing area. The thermocline depths usually ranged between 40 and 100 m., and currents setting easterly at a few knots prevailed in the better fishing area.

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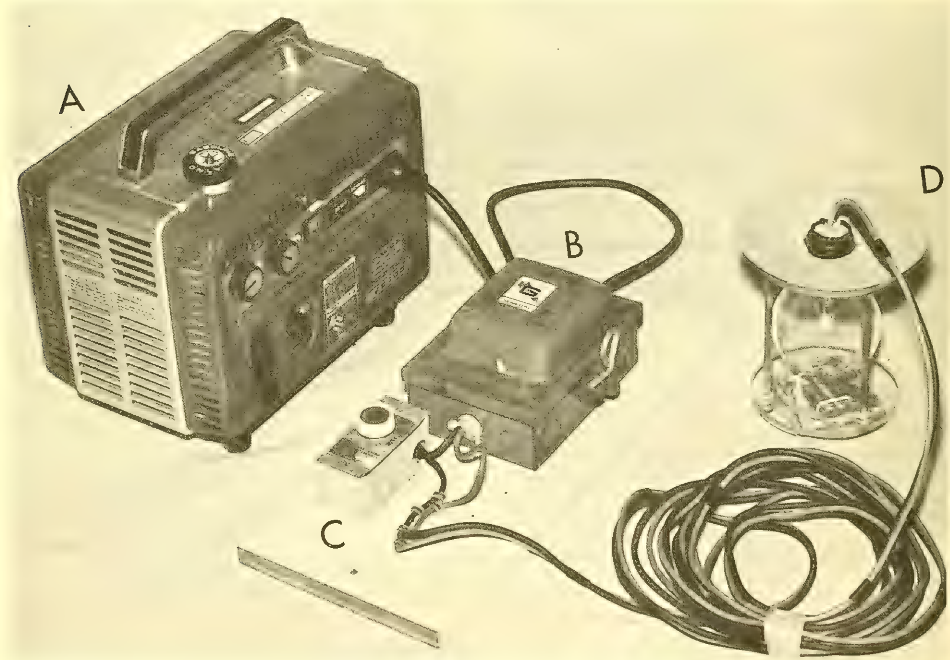
1969. Tuna schooling terminology. California Fish Game 55(2): 136-140.

NIGHT LIGHTING FOR HERRING--
AN OLD TECHNIQUE MAY HAVE NEW POSSIBILITIES

Alden P. Stickney

One of the most modern fishing techniques, which may also be as ancient as the art of fishing itself, is the use of artificial lights to attract fish at night. Several significant developments have contributed to the usefulness of this technique: the convenience and versatility of modern electric lighting equipment, new and ingenious methods of catching the fish, and a better understanding of fish behavior through research. At present, lights are used successfully in fisheries throughout the world.

The Atlantic herring (Clupea harengus) is one of many species that can be attracted to lights. Modern fishing vessels in several countries carry lights for this purpose, even though routine fishing may be carried on without them. In the United States, "torching" for herring is a very old method. Once it was used on the east coast, but now it is largely obsolete, although modern purse seiners on the west coast use lights very effectively for Pacific herring.



Experimental lighting gear used to attract herring at night.
A. 300-watt generator; B. Fuse box and switch; C. Dimming control; D. Waterproof lamp socket and bulb in weighted frame.

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Not Universally Accepted

The acceptance or belief in the efficacy of lights for catching herring is not universal among fishermen. Apparently, this stems from various local prejudices as well as the demonstrable fact that herring vary considerably in their response to lights. At the Bureau of Commercial Fisheries Biological Laboratory in Boothbay Harbor, Maine, experiments recently were conducted to learn more about the behavior of herring in response to lights. The hope is that this fishing method may provide a useful supplement to increase the flexibility of the New England herring fishery.

In recent years, a decline in the coastal sardine fishery of Maine, for example, seems to have resulted in part from behavioral and distributional anomalies that tend to reduce the availability of the herring schools. In some instances, particularly for the inshore stop seiners, a diversion of the schools by as little as a few hundred yards may mean the difference between a good catch and none at all. Even in the more flexible purse-seine fishery, slight differences in the depth or location of schools make significant differences in the ability of the gear to catch them.

Lab Experiments

Laboratory experiments[1/] at Boothbay Harbor have shown that the efficacy of a light in attracting herring is quite variable. It depends, among other things, on its brilliance, its location above or below the surface, the temperature of the water, and the physiological state of the fish. For this reason, some judgment is necessary in using a light effectively and, at times, using a light may be of doubtful value.

The Boothbay Harbor experiments showed that a very bright or very weak light is much less effective than one of intermediate brillance ;the optimum brilliance is dependent on the distance of the fish from the light. An underwater light is more effective than one above the surface, and any light seems more effective in cold water than in warm. Herring adapted to darkness are attracted less readily than those adapted to light; hence the use of lights would seem to be most advantageous shortly after sundown.

Lab Work Field Tested

Much of the experimental work was done in the laboratory, but field tests of an underwater light confirmed most of the laboratory conclusions. In trials during October-November 1969, a 250-watt incandescent bulb in a weighted watertight socket, lowered to a depth of about a fathom in 3 fathoms of water, attracted large numbers of herring and alewives. These results were achieved in a location usually providing good catches to stop seiners but which, for the past two years, has been relatively barren of fish. Fathometer recordings made during the day showed traces of small fish schools about 300 yards away from the location of the light. Shortly after sundown, when the light was turned on, fish began to appear within 15 to 60 minutes.

These tests did not give adequate information about the ability of the light to attract herring in commercially useful quantities. It is possible, however, that had such quantities been in the vicinity, they would have been attracted; also, that one or more such lights would have drawn them into an area in which they could have been caught more easily with conventional gear.

Research trials of underwater lights were made in 1966 by biologists of the Marine Biological Station at Grande-Riviere, Quebec, in the Gulf of St. Lawrence. In several trials, 25 to 40 tons of herring were attracted and taken in purse seines. Good catches were made in some instances when little or no indication of herring was shown on the fathometer.

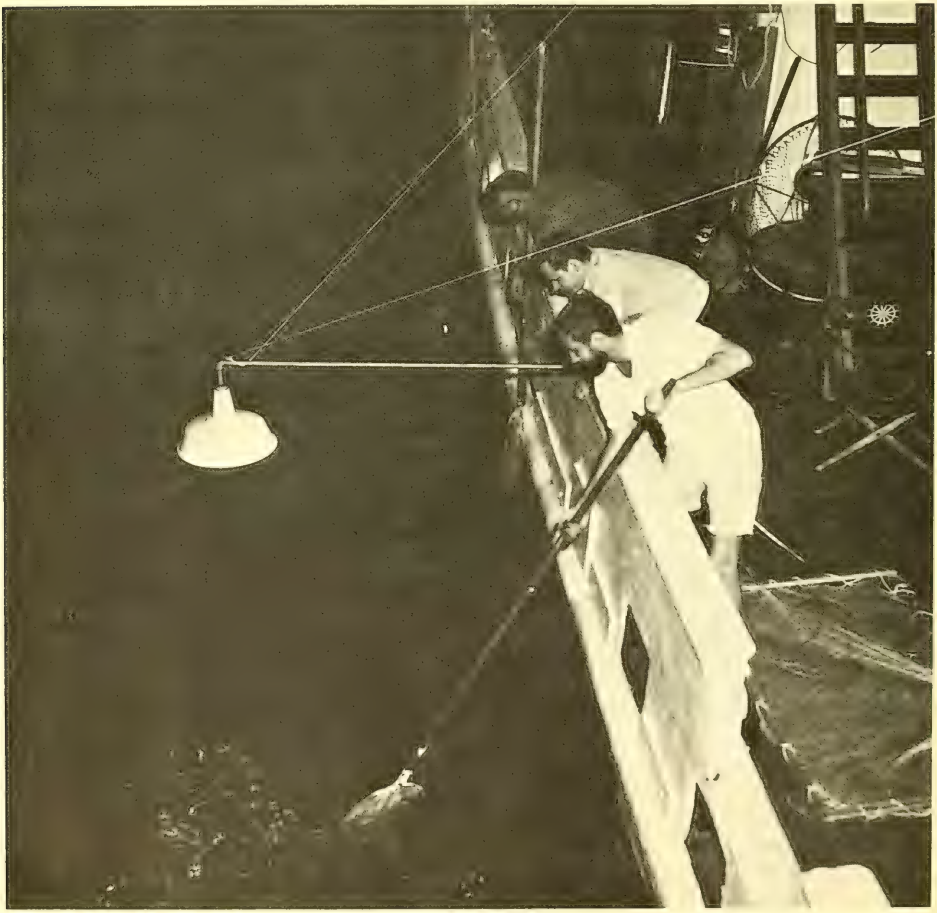
'Torching'

In the primitive method of "torching," an open flame is held in front of a moving boat. Although it is seldom used today, fishermen say it has yielded catches of as much as 60 bushels of herring in a few hours--using only a large dip net to capture the fish. There is some question as to whether the herring actually were attracted to the light, or whether they were already present in the water and were merely dazzled sufficiently to permit capture. Attempts to duplicate the technique with electric lights above the water generally have not been found satisfactory. In a comparison of a kerosene torch with an

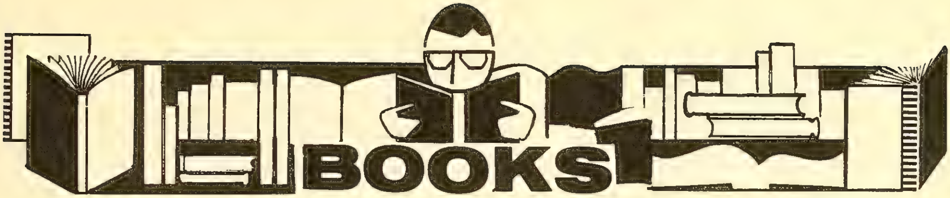
1/Stickney, Alden P. Factors influencing the attraction of Atlantic herring, Clupea harengus harengus, to artificial lights, U.S. Fish Wildl. Serv., Fish. Bull., Vol. 68: 73-85.

underwater light, we found the latter to be far more effective in attracting herring.

For some purposes, underwater light gear need not be expensive. In our field tests, we used a globe-type, 250-watt light bulb in a watertight socket, weighted so it would sink (photo p. 38). A 300-watt portable generator, suspended from aloft or set on a cushion to minimize vibration, provided power. The light circuit was connected to the generator through a control panel containing fuses and a dimmer. As the wattage rating or number of lights increases, or for illumination at greater depths, more rugged and expensive equipment would be necessary.



Dip netting at a light attraction station aboard the BCF research vessel 'Oregon.' (Photo: T. Iwamoto)



FISHING LIMITS

"Limits and Status of the Territorial Sea, Exclusive Fishing Zones, Fishery Conservation Zones and the Continental Shelf," FAO Legislative Series No. 8, $1. Sold by UNIPUB, Inc. 650 First Ave., P.O. Box 433, New York, N.Y. 10016.

This is a new listing of national claims on territorial seas, fishing and conservation zones and adjacent waters, and the Continental Shelf. It covers 106 countries and territories and is a convenient reference.

Forty of the nations listed claim territorial limits of 12 nautical miles; 29 claim 3 miles. The 40 include Mainland China and the USSR. Nations adhering to the 3-mile limit include Canada, Republic of China (Taiwan), France, Japan, the U.K., and the U.S. (Tradition has it that 3 miles was the limit of early cannon.)

At least 8 nations claim a 200-mile territorial sea and/or exclusive fishing zone: Argentina, Chile, Ecuador, El Salvador, Nicaragua, Panama, Peru, and Uruguay*. Guinea's territorial limits extend 130 miles.

Fourteen, including Israel, Italy, South Africa, and Spain, maintain 6-mile territorial limits. Others vary from 4 miles for Finland, Norway, and Sweden to 10 for Albania and Yugoslavia.

Nearly 30 nations claim exclusive contiguous fishing zones 12 miles from the coast. Canada, France, the U.K., and the U.S. among others. At least 6 nations, including the U.S. and some Asian countries, maintain fishery conservation zones outside territorial and/or exclusive fishing waters.

Most nations assert exclusive claims over exploitation of Continental Shelf resources down to 200 meters. Many are parties to the Convention on the Continental Shelf.

The study notes that the 1964 Convention on the Territorial Sea and the Contiguous Zone sets no limits on the breadth of the territorial sea and may imply it should not exceed 12 miles.

*Brazil has joined group. --Ed.

INTERNATIONAL CONTROLS

"Comparative Study of Laws and Regulations Governing the International Traffic in Live Fish and Fish Eggs," by R. B. Zenny, EIFAC Technical Paper No. 10, European Inland Fisheries Advisory Commission, FAO Legislation Branch, FAO, via delle Terme di Caracalla, Rome, Italy.

International health standards are rigid for humans and livestock. They are notoriously lax for live fish and fish eggs shipped to foreign countries. Most fish diseases and infections are harmless to humans--yet they can cross frontiers to decimate entire fish populations in ponds, culture stations, lakes, rivers, and streams. The problem has been acute in some European and North American countries where many fish deaths have been attributed to imports of infected or diseased fish and eggs.

This is a report on the growing international exchange of live fish and eggs for culture (principally salmon and trout). Based on reports received from 86 nations, it reviews national legislation on live fish and egg trade, and finds most inadequate. Thirty-eight countries reported no control; most others had inadequate or poorly enforced legislation; only 10 appeared to have effective regulations.

"National legislation and policies, where they exist, are fashioned with little regard to the standards and practices in other countries," Zenny writes. Moreover, "effective control may be exercised over internal traffic, but not over imports or exports; over internal traffic and imports, but not over exports; or over imports only. The relevant legislation may exist on the statute books and may either not be implemented or only partly so."

Warning that fish diseases know no frontiers, and citing ever-increasing trade in live fish and eggs, the study urges greater international collaboration on the establishment of a "uniform system of health control."

COD

"Géo-Économie de la Morue (Geo-Economics of Cod-Fisheries), edited by Jean Malaurie, Ecole Pratique des Hautes Etudes, Paris, published by Mouton & Co., P. O. Box 1132, The Hague, Netherlands. Price 65 Francs, 42 Dutch Guilders.

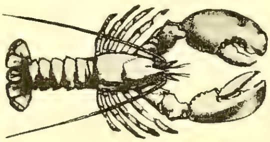
This is a compilation of papers presented at the first International Congress of the North Atlantic Cod Industry. The 25 papers cover production and processing, fishing methods, economics of fishing and production, biology, preservation and freezing, marketing, and recommendations for future action.

LOBSTER

"Lobster Storage," by H. J. Thomas, 55 pp., illus. Order from Sales Section, British Information Services, 845 Third Ave., New York, N.Y. 10022, 90¢.

Long-term storage--keeping lobster for several months--permits operators to take advantage of the high winter prices, and evens supplies in the process. It also enables the operator to sell on a good market rather than a glutted one. Short- and medium-term storage can increase profits by decreasing deaths in transit, and improving condition at market time.

This pamphlet is concerned mainly with medium- and long-term storage. It discusses methods used in Britain and abroad, and describes siting and construction; water conditions; handling; pests and diseases; welled boats; floating boxes and cages; pools and lobster ponds; refrigerated storage; and marketing.



AQUACULTURE

"Aquaculture: The New Shrimp Crop," Sea Grant Information Leaflet No. 1, Feb. 1970, U. of Miami, 10 Rickenbacker Causeway, Miami, Fla. 33149.

Interest in the commercial culture of marine and estuarine animals has been heightened by increasing need for more protein food--and by growing knowledge of the life histories of some animals that seem capable of being cultured.

Some schemes for producing marine resources by culture are considered impractical:

1. "It is very unlikely, for example, that aquatic farms will be set up in North America to grow marine plants for food. . . Although some seaweed are edible, they are relatively nonnutritious." And more important, there now is no food market for them.
2. "It seems unlikely that we can establish extensive marine fish farms in deep water because of the great practical and legal difficulties of creating and controlling large enclosures in these areas. Sea farms will, therefore, only be feasible in shallow water regions."
3. "At least in the beginning stages of marine aquaculture, only animals of market value can be raised profitably."

The possibilities of the commercial culture of crustaceans seem greater than those of other seafood. The U.S. demand for shrimp seems incapable of being satisfied. Demand in several other countries is growing too. Because of this, shrimp prices have reached high levels. "Consistently high market value encourages the hope that profitable culture operations may be possible."

There is a long history of attempts throughout the world to raise several species of shrimp: in India, Malaysia, Pakistan, Singapore, Vietnam, Cambodia, and Japan. Several of these are described.

At the University of Miami, marine aquaculture experiments have been launched with the pink shrimp, Penaeus duorarum. The procedures, as elsewhere in the U.S., "are similar to those of the Japanese and attempt to control the whole life history."

THE FOLLOWING ARTICLES ARE IN 'FISHERY BULLETIN,' VOL. 67, NO. 2. IT IS AVAILABLE FROM DIVISION OF PUBLICATIONS, BCF, 1801 N. MOORE ST., ARLINGTON, VA. 22209:

CHINOOK SALMON

"Egg-to-Migrant Survival of Spring Chinook Salmon ('Oncorhynchus tshawytscha') in the Yakima River, Washington," by Richard L. Major and James L. Mighell, pp. 347-359, illus.

Though the Columbia River runs are but a fraction of their former size, they are still a major producer of spring chinook salmon. In 1957, a study of egg-to-migrant survival of a population of spring chinook was begun on the Yakima River--a Columbia tributary. This paper summarizes the study from 1957 to 1963.

The Yakima was chosen because a trap in a diversion canal at Prosser, Wash., on the lower river, provided an unique opportunity to sample seaward migration.

Spring chinook spawning both in tributaries of the Yakima and in its upper stretch migrate in their second year. Comparison of the number of migrants with the number of eggs deposited by female spawners yielded an estimate of survival to the seaward migrant stage.

"Contribution of Columbia River Hatcheries to Harvest of Fall Chinook Salmon ('Oncorhynchus tshawytscha')," by D.D. Worlund, R.J. Wahle, and P.D. Zimmer, pp. 361-391, illus.

There are over 15 salmon-producing hatcheries on the lower 180 miles of the Columbia River. They were built primarily to offset the loss of natural spawning and rearing areas for salmon and steelhead caused by water-development projects. Releases of fall chinook have varied from fewer than 10 million fish from 6 hatcheries in 1949, to about 56 million from 14 hatcheries in 1966.

This article describes an experiment with fall chinook from 12 hatcheries. They were marked in 4 consecutive years to estimate their contribution to the sport and commercial fisheries. It estimates returns, catch, value and cost-benefit ratios.

ESTUARINE DESTRUCTION

"Some Effects of Hydraulic Dredging and Coastal Development in Boca Ciega Bay, Florida," by John L. Taylor and Carl H. Saloman, pp. 213-241, illus.

Hydraulic dredging has been an accepted means of creating premium-value waterfront real estate in Florida since 1920. Since 1950, it has become a serious threat. Bay filling has been little regulated and, in most cases, estuarine biological and recreational resources have been disregarded.

Boca Ciega Bay is a part of Tampa Bay. Coastal development and progressively deteriorating water quality have affected both its plant and animal production adversely. This report describes some of the biological and physical changes that have followed alteration. It also compares estuarine conditions in dredged areas with relatively undisturbed areas.

Urging against further destruction by development, the authors note: "In Florida, and other States bordering the Gulf of Mexico, dredging and other forms of estuarine destruction damage fisheries, because most of the species taken in sport and commercial fisheries live in estuarines during part or all of their life cycle." They add: "Perhaps, the most timely argument against further destruction of estuarine habitats is the present and potential value of these areas for production of food."

The report also cites economic losses from filling and dredging:

"Fishery production alone in Tampa Bay estuary has an annual value of about \$300/acre. In addition, these waters are used by public utilities, industry, and commerce and serve recreational requirements of nearly a million residents and $1\frac{1}{2}$ million annual vacationers. Hence, total worth of each water acre in the estuary can be conservatively estimated at \$400/acre. At this rate, the 3,500 acres covered by bayfills in Boca Ciega Bay represent an annual loss of about \$1.40 million, which if capitalized at 6% would total a natural investment of \$23.3 million. This accounting is not complete because the undesirable aspects of coastal development extend well beyond bulkheads and outfalls."

PESTICIDES

"Effects of Pesticides on Embryonic Development of Clams and Oysters and on Survival and Growth of the Larvae," by J.C. Davis and H. Hidu, pp. 393-404.

To control certain insects and undesirable plants, highly persistent pesticides have been used extensively in recent years--not only on agricultural lands, but on recreational areas, lakes, streams, and marshes. This has made evaluation of their effects on fish and wildlife imperative. Attaining control of undesirable species, while doing the least possible harm to desirable ones, requires extensive knowledge of how each pesticide affects each species.

This is a summary of data obtained at BCF's Milford (Conn.) Biological Laboratory on the effects of various pesticides on development of fertilized eggs of hard clams and American oysters, and on survival and growth of the larvae. It also describes study methods, and cites the need for further work.

SHELLFISH PREDATORS

"Changes in Abundance of the Green Crab (Carcinus maenas, L.) in Relation to Recent Temperature Changes," by Walter R. Welch, pp. 337-345, illus.

The green crab catch is of minor commercial importance. It is fished only as bait for sport fishermen. Major interest in the species arises from the fact that it is a significant predator of the commercially valuable soft-shell clam, Mya arenaria. Mass mortalities of green crabs coincide with periods of severe cold. The commercial catch of soft-shell clams increases markedly when the crabs decline.

This paper documents the changes in abundance of green crab from its peak in the mid-1950s, relating changes to concurrent changes in temperature.

"The Feeding Habits of the Green Crab, Carcinus maenas, L.," by John W. Ropes, pp. 183-203.

This is a study of the feeding habits of green crabs. It contains observations on the relation of feeding behavior to environment and available food.

MARINE RESOURCES & COURSES

"Oceanography in Florida 1970," Florida Department of Commerce, 262 pp., $1. Available from E. Earl Donaldson, Executive Director, the Florida Council of 100, P.O. Box 2192, 601 Twiggs Street, Tampa, Fla. 33601.

A comprehensive analysis of marine science, technology, and oceanographic activities. It includes a complete description of all Florida's sea-related organizations, facilities, and natural resources.

"Directory of Academic Marine Sciences Programs in New England," New England Marine Resources Information Program, University of Rhode Island, 51 pp. Free copies available from NEMRIP, Narragansett Bay Campus, URI, Narragansett, R.I. 02882.

The directory lists the courses in marine sciences offered by 41 institutions of higher learning in the six-state New England region. It includes those of the Woods Hole Oceanographic Institution.

--Barbara Lundy

INTERNATIONAL

FORECAST SLIGHT RISE IN MARINE-OIL OUTPUT FOR 1970

Although fish-oil production declined in 1969, world output of marine oils is forecast to increase slightly in 1970. However, it is expected to be somewhat below 1968's record. Baleen-whale oil may rise slightly; no appreciable change in sperm-whale output is anticipated.

Baleen Oil

After a long downtrend starting in 1962, baleen-whale oil production is expected to increase. This estimate is based on a fairly large Norwegian Antarctic catch. Production outside the Antarctic is not expected to change significantly.

Quotas

The 1969/70 Antarctic pelagic whaling countries (Japan, Norway, USSR) agreed to a reduced global quota of 2,700 blue-whale units (BWU)--roughly equivalent to 56,000 tons of oil. The 1968/69 quota was 3,200 BWU. The catch was only 2,469 BWU, with an estimated output of about 51,000 tons of oil. Japan and the USSR both filled their 1968/69 quotas. Norway (quota of 731 BWU) did not participate; her quota later was cut to 231 BWU--roughly equivalent to 5,000 tons of oil. Reportedly, Norway plans to participate in the 1970 expedition.

Forecast Assumptions

The 1970 forecast assumes: 1) fulfillment of the 2,700 BWU global quota; 2) an oil yield approximating 1969's 20.8 tons per BWU; and 3) continuance of output outside the Antarctic at the 1969 level.

Sperm-Whale Oil

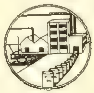
Sperm-whale oil production is not controlled under the Antarctic quota agreement. It is not expected to change significantly. This production has continued to be relatively stable, slightly above volume produced during 1962-66. The biggest producer, the Soviet Union, has expanded output substantially in recent years, while output by small producers has been sharply reduced. The North Pacific output has expanded; Antarctic pelagic output has remained about the same; output from shore stations outside the Antarctic has declined.

Fish-Oil Prediction Difficult

Forecasting world output of fish body and liver oils a year in advance is a precarious task. Among the uncertainties are: probable catches by major countries; possible changes in catch restrictions in countries like Peru; closed seasons; possible strikes; probable oil yields; and possible effects of higher prices tending to stimulate fishing activity.

Forecast

Peruvian fish-oil output in 1969/70 season is not expected to change appreciably, despite a probable decline in the catch limit. The Peruvian Marine Institute has recommended an anchovy catch limit of 9.4 million short tons, compared to 10.9 million tons in 1968/69. The expected oil output is based on an anticipated recovery in oil extraction rate. Some recovery in output from last year's reduced volumes is expected in Norway and Iceland. Possible small increases by Canada, the USSR, and Japan may lead to some overall increase in 1970 world fish-oil production. ('World Agriculture Production and Trade,' Jan. 1970.)



WORLD FISHERY TRADE INCREASED IN 1968

Both quantity and value of world trade in fishery commodities increased in 1968. The share of fish used for fish meal reached a new high. This information comes from FAO's recently released 'Yearbook of Fishery Statistics (Commodities).' The volume lists 1968 commercial and production figures for 150 countries, excluding Mainland China.

Quantity & Value

The value of trade in fish and fish products increased to about US$2,560 million from about $2,400 million in 1966 and 1967. The rise was due largely to improved fish-meal prices. Volume increased from 6,400,000 metric tons in 1966, and 7,103,000 tons in 1967, to 7,841,000 tons in 1968. Fish meal accounted for 3,591,000 tons and $456 million.

Consumption

The Yearbook also shows consumption of the 64,000,000-metric-ton 1968 world catch of marine and inland-water fish. Almost two-thirds (40,200,000 tons) was frozen, cured, canned, or eaten fresh; 22,800,000 tons, or 35.6%, went into fish meal for animal feed. In 1958, only 13% of the total fish catch was used for fish meal.

HALIBUT SURVEYED IN SOUTHEASTERN BERING SEA

The trawler 'St. Michael' left Bellingham, Washington, Feb. 17, 1970, on a 65-day halibut survey in the southeastern Bering Sea. Sailing under charter to the International Pacific Halibut Commission (IPHC), she is evaluating the incidental catches of halibut in the food-fish catches of foreign trawl fleets. Small, and probably large, halibut are particularly vulnerable to such fishing at this season. The vessel's crew also is doing extensive tagging.

The Commission is responsible to Canada and the U.S. for maintaining halibut stocks at maximum productivity. (IPHC, Feb. 16.)

ATLANTIC SALMON HIGH-SEAS FISHERY INCREASED IN 1969

The 1969 Atlantic salmon catch off Greenland was about 2,210 metric tons, 39% over the previous high in 1967. Fish were prevalent over a wide area of Davis Strait and a substantial fleet took advantage of the situation. Fleets from Denmark, Norway, and the Faroes notably expanded the offshore drift-net fishery. They caught 1,280 tons compared to 544 in 1968. Greenland's catch, up from near-failure in 1968, was still 25% less than her 1967 and 1966 inshore catches; 1969 was the first time Greenland had participated in the offshore fishery.

Larger Fleets & Catches

Danish fishermen made the largest gains. With 18 vessels, they tripled their 1968 catch, when they had only 7. Norwegian and Faroese vessels more than doubled, but catches rose only about two-thirds.

Catch Off Norway

Danish, Swedish, and Norwegian vessels are rapidly expanding the high-seas fishery for Atlantic salmon off Norway. The fishery is some 12 to 200 miles offshore, northward from Bergen to Finmark. Norway is seriously concerned that her valuable salmon stocks are being depleted. The 1969 catch probably will be over 800 metric tons, more than double 1968's. A sharp increase is reported in participating Norwegian and Danish vessels. Norway has protested the salmon's "ruthless exploitation" by Danish vessels. Five German vessels participated for the first time.

Norwegian Restrictions

Norway severely curtailed her inshore and river fisheries. Longline fishing has been forbidden for some time in Norwegian fishing limits. However, drift gill nets are permitted up to the inshore base lines of her territorial sea. Danish and Swedish fishermen initiated longlining beyond the fishing limits, and Norwegians recently entered the fishery with great vigor. Charges that offshore fisheries are destroying the benefits of inshore conservation are being discussed violently.

Reports from Norway indicate that if developments in the salmon fishery continue to be favorable, as many as 300 vessels might participate in the offshore fishery.

Baltic Fishing

Atlantic salmon are exploited extensively in the practically land-locked, brackish-water Baltic Sea. The salmon exchange between the Baltic, the North Sea, and the Atlantic Ocean is relatively minor. Total Baltic high-seas catch in recent years has been 2,000-2,500 tons. More than half is taken by Danish fishermen; Sweden takes 20%, and West Germany 10%.

Denmark catches almost equal quantities of salmon in the Baltic and off Greenland. In the 1968/69 season (July-June), the catch totaled 1,465 metric tons, 13% below the previous record but still near 1966/67 (and earlier) catch levels. Up to 1963/64, annual catches were mostly near, or below, 1,000 tons. (Reg. Fish. Attaché, Copenhagen, Feb. 19.)

WORLD'S FIRST FLOATING FPC FACTORY IS OPERATING

Last month, Astra Nutrition began operating the world's first floating factory to produce high-quality fish protein concentrate (FPC). The firm is part of the Astra group, Sweden's largest pharmaceutical house.

Harry Wendeus, managing director of Astra Nutrition, said recently: "The world's first continuous processing plant for producing human grade fish protein concentrate went into production late in 1969 at Bua, a fishing community on the West Coast of Sweden. Its output will be supplemented when a 25,000-ton modernized and fully-equipped 'floating factory', upon which more than $7,000,000 has been spent, goes into operation in international waters. This ship will be attended by 11 fishing boats that will provide the mother ship with a constant supply of fresh fish." He noted the importance of a fresh fish supply to insure quality control. Astra Nutrition has applied for process patents in 40 countries.

Fig. 1 - Motor/Ship 'Astra', a 25,000-ton, $7-million "floating factory" operated by Astra Nutrition of Sweden. It will process high-grade fish protein concentrate (FPC) from daily catch of fishing boats.

The principle used in the Astra process is extraction of water and oil from the fish with isopropyl alcohol. This is the basic method for making wholesome and acceptable fish protein concentrate that the Bureau of Commercial Fisheries developed and demonstrated to the U.S. Food and Drug Administration--enabling FPC to be used as a food in the United States.

The protein will be used as an ingredient in products for developing countries.

Obstacles Overcome

Astra developed a laboratory method of producing defatted fish protein concentrate in 1957, producing 20 grams during the first year

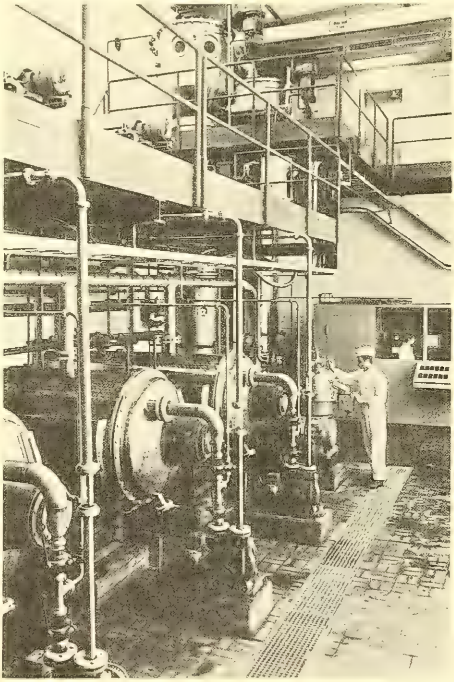
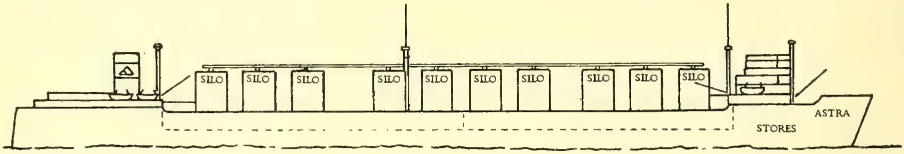
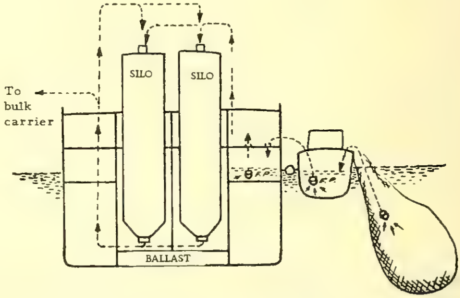


Fig. 2 - Astra's FPC processing method first removes fat and bones. The stainless steel equipment readies powdered concentrate for storage in 20 large silos that extend above and below decks.



Astra Nutrition believes factory ships can solve problem of obtaining large quantities of fish needed to produce high-grade protein. The M/S Astra will operate in international waters, accompanied and supplied by 11 smaller fishing boats. The landing capacity of these boats is estimated at 200,000 tons annually. Combined crews will number 160 persons.

The 20 silos on board will hold 6,000 tons of finished product. This will be transferred by vacuum every 35 days to a bulk carrier.



in 4 days. In 1960, the difficulties of transferring the manufacturing process from laboratory to plant scale "seemed unsurmountable," Wendeus said. "By 1961 we had to re-evaluate the entire method and start over again." By 1963, Swedish authorities approved FPC as a foodstuff. A continuous, rather than batch, process was developed.

Wendeus said product compares favorably with animal protein from other sources. It is a "complete animal protein with a high nutritional content, about 93% protein, with a good amino acid balance. It contains phosphorous, calcium and minerals in proper proportion."

All protein molecules combine smaller chemicals called amino acids. Generally, proteins from animal sources are of higher quality than those from vegetables. Of 22 amino acids that have been isolated, eight are regarded essential in the diet.

Astra Joins National Biscuit

In Jan. 1970, Astra and National Biscuit Co. of New York formed joint venture--Nabisco-Astra Nutrition Development Corp.--to research and develop sources of essential low-cost protein for use in human food products. The new company will direct its efforts toward reducing the serious protein deficiency in many developing nations.

FAO MASTERFISHERMAN FOR DEVELOPING WORLD

An FAO feature written by Gabriel De Sabatino tells the story of Captain Pierre A. Lusyne, a 60-year-old Belgian who went to sea in sailing ships at 14 and who, as an FAO Masterfisherman, has been sharing his experience with apprentice fishermen in developing countries for the past 15 years.

Lusyne, a native of Ostend, has organized and directed some of the fishing training centers FAO has established around the world under the United Nations Development Programme.

FAO believes the centers are essential to train crewmen properly at a time when fishing vessels have computers and other complex equipment for finding and catching fish. Highly skilled hands are required. Education and training are so vital to fishery development and to food production that the matters will be discussed at the Second World Food Congress FAO is convening at The Hague, Netherlands, June 16 to 30.

His Proudest Achievement

Lusyne's proudest achievement is the Deep Sea Fishing Training Centre he organized for the Republic of Korea (S. Korea) to provide trained crewmen for the country's growing fishing fleet. The center was established in Pusan in 1965 under a 5-year $2,800,000 FAO project financed jointly by UNDP and Korean Government. The center was so successful that Lusyne turned its direction over to the Koreans on schedule in 1969. "They are operating it entirely on their own with just occasional help from us," he said in Rome. "It's all their show now."

Lusyne, who speaks no Korean, had to start from scratch, as he did with the other projects. In less than a year after the project was negotiated, the center was operating. He noted: "We started out with 50 trainees out of 300 applicants and only five instructors, all of whom I had to brief myself. Now there is a much larger staff and the centre graduates about 150 apprentice fishermen a year."

The Center

The course lasts 18 months: 10 months' shore training, 7½ months at sea aboard the center's two training ships. Then there are 15 days of summing up and examination.

The trainees, who include non-Korean nationals, are selected carefully and live at the center. The center is well equipped with workshops and demonstration rooms. The trainees receive blue uniforms, red caps, and a small allowance. They make their own tools and gear for the fishing trials aboard the ships. The tuna they catch is sold to a cannery in Samoa, and the money helps pay for the school.

Discipline and cooperation are excellent, reports Lusyne, who runs his schools with near-naval discipline. "The trainees are encouraged to keep busy even in their spare moments and physical exercise is a daily 'must.' It is good for morale as well as for physical fitness. It instils a good team spirit and a sense of participation among the men."

In his 5 years at the school, Lusyne never had to put a trainee in his place. "Only once, aboard one of the training vessels, we had a little incident when the trainees got tired of being at sea and wanted to return to port. The FAO Masterfisherman told them he would be fired if he did so and retired to his cabin until they reported ready for work. The matter ended there and then."

Survived Dunkirk

Lusyne became an instructor after a World War II eye injury disqualified him for sea duty. He had taken part in the evacuation at Dunkirk in 1940 and was almost killed when his ship was rammed accidentally in the dark by a destroyer and sank with 300 troops. He says his survival was a pure miracle.

In 1945, he organized a fishing-training school in Ostend as part of Belgium's reconstruction efforts. In 1955, he joined FAO and was sent to India. There, working under a Technical Assistance project, he organized 4 training centers, which later expanded to 12. Later, he set up schools in New Caledonia in the western Pacific, in Suez, U.A.R., and in Vang Tau, Vietnam. He also served as a training adviser in Pakistan. In 1964, he was sent to Korea to establish the deep-sea training center.

The Sea at 13½

The Belgian sea veteran has excellent credentials as a seagoing schoolmaster. His father ran a fleet of fishing smacks that sailed by wind power alone. He gave Pierre his first taste of the sea when he was $13\frac{1}{2}$. The elder Lusyne, an old-school captain, rejected engines--and lost out to motorized competitors. "He had put all his faith in sails," Lusyne says nostalgically.

Now Lusyne is preparing for yet another assignment, perhaps South America.

1970 YELLOWFIN TUNA SEASON IN EASTERN TROPICAL PACIFIC ENDS

The season for harvesting yellowfin tuna in the eastern Tropical Pacific Ocean ended at 12:01 a.m., local time, on March 23, 1970.

On March 18, the Director of Investigations, Inter-American Tropical Tuna Commission, recommended the closure data to all nations with vessels in the regulatory area. It was done to assure that the established catch limit of 120,000 short tons for 1970 would not be exceeded.

Nearly 68,000 Short Tons

The catch reported by the Commission, Jan. 1-Mar. 23, 1970, was 67,913 short tons. This is 14,383 tons, or 27%, greater than the 53,530 tons of the comparable period in 1969.

JAPANESE SOUND OUT MEXICANS ON JOINT FISHING IN MEXICO

The Japanese Nichiro Fishing Co. is sounding out Mexican fishery interests on the proposed joint fishing venture to promote Mexico's fisheries. Although the details are unknown, the proposed plan calls for Japanese-U.S.-Mexican fishing company in Ensenada to produce tuna, shrimp, and fish meal. Also planned is the sale of fish-meal plants.

U.S. Firm Would Sell Catch

The U.S. partners reportedly would handle all sales of fish caught. The Japanese firm is seeking a loan from its government on grounds that the venture would extend Japanese technology to Mexico. Japan has concluded a fishery agreement with Mexico. If the proposal takes shape, the Japanese firm plans to send a survey team to Mexico around May. ('Suisan Keizai Shimbun,' Mar. 6.)

JAPAN AND MAURITANIA REACH FISHERY AGREEMENT

On Feb. 19, 1970, Japan and Mauritania signed an agreement permitting Japanese trawlers to fish inside Mauritania's 12-mile exclusive fishery zone. The pact became effective April 10 and will run one year. Then it may be extended by mutual agreement.

What Agreement Provides

The agreement provides that: (1) 24 large Japanese trawlers will be permitted to enter Mauritania's 12-mile exclusive fishery zone from April 10; also 5 small vessels (30-50 gross tons) will be allowed inside the 3-mile territorial water zone to train 1-3 Mauritanian fishermen aboard those vessels; (2) fish catches by the 5 small vessels will be delivered to shore-based cold storages for sale at prices determined by committee of Japanese and Mauritanians; and (4) fishing fee will be assessed as 'cooperation fee'; it will includes charges for use of port and other fishing-connected facilities. The amount of assessment reported was about US$27.80 per gross ton of vessel, agreed to in earlier talks. ('Suisan Tsushin,' Feb. 26.)

CANADA

NEWFOUNDLAND'S 1969 LANDINGS TOPPED BILLION LBS. FIRST TIME

Newfoundland's sea fish landings in 1969 exceeded one billion pounds for the first time on record, reported the Canadian Dept. of Fisheries & Forestry. It was an increase of 6.7% over 1968's 951 million pounds. The gross landed value of C$28.2 million was up 1.1% from 1968's record C$27.9 million. The lower relative increase in landed value reflected a further increase in herring landings--as average groundfish and shellfish prices remained stable.

Groundfish Down

Groundfish landings were 610 million pounds, down 1.8% from 1968. Cod landings, which fell 11.3% to 329 million pounds, accounting for most of decrease in groundfish catch. A poor Labrador fishery and decreased catches in northern Labrador caused the decline.

Flounder landings rose to 163 million pounds from 136 million pounds in 1968. The ocean perch (redfish) catch declined slightly from 1968's 76 million pounds. Landings of Greenland turbot rose 27% from 1968's 30 million pounds because fishing increased on new grounds. Other groundfish amounted to 11 million pounds, compared to 1968's 8 million pounds.

Offshore Trawler Landings

Groundfish landings by Newfoundland's offshore trawler fleet were 276 million pounds, 2.6% over 1968. This fleet accounted for 45.3% of total groundfish landings, 20% of cod landings, 87% of flounder and ocean perch.

Pelagic & Estuarial Species

Landings of pelagic and estuarial species were 401 million pounds, up 22.6% from 1968. Herring landings of 390 million pounds showed another substantial increase. Reduction plants continued to operate at full capacity during herring season; there was increased demand by producers of pickled products.

Salmon landings declined slightly from 1968's 3.2 million pounds. Capelin landings of 7.6 million pounds were virtually the same.

Shellfish Climbed 11.3%

Landings of shellfish increased 11.3% from 1968's 4.4 million pounds due to higher catches of scallops and crabs. The lobster catch fell 4.9% from 1968's 4 million pounds; however, higher prices offset volume decline, and value remained C$2.4 million.

The scallop fishery yielded 275,000 pounds, more than double 1968's catch. Crab landings were 730,000 pounds; 190,000 pounds in 1968. Squid landings were insignificant.

Fewer Fishermen

The number of commercial fishermen fell from 19,355 in 1968 to 18,150. Of these, 3,430 fished 10 months or more, 8,500 5 to 10 months, and 6,220 less than 5 months.

There were 16,700 inshore fishermen in 1969, 18,041 in 1968. There were substantially fewer Labrador fishermen.

The stationers and floaters who did not go to Labrador apparently remained out of the fishery from the island as well. The offshore fleet provided jobs for 1,450 men; in 1968, 1,314.

Fewer Motor Boats

With fewer fishermen and the shift to small longliners continuing, the number of motor boats decreased by 1,000 to 9,500. The number of row boats also declined to 3,900 from 4,440 in 1968. The fleet of small longliners (under 25 gross tons) increased by 44 to 375 at year's end. Most of this increase occurred in the Fogo Island-Twillingate and Port au Choix areas.

Variety of Vessels

Some large longliners and jackboats (over 25 gross tons) remained in use, with new vessels replacing those not used. At year's end, there were 67 otter trawlers in operation, compared with 60 a year earlier. Also, five small inshore draggers operated, two fewer than in 1968.

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CANADA (Contd.):

BRITISH COLUMBIA'S FISHING INDUSTRY VIEWS THE 1970s

The Fisheries Association of British Columbia, in its monthly "Facts on Fish" (Jan. 1970), listed problems it would like to see resolved in the 1970s:

(1) Protection of coastal fish stocks from foreign fleets. This refers primarily to U.S. fishermen. (2) Protection from huge Japanese and Soviet trawl fleets. (3) Exclusive jurisdiction by coastal state over its Continental Shelf; control of fisheries resources made a part of international law. (4) Protection of halibut nursery stocks from Soviet and Japanese trawl fisheries. (5) Control of pollution. (6) Increase of salmon resources and more consistent production. (7) Better use of dogfish. (8) Better pay for fishermen, and (9) Greater consumption of fish.

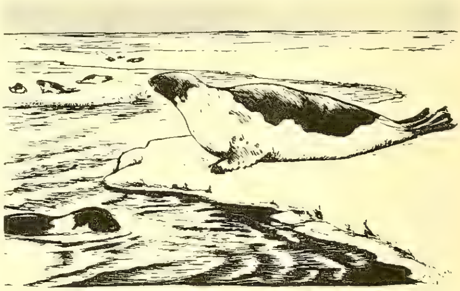
Difficult Decade

The Jan. 1970 "Western Fisheries," a Vancouver monthly trade magazine, states that the 1970s will bring a decade of hard negotiation between Canada and the U.S. The article concedes that the fisheries of the two countries are so interwoven that compromise and full cooperation in conserving and exploiting the stocks are primary requirements. However, two views are elaborated that seem to indicate that either Canada should go it alone--or renegotiate a treaty with a greater percentage of increase in fisheries going to Canadian fishermen.

* * *

EXTENDS BAN ON HUNTING BABY SEALS

The ban on killing baby "whitecoat" seals, announced in October 1969, has been extended to the North Atlantic. Norway is honoring the ban. The March 22 opening date for the hunt, both in the Gulf of St. Lawrence and off Labrador's east coast, should prevent the taking of baby seals. (Canadian Dept. of Fisheries and Forestry, Jan. 30.)



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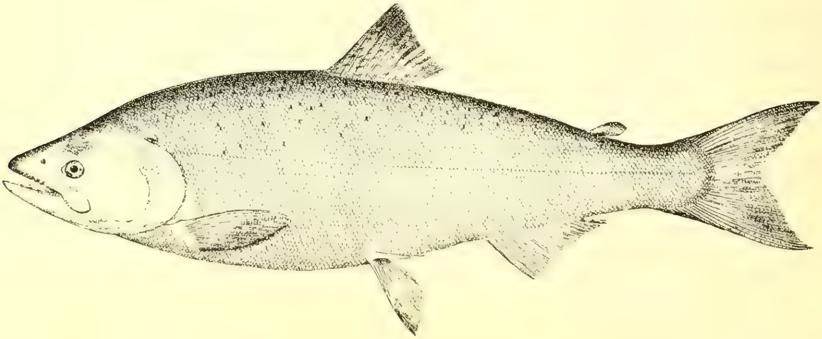
APPROVES LEGISLATION FOR SALT FISH CORPORATION

The House of Commons' Fisheries and Forestry Committee has approved authorizing legislation for a Salt Fish Corporation. The corporation would regulate interprovincial and export trade in salt fish. It would be provided with C$10 million to buy and hold fish in advance of sales. The money also could be used for loans to fishermen.



EUROPE

USSR

PLAN TO EXPAND FISH FARMING

The Soviets are speculating on the possibility of farming algae (Ahnfeltia, Phyllophora, Furcellaria, Laminaria, and Chlorella) for human and animal food. Scuba divers would "farm" the sea algae; fresh-water species would be cultured at animal-breeding farms. Soviet scientists claim 20% of fishery resources of world's oceans must be left intact to ensure safe replacement of stocks. This "danger limit" is being approached rapidly. It is why need arises for effective "management." Now, only half world's catch is used for food; the other half is processed into fish meal, fertilizers, oils, etc.

The Soviet Continental Shelf covers 6.6 million square kilometers--nearly half in waters less than 50 meters deep. This area offers greatest potential for resource management or fish farming. ('Sots. Ind.,' Nov. 23, 1969.)

V. P. Zaitsev, a leading scientist, reported experimental Ahnfeltia farming in Soviet Far East and on Solovetskie Islands in White Sea; this showed that algae can be improved by hybridizing and fertilization. He claims Chlorella has as much vitamin C as lemons and 4 times as much protein as wheat. Many tasty dishes can be prepared from sea kale, which also has medicinal value.

Black Sea

Experimental oyster and mussel (Mytilus) farms on the Black Sea become economically self-sufficient in 3 years, according to Zaitsev. Fish can be "pastured" in lagoons saturated with nutrients. ('Pravda,' Oct. 22, 1969.)

Far East

In the Far East, a special 80-vessel fleet is "harvesting seaweeds and mollusks" for several processing plants. The Far East is their main harvesting and processing base for Pacific algae, squid, octopus, sea cucumbers, crustaceans, and shells. Catches of marine products other than fish reach tens of thousands of metric tons.

Barents Sea

The first Soviet commercial farm to operate on the Barents Sea will experiment with breeding flounder, cod, haddock, and herring. It will be equipped with hatcheries, aquaria, and forage grounds for fish. If the experiment is successful, the Soviets plan a "network of underwater 'farms' with a sizable yield." (TASS, Dec. 2, 13, 1969.)

* * *

SCIENTISTS OBSERVE FISH WITH UNDERWATER TV

In 1969, scientists of the Kamchatka Branch of the Pacific Fisheries and Oceanography Research Institute (TINRO) used underwater TV cameras to observe salmon migration into Kuril Lake (Soviet Far East). They determined with "absolute accuracy" the number of migrating salmon. The new observation method is claimed to have great importance for determining fishery stocks and directing fishing operations. Research continues.

Detect Salmon 2 Km. Away

The scientists are also experimenting with a new hydroacoustic detection device aboard vessels on the high seas. The device has located salmon accumulations 2 kilometers away, and determined their number and migration path.

The expanded 1970 test program with the new device is aimed at making it suitable for detection of smaller fish like herring and perch.

* * *

UNDERWATER FILM SHOWS FISH CAN 'LEARN'

An underwater film on trawls and fish behavior shows that fish can "learn" how to avoid or escape nets, and hide behind rocks and between bottom rises where trawls cannot get them.

Since this ability will make conventional fishing gradually less efficient, scientists have suggested the use of artificial schooling

USSR (Contd.):

techniques with electric light, ultrasounds, feed concentrations, and even aromatic substances.

The photographers were 2 scientists of the Soviet Atlantic Fisheries and Oceanography Research Institute. ('Sotsialisticheskaia Industria,' Nov. 23, 1969.)

* * *

SEIZED 39 JAPANESE FISHING VESSELS IN 1969

In 1969, the Soviet Union seized and detained 39 Japanese fishing vessels and 363 fishermen. By year's end, 33 fishermen were still held.

The Soviets captured 40 Japanese vessels in 1968. From the end of World War II to December 1969, the Soviets seized 1,314 Japanese fishing vessels and 11,126 fishermen.

Japan Plans Aid

Japan plans to develop relief measures for owners and crewmen of the captured vessels; 7,488,000 yen (US$20,800) have been earmarked for that purpose in fiscal 1970 (April 1970-March 1971). ('Suisan Tsushin,' Feb. 2, and 'Nihon Suisan Shimbun,' Jan. 21.)

NORWAY

CANNED FISH EXPORTS FELL IN 1969

Although official Norwegian figures were available only through October 1969, it was predicted in January 1970 that 1969 canned fish exports would not match 1968 volume. This was attributed to inadequate supplies of raw material, particularly for the most important canned commodity, sild sardines. Stocks of several of the most popular packs were extremely short.

Kippers

Kipper exports fared even worse due to lack of raw material. For the past 2 years, exports have been less than half the volume of the late 1950s.

Herring Roe

Exports of soft herring roes dropped drastically as the winter herring fishery vanished.

Shrimp

Exports of peeled shrimp were only 3-4% of the volume of 10 years ago. The main reason is that the raw material has been used for other consumption and processing. Also, canned-shrimp production has developed tremendously in many other countries.

Brisling

Despite the canners' lack of raw materials for sild sardines and kippers, they were able to keep factories running fairly well due to good supplies of brisling. Brisling stocks were at normal levels. There were small stocks of several types of sild sardines. Kipper stocks were negligible and normally would have been completely exhausted, but small quantities were being held in reserve for old customers. ('Norwegian Canners Export Journal,' Jan. 1970.)

Exports (calculated in $\frac{1}{4}$ cases):

	Mid-Dec. 1967	Mid-Dec. 1968	Mid-Dec. 1969
Brisling	347,000	373,000	336,000
Sild	849,000	1,023,000	940,000
Kippers	254,000	182,000	197,000

* * *

HERRING FISHERY ON GEORGES BANK IS UNSUCCESSFUL

The factory vessel 'Gadus' returned to Norway after a 4-month fishing trip to Georges Bank and other areas of the American coast, where whe fished herring with a floating trawl. The results were below expectations.

The pack amounted to about 600 metric tons of herring fillets. Herring was considerably less abundant on Georges Bank. They arrived one month later than usual and were difficult to fish because they congregated in very shallow waters. Night fishing took place in 20 to 40 fathoms, and day fishing in deeper waters. In August, the fish were found in entirely uncustomary places.

The Fishing

Most herring were fished on Georges Bank toward northwest and northeast; some in the

NORWAY (Contd.):

Gulf of Maine. During the last leg, Gadus fished off Nova Scotia, where the herring were large and of high quality. During the end of October, the crew caught about 150 to 160 metric tons during one week. The herring were different from the species found on and near Georges Bank. Poor weather intensified toward season's end and retarded catch.

The bulk of the pack was delivered to Cuxhaven in Germany. (Reg. Fish. Attaché, Copenhagen, Feb. 19.)

* * *

SAITHE SALES TO EAST EUROPEAN MARKET WILL SET RECORD

Norwegian sales of deep-frozen saithe fillets to COMECON (Communist East European) countries will total a record 20,000 metric tons this year. The Soviet Union is expected to purchase most, 10,000 tons, after several years of declining purchases. This large purchase will not affect Soviet purchases from other areas, mainly Iceland and Britain.

Soviet Saithe Catch Drops

The Soviet catch of saithe decreased from 33,800 tons in 1966 to 11,900 tons in 1968; it is most likely reason for increased Soviet purchases abroad. Norway does not expect the increased sales to the Soviet Union to adversely affect sales to her more stable markets, such as Czechoslovakia and Hungary.

Wants Larger Saithe Market

Deliveries to the U.S., Western Europe, and other markets are based on cod, haddock, and other white fish, not saithe. Norway would like to change this. She considers saithe a delicacy and would like to expand its market. (Export Council of Norway, Mar. 1970.)

* * *

NEW WHALING FACTORYSHIP IS DELIVERED

A new factory whale catcher, 'Peder Huse,' has been delivered to Torodd Huse and Partners, Steinshamn, Norway.

She has been equipped with up-to-date machinery that will clean-cut vacuum-packed and frozen whale beef, freeze whale meat in blocks as raw material for sausage and fodder, and increase production of whale oil. Her loading capacity is 500 metric tons of whale meat and 250 tons of oil.

Packing & Production

Whale meat is stored in 2 cooling tanks aft. It is processed on 3 production lines consisting of conveyors, cutting tables, and freezers. The beef, clean-cut and packed by a special machine, is frozen and packed in cartons. The frozen blocks of sausage meat and fodder are glazed and packed in plastic bags. The whale oil is produced aft of the factory area.

Contracts Made

Contracts have been made to deliver whale meat to Japan, and fodder to England, after the 1969/70 Antarctic season ends. Norway returned to whaling for the 1969/70 season after a year's absence. ('Norwegian Fishing and Maritime News,' Vol. 4, 1969.)

* * *

WILL PURCHASE FLOATING HERRING-MEAL FACTORYSHIP

Norway may obtain her first herring-meal-and-oil factoryship. The 27,000-ton, US$8 million vessel will fish globally, aided by 10-20 purse seiners. NORGLOBAL A/S is backing the project.

NORGLOBAL

The cooperative NORGLOBAL has capital of about US$1 million; 53% is owned by north Norwegian interests. Factory and equipment is estimated at $3.5 million, and vessel purchase at $2 million. Total capital requirements amount to $7.4 million.

The vessel will require 20-25 men to work in its floating factory and 20-25-man crew. (Reg. Fish. Att., Copenhagen, Feb. 19.)

* * *

SHRIMP FACTORY SHIPPED TO KUWAIT

A complete shrimp factory has been shipped to Kuwait from the Norwegian engineering concern, Haahjem Mekaniske A/S of Vigra. The firm also is working on other orders for Kuwait.

NORWAY (Contd.):

The factory will be operated in connection with a fleet of shrimp trawlers, also built in Norway, which has been fishing with good results in the Persian Gulf for several years.

Previously, the Norwegian factory exported fish-processing plants and equipment for installation aboard factoryships. (Export Council of Norway, Feb. 1970.)

WEST GERMANY

HERRING FISHERY DEVELOPS OFF U.S. ATLANTIC COAST

The developing West German fishery for herring off the U.S. Atlantic coast was spurred by recent failures on European herring grounds. West German vessels began fishing the Georges Bank area to ensure adequate supplies for their domestic industry.

This fishery began in earnest in Aug. 1967 with the appearance of 5 freezer-trawlers. Vessels arrive in July and stay until Dec. The main months are Aug., Sept., and Oct., with up to 35 vessels fishing.

The Catches

The 1968 catch was about 38,000 metric tons, product weight--double 1967's. The 1969 catch was expected to be close to 90,000 tons (50,000 tons). Such quantities guarantee sufficient supplies.

Becoming More Important

For economic reasons, the bulk of herring from Georges and Banquereau Banks was landed and transshipped from St. Pierre et Miquelon on reefer ships to West Germany.

Production of frozen herring off the U.S. will become more important in West Germany's herring industry. Marketing of frozen herring rests exclusively with Seefrostvertrieg GmbH. This year's contract between the firm and German industry was arrived at quickly. It led to greater employment of the fleet on Georges Bank.

UNITED KINGDOM

FISH LEVY INCREASED & EXTENDED

The White Fish Authority's (WFA) general levy on fish was increased and extended on Feb. 15, 1970. Previously, WFA had collected a levy only on first-hand sales of white fish--sea fish, fresh or preserved, other than herring, salmon, and migratory trout. Now there are differential rates for landed or imported white-fish products. The levy also has been extended to include imported fish meal, and fresh and processed shellfish. The levy's purpose is to expand and diversify further WFA's current services to the white fish industry.

New Regulations

The WFA levy was increased from 1.0d. to 1.2d. per stone of white fish landed or imported. (1d. = 1 US¢; 1 stone = 14 lbs.; 1 sh. = 12 US¢.)

The new regulations extend the levy's scope: (a) For first time, a levy is imposed on oysters, scallops (Pecten maximus and Clamys opercularis), crabs, lobsters, crawfish, nephrops, shrimps, and other edible crustaceans. Molluscs in shell, other than oysters and scallops, are exempt from levy. (b) Fish landed or imported in processed form carries a differential levy calculated by reference to the approximate whole-fish equivalent. The rates are shown below. (c) A levy of 8 shillings per ton is imposed on imported fish meal, whether manufacturered from white fish or herring; a proportion of income from this levy will be paid to Herring Industry Board. (d) The levy on white fish purchased at first hand for the manufacture of fish meal has been reduced from one cent (U.S.) to 0.12d. per stone (14 lbs.). (e) Imports of processed shellfish (frozen crab meat, peeled shrimps, shelled Norway lobsters) will be levied at rate applicable to "any white fish product not referred to above." (f) The levy does not apply to imports of canned and bottled fish.

Who Pays Levy When

The increased rate is payable by first-hand purchaser unless the seller collects levy and adds it to his sales invoice. The levy on imports is payable by first-hand purchaser, usually the importer.

UNITED KINGDOM (Contd.):

The levy is payable weekly, unless other arrangements have been made. Payment is due 7 days after end of week in which fish were purchased. (U.S. Embassy, London, Feb. 11.)

The new rates of levy are:

	Rate Per Stone
FISH LANDED WHOLE OR GUTTED & WHOLE SHELLFISH	1.2d
DIFFERENTIAL LEVIES	
Fresh Frozen and Chilled White Fish:	
Headless & gutted	1.6d
Fillets, skin on	2.4d
Fillets, skinless	3.0d
Smoked White Fish:	
Headless and gutted	2.0d
Fillets, skin on	3.0d
Fillets, skinless	3.2d
Salted and Cured White Fish:	
Wet	2.4d
Dried	3.6d
Fish Meal	0.6d
White Fish Sold at First Hand for Fish-Meal Production	0.12d
Any White Fish Product Not Referred to Above	2.4d

ICELAND

JOINS EFTA

Iceland will join EFTA sometime in 1970 and come under all EFTA trade and tariff policies. On Jan. 1, 1970, she gained the same access to British market for frozen fishery products as other Nordic countries. On same date, Britain lifted all import restrictions on frozen fish in return for a minimum price system--increasing prices about 10%.

LATIN AMERICA

PERU

FISH-MEAL PRODUCTION AND EXPORTS ARE HIGH

Peruvian fish-meal production in Jan. 1970 set a record for Jan. It followed the excellent (a record) Dec. 1969 production.

Exports continued high. Stocks on hand, Feb. 1, 1970, were exceeded for that date only in 1967 and 1968.

Preliminary reports show high production (about 180,000 metric tons) for early Feb., although final figures have not been issued. (Fishery closed for 4 weeks on Feb. 14.)

Whether fishing would be as good when "veda," or closed season, ended on Mar. 16 remained to be seen.

Fish-Meal Production & Exports, Jan. 1968-70

	1970	1969	1968
		(Metric Tons)	
Production:			
Jan.	362,869	240,495	284,021
Exports:			
Jan.	173,404	140,283	192,056
Stocks on hand Feb. 1:	493,577	487,348	688,943

The current excellent fishing has given the industry a much-needed boost. (Sociedad Nacional de Pesqueria, Feb. 26.)

* * *

WORLD'S LARGEST STICKWATER MACHINERY BUILT FOR PERU

The Norwegian engineering concern, Bergs Maskin A/S, Trondheim, has produced the world's largest manufacturing unit for stickwater for a Peruvian company. The machinery, valued at US$2 million, will be installed by Bergs. Two similar but smaller stickwater machines are being produced at Bergs for other Peruvian firms. (Export Council of Norway, Feb. 1970.)

In Indonesia, breeding fish involves 200,000 Javanese. Fish and rice are staple diet. FAO encourages raising fish in ponds.
(Photo: UNations)

ASIA

JAPAN

"INVISIBLE" NET CATCHES MORE FISH

Fishermen in Japan and other countries are increasing their use of "invisible" nets. The nets are transparent nylon strand that is virtually invisible under water. Fish swim blindly into the net and become entangled.

The nets are so effective that almost all gillnet fishing in Japan is now done with them. Because they are so effective, they are banned in areas such as the salmon fisheries of Canada, where there is a serious need for conservation.

The Japanese also use "invisible" nets for trawling, especially in inshore waters where light penetrates to the bottom. The wings of the trawls are made of more visible material which deflects the fish into the transparent after body and codend where they are trapped.

Use of the nets was reported by Hilmar Kristjonsson, FAO fishing technologist, who recently visited the Far East to stimulate interest in FAO's world fishing conference in Reykjavik, Iceland, May 24 to 30.

His Report

Kristjonsson said: "In Japan, which produces about half of all the netting used in world fisheries, virtually all gillnets are now made of this material. It consists of a wire-like nylon monofilament which, because of its transparency, has proved far more effective in catching fish than the traditional twine.

"More than a decade ago, transparent nylon monofilaments, like those used by anglers, were used in some commercial gillnet fisheries but mainly in lakes. Recently there has been an almost 100 percent changeover to this invisible material in marine gillnetting in Japan."

Kristjonsson foresaw great possibilities in the use of such nets, particularly with low-powered fishing boats in clear tropical waters of developing countries at coastal depths of 5 to 20 fathoms. Small boats are very important to countries like India. There, the mechanized fishing fleet consists of about 7,000 vessels 30 to 36 feet long. In India, Kristjonsson said, "it will be interesting to test the effectiveness of monofilament trawl nets as compared with the twine nets used now in these countries."

Small Net Invisibility

He noted that net visibility generally is more important when fishing with small rather than large trawl nets. It is likely that nets with "invisible" sections may also be important to industrialized fisheries, especially in shallow grounds and in midwater.

These and other developments will be discussed at the FAO Technical Conference on Fish Finding, Purse Seining, and Aimed Trawling.

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FISHERIES AGENCY BUDGET INCREASED FOR FISCAL 1970

The Fisheries Agency budget for fiscal year (FY) 1970 (Apr. 1970-Mar. 1971) surpassed the US$100 million mark for the first time. It is about US$112.8 million, 22% over FY 1969's $92.4 million. It includes large increases in funding for fishing-port improvements; shallow-water fishing development; and biological research. The latter relates to international fisheries, such as North Pacific Alaska pollock and crab fisheries.

Overseas Developments

Overseas fishery development will include saury surveys by 350- and 530-ton exploratory vessels; bottomfish surveys off New

Program	Proposed FY 1970 Budget	FY 1969 Budget
	(in Millions US$)	
Fishing-port improvements .	60.11	48.16
Shallow-water fishery development	0.71	0.09
Overseas fishery development	2.27	1.96
Biological research relating to international fisheries .	0.65	0.53
Marine resources conservation and cultivation	1.69	1.53
Coastal fishery structural reorganization	3.84	4.34
Improvement of fishery disaster compensation system	6.40	2.79
Experimental undersea fish culture	0.19	0

JAPAN (Contd.):

Zealand and west Africa; and exploratory tuna longlining in the high latitudes of the South Pacific. ('Suisan Keizai Shimbun,' Feb. 3.)

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COASTAL FISHERIES HURT BY SOVIET AND SOUTH KOREAN VESSELS

Since early Feb. 1970, Japanese octopus fishermen off Hokkaido's Pacific coast (8-11 miles off Shiranuka) have suffered substantial damage from one 300-ton South Korean (ROK) and 2 Soviet fishing vessels trawling in an area banned to Japanese trawlers.

Gear Damaged

Reportedly, the Soviet vessels came close to the Japanese territorial limit (3 miles) and badly damaged coastal octopus fishing gear. The damage was estimated at about US$30,000. The Japanese fishery cooperative is demanding compensation from the Soviets via the Japanese Foreign Office.

Soviet Bombing Exercises

An additional irritant: The Soviet Union informed Japan of 2-week bombing exercises on the high seas off Iturup Island (South Kuril Islands) beginning Mar. 1. The area is a Japanese cod fishing ground; its season usually opens prior to Mar. 1. ('Asahi Evening News,' Feb. 13.)

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TUNA SEINING IN EASTERN PACIFIC IS POOR

The seiner 'Hakuryu Maru No. 55' (500 gross tons), the only Japanese seiner in the eastern tropical tuna fishery since the season began January 1970, caught only about 35 tons of yellowfin by late February. Because the vessel must catch 1,000 tons to cover expenses, its catch so far has been disappointing.

2 Unsuccessful Years

The vessel experienced two bad years in the fishery. So this year she is using three speed boats, like those used by U. S. seiners in pursuing porpoise-associated yellowfin schools. However, unsatisfactory radio communication between speed boats and mothership is hampering coordination of operations. ('Shin Suisan Shimbun Sokuho', Feb. 25.)

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WILL EXPORT ALASKA POLLOCK TO U.S.

The Federation of Hokkaido Fishery Cooperative Associations is planning to export frozen Alaska pollock fillets to the U.S. Initially the Federation plans to sell around 500 tons. If a steady trade can be built up, it hopes to increase shipments to around 4,000 tons.

Trial Shipment Made

Sales negotiations began in October 1969, when the president of a U.S. firm visited Hokkaido to study Japanese fillet processing. This resulted in a 5-ton trial shipment to the U.S. for quality evaluation and to determine U.S. consumer reaction.

May Open New Market

The planned shipment is attracting attention in Japan as opening a new market. The Japanese use Alaska pollock primarily for 'surimi' (minced fish meat) for use in 'kamaboko.' ('Suisancho Nippo,' Feb. 7.)

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MAY BUY SEA URCHIN FROM AUSTRALIA

A leading Japanese sea-urchin paste manufacturer is investigating the possibility of importing sea urchin roe from Australia because of the supply shortage. Sea urchin, abundant along the coast of Australia, are not harvested.

The Japanese company recently obtained samples from Australia and found them comparable in quality to imports from South Korea, North Korea, Taiwan, and Okinawa.

May Begin Importing

If first-stage processing (removing the shells) can be performed in Australia, the Japanese firm hopes to begin importing around US$28,000 worth a month.

In 1969, three major sea-urchin processors in Shimonoseki imported in 6 months a combined monthly average of around $83,000 worth. ('Minato Shimbun,' Feb. 11.)

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JAPAN (Contd.):

JAPAN AND KENYA TO BUILD JOINT COLD STORAGE

Japan's Taiyo Fishing Co. and Ataka Industries, with the government of Kenya and a local fishing company, plan to build a 2,000-ton capacity cold-storage in Mombasa. Half the financing will come from the government of Kenya; the other half will be shared equally by the 3 companies. Construction was scheduled to begin in February 1970. Completion is scheduled for October. The plant will store tuna for Taiyo, and other fish for the local market.

Taiyo already operates a fishing base at Mombasa. It buys tuna from South Korean and Taiwanese longliners for export to Italy and other countries. ('Katsuo-maguro Tsushin,' Feb. 6.)

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EXPORTS OF CANNED TUNA WENT UP IN 1969

Japanese canned-tuna exports in 1969 were 64,489.3 metric tons worth US$65.8 million. In standard cases of 48 7-oz. cans, this was about 6.72 million cases, a 9% increase over 1968 exports of 6.14 million cases.

Exports of canned-tuna-in-brine in 1969 surpassed the 3-million case level for the first time. ('Suisan Tsushin,' Feb. 19.)

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EXPORTS OF FROZEN TUNA DOWN SHARPLY, OTHER FISH ROSE IN 1969

In 1969, Japanese frozen-tuna exports were 65,280 metric tons worth US$27.46 million. These were down about 40% in quantity and 33% in value from 1968 exports of 197,000 tons worth $41.06 million.

Tuna exports peaked at 177,000 tons in 1966, declined to 107,000 tons in 1967 and 1968, and dipped sharply in 1969. This one-time earnings leader of all fishery and agricultural products dropped from top place.

Yellowfin Fell Far

By species, yellowfin declined drastically as reflected in the sharply reduced shipments to Italy. Italy, a major importer, uses an estimated 40,000-45,000 tons of raw tuna a year. She is becoming a very important market for Taiwan, South Korea, and the U.S.

Saury Exports Continue Rise

The 1969 exports of other fishery products show saury up with 16,171 tons; this compares with 14,367 tons in 1968, and 13,000 tons in 1967. Saury exports are rising steadily despite poor catches in recent years.

The 1969 average export price for frozen saury was $460 a metric ton, over 50% above the 1968 average price of $305 a ton.

Seed oyster exports totaled 2,672 tons, including 2,238 tons sold to the U.S., 321 tons to South Korea, 102 tons to France, and 8 tons to Spain. Previously, they were exported almost entirely to the U.S. which, in 1968, took 1,858 tons. ('Suisan Tsushin,' Feb. 18.)

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PET-FOOD TUNA EXPORTS DOWN IN APR.-NOV. 1969

Canned pet-food tuna exports totaled 504,026 cases Apr.-Nov. 1969, 200,000 fewer than same period 1968 (707,726 cases). The decline was attributed to short supplies of raw material and increased production in the U.S. The U.S. imported almost 90% of the 1969 exports. ('Katsuo-maguro Tsushin,' Feb. 10.)

Canned Pet Food Tuna Exports, Apr.-Nov. 1969

	Can and Case Size	
	6-oz. 48's	1-lb. tall 24's
	(No. of Cases)	
U. S.	440,317	10,500
Canada	50,609	-
Netherlands	2,500	-
Belgium	100	-
Total	493,526	10,500

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IMPORTS OF FROZEN SHRIMP ROSE SHARPLY IN 1969

Japanese imports of frozen shrimp in 1969 reached 48,886 metric tons worth about US$121.75 million. This is an increase of nearly 39% in volume and 56% in value from 1968 imports of 35,204 tons worth $78.06 million.

JAPAN (Contd.):

Since Japan liberalized her shrimp imports in 1961, these began to rise steadily until 1968. Then they declined for first time due largely to drastically reduced shipments from the Soviet Union.

1969 Imports Up Sharply

In 1969, imports rose sharply--a recent high in volume and value. This resulted from continued imports particularly during second-half 1969, despite domestic oversupply, which disrupted shrimp market. Firms that had purchase arrangements with foreign suppliers had to buy regardless of Japanese demand. ('Suisan Tsushin,' Feb. 14, & 'Nihon Suisan Shimbun,' Jan. 7.)

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CANNED-MACKEREL EXPORT PRICE TO U. S. DROPS

Japanese prices for canned-mackerel exports to the U.S. declined in early Feb. 1970 to around c. & f. US$6.10 a case (48 1-pound tall cans); the mid-Jan. price was around $6.30 a case. The drop was attributed primarily to softening of Philippine market, the biggest, and in other southeast Asian countries.

Another contributing factor were foreign customers who, anticipating further price decline, did not buy. They were aware of reports Japanese packers and trading firms were carrying large unsold stocks. The export outlook appeared gloomy because the mackerel packers were in full production.

5 Million Cans

Canned-mackerel exports during Jan.-Dec. 1969 by 21 member firms of the Japan Canned Food Exporters Association were about five million cases. The trading firms Mitsui, Mitsubishi, and Taiyo handled over 50% of exports; the rest were sold mostly by Nozaki, Marubeni, C. Itoh & Co., and Kansmatsu. ('Kanzume Tokuho,' Feb. 9, 'Suisan Tsushin,' Feb. 9, and 'Katsuo-maguro Tsushin,' Feb. 4.)

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EXPORTS OF CANNED MACKEREL TO U.S. ARE GROWING

Japanese exports of canned mackerel to the U.S. in 1969 totaled 395,000 cases (1-lb. tall 48's) of natural pack. The U.S. is Japan's second largest market, next to the Philippines; in 1969, the latter took 1.15 million cases of natural pack. This was 40% of about 3 million cases of that style pack. Canned mackerel exports to the U.S. began growing around 1967, when U.S. packers were the principal buyers.

Private Brands Promoted

In recent years, major firms have been promoting their own brands in the U.S.; these sales now exceed quantity sold to U.S. packers. The outlook for mackerel exports to the U.S. is of steady increase. ('Suisan Tsushin,' Mar. 6 & Feb. 20.)

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MAY SELL MACKEREL PET FOOD TO CANADA

The Japanese Northern District Purse Seine Fishery Assoc. expects to export canned mackerel pet food to Canada. This would be the first time the Japanese have used mackerel in pet food; normally the dark meat of tuna is used.

The product was developed by the Aomori Prefectural Marine Products Research Institute, at the Association's request, to help stabilize mackerel prices in Japan.

Sample Favorably Received

The sample product was sent to Canada, where it was favorably received. A Canadian importing firm was sending a buyer to Japan to sign a purchase contract. ('Minato Shimbun,' Feb. 21.)

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SAURY FISHERY PLANNED OFF U.S. WEST COAST

About 10 large and small Japanese firms have indicated a desire to fish saury experimentally off U.S. west coast in 1970. Many more are reported interested. License applications may involve 30 vessels.

Some independent vessel owners want to operate with the big firms. Some coastal saury operators want to go it alone. Most major firms hope to conduct independent or two-boat operations; at least one firm plans to send a mothership accompanied by several vessels.

The Fisheries Agency is studying licensing policy. Reportedly, it does not plan to restrict number of vessels if these are only 15 to 20. However, its decision will depend on attitude of coastal saury operators.

1969 Operation

The 1969 Japanese saury catch off the U.S. west coast by six exploratory vessels was about 460 metric tons. The saury operations were east of 124° W. longitude from Sept. 23 until late Nov. Medium and small saury were abundant between 40° N.-45° N. latitudes; small fish ran heavy north of 44° N. latitude.

Good catches were made between 40° N.-43° N. latitudes, where medium fish were mixed with small. Saury were concentrated in areas with well-defined current boundaries located not very far from shore. Conditions relating to seaward and north-south migrations are unknown; the relationship between fishing season and fish concentrations could not be established.

Narrow & Light Weight

The eastern Pacific saury had many parasites. Their bodies were narrow and light in weight--considering their length. From early Oct., stormy weather persisted. ('Shin Suisan Shimbun Sokuho' and 'Suisan Tsushin,' Mar. 3.)

SOUTH KOREA

1969 CATCH WAS 98% OF GOAL

The Republic of Korea's 1969 catch totaled 858,000 metric tons, 98% of the goal set early in the year. The coastal catch was 534,000 tons; offshore, 158,000 tons; fish culture, 85,000 tons; and distant water fishery, 81,000. ('Suisancho Nippo,' Jan. 31.)

Growth Rate Slowing

South Korea's catch has grown rapidly during the last 4 years: from 701,000 metric tons in 1966, it increased over 20% in 1969. However, the growth rate is beginning to slow. It was 6.8% in 1967 (749,000 tons), 12.3% in 1968 (841,000 tons), and only a little over 2% in 1969.

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KOREAN & TAIWANESE TUNA FLEETS GROW STRONGER

In January 1970, Taiwan had about 80 tuna vessels in the Atlantic Ocean and the Republic of Korea (S. Korea) around 70. Together, they had almost four times as many vessels in the Atlantic as Japan (40 longliners). Their operations extended from north of the equator to off Brazil. Most of the vessels concentrated on albacore.

In January 1970, there were 60 Taiwanese, 50 South Korean, and only 3 Japanese long liners operating out of American Samoa. ('Suisancho Nippo,' Jan. 22, 1970.)

Dominate American Samoa Scene

In November 1969, the Korean tuna fleet out of American Samoa had 73 long liners. Taiwan had 58 long liners, and Japan only 7. The Japanese are steadily withdrawing their long liners because of smaller profits. ('Katsuo-maguro Tsushin,' Dec. 4, 1969.)

MID EAST

UNITED ARAB REPUBLIC

FISHERIES AFFECTED BY ASWAN DAM

Partly because of the Aswan Dam, United Arab Republic (UAR) fishery catches have declined steadily since 1964. This is disclosed in a report by FAO's General Fisheries Council of the Mediterranean: 'GFCM Studies and Reviews, No. 43, Marine Resources of the United Arab Republic.'

It covers the years up to 1967. It notes that catches of marine and freshwater fish increased from about 52,000 metric tons in 1952 to about 125,000 tons in 1962. Over the next 5 years, average annual total was about 106,000 tons.

Catches Drop After 1964

After the Aswan High Dam became operational in 1964, catches began to drop along the northern coast. Sardine catches that previously averaged 15,000 tons a year decreased to 4,600 tons in 1965, and to 554 in 1966. Total UAR catches reached a record 135,000 tons in 1964, declined to 102,400 tons in 1965, and dropped to 85,000 in 1967.

Decreased Water Fertility

The report attributes the decline to the dam. In checking the periodic Nile floods, the dam reduced the flow of water rich in natural fertilizers--phosphates, nitrates, and other nutrients--into the Mediterranean. The coastal fisheries, especially sardine, had thrived on these. The lowered water fertility discouraged fish concentrations and migrations in the area.

Increased Erosion and Salinity

The report recognizes the dam's value in providing water for power, irrigation, and in flood-control. But it emphasizes the need for a close watch on the ecological and physical changes dam has caused. These include increasing salination of the delta's coastal (and eventually lake) waters, and increased coastal erosion. The Nile used to counteract this erosion by depositing 140 million tons of mud and silt a year in the area. The dam has greatly reduced this natural action.

Other factors contributing to reduced catches are growing water pollution (industry and tankers), overfishing, use of prohibited gear and small-mesh nets, and reclamation of lakes for agricultural purposes.

The Future

However, the report is optimistic about future development. It describes the 'vast' fishery potential of Lake Nasser. When fully realized, the lake will flood 4,200 square kilometers of UAR and Sudanese territory. FAO already has begun a 5-year, US$2,684,000 project to develop fishery, forestry, water, and other resources.

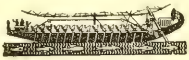
Inland & Distant-Water Fisheries

The report also recommends development of inland fisheries elsewhere in the country, particularly in the northern lakes. Salt-water fish have been introduced successfully in these lakes to meet their already increased salinity. The possibility of speeding development of a high-seas fleet to fish in international waters is cited.

Coastal Fisheries

It urges wider exploitation of the northern Continental Shelf, where fishing now tends to hug a narrow area between Alexandria and Port Said. The flat, muddy bottom offers excellent trawling possibilities, especially for shrimp. Other recommendations are: development of Red Sea's fisheries, especially for shark-liver oil, fish meal, and shellfish; improved fishery education and training; more marine biological research; and water-pollution control.

The report emphasizes the need for increasing protein production in the UAR. Annual per-capita consumption of animal protein is now only 10 kilograms (22 lbs.). The population of 30 million is expected to double by the year 2000.



AFRICA

SOUTH AFRICA

IMPROVES FISHING FLEET

The 1970 fishing season opened in South Africa on January 1; in South-West Africa, on February 1. In South Africa, the January catch was 41,000 short tons of fish; it was 69,000 tons in January 1969. Weather improves in February and fishing was expected to be better.

9 New Steel Vessels

This year the fishing fleet was strengthened by nine steel purse seiners, 100 to 120 feet long. (The largest wood vessel is only 85 feet long.)

Seven of the steel vessels were purchased in Norway, and two in Iceland. These vessels are faster, more comfortable, and have refrigeration. All will be used for the Walvis Bay factories, or fish for the factoryships.

Spotter Aircraft Added

Also, a new spotter aircraft was obtained: a twin-engined, short-take-off-and-landing aircraft (STOL). It can cruise from 40 to 200 miles an hour. It flies at night at about 700 feet to help locate fish schools, which appear as readily identifiable luminous patches. ('Cape Times,' Feb. 21.)

* * *

IMPROVES FISHING HARBORS

To provide better facilities for a rapidly growing fleet, South Africa's Fisheries Development Corporation is spending US$15.4 million on fishing-harbor extensions, according to the 'South African Financial Gazette'.

The work, underway or just completed, is being done at seven fishing ports along South Africa's coast.

The 7 Harbors

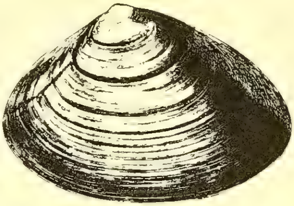
The biggest project is at Gansbaai, where $4.9 million is being spent. Construction of a new breakwater and quay will ultimately increase the little port's berthing capacity by about 50%.

Expenditure at Saldanha Bay is $3.5 million and includes reclamation work, a new quay, a 1,200-ton slipway, and a new crayfishing jetty. This project will be completed around mid-1970.

The corporation is spending $3.5 million on construction of a new breakwater, slipway, and coaster berth at St. Helena Bay, further up the west coast.

The corporation also is financing extensions worth $1.9 million at Hout Bay, $1.5 million at the Berg River mouth, $322,000 at Hermanus, and $280,000 at Lamberts Bay.

FOOD FISH FACTS



Surf Clam
(Spisula solidissima)

The name "clam" covers a wide variety of bivalve mollusks found along the coastlines of the United States. For thousands of years Indians utilized clams as food and used the shells of some species as decorations and as wampum. Early settlers in America soon found ways to enjoy these tasty gifts from the sea which were free-for-the-taking. Today clams are more popular than ever and the fishery has increased enormously in the past two decades. In 1967 the fishery yielded 71.5 million pounds of meats as compared to 39.6 million pounds in 1950. Surf clams accounted for over 45 million pounds of the total catch.

DESCRIPTION

The bivalve shells which encase the clam's body are joined together at the back by a hinge ligament which is usually visible from the outside. The shells, while varying in shape, are composed of three layers. The outer layer is often varnishlike; the thick middle layer is somewhat chalky; and the inner layer, which is usually hard, is often iridescent or lustrous in some species. Concentric rings are laid down on the shells as the clam grows. Some species have ridges which radiate from the hinge to the edge of the shell. Colors of the shell vary as they are affected by the habitat.

The two most prominent features of the clam's body are the foot or adductor muscle and the siphon or "neck." The muscular foot aids the clam in digging up or down in the soft sand or mud as well as in the opening and closing of the valves. The retractable siphon is a tube-like extension which conducts water in and out of the clam. In some species the siphon consists of two tubes. The incoming water brings food and oxygen to the clam; the outgoing water carries waste products and, during spawning, the eggs or sperm.

Along the Atlantic coast the three species which rank highest in commercial importance are:

The hard clams (Venus mercenaria) are known locally as quahogs. These clams are the most valuable of the three. Littlenecks and cherrystones are trade names for smaller-sized hard clams.

The surf clams (Spisula solidissima) are also known as skimmer, beach, giant, sea, hen, or bar clams. This species makes up the largest volume caught along Atlantic shores, but is not as valuable as the hard or soft-shell clams. Canned clams are practically all surf clams.

The soft-shell clams (Mya arenaria) are known in the Chesapeake Bay area as "manninose." These popular clams, unlike the hard and surf clams, have elongated shells that are very thin and brittle. The soft-shell clams cannot close tightly because their long necks extend beyond the shells.

(Continued following page.)

Pacific coast clams accounted for nearly 600 thousands pounds taken commercially in 1967. Pacific coast clams include:

The razor clams (Siliqua patula); butter clams (Saxidomus nuttalli) and (Saxidomus giganteus); littleneck clams (Protothaca staminea); the Atlantic softshell clams (Mya arenaria) which have been transplanted; and the geoducks (Panope generosa) which may become commercially important with new beds discovered off the coast of Washington State.

HABITAT

Clams are found in subtidal or intertidal zones of beaches and mud flats out to depths of over 30 fathoms. Some live in quiet waters along the bottoms of protected bays, inlets, and sounds while others prefer sandy beaches on the open coast. Clams are usually buried in the bottom from just under the bottom surface to depths of over 4 feet, depending on the species. Atlantic clams range along coastlines of New England, the Middle Atlantic States, Chesapeake Bay, and some are found along South Atlantic shores. Pacific clams are found all along the coast with the largest commercial production in Washington.

HARVESTING CLAMS

Commercial harvesting of clams employs approximately 11,700 persons. These fishermen utilize around 346 vessels of 5 net tons or more and about 5,600 boats. Many of the boats or vessels are equipped with electronic depth recorders and hydraulic escalator dredges which are pushed along the bottom. The clams are loosened from the bottom with a high-pressure water spray, scooped onto a chain-mesh belt, carried up to the boat, and sorted by the crew. Commercially sized clams are retained, all debris and small clams fall back into the water. Fishing is restricted to certain areas and most dredges have a daily quota. Clam dredges are not used as extensively for commercial purposes on the Pacific coast as they are on the Atlantic coast. Other methods of taking clams include tongs, rakes, forks, shovels, or by hand.

CONSERVATION AND MANAGEMENT

Many factors, some beyond man's control, affect the abundance of clams. However, it is well known that pesticides; pollutants such as fuel oil, gasoline, and other liquid petroleum products; and the dumping of industrial wastes can and do destroy or otherwise damage this valuable resource. In most States special fishery agencies have been established to enforce laws and protect supplies of fishery products. The Bureau of Commercial Fisheries is making extensive studies of the occurrence and effects of pesticides and pollutants on shellfish.

Recent advances in techniques at the Bureau of Commercial Fisheries Laboratory in Milford, Connecticut, show that commercial propagation of clams may soon be feasible as well as profitable. The Washington State Laboratories at Brinnon, Washington have also done considerable study in the cultivation of clams. Within the next few years clam farming may be a new and profitable venture.

USES OF CLAMS

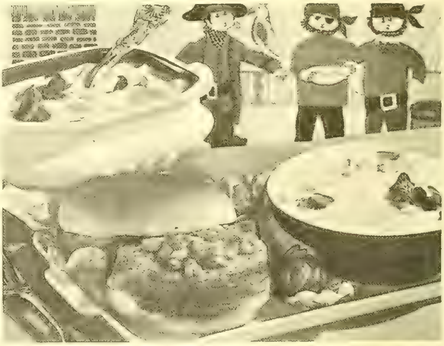
Clams, one of our most delicious shellfish, are high in protein, contain some calcium and iron, and have no fat. Fresh clams may be purchased alive in the shell; shucked; or shucked and quick frozen. Live clams in the shell should be tightly closed. Canned whole shucked meats; minced meats; bottled clam juice; and many frozen clam specialties are also available. Clams may be used in a variety of ways including a clambake; steamed-in-the-shell; broiled-on-the-half-shell; in chowders, fritters, sauces, dips, salads, or canapes; fried; or combined with other foods. (Source: National Marketing Services Office, BCF, U.S. Department of the Interior, 100 East Ohio Street, Rm. 526, Chicago, Illinois 60611.)

SOUPS AND SANDWICHES BEGIN WITH SEAFOODS

Here's a meal that was made for flavorful family enjoyment. Serve Saucy Sandwiches and Savory Chowder, and watch everyone from Junior to Grandpa dig in. You won't need to be a French chef to set this combination aglow with goodness; it sells itself with built-in helpings of heartiness.

Seafood is a favorite of the younger set, and they will quickly tackle this Saucy Sandwich, made with inspected fish portions. Its crisp fresh freshness is topped tantalizingly with an easy-to-do combination of cheese, chili sauce, mustard, and horseradish that will set taste buds a-tingling. Its familiar wholesomeness will appeal to the youngsters, who want plenty of good food without frills and who usually want it in a hurry. Be at your alert best with this high-protein sandwich.

Complete the meal with Savory Chowder. Your family's appetite will rise to the occasion when you place a steaming pot of chowder on the table. It is highly nutritious, based on tender minced clams, with bits of bacon, onion, celery, potatoes, carrots, and butter included to help balance the daily diet.



You won't need a dinner bell to call a hungry crew to this meal. Junior will even leave the television before the end of the program to get his share of this tasty duo. Who could blame him if he forgets to comb his hair? His thoughts are already seated at the table. Dad's newspaper will stop rustling the minute chowder flavors drift past his nose.

So break out the ingredients for these tasty sea treats, and you will soon be queen of a crowded kitchen.

SAVORY CHOWDER

3 cans ($7\frac{1}{2}$ or 8 ounces each) minced clams	1 cup clam liquor
3 cups milk	1 cup diced potatoes
$\frac{1}{2}$ cup crushed saltines	$\frac{1}{2}$ cup sliced carrots
$\frac{1}{4}$ cup chopped bacon	1 small bay leaf
$\frac{1}{2}$ cup chopped onion	2 tablespoon butter or margarine
$\frac{1}{4}$ cup chopped celery	Chopped parsley

Drain clams and reserve liquor. Combine milk and saltines. Fry bacon until crisp. Add onion and celery and cook until tender. Add clam liquor, potatoes, carrots, and bay leaf. Cover and simmer for 15 to 20 minutes or until vegetables are tender. Add butter, milk mixture, and clams. Heat. Sprinkle with parsley. Makes 6 servings.

SAUCY SANDWICH

$1\frac{1}{2}$ pounds frozen, raw, breaded fish portions	1 tablespoon prepared mustard
1 cup grated cheese	2 teaspoons horseradish
2 tablespoons chili sauce	6 hamburger rolls

Place frozen portions in a single layer in a frying basket. Fry in deep fat, 350° F., for 4 to 6 minutes or until brown. Drain on absorbent paper. Combine cheese, chili sauce, mustard, and horseradish. Split rolls and toast. Place the bottom half of the rolls on a cookie sheet, 15 x 12 inches. Place a fish portion on each half. Spread one tablespoon cheese mixture over each portion. Broil about 3 inches from source of heat, 2 to 3 minutes or until cheese melts. Top with second half of roll. Serves 6.

The latest methods for purchasing, handling, storing, and preparing fish are included in the new, 60-page, complete guide to fish cookery, "Let's Cook Fish." This valuable, full-color reference and recipe book is available by sending 60¢ to the Superintendent of Documents, Washington, D.C. 20240.

JAPANESE KNOW-HOW BENEFITS U. S. FISHERMEN

Food product research conducted during the past year by scientists of the BCF Technology Laboratory, Seattle, Wash., and a Japanese scientist from the Tokai Research Laboratory, Tokyo, has opened possibilities of using for food many abundant and unutilized species present in U.S. coastal waters.

The cooperative study developed from the interest of scientists at the Seattle laboratory in processing techniques used by the Japanese fishing industry. And the Japanese scientists were very interested in studying the little-used species off U.S. Pacific coast for possible import by Japanese industry. So a leading Japanese biochemist, Dr. Minoru Okada, visited the Seattle laboratory for 10 months to study the suitability of various Pacific coast fish for manufacture into food items popular in Japan. These products are fish sausage, fried fish cakes, and kamaboko--a sort of steamed fish pudding or cake.

All Edible Flesh Used

An attractive aspect of these Japanese processed foods is that all of the edible flesh from several species--including pollock, hake, rockfish, shark, and even dogfish--can be used. The flesh is ground, washed, and modified during processing to form a food that no longer resembles fish. In some cases, the resulting pudding or fish cake can be flavored and modified to taste like anything from cheese to spiced meat. Once the Seattle scientists learned techniques of changing texture as well as flavor, they were able to produce a variety of products ranging from cocktail-type spreads of different flavors to the firm elastic-gel product known as kamaboko.

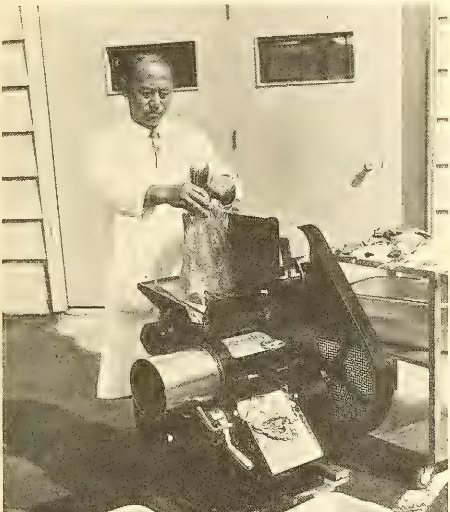


Fig. 1 - This Japanese machine separates fish flesh from skin and bones. It was put to use recently by scientists at the BCF Fisheries Technology Laboratory in Seattle, Washington. The machine was used during cooperative U.S.-Japan studies on increased use of latent Northeast Pacific fishery resources. BCF scientists believe the potential for mechanizing the process of flesh separation and recovery could lead to a new concept in fish utilization and processing in the U.S.

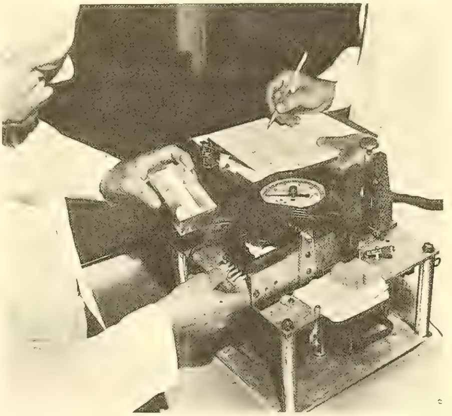
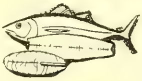


Fig. 2 - Technologists at the BCF Technology Laboratory in Seattle, Washington, test the textures of new products made from ground fish. Scientists can modify texture over a wide range and simulate that found in wieners, sausages, hard cheeses, and spreads. The lab designed this shear-texture instrument to produce the cutting and pressure action of the teeth in chewing various foods. The instrument registers hydraulically the jaw pressure on the dial as test samples are cut by the machine teeth.

A valuable offshoot of the cooperative research has been the opportunity for U.S. scientists to learn techniques and equipment used by the Japanese to recover separate fish flesh from skin and bones. Conventional filleting techniques used to remove meat from rockfish will yield about one-third the original fish weight. With one Japanese flesh-separating machine being tested by the laboratory, over half the weight of the whole fish can be recovered as edible flesh for processing. The laboratory staff says the economics of this increased yield and the potential for mechanizing the whole process of flesh separation and recovery can lead to a new concept in fish utilization and processing in the U.S.

What's Ahead

Much research still is needed to determine how fish should be handled, but the door has been opened to new areas of fish utilization. Dr. Okada has returned home, but the Seattle lab now has a full-time research team using the new knowledge. As the BCF scientists see it, the real future is using the new technology to exploit long-neglected species to produce processed fish foods and snack-type, high-protein items that will benefit the U.S. fisherman and consumer. (Source: National Marketing Services Office, BCF, U. S. Department of the Interior, 100 East Ohio Street, Rm. 526, Chicago, Illinois 60611.)



SEAFOOD STORAGE AND THAWING

Whether they are cooked within hours of being caught or prepared later for a family man, fish taste better when properly handled, say the seafood marketing experts of the Texas Parks and Wildlife Department.

If fish are to be stored between hooking and cooking, it must be remembered that they are perishable and should be protected against bacteria which can lead to spoilage.

Before storing fish, wash them in cold running water and then wrap in a moisture-proof, vapor-proof paper, or place in an airtight, rigid container. Fish should always be stored in the coldest part of the refrigerator since a storage temperature of 35° to 40° F. is needed to maintain the quality of the fish product. Do not hold fresh fish in the refrigerator longer than a day or two before cooking.

Commercially packaged frozen fish should remain in the unopened package and stored in a freezer which maintains 0° F. When fish is to be frozen, it should be wrapped in heavy freezer paper or placed in freezer containers. Wax paper or thin polyethylene materials are not moisture or vapor-proof and will not properly preserve the quality of the fish during freezing. When fish thaws, it should be cooked immediately. Never refreeze fish!

Freezer storage is a convenient way to keep fish; however, storage time should be limited in order to enjoy optimum flavor of the frozen fish. It is a good practice to date the packages as they are put in the freezer, and they should not be kept frozen for more than six months.

Frozen fish should be thawed in the refrigerator at 37° to 40° F. The fish should be held at this temperature only long enough to permit ease in preparation. It takes about 24 hours to thaw a one-pound package in this manner. If a quicker method is preferred, the fish, still wrapped in the moisture-proof, vapor-proof wrapping, may be held under cold running water until thawed.

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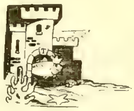

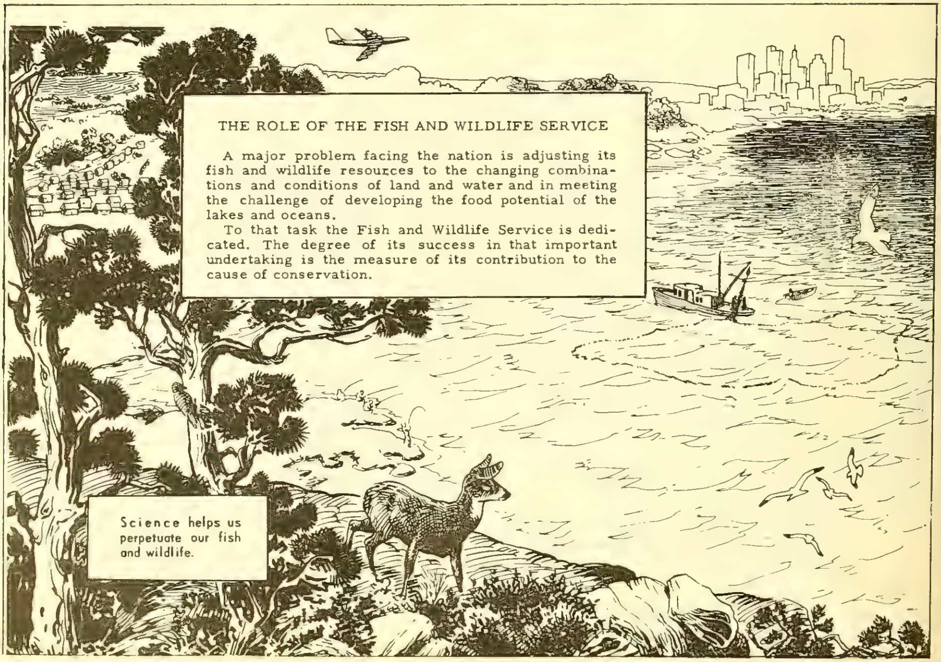

UNITED STATES DEPARTMENT OF THE INTERIOR
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Charles H. Meacham, *Commissioner*, U.S. FISH AND WILDLIFE SERVICE
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As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States -- now and in the future.

BACK COVER: Home of Cordova, Alaska, fishing fleet. (Photo: J. M. Olson)

COMMERCIAL FISHERIES Review

VOL. 32, NO. 5 MAY 1970

COVER: 'Perry Cubmarine' on 1969 scallop survey off Cape Kennedy, Florida. (L. May)

COMMERCIAL FISHERIES

Review

A comprehensive view of United States and foreign fishing industries--including catch, processing, marketing, research, and legislation--prepared by the Bureau of Commercial Fisheries.

FISHERMEN'S MEMORIAL--GLOUCESTER, MASS.

Managing Editor: Edward Edelsberg

Production: Jean Zalevsky
Alma Greene

The Bureau of Commercial Fisheries and The Bureau of Sport Fisheries and Wildlife make up The Fish and Wildlife Service of The United States Department of the Interior.

Throughout this book, the initials BCF stand for the Bureau of Commercial Fisheries.

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CONTENTS

Unloading catch aboard BCF's 'Albatross IV'. (R. K. Brigham)

FORECAST GROUNDFISH ABUNDANCE ON NEW ENGLAND BANKS

The abundance levels of groundfish species fished by New England fishermen are expected to show patterns of change in 1970, reports Russell T. Norris, Director of BCF's North Atlantic Region.

- Haddock and whiting are expected to continue at low levels of abundance.

- Cod, ocean perch, and industrial fish species are expected to equal or exceed 1969 levels.

- The yellowtail flounder has been at high level, but there are signs of somewhat lower abundance in the next years.

Information by BCF Biologists

These forecasts were based on information provided by biologists of BCF's Woods Hole (Mass.) Laboratory. They normally monitor landings by commercial fishermen. They also study populations of fish and shellfish on offshore banks by samples taken by BCF's 'Albatross IV.'

Georges & Browns Bank Haddock

The vessel's annual fall groundfish survey showed 1969 year-class of haddock was poor on Georges Bank. It was the sixth continuous year of very low indexes. As a result, low abundance was expected to continue for at least three years.

On Browns Bank, the survey showed abundance of 1969 year-class haddock had improved over previous years. Because of previous poor year-classes, however, abundance was expected to decrease for the next three to four years.

ICNAF Conservation Measures

As conservation measures for haddock on Georges and Browns Banks, the International Commission for the Northwest Atlantic Fisheries (ICNAF) has instituted catch quotas and closed seasons. It is hoped these measures will aid recovery of depleted haddock stocks off New England.

GEORGES BANK HADDOCK SPAWNING IS WATCHED CLOSELY

The success of haddock spawning on Georges Bank and Browns Bank again is being followed carefully by biologists of the BCF Woods Hole Biological Laboratory and Canadian Biological Station, St. Andrews, New Brunswick.

The Georges Bank area is of particular interest this season. It used to be the primary producer of haddock, but now the population is at an all-time low. Haddock born in 1963 and age seven in 1970 are still the mainstay of the Georges Bank fishery. Haddock-spawning studies underway at the Boston Fish Pier and aboard research vessels surveying the fishing banks could provide earliest evidence of the emergence of a large year-class.

General Conclusions

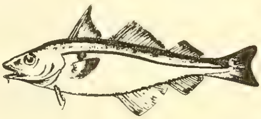
By frequent examination of samples of haddock gonads, it has been possible to monitor the progress of spawning--and to draw these general conclusions about the duration of the spawning season on Georges Bank:

1. The largest haddock spawn first, usually in shoal water on top of the banks, both inshore and offshore.

2. Prior to onset of spawning, ripening haddock of all sizes are found in deep waters along Northern Edge of Georges Bank and in South Channel. The maturity of fish from deep water usually is one or two stages behind those from the shoals.

3. Ripening of fish and their movement from deep water seem associated with seasonal warming of bottom waters. However, this does not explain the early spawning of large haddock on the shoals.

4. The number of immature haddock in the samples has decreased steadily since sampling began in 1968. Less than 2% of fish sampled through March 1970 have been immature.



BCF LOOKS FOR BLUEFIN TUNA

"Bluefin tuna are great travelers," confides BCF La Jolla, Calif. Fish tagged and released in the California fishery have been recaptured several years later off Japan. During late spring, the bluefin visit the waters off southern Baja California. In 1969, U.S. fishermen caught 7,500 tons of the highly prized fish.

Waiting for the bluefin this year as they approached the coast were oceanographers and fishery biologists of the BCF La Jolla laboratory and the Scripps Tuna Oceanography Research program (STOR). They had left San Diego on April 13 aboard BCF's 'David Starr Jordan', led by Dr. Maurice Blackburn of STOR, on a 21-day, 4,100-mile cruise. Its purpose, explained Dr. Alan R. Longhurst, director of BCF La Jolla, was to give the tuna industry up-to-date information on the oceanographic mechanisms that determine routes of bluefin tuna into the coastal region--hence, the location the fishery would open in 1970.

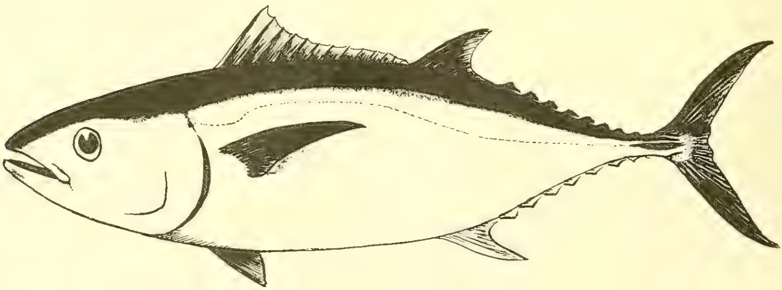
Equipment Used

Ninety percent of bluefin tuna are caught in 62°-70° F. water, beginning in late May each year. Almost nothing else is known about their environmental preferences.

The scientists hoped to locate offshore bluefin by longlining, basing the fishing tracks on the long-term mean position of the 62° and 70° isotherms. They were using a battery of oceanographic, biological, and meteorological instruments to measure the ocean environment--and to attempt to relate findings to tuna fishery.

Early Information Important

The information on bluefin distribution weeks before they normally reach Baja California has immediate practical value to U.S. tuna fishermen. These fishermen were looking for alternate resources because the yellowfin tuna quota had been filled for 1970. Locations of any bluefin catches would be radioed to La Jolla by the David Starr Jordan. The information would be passed on to southern California tuna fishermen.



AMERICANS EAT MILLION POUNDS OF SHRIMP A DAY

In 1968 and 1969, Americans ate a million pounds of shrimp a day. In 1969, consumption of shrimp in all forms was 361.6 million pounds, heads-off weight. This was a drop of 1.3% from 1968's record 366.2 million pounds. Nevertheless, shrimp remained unchallenged as the most popular shellfish.

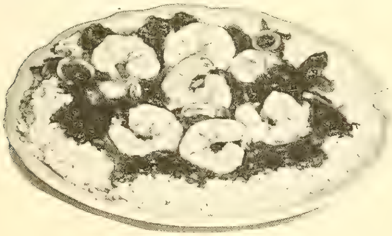
On a per-capita basis, Americans are eating about twice as much shrimp as they did in years immediately following World War II.

Reasons for Growth

BCF economists say no single answer explains why Americans are eating more shrimp. Contributing factors have been rising purchasing power, growing popularity of shrimp, new products, wider distribution, improved quality, and more promotion.

U.S. Shrimp Industry

The U.S. shrimp industry is located primarily in the Gulf and South Atlantic States. Additional supplies come from New England, Pacific Coast, and Alaska. The U.S. also imports large quantities. In recent years, Latin American and Asian countries have supplied larger quantities.



BROWN SHRIMP REARED IN ARTIFICIAL MEDIA

Techniques for rearing larval penaeid shrimp that were developed at the BCF Biological Laboratory, Galveston, Texas, continue to pay dividends. In a recent experiment, about 250,000 brown shrimp were reared to postlarvae from eggs spawned in the laboratory. Survival rates of up to 84% were observed as the young shrimp developed from the naupliar to the postlarval stage.

Maintained in 250-gallon tanks, one batch of shrimp was cultured in a completely defined medium consisting of distilled water with an artificial sea salt added. This technique interests scientists working with larval shrimp nutrition because of the possibility that the larvae may absorb organic molecules directly from the water. It also provides a method of culturing shrimp larvae that can be duplicated at any laboratory--and is not dependent upon unknown characteristics of the water.

Greater Densities Obtained

Cultures of the diatom Skeletonema, used as food for the larval shrimp, were maintained in tap water and the artificial sea salt. Densities of 8,000,000-10,000,000 cells per milliliter of water were obtained. Previously, maximum densities were 300,000-500,000 cells per milliliter in natural sea water. The variable chemical nature of the sea water used previously made it difficult to obtain optimum concentrations of the nutrients utilized by the diatoms.

Of all postlarval shrimp harvested, about 100,000 were supplied to five organizations involved in research on shrimp mariculture.

HAWAII'S COMMERCIAL FISH LANDINGS DROP BUT VALUE RISES

Commercial landings of fish and shellfish in Hawaii during the 1968-69 fiscal period totaled 11,096,116 pounds worth $3,378,553 to the fishermen--a decrease of 1,733,210 pounds, or 13.5%, from previous year. However, generally better prices prevailed, so exvessel value rose $124,931 (3.8%).

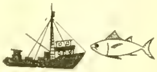
Ups & Downs

The lower total harvest was due largely to decreased landings of aku (Katsuwonus pelamis). These dropped 1,453,033 pounds, or 16.1%. Other important fisheries fell too: yellowfin tuna (Neothunnus macropterus) by 108,262 pounds (23.3%), akule (Trachurops crumenophthalmus) 215,826 pounds (20.8%), and striped marlin (Makaira audax) 172,572 pounds (35%).

Fisheries that increased were: bigeye tuna (Parathunnus sibi) by 95,552 pounds (19.5%), and opelu (Decapterus pinnulatus) by 53,811 pounds (27.7%).

Oahu Led

Oahu led the islands in landings with 9,027,407 pounds, or 81.4% of total State landings, followed by Hawaii, 897,134 pounds (8.1%), Maui with 847,269 pounds (7.6%), Kauai 282,830 pounds (2.5%), and Lanai and Molokai combined, 41,476 pounds, 0.4%.



PRAWN CULTURE IN HAWAII PROGRESSES

The development of techniques to mass-rear the giant, long-legged, fresh-water prawn (shrimp), 'Macrobrachium rosenbergi', continued in Hawaii during July 1968-June 1969. This was reported to Governor Burns by the Department of Land and Natural Resources.

During that year, 700,000 juvenile prawns were produced--500,000 more than in the previous year. The planners believe this "demonstrates that sufficient numbers of young prawns can be propagated to supply commercial prawn farmers." They are concentrating now on reducing production costs from $6.47 per thousand to about $2.

Fishpond Owners Cooperate

The number of privately owned fishponds cooperating with the Division of Fish and Game to test-rear young juveniles to market size rose from 2 to 9. The ponds are $\frac{1}{4}$ to 6 acres; combined surface area is about 10 acres. About 207,000 juvenile prawns were stocked. The use of supplemental feed improved growth rate of pond-raised prawns. It used to take 2 years to raise a prawn from egg to market size; now, just over 1 year.

Wild Stocks

In continuing attempts to establish wild stocks, 128,000 prawns were released into streams throughout Hawaii.

DR. GLASGOW URGES ADOPTION OF EFFECTIVE FISH DISEASE CONTROL PROGRAM

Dr. Leslie L. Glasgow, Assistant Secretary, Fish and Wildlife, Parks, and Marine Resources, U.S. Department of the Interior, testified before the Energy, Natural Resources, and Environment Subcommittee of the Senate Commerce Committee, March 13, on the need for a fish disease control program.

Dr. Glasgow said:

Efforts to control fish diseases in this country were begun a century ago by Spencer Fullerton Baird, the first Commissioner of the U.S. Commission of Fish and Fisheries. In 1898, the Commission requested Congress to authorize a full time fish pathologist. In 1915 the position was authorized and the study of fish diseases has been an important function ever since. The Bureau of Sport Fisheries and Wildlife in 1968 expended 380,000 dollars on fish disease research and 120,000 dollars on fish disease control in national fish hatcheries. Yet these are minuscule amounts in relation to the total values of our fish resources.

Value of Hatchery & Pond Fish

In 1966 alone, the Pacific salmon and steelhead trout caught by commercial and sport fishermen were valued at 28.5 million dollars. At least 55% of the salmon and steelhead catch originated in either a State or Federal fish hatchery. Commercial hatcheries in 1968 produced 18 to 20 million pounds of trout valued at 11 million dollars. In the South Central States fish farmers produced 40 million pounds of channel catfish valued at 12 million dollars, and 40 to 50 million pounds of bait minnows valued at 50 million dollars are produced annually. The stocking programs carried out by State and Federal fish hatcheries provide one third of the sport fishing in the United States and result in 943 million dollars being spent for recreation with a total contribution of 3.9 billion dollars to the gross national product of the United States.

Fish Resources Threatened

As the industry continues to grow, the lack of attention to matters of fish health on both the state and national level brings us to the point where our fish resources are threatened by uncontrolled diseases.

There are a number of serious fish diseases, some of which are causing losses in the United States, and at least two diseases, currently rampant in Europe, that have not been introduced into North America. These diseases include whirling disease, infectious pancreatic necrosis, viral hemorrhagic septicemia, corynebacterial kidney disease, infectious hematopoietic necrosis, virus disease of channel catfish, Ceratomyza infection of salmonids, Minchinia infection of oysters, microcell disease of mollusks, molluscan neoplasm disease and French mycelial disease of oysters.

Whirling Disease Closes Hatcheries

Whirling disease has had a serious impact wherever it has occurred. Authorities in Pennsylvania report that this disease caused the closing of five commercial trout hatcheries which had a combined production worth over 250,000 dollars wholesale. The hatcheries were forced to close because the disease had infested the ponds to the point where, without expensive rehabilitation, they were useless for further production of trout.

In New Jersey, whirling disease had been a problem since July 1967. Brook trout production at a major State installation was reduced by 40 percent and expensive changes in hatchery operations were required.

The recent confirmation of whirling disease in the State of Michigan caused the Department of Natural Resources to impose on August 30, 1968, a quarantine on all fish-rearing firms in the State. Investigations are still in progress and there is concern that the disease might spread to the highly popular coho salmon in the Great Lakes.

Even closer to home, whirling disease was found at the Lahontan National Fish Hatchery in November 1969. We will have to destroy three quarters of a million cutthroat trout. In addition, we have lost 12,000 cutthroat broodstock. It took us ten years to develop this broodstock. The Lehontan cutthroat trout is considered an endangered species by the International Union for Conservation of Nature and we regret having to take such drastic measures with an endangered species.

Infectious Pancreatic Necrosis

The Bureau of Sport Fisheries and Wildlife has records of outbreaks of infectious pancreatic necrosis from at least 23 States, several Provinces of Canada, and from France and Denmark. The disease directly affects the output of commercial, State and Federal fish hatcheries whenever it occurs. Following an outbreak, facilities must be disinfected and the fish must be replaced. If the fish are replaced with eggs, a delay of several months in the production program is encountered. This is a great setback, particularly for the small commercial producer. Egg producers are especially hardhit when IPN occurs since, in most cases, valuable broodstocks must be destroyed and a loss of consumer confidence often results.

Interior's Authority Fragmentary

The existing authority of the Secretary of the Interior to control fish diseases is fragmentary.

The Lacey Act of 1900 gives the Secretary the authority to regulate the importation of fish and wildlife to protect the resources of the United States.

Under the Lacey Act, Title 50, CFR, Part 13.7 was revised on December 21, 1967, to prevent the introduction of two fish diseases into this country.

The Black Bass Act of 1926, as recently amended in 1969, prohibits importation or transportation in interstate or foreign commerce of fish in violation of foreign, State, or other law.

The 1934 Fish and Wildlife Coordination Act, as amended in August 1958, authorizes the Secretary to provide assistance to and cooperate with Federal, State, and public and private agencies and organizations in the development, protection, rearing and stocking of all wildlife resources and in controlling losses from disease.

The Act of March 15, 1958 (16 U.S.C. 778-778c) authorized the Secretary of the Interior to establish fish farming experimental stations to conduct research on methods of fish farming including the control of fish diseases. Two such stations have been established in the Bureau of Sport Fisheries and Wildlife.

The Act of September 2, 1960 (16 U.S.C. 753a-753b) authorized the Secretary of the Interior to enter into cooperative agreements with colleges and universities, with State game and fish departments, and with non-profit organizations, relative to the establishment of research and training programs for fish resources. There are 23 cooperative fishery units operated by the Bureau of Sport Fisheries and Wildlife.

The Act of August 9, 1962 (16 U.S.C. 760j-760l) authorized the Secretary of the Interior to assist the States in developing disease resistant oysters. The Bureau of Commercial Fisheries now operates this and other disease control programs under PL 88-309. Under the disaster clause of this law, the State of Michigan received 65,000 dollars to control whirling disease, but a similar request by the State of California for 400,000 dollars to control a virus and a parasite disease at a State hatchery was denied because of a shortage of funds.

Senate Bill Useful

None of the above Acts was specifically intended to promote the control of fish diseases, and all of these collectively are still inadequate. S. 1151 includes in one piece of legislation the authority to set up and operate an effective fish disease control program.

The bill authorizes the Secretary of the Interior to:

(1) Control the interstate traffic of diseased fish.

(2) Inspect premises and conveyances.

(3) Compensate the owner for fish which must be destroyed.

The bill also instructs the Secretary to prepare regulations to:

(1) Control the traffic of diseased fish.

(2) Set up methods whereby fish diseases can be eradicated.

Under such authority I believe that the menaces of fish diseases can be effectively reduced and finally eliminated. We urge early enactment of this legislation.

HICKEL PLEDGES LAKE ERIE CLEAN-UP

Secretary Walter J. Hickel announced on April 21 that Interior Department was initiating a campaign to clean up Lake Erie. This followed reports of lethal discharges of mercury into the lake--and into the Detroit River, which empties into Lake Erie.

He said he was distressed by the economic losses and possible health hazards to residents of Lake Erie area by mercury contamination of fish.

Secretary Hickel moved on these fronts:

• An enforcement conference on Lake Erie will be reconvened in Detroit. It will be followed by enforcement workshops in Toledo, Cleveland, Lorain, Dandusky, and Ashtabula, Ohio; Erie, Pennsylvania; and Lackawanna, New York.

• Increased monitoring and research will begin on the toxicity of mercury and other metal compounds, and their effect on fish and other aquatic life. The work will be done by BCF Ann Arbor, Michigan.

• The Federal Water Quality Administration (formerly Federal Water Pollution Control Adm.) has been directed to identify and list all toxic substances being discharged into U.S. waters.

CONFERENCE ON ENVIRONMENTAL POLLUTION SCHEDULED

The Department of the Interior will sponsor a 4-day conference and exposition on environmental pollution at the Sheraton Park Hotel in Washington, D.C., Sept. 29-Oct. 2.

Secretary Walter J. Hickel said the conference was being called in response to President Nixon's call for "a total mobilization" to clean up the environment.

More than 3,000 leaders from industry, government, national organizations, and universities are expected to participate.

Hickel's Statement

Secretary Hickel said: "In his message to the Congress on the environment on February 10, President Nixon said that the task of cleaning up our environment calls for a total mobilization of all of us--involving governments at every level and requiring the help of every citizen.

"We hope to make this conference a productive answer to the search for new and more efficient methods, approaches, and techniques for winning the battle for a better national environment.

"Our purpose is not only to focus national attention on the threat to our environment but to help muster a nationwide effort in corrective actions to improve it."

Exhibits

At the concurrent national exposition, the participating groups will be invited to display pollution abatement equipment, techniques, and services.

MAN COMPETES WITH OTTER FOR ABALONE

Wallace Turner

(This article appeared in The New York Times May 10.)

In San Francisco, a waterfront diner raises a bite of the succulent, delicately flavored shellfish to his mouth and chews dreamily as he gazes out at the boats bobbing in the swells.

A hundred miles or so to the south, a sea otter slumps comfortably on his back as he rides the swells of the open sea and with quick, tiny bites rips through the rubbery flesh of the same kind of shellfish.

They are competing, the sea otter and the gourmet, for a dwindling population of abalone, a prized shellfish that grows amid the kelp beds on the rocky sea floor along the central California coast.

To the competitors themselves, the abalone simply means choice food. But both sides have allies in the turbulent world of conservationist and economic pressures, and to them serious issues are at stake.

Seek Thinning of Herd

Working for the gourmet are the divers who walk the sea floor in search of the abalone and the processors who slice the meat and pound it for tenderizing. They have sought legislation to permit the thinning of the otter herd as a means of protecting the abalone fishery.

And speaking for the small furry sea animals is Margaret Owings, president of Friends of the Sea Otter, a group demanding that nothing be allowed to interefere with the natural growth of the otter population.

Mrs. Owings, the wife of Nathaniel A. Owings, the architect, directs her campaign from Wild Bird, one of the nation's most stunning homes, designed by her husband and built on a point hundreds of feet above the surf of Big Sur.

From her balcony she can see a crescent of sand that is a sunning place for a herd of sea lions and a kelp bed that is home for a half-dozen sea otter. Gray whales pass sometimes just outside the kelp.

'Man and Wildlife'

"We're not just dealing with otter," Mrs. Owings said in a recent interview. "We're dealing with the whole question of man and wildlife. If we lose this one, we've lost a foothold on future attempts to preserve a rare species."

Far to the north, a larger band of sea otter wanders around Amchitka Island in the fog, cold and gloom of the outer Aleutian chain. It feeds heavily on sea urchins, who have no friends.

The smaller herd to the south, regenerated from a few individuals that escaped the fur hunters of the 18th and 19th centuries, now number about 1,500 between Morro Bay and Monterey.

They are increasing at the rate of 4 to 6 per cent a year, and they are gobbling up the abalone. Mrs. Owings argues that a part of the decrease in abalone comes from overharvesting by divers, but she agrees that "we know perfectly well that the otter like abalone."

The divers who go down in bulky suits, trailing yards and yards of rubber hose, to pry the abalone from the rocks have great respect for their rivals' fishing skill.

'Don't Waste Any Time'

"I remember the first time I saw an otter break an abalone with a rock," said Ernest Porter, who has been diving for about 20 years. "They don't waste any time with it. They get a rock, and just like a carpenter nailing a board, they know what to do with it."

The Pacific coast abalone grow large enough for their edible portions to weigh as much as five or six pounds. But the seven-and-three-quarters inch size that may be harvested commercially usually produces about two to two-and-a-half pounds.

"Of course the sea otter doesn't understand about the limits," said Dr. H. G. Orcutt, laboratory supervisor for the California Fish and Game Department. "He eats any abalone he can get."

The abalone has an oval shell top and travels on a snail-like "foot" that holds it to rocks, along which it moves, slowly feeding on the leaves that fall from the kelp.

While divers must use a steel bar to pry it free, the sea otter simply takes a rock and breaks the shell so that the abalone loses its grip and can be carried to the surface and eaten.

Hunt Other Shellfish

The otter also hunt other shellfish. They break clams open by banging them together until they crack, and they handle a dungeness crab by holding one pinching claw while eating the other, then eating the one that was held, and then ripping off the bottom shell to clean out the crab's insides.

The otter live in a cold sea. They lack the fat layer that protects the sea lion, harbor seal or whale, but they have a thick fur that they constantly preen to prevent heat loss.

And they eat. A sea otter will consume his weight of 45 to 75 pounds in shellfish in three or four days. After a complex calculation, and allowing a wide margin for variables, Mr. Odemar, the fish and game biologist, estimated that one herd of 97 otter in one year ate between 627,800 and 1.15 million pounds of abalone.

There is no question that the supply of abalone is disappearing. The divers maintain that abalone disappear wherever the otter population is found as it moves slowly southward from the fastnesses of the rugged coast along Big Sur. In 1957 divers limited themselves to 50 dozen each a day; now getting five dozen abalone is a struggle.

The divers work in water 20 to 70 feet deep, in a cold that after a couple of hours penetrates their black rubber suits, the lining and their bones so that they must go topside and warm up.

Water Rough All Year

The water here is rough the year around.

"Sometimes a surge in the waves will throw you 60 feet and up against the rocks," said Duane Brown, 35 years old, who five years ago left a dough mixing job in a Phoenix, Ariz., bakery to be an abalone diver.

He worked for eight hours that day to have about three hours on the sea bottom, and he brought back about $41 worth of abalone. He dived alone, too, which means that any serious accident would have been fatal.

Charles Sites, who operates an abalone processing plant, pays $18 a dozen for abalone. He said there were no more than 10 abalone boats, with about 20 divers, working out of Morro Bay now. In 1960 there were more than 50 boats.

"The otter have moved south and they just clean up the abalone," he said. The diving now centers near Santa Barbara, but divers here maintain that the otter will spread there and wipe out the marketable shellfish.

Abalone Sure to Survive

Biologists for the State Fish and Game Department say that the abalone species will not be wiped out, for they spread too many eggs for that. But they agree that a commercial fishery cannot exist alongside an unlimited herd of sea otter, who eat the abalone before they reach marketable size.

State Senator Donald L. Grunsky, who represents this area at Sacramento, introduced a bill this year that would have allowed state biologists to capture and try to move the otters to keep population down.

After hearings at which Mrs. Owings and other friends of the otter testified, he asked that his bill be turned into a study proposal, which means the end of it for now.

Charles Sites' wife spoke in good humor of "our group that we called Friends of the Abalone."

"We had a little money and opened a checking account, and a while back we wrote a check for $10 and it bounced," she said. "We'd forgotten about the service charges."

RENOWNED SCOTTISH MARINE BIOLOGIST VISITS BCF OXFORD LAB

Dr. C. Maurice Yonge, a world leader in marine biology, toured BCF's Biological Laboratory at Oxford (Md.) on April 13 and presented an informal seminar.

Dr. Yonge holds the Regius Chair of Zoology at the University of Glasgow, Scotland. He is president of the Scottish Marine Biological Association. He received his doctorate from the University of Edinburgh in 1922 for original studies of food and feeding in 'Mya arenaria'--the U.S. common soft-shell clam, or mannose.

His research career began at the Plymouth, England, marine biological lab where he studied metabolism in the European oyster.

In the late 1920s, he led an expedition to Australia's Great Barrier Reef. It resulted in significant contributions to marine science and the founding of the Heron Island lab for continuing reef studies. He has worked at marine stations all over the world.

Classics of Marine Biology

Dr. Yonge's two most famous books, "The Oyster" and "The Sea Shore," are classics. The results of his research have influenced the direction of modern invertebrate biology. He is now interested in the relationship between the shape or anatomy of marine bivalves (oysters, clams, mussels) and their ability to adapt to the environment.

Oxford Seminar

His seminar at Oxford reviewed the world status of molluscan culture, or sea-farming. He related the development of aquaculture to biological events. He used personal observations from more than 20 visits to the U.S. and Canada as examples of dynamic changes in the shellfisheries.

James B. Engle, Chief, Shellfish Advisory Service (left), Dr. C. Maurice Yonge (center), and Arthur S. Merrill, Laboratory Director, BCF Biological Laboratory, Oxford (right).

This was Dr. Yonge's first visit to the Eastern Shore and he was impressed by its natural beauty and by the ever-present artifacts of the Bay fisheries. He was fascinated by the similarities between small U.S. villages, such as Oxford, and coastal villages in England.

Dr. Yonge lauded the European oyster as "the best in the world"--but he admitted the possibility that the U.S. oyster might be second best!

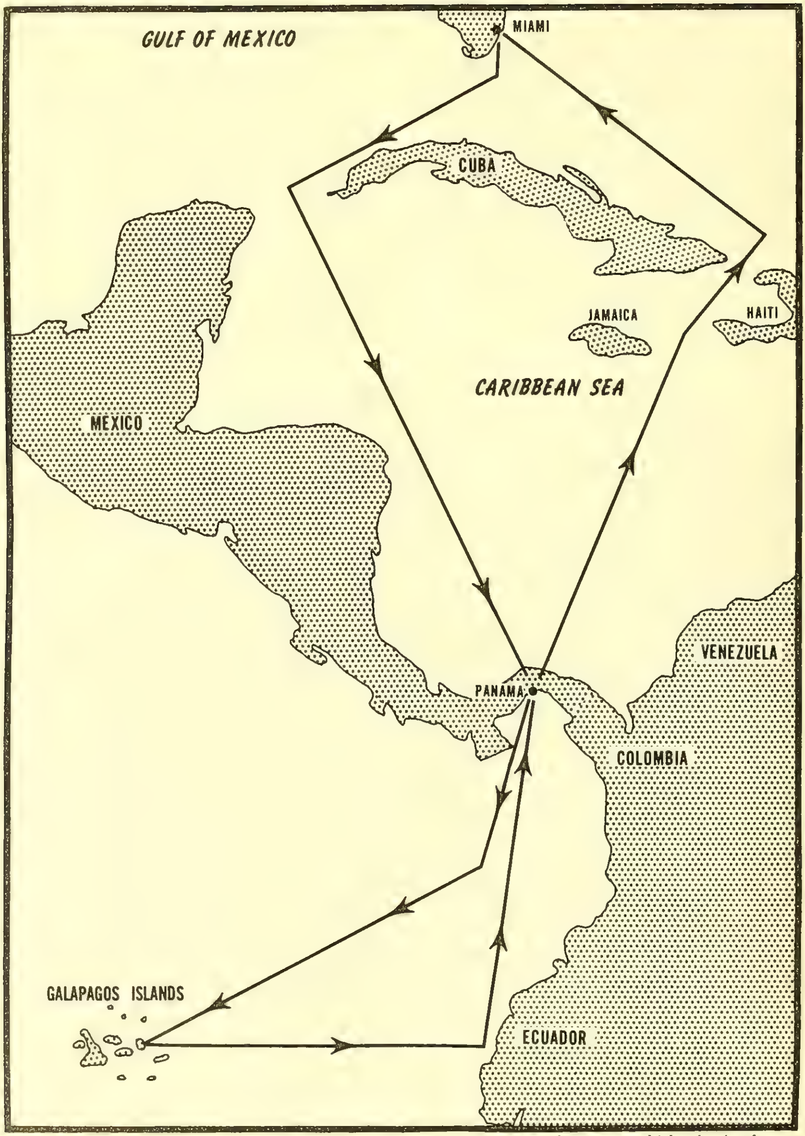
JAPANESE SHELLFISH AQUACULTURE AUTHORITY VISITS U.S.

Dr. Takeo Imai, Professor Emeritus Tohoku University and Director of Oyster Research Institute in Sendai, Japan, was a recent visitor to BCF Washington, D.C.

Dr. Imai, a world-famous authority on shellfish aquaculture, was in the United States primarily to study the effects of warm-water effluents on shellfish culture. He toured Federal, State, and industry installations on both coasts and the Gulf of Mexico.

Dr. Imai also lectured at the University of Washington's School of Fisheries in Seattle.

L to R: William N. Shaw, BCF, Oxford, Md., Neal Kelly, HEW, Washington, D.C., Dr. Takeo Imai, William M. Terry, Acting Deputy Director, BCF, Washington, D.C., James B. Engle, BCF, Oxford, Md., William Davis, BCF, Washington, D.C.
(Photo: Bob Williams)



Route of U.S. Coast & Geodetic Survey ship 'Oceanographer' during one-month cruise on which scientists from nine nations will attempt to establish an international standard for measuring ocean phenomena.

OCEANOGRAPHY

9 NATIONS SEEK STANDARDS TO MEASURE OCEAN & ATMOSPHERE

On April 30, 25 scientists from 9 nations sailed from Miami, Fla., aboard the 'Discoverer' to the Gulf of Mexico, Caribbean Sea, and Pacific Ocean in a 1-month attempt to establish international standards for measuring ocean and atmospheric phenomena. The Discoverer is an oceanographic 'floating laboratory' of the Coast and Geodetic Survey.

The scientists are oceanographers, physicists, and meteorologists from the U.S., the Soviet Union, Australia, Denmark, France, Japan, Norway, Great Britain, and West Germany.

Sea and air experiments are being conducted in and over the Gulf of Mexico and Caribbean Sea, and in the offshore waters of South America southwest of Panama. The ship will return to Miami via the Caribbean and the Sargasso Sea.

Measuring Sea's Productivity

Scientists from the U.S., Soviet Union, Australia, Denmark, France, Japan, Norway, and Great Britain are measuring the ocean's primary productivity. Essentially, this is a measure of the rate phytoplankton utilize radiant energy from the sun and nutrients from the sea to produce carbohydrates, oxygen, and other products through photosynthesis.

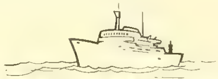
Incoming radiation at sea's surface and several levels below will be measured, together with the water's optical properties.

By bringing together scientists, measuring devices, and techniques from different countries, the planners aim to develop a means for intercalibrating the results--so measurements can be compared on an international basis. If a technique is agreed upon, it will be recommended to scientists throughout the world concerned with measurement of the sea's productivity.

Measure Radiation in Atmosphere

Meteorologists and technicians from the U.S., Soviet Union, Japan, and West Germany are attempting a comparable intercalibration of radiometersondes they use to measure radiation in the atmosphere. The instruments, carried aloft by helium-filled balloons, radio back to the ship data on variations in radiant energy versus height above sea. Instruments of the 4 nations fly from the same balloon. So the scientists are measuring the same thing and will be able to intercalibrate their equipment.

The radiometersondes are measuring the thermal radiation emitted upward and downward from the atmosphere, and upward from the sea. As the balloons rise, the instruments gather data to provide a vertical profile of the variation in radiation. The radiation is emitted by water vapor, carbon dioxide, ozone, dust, and ice crystals in the atmosphere; radiation increases in intensity as temperature increases. Such data are considered vital for a useful understanding of what drives the global weather "machine."



PHOTOGRAPH MARINE LIFE AT ARCTIC BOTTOM

J. H. Kravitz, a geologist at the U.S. Naval Oceanographic Office (NOO) has presented photographic evidence that there is marine life even in near-freezing conditions on the bottom of Arctic waters. NOO says it probably was the first time it has been photographed.

Starfish live on Arctic bottom.
(Photo: U.S. Naval Oceanographic Office)

Kravitz reported: "We have a picture of brittle stars and starfish living on the sea floor at a point about 30 miles west of Franz Josef Land." He and 5 other scientists aboard the Navy icebreaker 'Atka' reached the far northern point in early autumn. At that season, the Arctic ice pack surrounding the 70 Franz Josef Land islands--all lie above western USSR in Barents Sea--yields somewhat to warmer temperatures.

Camera Near Sea Bottom

"But, even then, we had to ward off ice flows and small icebergs called 'growlers' to get this shot," Kravitz recalls. The camera system was lowered about 1,000 feet to a point about six to nine feet above the bottom. Then it was activated long enough to get 61 pictures "before the ice forced us to cut the camera run short and abandon the site." The photo on page 13 shows the marine animals living on a "rather smooth, tranquil bottom" close to the freezing point--0.52 degrees centigrade.

May Be First

According to Kravitz, the photo may represent "the first time scientists have ever used a camera aboard an icebreaker, or any surface ship for that matter, to photograph the ocean floor this far north, although photographs of the Arctic Basin have been taken from floating ice islands."

GULF OF MEXICO 'ESSENTIALLY SAME' AS 100 MILLION YEARS AGO

"The Gulf of Mexico is essentially the same now as it was 100 million years ago." That was the conclusion of scientists who completed Leg Ten of the Deep Sea Drilling Project.

"We found nothing in the Gulf to support or deny the theory of continental drift," said Dr. J. Lamar Worzel, Associate Director of Columbia University's Lamont-Doherty Geological Observatory in Palisades, New York. "Our findings do deny any continental drift occurring there for about the past 100-135 million years. Beyond that I cannot say, but up to that time the deep basin was there and existed in essentially that same environment and location as it does today." Dr. Worzel was co-chief scientist with Dr. William R. Bryant, Texas A & M University, College Station, aboard the research vessel 'Glomar Challenger' during the cruise across the Gulf of Mexico from Galveston, Texas, to Miami, Fla.

A Theory About Gulf

Some geologists have theorized that the Gulf of Mexico once had been shallow and had sunk. Their estimates of when this happened range from 10 million to over 100 million year ago.

Scripps Institution of Oceanography, University of California at San Diego, is managing the Deep Sea Drilling Project under contract to the National Science Foundation. The Project is a part of the Foundation's Ocean Sediment Coring Program.

STUDY PESTICIDES DISCHARGED BY MISSISSIPPI R. INTO GULF

In April, researchers aboard the University of Miami's 'John Elliott Pillsbury' sampled and analyzed hydrocarbon pesticides in the water and bottom sediments of the Mississippi River delta and similar estuarine areas along the Gulf of Mexico's northeast coast.

Dr. Eugene F. Corcoran, Chief Scientist, said: "The Mississippi River is grossly modified as it flows nearly 2,500 miles from its beginning in a small lake in Minnesota to the Gulf of Mexico by the agricultural, industrial, and urban activities of a large complex society. When the river system discharges into the Gulf of Mexico, it carries with it much of the man-made pollution resulting from these activities. An important part of our expedition will be to show how the contaminated effluent is dispersed in the deep waters of the Gulf of Mexico, and what effect it has on the chemical and biological production in these areas."

The expedition also gathered information on the pesticide content of water taken from the Mississippi River delta for human consumption.

Chlorinated Hydrocarbons

The pesticides studied included DDT, dieldrin, aldrin, endrin, toxaphene, lindane, chlordane, and heptachlor. Almost insoluble, and extremely resistant to microbial degradation, these compounds can persist almost indefinitely in the water. They are also the most toxic to higher forms of aquatic life.

In addition to pesticides, the researchers also measured the salinity, oxygen, inorganic phosphates, nutrients, and trace metals at each sampling station.

U.S. COAST PILOTS 1 & 3 WILL BE UPDATED

The Coast and Geodetic Survey (C&GS) announced in late March that it will inspect navigational facilities and conditions between Eastport, Maine, and Cape Cod, Mass., and between Sandy Hook, N. J., and Cape Henry, Va., including Delaware and Chesapeake Bays.

Findings will be incorporated into new editions of "U.S. Coast Pilot 1, Atlantic Coast, Eastport to Cape Cod," and "U.S. Coast Pilot 3, Atlantic Coast, Sandy Hook to Cape Henry," scheduled for 1971. Eight of the nautical books are issued by C&GS; new editions are published at intervals of four to ten years.

The Information Furnished

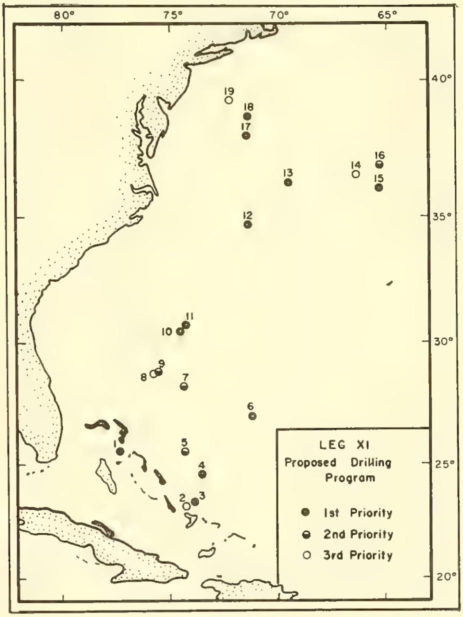
Generally, the books furnish in narrative form information that cannot be shown graphically on marine charts--navigation regulations, weather, ice, freshets, routes, and port facilities.

Coast Pilots and the annual cumulative supplements that keep them up to date are used by skippers of naval and commercial craft and by small-boat operators.

SPLIT OF EUROPE & N. AMERICA AGES AGO STUDIED

Deep-sea sediment now being recovered by the research vessel 'Glomar Challenger' during Leg Eleven of the Deep Sea Drilling Project is expected to produce scientific information on what happened millions of years ago when North America and Europe were pulled apart. Leg Eleven began in Miami, Fla., April 7, and ends in New York May 31.

Scientists are interested in what happened to the earth's crust as the continents tore apart. A major objective of the drilling is the investigation of this event by examining the oldest sediments in the Atlantic Ocean deposited when the continents separated.



FOREIGN FISHING OFF U.S. IN MARCH 1970

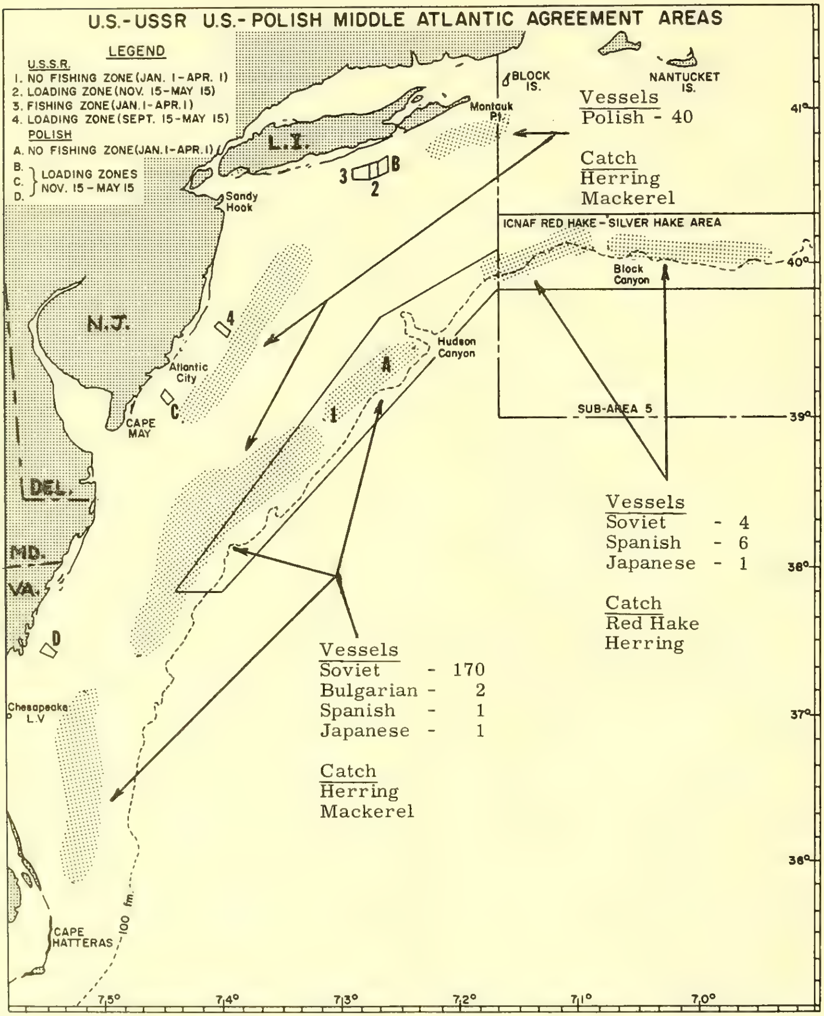


Fig. 1 - Foreign-flag vessels fishing off southern New England and Georges Bank, Mar. 1970 (shows no. of vessels and species fished).

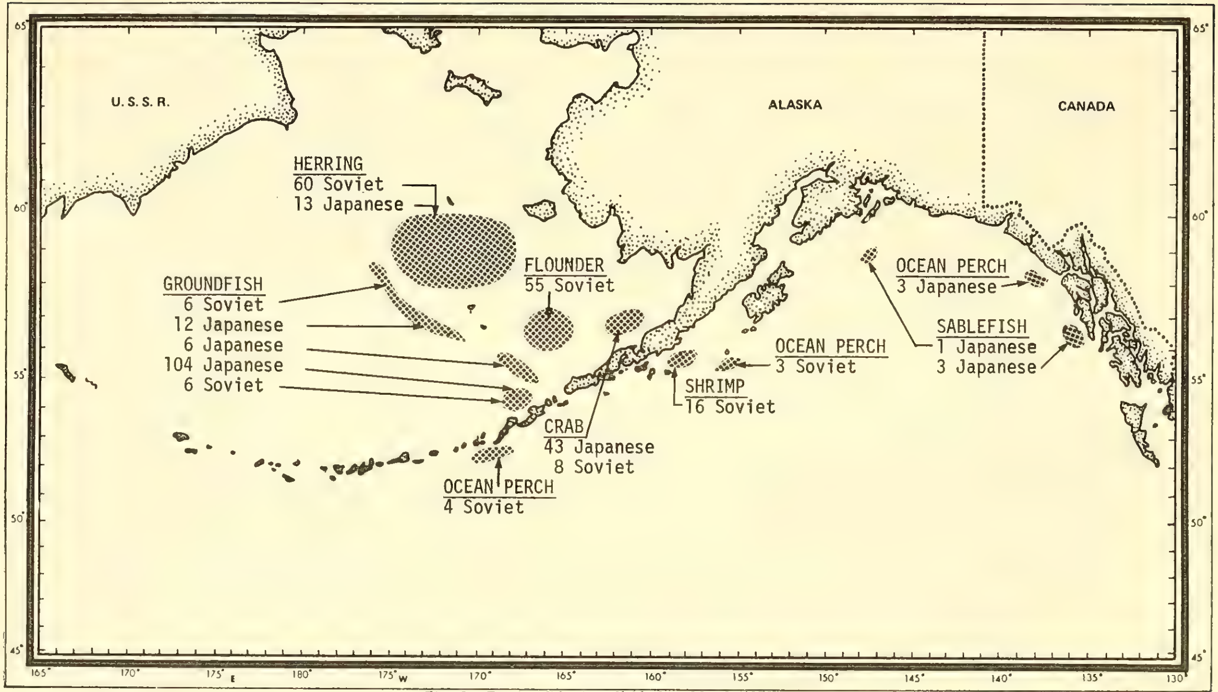


Fig. 2 - Foreign fisheries off Alaska, March 1970.

ALBACORE OF HAWAIIAN WATERS

• Thunnus alalunga •

Tamio Otsu and Ray F. Sumida

Only a small quantity of albacore is caught in Hawaiian waters by the long-line fishery, incidental to catches of other species of tunas and billfishes. The fish are large and appear to be part of the reproductive component of the North Pacific albacore population. The albacore arrive in Hawaiian waters in early summer after spending about 6 years in the temperate North Pacific.

This paper documents their occurrence, describes their size composition and abundance, and discusses their possible role in the North Pacific population.

In their model of albacore migration in the North Pacific Ocean, Otsu and Uchida postulated in 1963 that the albacore in Hawaiian waters belong to the reproductive segment of the North Pacific population. The history of the fish would be this: they spent several years in the temperate North Pacific where, alternately, they were exposed to American and Japanese fisheries during their extensive east-west migrations. After attaining sexual maturity at about age 6 (90 cm. in length), they migrated south into subtropical waters.

The inferred spawning grounds of the albacore extend in a wide belt centered along lat. 15° N., and reach from the Philippines in the west to about the Hawaiian Islands in the east. Thus, say Otsu and Uchida, the albacore in Hawaii are probably the easternmost component of the North Pacific spawning population.

The albacore are only a small part of the landings of Hawaiian fisheries: in weight, less than 3% of total tuna and billfish landings. Though relatively scarce, these albacore are, nevertheless, an important reproductive component of the North Pacific population.

NORTH PACIFIC ALBACORE FISHERIES

There are three major fisheries for albacore in the temperate North Pacific Ocean: (1) the Japanese live-bait fishery during April-July off Japan (Van Campen, 1960); (2) the Japanese long-line fishery during October-March from Japan east to about long. 170° W. (Nankai Regional Fisheries Research Laboratory, 1954); and (3) the U.S. west coast trolling and live-bait fishery during June-November between Baja California and the Pacific Northwest (Clemens, 1955). These account for virtually all the commercial landings of albacore in the Northern Hemisphere.

Albacore are also taken in small quantities throughout the tropical and subtropical regions of the Northern Hemisphere by the Japanese long-line fishery (Nankai Regional Fisheries Research Laboratory, 1959), and off Hawaii by the Hawaiian long-line fishery.

The albacore in Hawaiian waters are found only at great depths, perhaps 150 or 200 m. They are taken by deep-fishing long-line gear (Yoshida, 1966)--unlike albacore in temperate waters, which also occur at the surface. In the temperate waters, they are taken by surface fishing: surface trolling and live-bait fishing by Americans in eastern Pacific, live-bait fishing by Japanese in western Pacific.

Young albacore (less than about 90 cm. long) are found in temperate latitudes. In temperate North Pacific, between Japan and the U.S., they are both at surface and at considerable depth. The adults migrate south into tropical and subtropical waters, where

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they are exclusively at great depths (Otsu and Yoshida, 1967). The fisheries are geared to take advantage of this unwavering regularity in the fish's life pattern. Thus, throughout the tropics, including Hawaii, the long-line method is the only way known for capturing these deep-swimming albacore.

The Fleet and the Catch

In Hawaii, the long-line fishery operates mostly in "inshore" waters; boats range in size from 5 to 38 gross tons (Hida, 1966). In 1950, the fleet consisted of 76 boats; not all fished full time. The number has dwindled steadily since then and, by 1968, only 22 boats operated. The boats have crews of two to five men and make trips averaging about 9 days. Although most fishing is within 40 km. of the main Hawaiian Islands, a few boats occasionally have ventured as far as 500 km. from port. A new long-line vessel, the 'Kilauea', joined the fleet in 1969. She has made regular trips to fishing grounds 500 to 800 km. south of Honolulu.

The principal long-line catches in Hawaiian waters are the bigeye tuna, Thunnus obesus, and the yellowfin tuna, Thunnus albacares. Among the billfishes, the Pacific blue marlin, Makaira nigricans, and the striped marlin, Tetrapturus audax, are the most abundant. Less abundant species are the broadbill swordfish, Xiphias gladius; sailfish, Istiophorus orientalis; shortbill spearfish, Tetrapturus angustirostris; black marlin, Makaira indica; wahoo, Acanthocybium solandri; skipjack tuna, Katsuwonus pelamis; dolphin, Coryphaena hippurus; and the albacore.

More detailed descriptions of the Hawaiian long-line fishery are found in June (1950), Otsu (1954), Shomura (1959), Hida (1966), and Yoshida (1966).

LANDINGS OF ALBACORE IN HAWAII

The annual landings of albacore in the Hawaiian long-line fishery in 1948-68 ranged from 3 metric tons in 1965 to 48 metric tons in 1952 (fig. 1); these accounted for 0.4 to 3.0% of total tuna and billfish landings (table 1). The catches were relatively higher in earlier years of study period, 1948-53, when 23 to 48 metric tons were landed each year. Since then, however, the landings have been considerably lower: less than 13 metric tons.

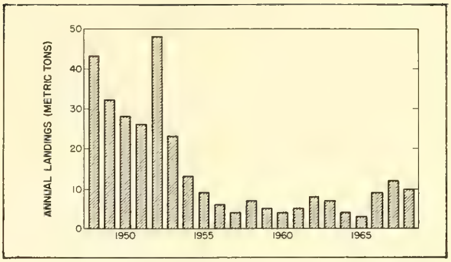

Fig. 1 - Annual landings of albacore in Hawaiian long-line fishery, 1948-68.

Monthly landings of albacore increase markedly in June and are relatively good for remainder of year (fig. 2). The best catches, however, are between June and October.

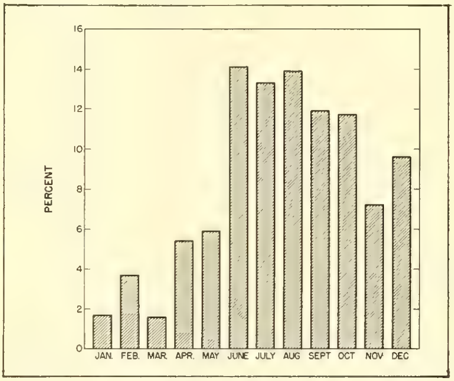

Fig. 2 - The average monthly landings, in percent, of albacore in Hawaiian long-line fishery, 1948-68.

SIZE COMPOSITION OF CATCH

The albacore taken in Hawaii are generally large fish; they range in length from about 85 to 130 cm. (14 to 44 kg.). Eighty percent of the fish landed are longer than 100 cm. (21 kg.). The males are larger and more numerous than the females. The average length in 1965-68 was 102.2 cm. for females and 106.0 cm. for males; the males outnumbered females 1.9 to 1. There has been a marked decline in albacore lengths since the 1950s. Because so few albacore are landed each year, the size data were grouped into three time

Table 1. Landings of Tunas and Billfishes in the Hawaiian Long-line Fishery, 1948-68[1/]

Year	Total Tunas and Billfishes	Total Albacore	Albacore Landings
	Metric Tons	Metric Tons	Percent
1948	1,435	43	3.0
1949	1,419	32	2.2
1950	1,787	28	1.6
1951	1,811	26	1.4
1952	1,876	48	2.5
1953	2,032	23	1.1
1954	1,985	13	0.7
1955	1,540	9	0.6
1956	1,511	6	0.4
1957	1,198	4	0.4
1958	1,236	7	0.6
1959	1,218	5	0.4
1960	1,016	4	0.4
1961	926	6	0.7
1962	976	8	0.8
1963	865	7	0.8
1964	939	4	0.5
1965	849	3	0.4
1966	817	9	1.1
1967	798	12	1.5
1968	704	10	1.5

1/Data obtained from State of Hawaii, Division of Fish and Game Statistics, Annual Summary, and may include small amounts of tunas and billfishes taken by methods other than the long-line.

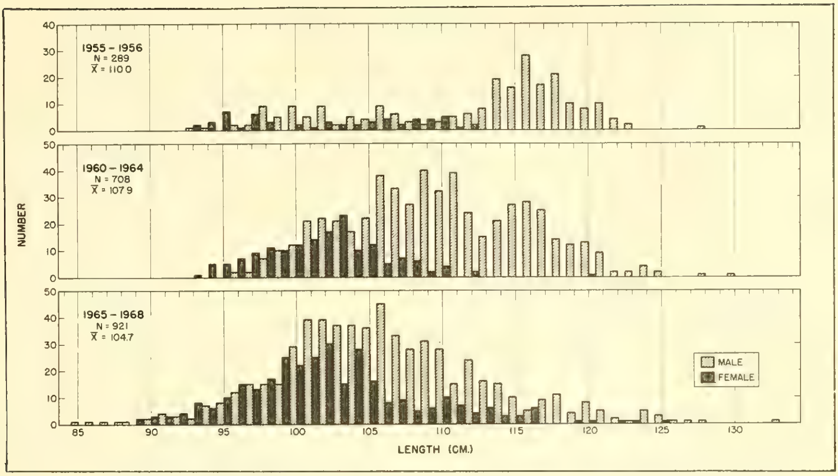

Fig. 3 - Length frequency distributions of albacore from Hawaiian waters, 1955-56, 1960-64, and 1965-68.

periods: 1955-56, 1960-64, and 1965-68 (fig. 3). No data are available for 1957-59 because the Honolulu markets were not sampled then. The average length (sexes combined) of 110.0 cm. in 1955-56 decreased to 107.9 cm. in 1960-64, and to 104.7 cm. in 1965-68. This decrease is even more striking when males are considered separately. The modal sizes decreased from about 116 cm. in 1955-56 to 109 cm. in 1960-64, and to about 105 cm. in 1965-68. There was no reduction in mean size of females over the years.

An outstanding feature of the albacore taken in Hawaii is their very large size; in fact, they are generally larger than those taken anywhere else in the Pacific. Otsu and Uchida reported in 1959 a 127.6-cm. (42.2 kg. or 93 lb.) male as the largest albacore landed in Hawaii in 1955 or 1956. Since sampling was resumed in 1960, four unusually large specimens (all males) have been recorded (table 2). The longest (taken July 21, 1966) measured 132.7-cm. and weighed 40.8 kg. (90 lb.); the heaviest (taken October 25, 1965) weighed 44.5 kg. (98 lb.; length, 128.4 cm.). In comparison, only 22 of 373,754 albacore sampled from the Japanese long-line fishery in the North Pacific in 1949-59 (Suda, 1963a) were longer than 120 cm.; the maximum length was 124 cm.

Table 2 - Records of the Five Largest Albacore (All Males) Taken by the Hawaiian Long-line Fishery and Sampled at the Honolulu Markets Since 1955

Date	Length	Weight
	Cm.	Kg.
July 8, 1955	127.6	42.2
June 26, 1964	129.7	44.0
September 28, 1964	128.2	37.2
October 25, 1965	128.4	44.5
July 21, 1966	132.7	40.8

The albacore caught throughout the South Pacific by long-line vessels based at American Samoa are also considerably smaller than Hawaiian. They are believed to be the Southern Hemisphere counterpart of the albacore, which appear in the tropical and subtropical regions of the North Pacific (Otsu and Yoshida, 1967); populations in the North and South Pacific are believed to be separate. The albacore taken in the fishery based at American Samoa average about 90 cm. in length (16 kg. or 35 lb.). The largest caught in 1968 (in January, at lat. 18° S., long. 171° W.) was 113 cm. long (31 kg. or 68 lb.).

APPARENT ABUNDANCE

Because albacore have been uncommon in the landings of recent years, it is surprising to learn that Hawaii exported albacore to California in the late 1920s and early 1930s (table 3). These exports, probably not the entire catch, indicate that landings were considerably greater then. The relatively good catches may have continued into the early

Table 3 - Export of Hawaiian Albacore to California		
Year[1/]	Amount Exported	
	Pounds	Metric Tons
1928	57,500	26.1
1929	43,054	19.6
1930	5,426	2.5
1932	98,720	44.9
1933	43,612	19.8
1934	25,900	11.8

1/No albacore exported in 1931.
Source: California Department of Fish and Game, 1937.

1950s (no catch statistics are available for 1935-47). Albacore landings were under 10 metric tons per year in 1955-66, but totaled 12 metric tons in 1967 and 10 metric tons in 1968 (fig. 1).

Although this decrease in Hawaii albacore catch may have been due at least partly to smaller fishing effort (decrease in fishing vessels), it is reasonably certain that low catches in 1954-65 were due largely to actual decrease in abundance. Figure 4 shows the per-boat catch of albacore and of all tunas and billfishes in long-line fishery from 1948 to 1968. The catch of tunas and billfishes per boat--except in 1952, 1953, and 1954--tended to increase gradually over the years, though fluctuating greatly from year to year. No such tendency was seen in the catch of albacore. Furthermore, the proportion of albacore in total tuna and billfish landings was markedly lower in 1954-65 than in other years (table 1 and fig. 5).

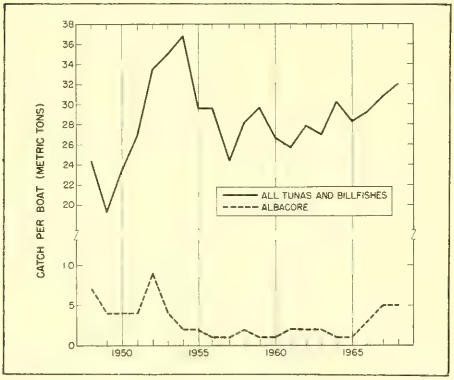

Fig. 4 - The catch per boat of tunas and billfishes and of albacore in the Hawaiian long-line fishery, 1948-68.

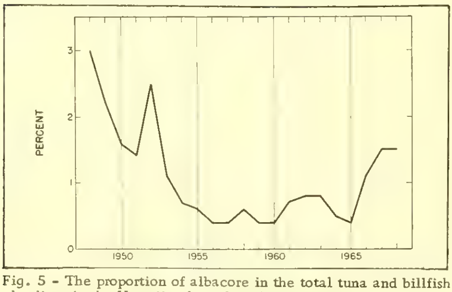

Fig. 5 - The proportion of albacore in the total tuna and billfish landings in the Hawaiian long-line fishery, 1948-68.

SIGNIFICANCE OF HAWAIIAN-CAUGHT ALBACORE

Albacore occur in temperate waters when they are young. They migrate seasonally from eastern Pacific, where they form basis of an American summer fishery, into central western Pacific, where they are basis of Japanese winter long-line fishery. They next appear in the Japanese coastal fishery in the spring; from there, they return once again to winter long-line fishery (fig. 6: Otsu and Uchida, 1963). One hypothesis is that when the fish attain sexual maturity, some adults in Japanese winter long-line fishery move south into subtropical waters during spring; there they form reproductive segment of North Pacific population. It has been postulated further that fish of this reproductive segment appear in Hawaiian fishery. These points are supported by the abrupt increase in albacore catches in Hawaii beginning in June, near the beginning of their spawning period in Hawaiian waters.

Otsu-Uchida Study

In their 1959 study, Otsu and Uchida found no albacore in spawning or near-spawning condition in temperate North Pacific, but they noted that albacore from Hawaii possessed well-developed gonads. The fish from the central equatorial Pacific were in an intermediate stage between the two groups; a few had ovaries in the "late developing" stage. The evidence presented by the Hawaiian albacore pointed to a summer spawning, probably between June and August.

Thus, it appears that the increased landings of albacore in Hawaii beginning in June mark the arrival of fish from the North Pacific Japanese winter long-line grounds. Furthermore, since increased landings correspond in time to spawning period, we may state with some confidence that the Hawaiian

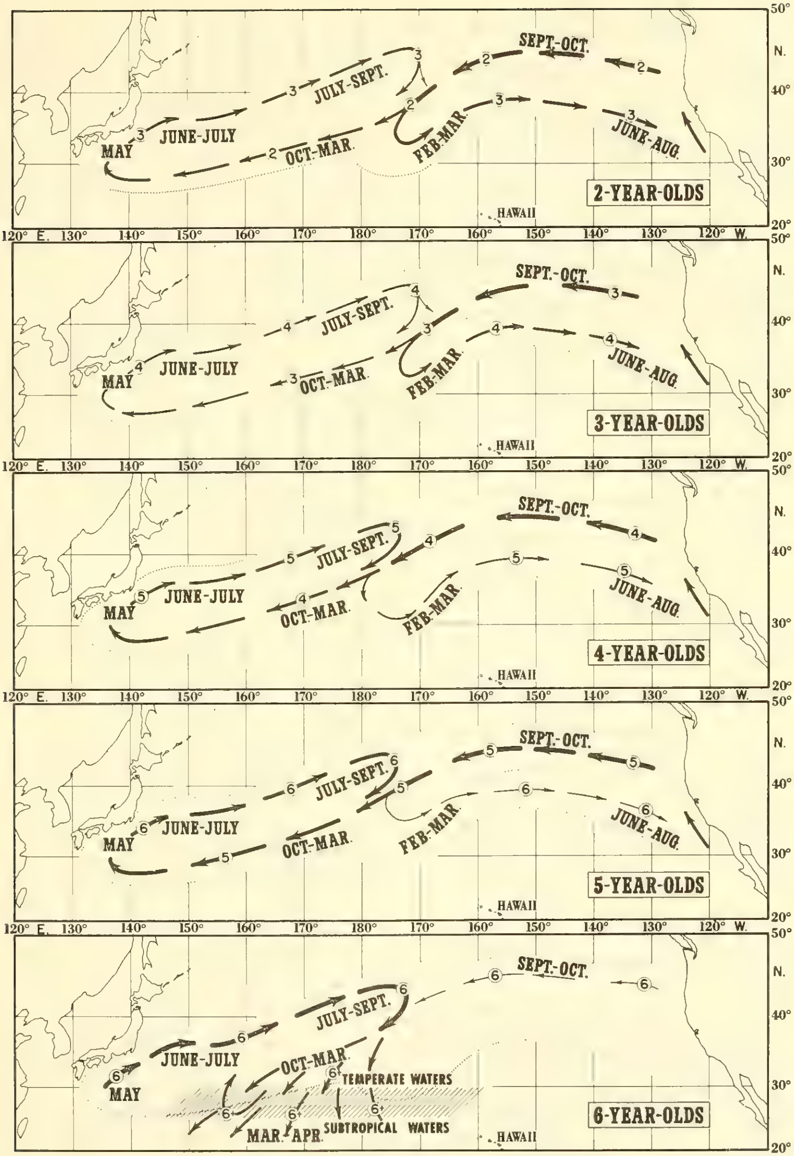

Fig. 6 - Model of albacore migrations in the North Pacific Ocean, by age groups (ages encircled). (Reproduced from fig. 9: Otsu and Uchida, 1963.)

fish are part of the reproductive segment of North Pacific population.

The significance, if any, of the relative scarcity of albacore in Hawaiian waters in recent years is not clear. It is possible that the few fish taken in Hawaii can serve as an index of the relative abundance of albacore in the North Pacific population. Rothschild and Yong* reported a clear decline in albacore abundance in North Pacific long-line grounds during their 1949-61 study period.

The decrease in average size of albacore taken in Hawaii during 1955-68 may reflect further such a decline in the North Pacific population. If albacore abundance in the North Pacific had decreased due to an increase in total mortality, we might expect to see such a decrease in average size (age).

Fewer Older Albacore,
Average Lengths Stable

Rothschild and Yong noted that such a reduction of older albacore in the North Pacific was indicated by Suda (1959, 1963b). On the other hand, having computed the average lengths of albacore taken in all three North Pacific fisheries, they could find no apparent decline in average lengths. They concluded: "We cannot, at present, reconcile the decline

Table 4. Average Catch Rates of Albacore in the Japanese Winter Longline Fishery, by Quarters, for the 1962-66 Fishing Seasons1/

Season2/	Quarters	Catch Per 100 Hooks
		Numbers
1962	Oct.-Dec. 1962	0.57
	Jan.-Mar. 1963	1.18
	Season average	0.88
1963	Oct.-Dec. 1963	1.06
	Jan.-Mar. 1964	2.43
	Season average	1.66
1964	Oct.-Dec. 1964	0.41
	Jan.-Mar. 1965	1.54
	Season average	1.05
1965	Oct.-Dec. 1965	0.96
	Jan.-Mar. 1966	2.58
	Season average	1.76
1966	Oct.-Dec. 1966	1.09
	Jan.-Mar. 1967	2.54
	Season average	1.97

1/The data were compiled from "Annual report of effort and catch statistics by area in Japanese tuna longline fishery" for the years 1962-67, published by the Research Division, Fisheries Agency of Japan.

2/A fishing season extends from about October of 1 year through March of the following year. The fishing grounds are limited to lat. 20°-40° N., long. 140° E.-180°.

*Rothschild, Brian J. and Marian Y. Y. Yong. MS. Apparent abundance, distribution, and migrations of albacore, Thunnus alalunga, on the North Pacific longline grounds. Bureau of Commercial Fisheries Biological Laboratory, Honolulu, Hawaii 96812.

in one set of the Japanese data and the lack of a decline in the other."

Although a decline in average fish sizes in the North Pacific has not been clearly demonstrated in the Japanese data, reduction in relative abundance of the oldest segment of the population is evident in the Hawaiian data. We believe that this decrease is related to a decline in the apparent abundance of albacore in the North Pacific Ocean as a result of increased total mortality.

Catch Rates Compared

To determine this relationship, the Japanese catch rates in the North Pacific and the Hawaiian landings were compared. Table 4 shows the albacore catch rates in the Japanese winter long-line fishery during the 1962-66 fishing seasons as compiled from data published by the Fisheries Agency of Japan. To maintain consistency in the data, we did not attempt to compile unpublished data for earlier years. The catch rates were generally low, under two fish per 100 hooks, but increased slightly during the 1965 and 1966 seasons; this corresponded to increased landings in Hawaii after 1966.

Table 5 - Average Catch Rate of Albacore in the Japanese North Pacific Winter Long-line Fishery, 1949-57 (from Suda, 1958: Table 2)

Year	Number of Albacore Per 100 Hooks
1949	2.36
1950	2.23
1951	2.86
1952	2.71
1953	1.86
1954	1.55
1955	1.20
1956	2.54
1957	2.82

Suda (1958) published average catch rates for the same fishery during 1949-57 (table 5). These data are not strictly comparable with those in table 4 because different data sets are probably involved. Suda reported slightly higher catch rates than those in more recent years. There was little correlation between these catch rates and annual Hawaiian landings. Despite this lack of correlation, we feel that Hawaiian landings, particularly if standardized in catch-per-unit effort, should reflect changes in albacore abundance in the North Pacific long-line grounds--and, more particularly, in abundance of older fish in the population.

ACKNOWLEDGMENTS

We thank Brian J. Rothchild, Fisheries Research Institute, University of Washington, and William L. Craig, California State Fisheries Laboratory, for their critical reading of this paper.

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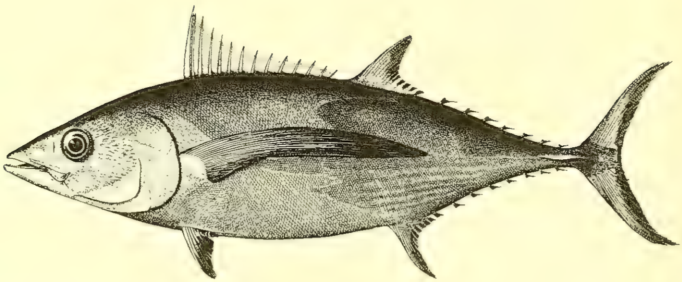

SEASONAL AND GEOGRAPHIC CHARACTERISTICS OF FISHERY RESOURCES

California Current Region--I. Jack Mackerel

David Kramer and Paul E. Smith

This is the first of a series of brief reports in which we intend to describe seasonal and geographic characteristics of the fishery resources in the California Current region. Emphasis will be placed on the use of summarized data to predict when and where adult spawning populations may be found--and whether or not such populations might be available to the fisheries during their spawning cycles. This first report deals with the jack mackerel.

These accounts will introduce a series of existing and future comprehensive reports and analyses in a program of intensive research carried on for more than 20 years by the California Cooperative Oceanic Fisheries Investigations (CalCOFI). The investigations were founded in 1949 to determine the reasons for the decline of the sardine fishery. The chief participants of the CalCOFI are the Scripps Institution of Oceanography (SIO), the California Department of Fish and Game (CF&G), and the Bureau of Commercial Fisheries (BCF). The investigations designated an area for their studies covering approximately 500,000 square miles from the California-Oregon border to the tip of Baja California (fig. 1). Their major task was to study the effects of the biological, physical and chemical environment upon the resources. The role of BCF was to determine the distribution and size of adult fish populations from egg and larva censuses.

In order to determine when and where spawning populations may be found, the data for 10 years, 1951-60, are summarized by grouping ("pooling") stations on the CalCOFI pattern into 40 X 120-mile areas (fig. 2) and observing percentages of occurrences of fish eggs and/or larvae. (Percentages of occurrence are the number of times larvae are found in a sample, divided by the number of samples taken in a particular season and area during the decade.)

In the instance of jack mackerel (fig. 3), the data show that the major centers of spawning (49 percent or greater occurrence of larvae) occur first in March off southern California and northern Baja California; then, as the waters grow warmer, the major centers spread gradually northward as far as San Francisco in July. The absolute range of jack mackerel spawning areas has not been delimited by the CalCOFI. We know from additional surveys by CalCOFI, and other organizations in the United States and Canada, that the jack mackerel populations may extend as far offshore as 800-1,200 miles, as far north as the Gulf of Alaska (Blunt, 1969), and as far south as Cape San Lucas.

The jack mackerel fishery, once only incidental to those of the sardine and Pacific mackerel, suddenly became a major one in 1947--when its total landings were 65,000 tons from a few-thousand-ton fishery in previous years. In the next two decades, 1947-56 and 1957-66, it averaged 40,000 and 35,000 tons per year respectively.

Most landings of jack mackerel are juveniles or young adults taken within 50 miles offshore from San Diego to Point Conception. A small, variable fishery is carried on in Monterey Bay. The Mexican fishery, based in Ensenada, is a moderate one off northern Baja California. The fishery probably uses only a small part of the adult resource, which is estimated to be about 1.4-2.4 million tons within the CalCOFI pattern alone--and approximately twice that amount by adding what is estimated to be in the portion not delimited by the CalCOFI surveys (Ahlstrom, 1968). In

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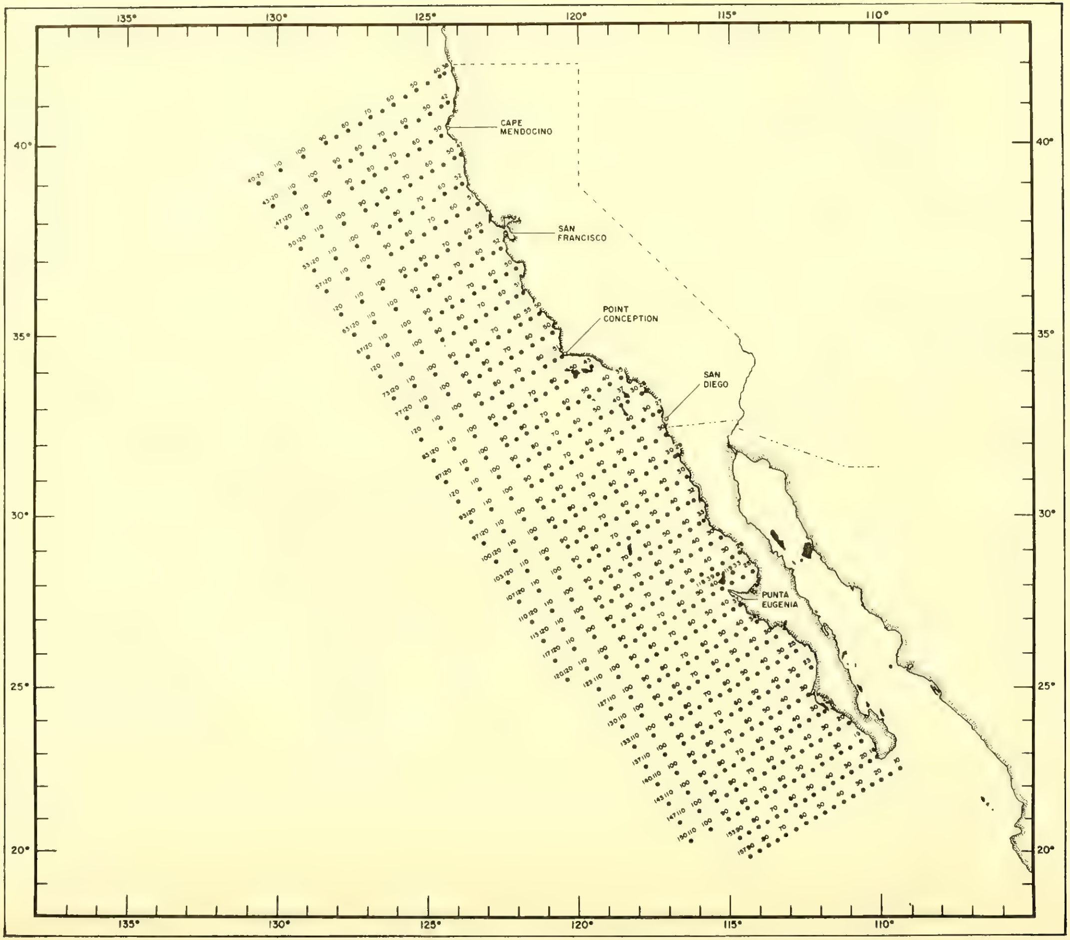

Fig. 1 - Station pattern of the California Cooperative Oceanic Fisheries Investigations (CalCOFI).

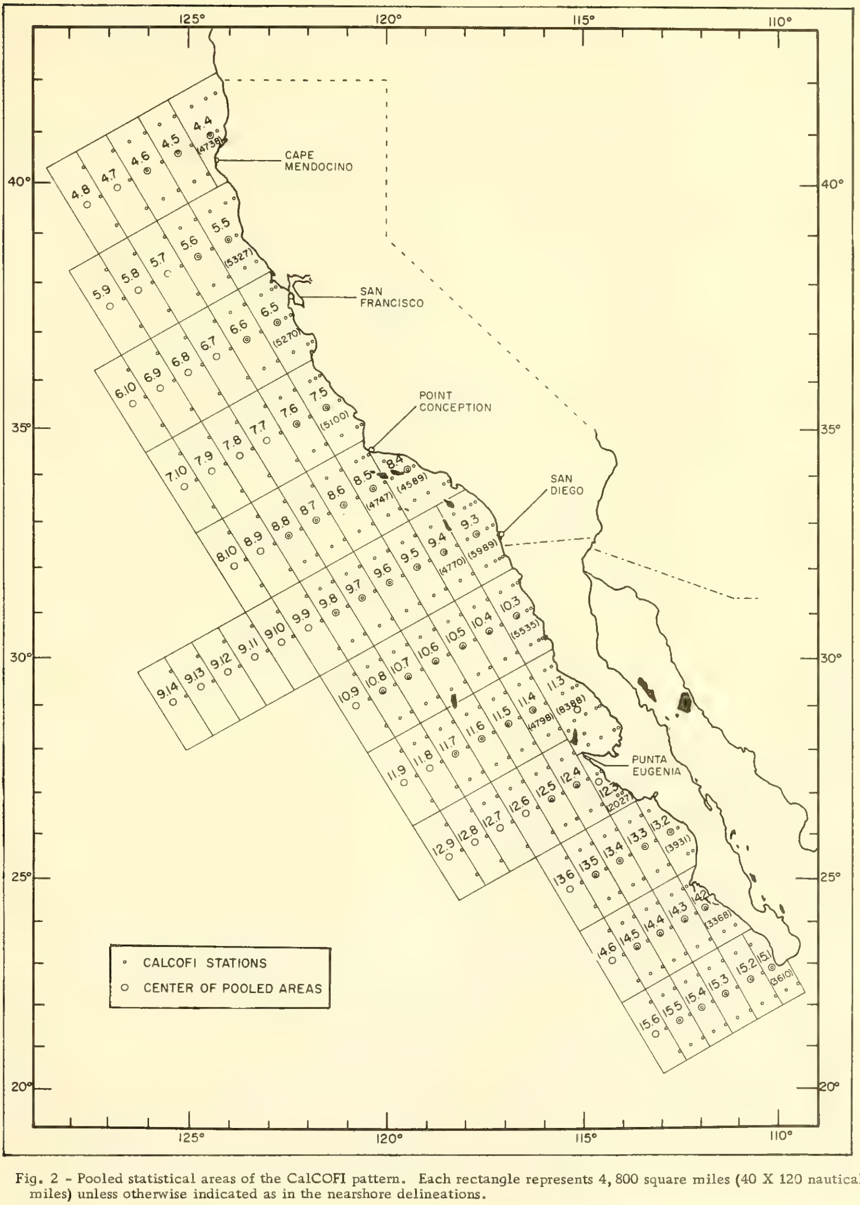

Fig. 2 - Pooled statistical areas of the CalCOFI pattern. Each rectangle represents 4,800 square miles (40 X 120 nautical miles) unless otherwise indicated as in the nearshore delineations.

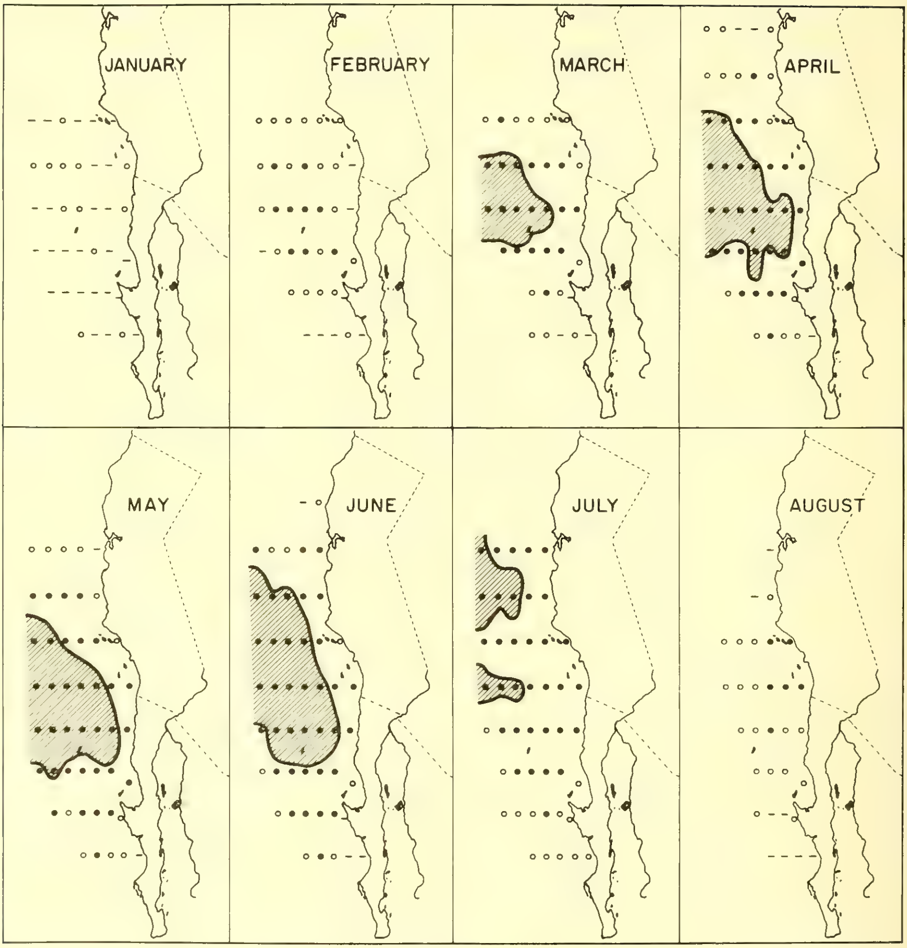

Fig. 3 - Percent occurrences of jack mackerel larvae in 1951-60 on the survey pattern of the California Cooperative Oceanic Fisheries Investigations (CalCOFI). Each line, circle or dot represents a pooled statistical area (see fig. 2). (o) - less than 10% occurrence; (•)- equal to or greater than 10% occurrence; shaded area - greater than 49% occurrence; (-) - area occupied with no occurrences.

addition, the taking of young adults may indicate that the fishery seldom harvests the adult spawning population shown by the major spawning centers in figure 3, except where those centers extend closest to shore.

It is likely that this could be made a much larger fishery by extending its range to the north and seaward during the spring and summer months.

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'North Pacific': 64-ft., San Pedro-stationed jack mackerel purse seiner; 82-ton capacity. (Photo: W. R. Perrin, BCF La Jolla)

BRIT HERRING ALONG MAINE'S COAST

C. W. Davis and J. J. Graham

The Maine sardine industry prefers to can 2-year-old Atlantic herring, Clupea harengus harengus, but when they are not available, 1- and 3-year-old fish are used. To assist the industry in using the herring resource more efficiently, the BCF Biological Laboratory at Boothbay Harbor, Maine, seeks to predict the annual abundance and availability of the 2-year-old fish. As part of this program, herring are studied from the time they hatch in the autumn until the time they may enter the fishery 1 year later.

This preliminary report describes the summer distribution and relative abundance of 1-year-old, or "brit" herring, 2 to 4 inches in length, along the Maine coast in 1966-69.

METHODS AND GEAR

Surveys for brit herring were made twice each summer on inshore and offshore cruise tracks along the Maine coast (fig. 1) with the Department of the Interior vessel 'Rorqual'. The ship's echo-sounder was operated continuously during the surveys, which were made at a vessel speed of about 10 knots. Inshore tracks were covered during daylight, and offshore tracks at night, in 1966 and 1967; both tracks were covered during daylight in 1968 and 1969. Echo-sounder traces were classified as "heavy," "medium," or "light" to denote relative abundance (fig. 2).

A 16-foot semiballoon trawl, fitted with a $\frac{1}{2}$-inch stretch-mesh liner in the cod-end, and a Boothbay Depressor Trawl were used to determine if traces on the echo-sounder were herring. Previous calibration of gear depth to amount of wire out usually enabled us to place the trawls at or near the same depth as the fish traces. Speed of the vessel during towing was approximately 6 knots; duration of the tows was 10 to 30 minutes.

SURVEY RESULTS

Distribution and Abundance

This study and earlier explorations indicate that inshore populations of brit herring remain in the coastal waters throughout the summer. The heaviest concentrations were detected during early summer (late June to mid-July) in the central and eastern coastal areas (figs. 3 and 4). In subsequent cruises (mid-July to late August), the only brit observed were in upper Penobscot Bay, and even there they were scarce. No significant numbers of brit were found along the offshore cruise track in any year.

Brit were noticeably scarce in western Maine compared to central and eastern Maine during these years. No fish were located below Casco Bay.

Sardine Catch Relationship

The persistent occurrence of brit for 3 consecutive years (1966-1968) in central and eastern Maine is reflected in the subsequent total sardine landings. These two areas accounted for over 75% of the annual Maine catch from 1967 to 1969. In western Maine, the brit were very scarce in 1966 but somewhat more abundant in 1967 and 1968. Landings of herring in this region reached a 20-year low in 1967 but increased about 8% in both 1968 and 1969.

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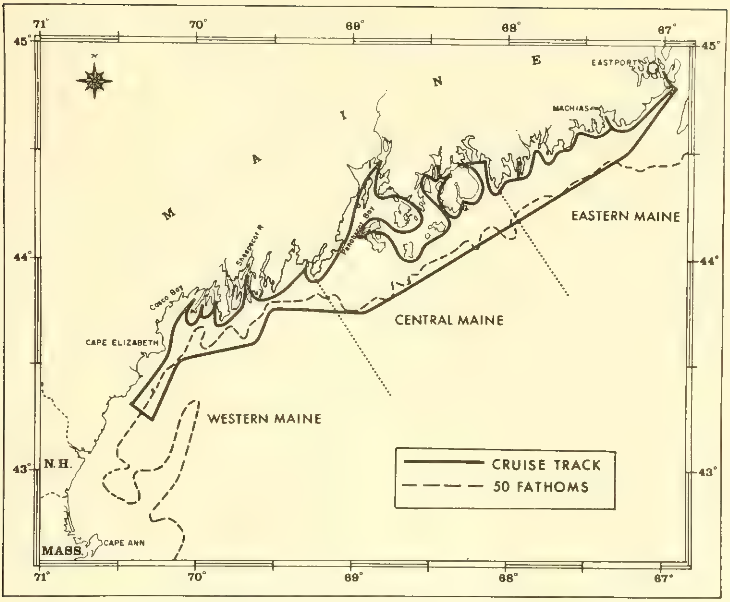

Fig. 1 - Survey area and general course of cruise track.

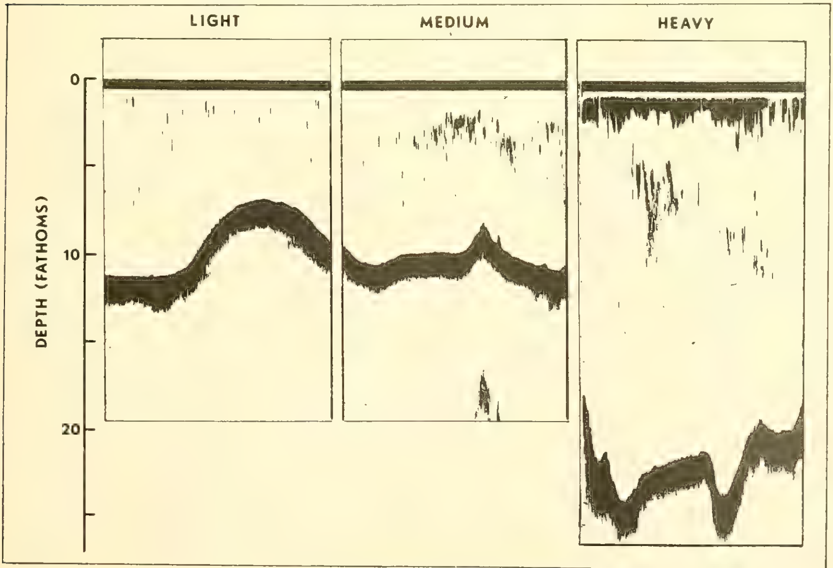

Fig. 2 - Echo-sounder traces and classification of brit herring concentrations.

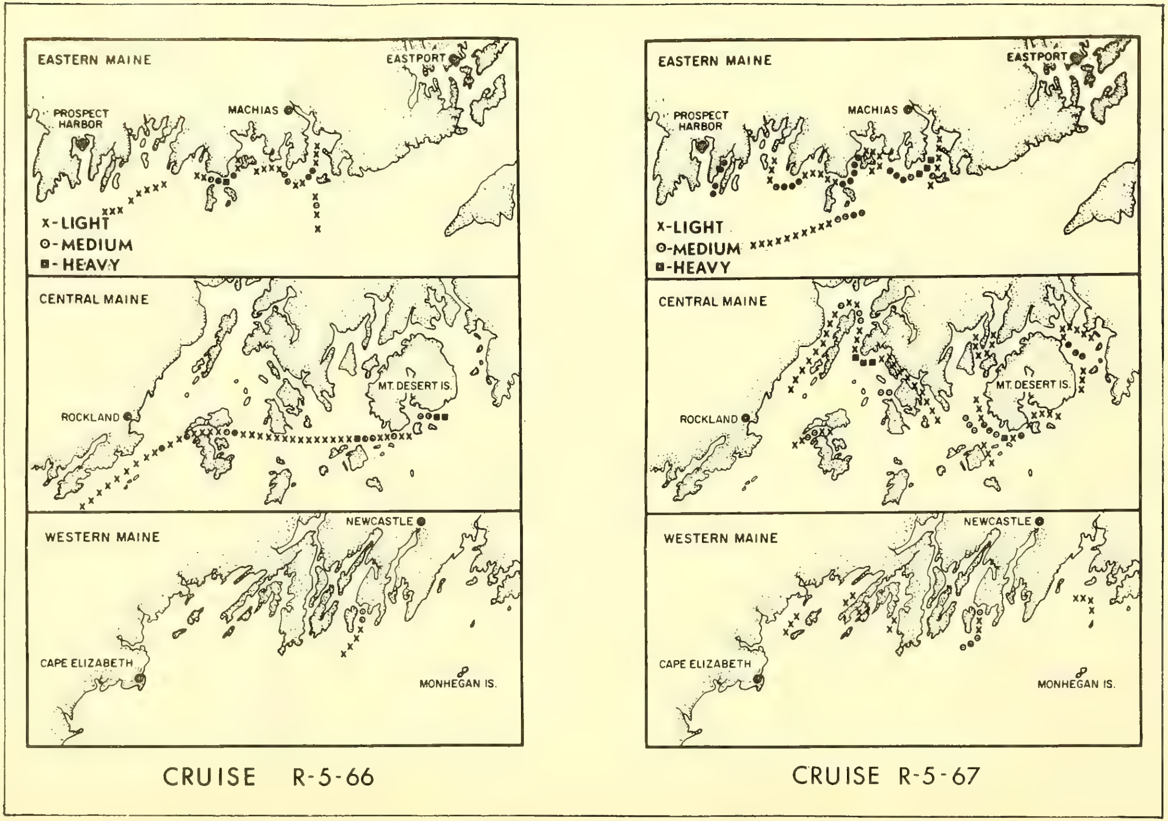

Fig. 3 - Distribution and relative abundance of brit herring along the Maine coast, 1966 (R-5-66) and 1967 (R-5-67).

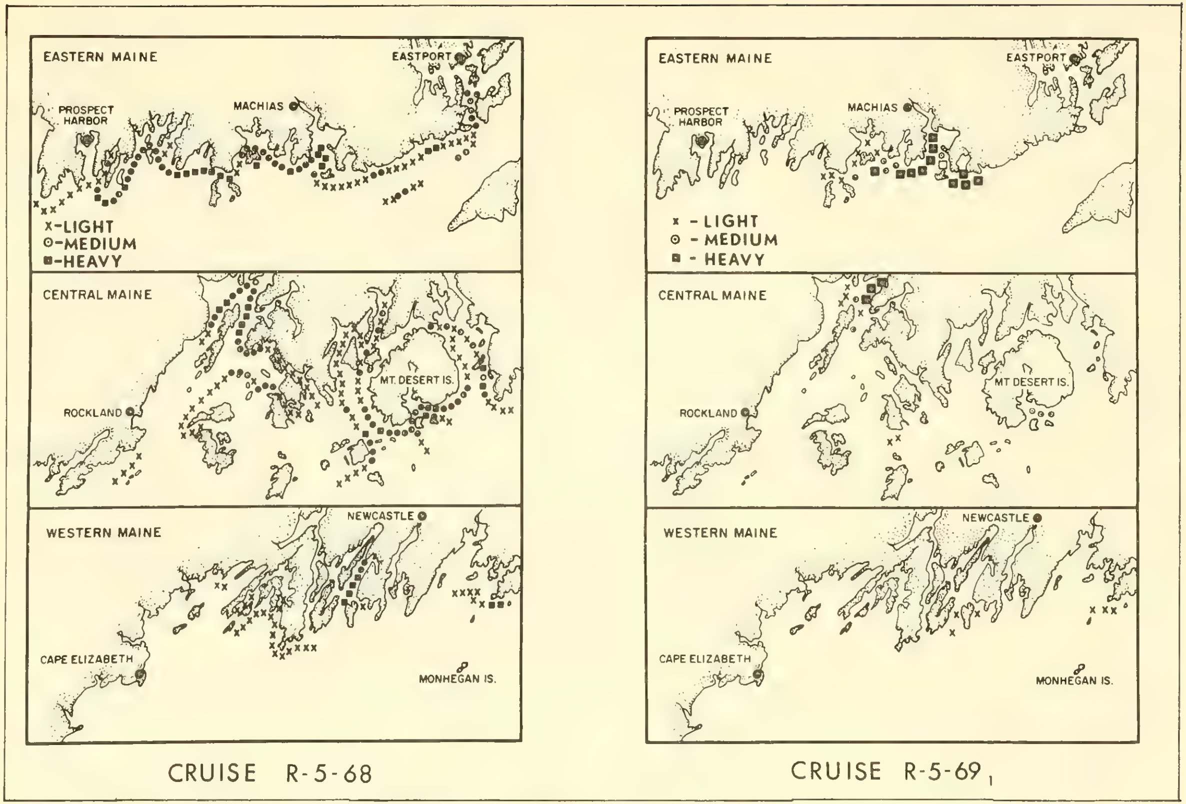

Fig. 4 - Distribution and relative abundance of brit herring along the Maine coast, 1968 (R-5-68) and 1969 (R-5-69).

Fig. 1 - BCF's new bathysphere will transport two observers at atmospheric pressure to a depth of 675 feet. The bathysphere is about 8 feet high and weighs nearly 9,300 pounds (including 2,500 pounds of ballast).

A BATHYSPHERE FOR FISHERY RESEARCH

John R. Pugh and Richard B. Thompson

The Bureau of Commercial Fisheries (BCF) Biological Laboratory in Seattle, Wash., has acquired a bathysphere and a support barge for fishery research. The system will be used in studies to determine the behavior of commercially important marine organisms in their natural environment.

BATHYSPHERE

The bathysphere (fig. 1) was constructed by the Ocean Engineering Division of Reading and Bates of Tulsa, Okla. It is designed to transport two observers at atmospheric pressure to a depth of 675 feet. The sphere is constructed of special steel-plate alloy; the walls are 0.625-inch thick, and the total weight, including the ballast, is about 9,300 pounds. The inside diameter is 5 feet 6 inches. The overall height, including a sturdy-steel framework that supports the bathysphere, is about 8 feet. The bathysphere has two access hatches--one on the side to facilitate entry on deck and horizontal mating with a deck decompression chamber, the other on the bottom to permit divers to exit or enter the pressurized bathysphere at depth. Both hatches have double doors--an external one to withstand sea pressure, and an internal one to withstand interior pressure during lock-out dives. Sixteen portholes (six, 12-inch; ten, 6-inch) provide excellent viewing in all directions. Neoprene bumper pads spaced around the horizontal centerline between the ports help protect the bathysphere during operations at sea. Two fixed quartz iodide lights, each 750 watts, provide illumination for underwater viewing. Electricity for the lights is supplied by surface generators.

Life-support equipment in the bathysphere includes a 48-hour oxygen supply for two observers, and the necessary equipment for removal of carbon dioxide. There is also an auxiliary air supply that can be used: (1) in an emergency, such as failure or contamination of the regular oxygen supply, or (2) for pressurizing the bathysphere at shallow depths (less than 100 feet) for lock-out dives, or (3) by divers with "Hookah" attachments working outside the bathysphere. During dives of long duration, the breathing mixture can be supplied from surface compressors. One instrument allows the observers to monitor the percentage of oxygen in the bathysphere; another allows them to check the carbon dioxide level. A hardwire communications system provides direct contact between the bathysphere and the support barge. One depth gauge allows the observers to monitor their rate of descent or ascent; a second gauge allows them to monitor the pressure in the bathysphere when pressurization is required for lock-out dives.

The bathysphere is about 600 pounds buoyant. Sufficient ballast to make it sink and to stabilize it (about 2,500 pounds) is attached by a $\frac{3}{8}$-inch diameter cable, 100 feet long, to an electrically powered submersible winch fastened to the support frame on the sphere's underside. Under normal operating conditions, the winch cable is wound tight, and the ballast is carried close to the bottom of the sphere. In an emergency, the ballast can be jettisoned, allowing the bathysphere to return to the surface. The bathysphere is also equipped with a release mechanism on the main lifting cable; the occupants can free the sphere from the cable if it becomes fouled.

Flexibility of operation was a major consideration in the bathysphere's design. The submersible winch attached to the support frame is controlled from within the sphere and allows the occupants to position it at various distances above the ocean floor--depending on length of ballast support cable--while remaining independent of the motion of the surface vessel. By directing crane operator to slacken main lifting-cable, and by reversing drive motor on submersible winch, the occupants can leave the ballast on the ocean floor to serve as an anchor. The bathysphere

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will rise toward the surface, allowing the occupants to make observations and a controlled ascent up to the length of the winch cable. Since the winch is electrically powered, the occupants can winch the bathysphere back to the bottom if they desire.

SUPPORT BARGE

In Puget Sound, the bathysphere is transported and supported by a self-propelled barge (fig. 2), which is 104 feet long, 31 feet wide, and displaces 240 gross tons. (However, the sphere can be supported by any vessel that has adequate deck space and is capable of lifting about 5 tons.) The barge is equipped with a diesel-powered, friction-driven crane that has a 15-ton lifting capacity. The crane drum holds about 1,200 feet of nonrotating $\frac{7}{8}$-inch cable with a rated breaking strength of 32,000 pounds. About 1,100 square feet of uncluttered deck space forward of the crane provides ample room to stow or support the bathysphere.

The barge requires a minimum crew of three--a helmsman, an operating engineer, and a deckhand. During diving operations, when the barge is securely moored, the engineer operates the crane and the helmsman and deckhand tend the bathysphere. Usually, two or more biologists serve as observers in the bathysphere and assist the barge crew wherever needed during station changes and mooring operations.

PRELIMINARY TESTS

In June 1969, the bathysphere, unmanned, was successfully tested to a depth of 1,500 feet. The BCF research vessel 'Miller Freeman' (fig. 3) transported the sphere to Jervis Inlet, about 60 miles north of Vancouver, B.C., the only nearby site in protected waters with suitable depth. The bathysphere was lowered and raised with the conventional trawling winches, cable, and gantry permanently installed aboard the vessel.

The purposes of the tests were: the final acceptance trial under the terms of the contract; to demonstrate the bathysphere's structural integrity, and to show its ability to withstand pressures at depths far greater than those at which it will be used in fish behavior research.

The first manned dives were conducted at the BCF research station at Manchester, Wash., on Puget Sound, from September 30 to

Fig. 2 - The bathysphere's self-propelled support barge, a converted airplane salvage barge, 104 feet long, has a cruising speed of about 8 knots; it carries two scientists and a crew of three. The crane on the barge is capable of lifting 15 tons.

Fig. 3 - The bathysphere can be lowered and raised with the trawling winches, cables, and gantry that are permanently installed aboard the 215-foot Miller Freeman, the Seattle Biological Laboratory's research vessel.

October 8, 1969. The various safety devices and life-support systems of the bathysphere were tested. All systems functioned according to design.

There were additional tests to determine the ability of observers to recognize objects of unknown size and to estimate the distance of various objects from the bathysphere. The results showed that each of four observers tended to underestimate both the size and the distance of objects from the bathysphere.

Another test at Manchester was designed to determine underwater viewing capability from the bathysphere. It showed that the cone of vision through the view ports decreased from about 120° when the bathysphere was above the surface to about 90° underwater. An example of the underwater view through one of the 12-inch ports is shown in figure 4. There was variation caused by the diameter of the viewports; also, the cone of vision varies according to the porthole used because the arrangement of instruments restricts observer's ability to place his eyes close to the inside surface of some portholes. Since the portholes tested were in favorable locations, a 90° cone of vision probably is the maximum attainable viewing capability. The 16 viewports spaced around the bathysphere provide a good view in all directions.

Fig. 4 - Sea anemones (Metridium) attached to concrete blocks as observed at a depth of 40 feet from one of bathysphere's 12-inch viewports.

APPLICATION

The bathysphere has the flexibility to permit "lock-out" dives; trained SCUBA divers can exit from the pressurized sphere through the lower hatch to perform work outside (fig. 5). Captured fish may be examined, tagged, and released at depth by divers; this capability will eliminate the damaging effects of pressure changes that can occur when fish are brought to the surface for tagging. Species studied will probably be shellfish (scallops), rockfishes (Pacific ocean perch), and flatfishes (soles, flounders). The initial use of the bathysphere, however, will be as a personnel-transfer capsule in the TEKTITE II program. The Department of the Interior is responsible for implementing and managing program now underway in the U.S. Virgin Islands.

Fig. 5 - Trained SCUBA divers can emerge from the pressurized bell through the lower hatch to perform work outside.

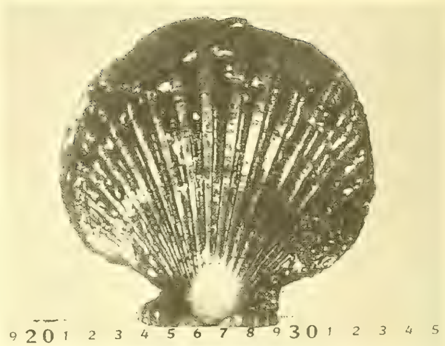
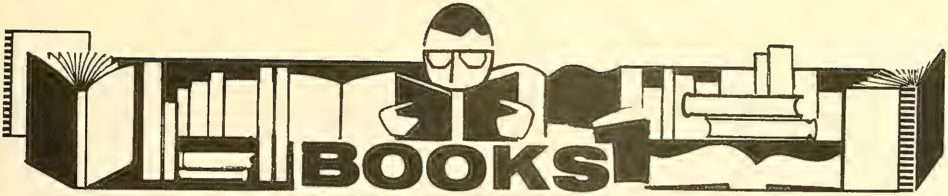


Fig. 6 - The weathervane scallop ('Patinopecten caurinus') will be the object of study in one of the bathysphere's first applications. Scientists hope observations on scallop behavior will explain inconsistency of commercial catches.

As one of the first practical applications for the bathysphere locally, we propose to study the natural behavior of weathervane scallops, Patinopecten caurinus (fig. 6) on commercial dredging grounds near Bellingham, Wash. On the basis of reports from commercial scallop fishermen, we believe the species may be exhibiting some natural evasive reaction to scallop dredges. A difference between their day and night behavior is also suspected. Perhaps these responses can be observed from the bathysphere. We will look for natural behavior patterns--such as burrowing, prolonged or erratic swimming, mass migrations, and reactions to changes in light intensity, tidal flow, turbidity, and temperature--which might help explain the inconsistency of scallop catches. Future observations on rockfish and flatfish may take the bathysphere onto the Continental Shelf.



DISEASES

"Principal Diseases of Marine Fish and Shellfish," by Dr. Carl J. Sindermann. Academic Press of New York and London.

The book "represents the first attempt ever to summarize information about diseases of marine fish and shellfish." It "first reviews the principal diseases of marine organisms, then examines disease-caused mortalities, disease problems in mariculture, internal defense mechanisms, and the relation of human diseases to those of marine animals. It also assesses the impact of disease on marine populations."

The book will be useful particularly to persons involved in oceanography, marine biology, and aquaculture. Because Dr. Sindermann's style is "straightforward and his language not unduly scientific," the book will interest both layman and scientist.

Dr. Sindermann is director of BCF Tropical Atlantic Biological Laboratory (TABL), Miami, Fla.

POLLUTION

"Effects of Abatement of Domestic Sewage Pollution on the Benthos, Volumes of Zooplankton, and the Fouling Organisms of Biscayne Bay, Florida," by Dr. J. Kneeland McNulty. University of Miami Press, Drawer 9088, Coral Gables, Florida 33124. 128 pp., clothbound, $6.95.

A study of the effects of pollution on marine life. "Such studies are rare because the onset of pollution is generally gradual, and, by the time that the need for a study is recognized, it is too late to obtain data on earlier, unpolluted conditions." The study "is especially important because the fauna and flora of Biscayne Bay are tropical, and very little is known of the effects of pollution in the tropics."

Florida's Biscayne Bay offered the opportunity of comparing polluted conditions with the situation some years after a sewage treatment plant was installed. Various elements of the biota of northern Biscayne Bay were studied before and after abatement of pollution. The pollution consisted of 136 to 227 million liters per day of untreated domestic sewage.

Four years after removal of pollution, some changes had taken place.

Dr. McNulty states: "At distances of 100 to 740 meters seaward from outfalls, in water depths of one to three meters in hard bottom, populations of benthic macroinvertebrates had declined from abnormally large numbers of species and individuals to normal numbers of each, while soft-bottom populations had changed qualitatively but not quantitatively. Adjacent to outfalls, populations had increased in numbers of species and numbers of individuals in hard sandy bottoms only. Volumes of zooplankton had decreased to about one-half the pre-abatement values in poorly flushed waters; elsewhere, they remained about the same. Dissolved inorganic phosphate-phosphorus decreased similarly. Abundance of amphipod tubes had declined markedly, a change not shared by quantities of other fouling organisms (including barnacles), which remained about the same. There was no evidence of improved commercial and sport fishing following abatement; this is interpreted to mean that long-lasting detrimental effects have resulted from pollution and dredging."

THERMAL WORKSHOP

Proceedings of the 2nd Thermal Workshop, U.S. International Biological Program, 'Chesapeake Science', Sept. & Dec. 1969. The workshop was sponsored by the National Academy of Sciences and held at the University of Maryland Nov. 3-7, 1968. Attending were about 200 persons representing University, Federal, state, and industrial interests from 27 states and 6 nations.

The conference focused on "the effects of temperature and temperature change in the aquatic environment." The biological role of temperature was stressed, although some physical and chemical aspects were covered.

It was divided into 4 sessions: 1) presentations concerning role of temperature--in basic and applied sense--on plant and animal populations; 2) results of cooperative study on ecological effects of thermal discharge from a steam electric station upon the Patuxent Estuary; 3) demonstrations of field and laboratory equipment and methods used in the Patuxent Estuary studies; 4) discussions of research design, methodology, equipment in such areas as primary production, invertebrates, vertebrates, management, and respiration.

THE FOLLOWING PUBLICATIONS OF THE DEPARTMENT OF INTERIOR, FISH & WILDLIFE SERVICE, ARE AVAILABLE FROM DIVISION OF PUBLICATIONS, BCF, 1801 N. MOORE ST., ARLINGTON, VIRGINIA 22209:

FISH HANDLING

"Recommended Practices For Vessel Sanitation And Fish Handling," by Edgar W. Bowman and Alfred Larsen, Circ. 333, March 1970, pp. 1-27, illus.

Fish-handling practices aboard commercial fishing vessels have evolved "largely through trial and error"--and not through adoption of research findings. Fishermen "have not always kept pace" with public's increasing demands for higher-quality fishery products. This booklet provides industry with a measuring rod to evaluate itself. Also, it recommends ways to improve vessel sanitation and fish-handling techniques.

The gear and techniques of modern fishing have facilitated larger catches in shorter time. The technology of processing and fish use gives the public more new products: from "traditional dried and salted fish to the ultra-convenient boil-in-the-pouch items." Despite sophisticated processing, however, there is no way to restore fish quality once it has been lost through mishandling aboard the vessel. "The final product placed on sale in the market can be no better than the fish itself."

The booklet covers: fish-handling procedures, refrigeration of fresh fish, holding fresh fish, effective and constant sanitation, personnel sanitation practices, present and future vessel design.

SALMON

"Effect of Flow on Performance and Behavior of Chinook Salmon in Fishways," by Clark S. Thompson, SSR--Fish. No. 601, March 1970, 11 pp., illus.

The author studied adult fall-run chinook salmon (Oncorhynchus tshawytscha) during "plunging and streaming conditions of flow in a pool-and-overfall fishway that permitted recycling of fish after each completed circuit." The flows were controlled by adjusting valves in a lock at head of fishway. Individual fish were timed as they ascended a certain number of pools under each condition.

The data suggest that "plunging and streaming flows may be equally suitable for the passage of chinook salmon in a pool-and-overall fishway." About 60% of fish "ascended slightly faster in the streaming flow"; the average ascent rate for all fish was "slightly higher in a plunging flow."

Mr. Thompson describes orientation of fish to type and velocity of flow. He states: "Most fish preferred to rest in the lower downstream quadrant of the pool in a plunging flow; conversely, the lower upstream quadrant was preferred in a streaming flow. Resting fish always faced the current."

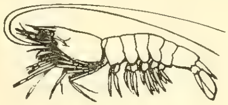
"Birectilinear Recruitment Curves to Assess Influence of Lake Size on Survival of Sockeye Salmon (Oncorhynchus nerka) to Bristol Bay and Forecast Runs," by Ralph P. Silliman, SSR--Fish. No. 600, March 1970, 9 pp.

"Comparison of the sizes of lakes and the sizes of sockeye salmon runs to Bristol Bay shows that the two variables are closely related. Birectilinear reproduction curves express quantitatively the dependence of small returns on escapement numbers and of large returns on lake capacity. Comparison of 'hindcasts' from the birectilinear curves with published forecasts for 1961-67 showed that those from the birectilinear curves were closest to the actual returns. This situation changed in 1968-69. A composite of birectilinear return estimates and 'probability tree' age allocations is worth considering."

SHRIMP

"Western Atlantic Shrimps of the Genus Penaeus," by Isabel Perez Farfante, Fishery Bulletin, Vol. 67, No. 3, June 1969, pp. 461-591.

"Four subgenera of the genus Penaeus are described (Litopenaeus, Penaeus s.s., Fenneropenaeus, and Melicertus). Eight species and subspecies (P. setiferus, P. schmitti, P. duorarum duorarum, P. duorarum, notialis, P. aztecus aztecus, P. aztecus subtilis, P. paulensis, and P. brasiliensis) are recognized as occurring in the western Atlantic. Synonymies are given. Lectotypes have been designated for two species, and the disposition of all types is shown. Diagnoses, detailed descriptions, and illustrations are presented for each species and subspecies. Geographic and bathymetric distributions are given. Affinities are discussed, and conclusions concerning ranges of variation and their spatial distribution are based on morphometric studies and other characters. The development of the external genitalia through the juvenile stage and the size range at which each taxon reaches the subadult stage are presented. Many details of ecology and life history are critically summarized and reviewed. A brief appraisal of the commercial importance of each form is also given."



ROCKFISHES

"Fecundity, Multiple Spawning, and Description of the Gonads in Sebastodes," by John S. MacGregor, SSR-Fish. No. 596, 12 pp., Mar. 1970.

"The rockfishes of the genus 'Sebastodes' (family Scorpaenidae) support an important commercial and sport fishery along the coast of California, where more than 50 species occur. . . . These fishes are of special biological interest because they are ovoviviparous [producing eggs that have a well-developed shell as in oviparous animals, but which hatch within parent's body, as in many reptiles and elasmobranch fishes]. Together with 18 species of viviparous Embiotocidae they contribute to a marine fauna that probably contains a higher proportion of species of live-bearing fishes than that in any other similar area in the world.

"Estimating the seasonal fecundity of a fish species presents two primary problems. The first and easier problem is to determine the numbers and size distribution of yolked eggs in the ovary. The second and more difficult is to determine how many times the fish spawns during the spawning season."

"In the ovaries of nine species examined, evidence of two spawnings per spawning season was found in three (S. ovalis, S. constellatus, S. paucispinis) but not in the other six (S. carnatus, S. rosaceus, S. serriceps, S. serranoides, S. atrovirens, S. ruberrimus). Two spawnings were indicated by either (1) small numbers of advanced larvae entrapped in the ovaries and associated with full complements of developing eggs or early embryos or (2) a secondary group of developing eggs along with about equal numbers of advanced embryos. The relative number of eggs or embryos was lower in the three species that gave evidence of two spawnings (162 eggs or embryos per gram of fish) than in the other six species (280 eggs or embryos per gram of fish)."

INTERNATIONAL

FAO AIDS ARGENTINE FISHING INDUSTRY

An FAO/UNDP fishery research vessel, the 'Cruz Del Sur' (Southern Cross), is helping to improve fish production in a land where beef is king: Argentina. The 107-foot, Norwegian-built, steel-hulled vessel belongs to an FAO development project.

The 5-year, $3,133,350 project, financed jointly by Argentina and the UN Development Program, seeks to develop the fishing industry, including marketing and distribution. It aims at a better, more varied, diet for Argentinians--and at building fishery exports and reducing imports through resources survey and exploratory and experimental fishing.

Fish Consumption Low

In 1968, Argentinians consumed an average of only 2.7 kilograms of fish, compared with 83.5 kilograms of beef and varying amounts of other meat products. (A kilogram is 2.2 pounds.) Fish consumption in greater Buenos Aires was almost 5 kilograms per inhabitant; in Corrientes and elsewhere, it was as low as 50 grams. Fishery imports increased from 1,438 tons in 1964 to 3,095 tons in 1968.

Vessel's Mission

The Cruz Del Sur was designed and built to FAO specifications for experimental trawling and purse seining. "Her mission: to conduct exploratory surveys and scientific research in demersal (bottom) and pelagic (open water) species--such as bonito, mackerel and hake--along Argentina's 4,100-kilometer coast."

She was launched in 1968. By 1969, she had set high standards of performance for her class. In 11 months, she sailed 45,000 miles, logged 220 days at sea, and sold her total catch for almost $40,000 in Mar del Plata. The money was put back into the project to buy fishing gear and other equipment.

Finds Fish

"Even more important, the vessel identified large stocks of anchovy, hake, bonito, mackerel, and other commercially valuable fish." She reported her findings to local fishermen. The vessel is studying and evaluating fishery stocks and helping to locate new and more profitable fishing grounds.

She is introducing new fishing techniques and gear for pelagic and demersal fishing. The FAO project has helped local fishermen catch enough bonito to reduce substantially bonito imports. Studies aim at improving marketing and distribution facilities for fresh and processed fish. Housewives have been polled to determine their preferences for fish foods.

Project manager is A.E. Fernandez y Fernandez of Spain, who heads a multinational staff of master fishermen, technologists, biologists, and economists.

FAO Fleet

The Cruz Del Sur will be joined by another research vessel provided by Argentina. There are more than 30 FAO/UNDP fishery research vessels--large stern trawlers-purse seiners to fresh water catamarans--which operate in Latin America, Africa, and Asia.

Two sisterships of the Cruz Del Sur are attached to projects in Colombia and Peru.

SCANDINAVIANS REJECT BRITISH SALMON-BAN PROPOSAL

Fishery associations in Norway, Sweden, and Denmark have rejected a British proposal for a total ban on salmon fishing in North Atlantic international waters, reports the Danish Fisheries Association (vessel owners).

The associations stated that the proposal lacked scientific basis and countered the principle of using the seas' riches.

The associations were willing to discuss arrangements to avoid excessive expansion of the international salmon fishery. (Reg. Fisheries Attaché, U.S. Embassy, Copenhagen, Mar. 24.)

FISHERY EDUCATION & TRAINING VITAL TO DEVELOPING NATIONS

"Fishery development requires urgent action to promote education and training in developing countries," an FAO conference concluded on April 16. This is particularly true for those fishermen who live off their catch. And they comprise 80% of the world's fishermen.

This was one recommendation of the 34-nation FAO Committee on Fisheries after a six-day review of world fishery problems in Rome. Observers from 23 member states and the USSR and representatives of a dozen international groups attended. Klaus Sunnanaa, Norway's Director of Fisheries, was chairman.

Educational Tools Needed

The need to train fishermen in developing countries in new industrial techniques was highlighted. The Committee agreed that the plight of subsistence fishermen, who literally live on what they catch, must be recognized. Speakers emphasized the need for simple teaching manuals, more training and use of extension workers, and manpower surveys.

Subsistence Fishermen

This need is "a great human problem," said A.W.H. Needler, Canada's Deputy Minister for Fisheries and Forestry. Subsistence fishermen account for half his country's fish catch, noted Domingo D. Tapiador, Deputy Commissioner for Fisheries of the Philippines. Any improvement in their lot would mean more production. He emphasized the need for better marketing and distribution facilities. He recommended joint ventures between government and private industry to promote fisheries.

Tapiador's points were supported by Stephen A. Tolbert, president of Mesurado Group of Companies Ltd., Monrovia, Liberia, in his keynote address. He urged combined efforts by government, industry, and private institutions to help developing countries establish and operate modern fishing industries.

Studies Needed

The Committee also urged continued work by FAO's Department of Fisheries in development and management of fishery resources, including stock assessment.

NORDIC FISH-MEAL FACTORYSHIP OPERATES OFF AFRICA

A Swedish-Norwegian firm has started fishing off West and South Africa with the mothership 'Astra' and 11 Norwegian purse seiners. The Swedish medical-supply firm Astra A/S and Thor Dahl's whaling concern of Sandefjord, Norway, are the principal operators.

Whaling Firm Involved

Sandefjord has reconstructed the 19,168-GRT whaling ship 'Thorshavet' into a floating fish-meal factory. The firm is registered in Bermuda as Astra Overseas Fishing Ltd. It has made Las Palmas, Canary Islands, its home port for the expedition.

The vessel is designed to produce fish meal from fresh fish especially for fish protein concentrate (FPC). The Astra's move into FPC field requires that it insure sufficient supplies of high-grade raw materials.

The Crew

The crew aboard the purse seiners are Norwegians. They are paid a monthly salary of US$285--plus a bonus of two kroners (28 US¢) a ton on delivered catch. Their 9-month contract will be in force through 1970.

The Catch

The catch, mostly pilchards, is expected to reach 200,000 metric tons of raw material. This would produce about 25,000 tons of concentrate.

The fleet sailed from Norway in late March 1970 for a rendezvous in Las Palmas. The seiners had been fitted out in Norway with netting costing $428,000.

Bad Year for Norwegians

The large Norwegian purse-seine fleet has had problems in the past year. Herring and mackerel were scarce in the Norwegian Sea and in the North Sea. International regulations of these waters are under consideration. The only chance today for profitable fishing is for capelin off North Norway's coast. However, the present fleet is too large and seeks new fishing areas. ('Fiskaren,' Mar. 12.)

JAPAN-USSR 1967-69 SALMON CATCHES REPORTED

On March 2, 1970, the Japanese Fisheries Agency released data on the 1967-69 salmon catches of Japan and the USSR, then meeting in Moscow to set 1970 quota. ('Suisan Tsushin', Mar. 4.)

Japan-USSR Salmon Catches, 1967-69

Salmon Species	Japan 1967	Japan 1968	Japan 1969	USSR 1967	USSR 1968	USSR 1969
	(Metric Tons)					
Red	20,493	16,766	15,502	3,018	2,249	1,640
Chum	51,630	42,519	30,171	20,639	13,697	5,867
Pink	64,481	42,787	69,520	50,701	16,253	63,436
Others	4,904	7,039	11,127	4,523	3,992	4,525
Total	141,508	109,111	126,320	78,881	36,191	75,468

ECUADOR SEIZES 2 JAPANESE FISHING VESSELS

Since the beginning of 1970, two Japanese fishing vessels (presumably tuna longliners) were seized by Ecuador: 'Seiyu Maru No. 12' (403 gross tons), on Feb. 19 near 0.5° S. latitude and 94° W. longitude off Galapagos Islands; and 'Sanyo Maru No. 38' (494 gross tons), an Okinawan vessel, on Feb. 25.

All crew members of the Seiyu Maru were reported released on Mar. 2. ('Katsuo-maguro Tsushin,' Mar. 5.)

JAPANESE PLAN JOINT SHRIMP OPERATIONS

The Hokuyo Suisan Fishing Co. was planning joint shrimp-fishing ventures with Sierra Leone and Gambia around April 1970. In Sierra Leone, where there is no shrimp fishery, the operation will be set up at Freetown. The Japanese will put up 60% of capital; Sierra Leone 40%.

In Gambia, Bathurst will be the site. Investment will be 50-50.

Gambia Favors Hokuyo Suisan

In Gambia, U.S., British, French, and Spanish fishery firms also are seeking shrimp-fishing licenses. Reportedly, Gambia intends to grant permission first to Hokuyo Suisan. That firm plans to use two 100-gross-ton vessels to serve both ventures. ('Shin Suisan Shimbun,' Mar. 2.)

SAVE 'CLEAN' WATERS OF AFRICA, FAO URGES

Action to protect the "clean" waters of Africa and other areas from pollution was urged by FAO's 34-nation Committee on Fisheries meeting in Rome in April.

E. S. Kanyike, Uganda Fisheries Department, said pollution in Africa was less serious than in Europe, but action should start immediately to meet the threat. He warned that agricultural development in his own country had increased the problem of water and fish contamination from insecticides.

"We send out pamphlets urging people to eat more fish. Perhaps we are saying to them to eat more DDT," he remarked.

Domingo D. Tapiador of the Philippines endorsed the FAO proposal. He said 12 factories in his country had been closed because of their discharges, and lawsuits were pending over pollution. Fish culture is especially vulnerable to pollution, he warned.

Philip M. Roedel, Director of the Bureau of Commercial Fisheries, U.S. Department of the Interior, said the U.S. was very aware of the "urgent need" to safeguard the quality of the environment. He urged FAO to study the inland waters of Africa which may be threatened by pollution. He strongly endorsed FAO plans to hold a conference in December 1970 on the effects of marine pollution on fisheries and other living resources.

Cedric G. Setter, Assistant Secretary of Australia's Fisheries Division, said pollution was beginning to threaten the famed Great Barrier Reef. One major oil spill already had taken place. His government was studying the whole subject. He urged a study and evaluation of detergents used in combating oil spills on the sea.

CANADA

EARMARKS PRICE STABILIZATION FUNDS FOR LAKE ERIE PERCH

C$1 million has been earmarked for a price-stabilization program for Lake Erie perch in 1970-71. It will be made available to the Fisheries Prices Support Board to ensure minimum prices to fishermen during peak periods. This was reported by Dept. of Fisheries and Forestry on March 16.

Under the program, the Board will purchase frozen perch fillets from processors--provided fishermen have been paid a minimum of 10 cents per pound for spring perch (April 1 to May 31) and 12 cents a pound for fall perch (June 1 to March 31). These prices are based on whole fish packed and delivered to processing plants.

Much Like 1969 Program

The program is similar to 1969 program except there will be no blending of spring price. Last year, spring production surplus that could not be filleted immediately was sold at a lower price; fishermen received average of lower and higher prices.

In 1969, Lake Erie fishermen harvested a record catch of nearly 30 million pounds worth C$3.2 million.

The Fisheries Prices Support Board is expected to recover cost of program later in the year. Processors selling fillets to Board during peak production periods undertake to buy back at cost all products in the program.

* * *

CONFERENCE ON CANADIAN SHRIMP FISHERY SLATED FOR OCT. 1970

The firm establishment of a prosperous shrimp fishery in Canada's Atlantic Coast provinces is the main objective of a conference to be held in Fredericton, N.B., Oct. 27-29, 1970. The three-day meeting will encourage development of a new fishery.

During past years, Federal and provincial explorations showed that commercial quantities of pink shrimp, Pandalus borealis, are present in the Gulf of St. Lawrence; comparatively small-scale fishing has supported prospects of profitable operations.

The Conference Agenda

At the conference, specialists from Canada and other countries will focus on successful catching and processing methods outside of Canada. Governmental and other experts will outline possibilities indicated by exploration work findings and discuss future plans. Quality control, storage, and marketing also will be discussed.

Pink Shrimp Fishery

The pink shrimp is smaller than Gulf of Mexico shrimp; it has a ready market in U.S. and Europe. There has been a limited fishery in Quebec in recent years and, for the past two years, in Bay of Fundy. There, 37 new Brunswick draggers landed about 2 million pounds in 1969. Most of catch was cooked before being landed for further processing at five shore-based plants.

Besides Gulf of St. Lawrence, good possibilities are reported from southwest coast of Nova Scotia, and off Newfoundland.

The Canadian Department of Fisheries and Forestry, in cooperation with the provinces, is continuing shrimp explorations.

ST. PIERRE ET MIQUELON

EXPANSION CONTINUES

Major construction is planned to begin this summer as part of St. Pierre's plan to expand facilities to attract more fishing vessels. A new 450-ft. wharf will be built. (U.S. Consul, St. Johns, Mar. 18.)

EUROPE

NORWAY

STUDIES COSTS AND EARNINGS OF FISHING VESSELS

Since 1950, the Norwegian Directorate of Fisheries has carried out annual costs and earnings investigations based on annual and seasonal accounts submitted by debtors of the State Fisheries Bank. This was reported on Feb. 12 by 'Fiskets Gang', a Directorate publication. The investigation covers fishing vessels 40 to 169 feet long (except trawlers more than 200 GRT) fishing for at least 30 weeks in 1967.

The Findings

The investigation shows increasing gross earnings with increasing size of vessels; on average, these range from about US$14,500 for vessels between 40 and 50 feet (South Norway) up to $246,000 for vessels above 120 feet (South Norway). Operating costs and depreciation increased correspondingly from $6,000 to $131,000.

Average Surplus

The average surplus on vessel and gear to the owner varied from minus $1,500 for vessels 80 to 100 feet (South Norway) to $19,700 in biggest size group (above 120 feet in South Norway). The three largest groups, IV, V, and VI in both South and North Norway, are dominated by herring purse seiners.

Wages

The average wage earning capacity per man-week varied from $47 to $139. This is gross earnings minus aggregate operating costs, depreciation, and calculated interest on capital. Except for vessels 40 to 50 feet, there was a covariation between wage-earning capacity per man-week and vessel size. But covariation was less clear than in 1966.

Fisherman's Annual Share

Also, fisherman's annual share increased with vessel size, except for vessels 40 to 50 feet. In 1967, fisherman's annual share varied on an average from $2,300 to $5,600. The fisherman's annual share is defined as share attained for a whole year's work. It is purely a work share; capital surplus is not included.

Rate of Capital Surplus

The rate of capital surplus, which is the amount of capital surplus as percentage of the market value of the capital employed, varied substantially--from minus 1 to plus 18% for vessels under 100 feet, and between plus 1 and 9 for vessels above 100 feet.

The vessels under study had been occupied in a variety of seasonal fisheries with highly varying economic results during the year. The average economic results of the vessels decreased considerably from 1966 to 1967 in majority of size groups.

For the most part, average wage-earning capacity too decreased from 1966 to 1967.

* * *

SEES U.S. AS GROWING MARKET FOR FROZEN FISH

Frozen-fish exports from Norway to all markets was about 117,000 tons in 1969, a substantial rise above 1968. Sales were handled by Frionor, Findus, and the Nordic Group.

The U.S. is a growing market. During 1967, only 7,000 metric tons were exported; in 1969, 42,000 tons: 30,000 tons produced by Frionor, one of world's largest exporters of these products, and 12,000 tons by Nordic Group, also firmly established in this highly important market.

Nordic Uses Other Trademarks

The Nordic Group has not sold its products under its own trademark. In most cases, the trademark of First National Stores (Finast) is used, but the frozen fish fillets are also sold under other private labels.

Main Items Researched

The main products are skinless and boneless fillets of cod and haddock. The items result from intensive market research by Nordic Group experts. U.S. preferences in taste, appearance, and packaging were examined thoroughly. The products marketed through First National Stores have proved very successful.

NORWAY (Contd.):

Nordic Group is joint export organization for 21 freezing plants, headquartered in Trondheim. ('Norwegian American Commerce', Jan.-Feb. 1970.)

WEST GERMANY

HERRING FISHERY OFF U.S. & CANADA GROWS STRONGER

The manager of a Norwegian herring fishery off Canada (Carino Company, Ltd.) has described to his firm the operation of West German factory vessels in the Western Atlantic:

There are 24 large factory vessels, 84 meters long, 3,200 h.p., with daily freezing capacity of about 50 metric tons a day. The vessels have up-to-date equipment to fillet herring and other fish. They use both a bottom and pelagic trawl guided by latest electronic gear. Eight pelagic trawls are carried on board each vessel of 4 different types. The factory vessels use St. Pierre as home base for repairs and transfer of catch and crew. Aboard each vessel are 60-70 men serving 7-month hitches. They choose their vacation time on three months' notice.

Mostly Cod Fishing

The fleet goes to Greenland from February to May to fish mostly cod. It uses a bottom trawl. The 1969 fillet production was about 2,000 metric tons per vessel.

Herring Fillets

After reloading and repairs in St. Pierre, the vessels sail to the banks outside Nova Scotia and to Georges Bank in June to fish herring with a pelagic trawl. They fish in the Gulf of Maine and elsewhere up to U.S. 12-mile limit. About 1,500 tons of herring fillets were packed from June to August, in addition to herring meal and oil. From mid-September to Christmas, "Vollherring" (herring without heads, frozen in the round) is produced. The captains estimated they could produce easily 2,000 tons per boat, which would yield annually 5,500 tons of frozen products, plus meal and oil.

20% Herring Fillets Salted

The Germans long ago stopped salting round herring from Georges Bank because they were unable to obtain acceptable quality with methods used. They now salt about 20% of herring fillets and have no problem achieving excellent quality.

Double Trawler Size

From a very small start in North Sea and Iceland, where they used reconstructed fresh fish trawlers, they have doubled size of giant trawlers. During last three years, they have been in full operation with floating trawls for herring.

Germans Outfished Norwegians

In 1969, the Norwegian factoryships that fished during same period and area produced 100 tons of herring fillets; the Germans produced 750 tons. This may show that more gear and equipment experience is needed than that with which Norwegians began.

Compared to bottom trawling, it appears pelagic trawl requires more powerful motors and winches. The vessel must be capable of changing trawl type according to conditions and be manned by experienced crew knowing the techniques. (Reg. Fisheries Attaché, Copenhagen, Mar. 24.)

* * *

MARKET FOR HERRING AND MACKEREL

The Norwegian Fisheries Attaché in Hamburg recently advised the Norwegian industry to pay more attention to W. German market for herring and mackerel. He reported:

West Germany is still the largest importer of fish and fishery products, after U.S. and Great Britain. In 1968, Germany's total consumption of fresh-frozen herring was about 250,000 metric tons (catch weight). Her own production reached top in 1965: catch weight of 774,000 tons, of which 40% was herring. Since then, however, North Sea fishery declined.

Herring Stock Decline

The decline in herring stocks produced large deficit in supply. Denmark took over

WEST GERMANY (Contd.):

more and more of market. To compensate for this, the German fleet looked for new herring grounds. During recent years, it succeeded in fishing herring on Georges Bank in Atlantic off U.S.

The 1967 production of frozen herring and herring fillets reached about 19,000 tons. In 1968, number of herring fillets 32,000 tons; round herring was 5,500 tons.

The number of W. German factory vessels in Georges Bank fishery was 18 during 1958, and more in 1969. W. German scientists fear that Georges Bank herring is being overexploited and that supplies from there will be reduced.

Denmark Is Main Supplier

It is questionable, however, whether German vessel owners will be able to cover expenses during 1970. Denmark has strengthened position as main supplier of herring to West Germany. Germany's imports from Denmark were 120,514 tons, or about 73% of herring imports.

Norway's share of German imports during 1968 was 11,385 tons, about 7.5%. Her exports of fresh round herring to Denmark in 1967 was considerable; the herring were filleted and reexported to West Germany.

Obtaining Enough Herring Difficult

West Germany's demand for raw material in catch weight (in addition to salted herring) is about 250,000 tons; of these 80,000 is used in canned products, 95,000 tons for marinated products, and remainder for smoking, fresh fish, and other purposes. The possibility of obtaining sufficient herring for all those purposes is limited.

If North Sea herring fishing declines further, unexpected possibilities might open for frozen mackerel fillets to W. German canning industry in future years. Mackerel consumption now is about 6,000 tons a year.

The Future

In 1968, German imports of fresh mackerel were about 2,500 tons: 280 tons from Norway and about 1,740 tons from Denmark. Expanded ferry connections in recent years between Norway and W. Germany should enable Norway to increase her share of fresh mackerel market.

Majority of mackerel is for smoking; a smaller part for canned products. Good possibilities exist to increase use of mackerel fillets for canning because several W. German canning factories fear insufficient herring supplies. They believe they must introduce new products from other fish. (Reg. Fish. Attaché, Copenhagen, Mar. 24.)

UNITED KINGDOM

TO ABANDON FATHOM MEASUREMENT

The British Government has asked Parliament to authorize use of the metric system aboard ships as part of a general move toward that system. The fathom, an ancient nautical measure for 6 feet (0.914 of a meter), will be replaced by the meter. ('New York Times,' Feb. 26.)

The tradition-weighed British Navy is last to bow to the inevitable. Bankers were first: British pounds were converted to the decimal system.

USSR

WORRY ABOUT LAKE BAIKAL FISHERY RESOURCES

Fifteen years of overfishing have so decreased the omul, or fresh-water whitefish ('Coregonus autumnalis migratorius'), resource on Lake Baikal that Soviet scientists believe it will take about 7 years to restore it to commercial level. Omul is one of the most important fisheries in Lake Baikal. To improve the situation, Soviet Fisheries Minister Ishkov, May 1969, banned commercial and sports fishing of omul, sig, a species of whitefish found only in Lake Baikal, 'C. lavaretus baicalensis', and sturgeon.

1970-75 Plans

According to chairman of Siberian Branch of Ministry's Ichthyological Commission, new omul hatcheries will be built and existing ones

USSR (Contd.):

expanded in Baikal area between 1970-1975. A "new" reproduction technique will be introduced: part of spawning omul will be allowed to spawn naturally; the rest will be harvested for artificial reproduction. After ban is lifted, omul will be caught only in the rivers where it migrates, but not in Lake Baikal. This will eliminate fishing fleets and save manpower and gear. ('Vostochno-Sibirskaia Pravda')

Controversy Over Baikal Pollution

Soviet concern about Lake Baikal was expressed too in a motion picture centering on 12-year-old controversy between conservationists and industry managers. The lake's fauna is threatened by pollution from wood pulp factories on its shores. The motion picture is pessimistic: there are no signs of improvement. ('New York Times,' Mar. 2.)

POLAND

ESTABLISHES EXCLUSIVE FISHING ZONE

Poland has established an exclusive fishing zone along her Baltic coast. It extends 12 nautical miles from the base line used to determine her 3-mile territorial waters.

Vessels of countries traditionally fishing in the 6-12 mile zone, and in the 3-6 mile zone, will be allowed to continue fishing; the latter on a temporary, transitional basis. In both cases, however, the countries must negotiate bilateral agreements with Poland in order to fish after January 1, 1971. (U.S. Embassy, Warsaw, Feb. 19.)

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PLANS INCREASED CATCHES OF BALTIC SALMON

Under the 1970-1985 fisheries development plan, Poland plans catches of salmon species in the Baltic of 740 tons a year. Several programs have been devised: (1) conversion of drift-net materials from hemp to synthetic fibers; (2) training fishermen in modern salmon-catching techniques; (3) equipping nets with floats having radar reflectors; and (4) construction of prototype salmon cutter to begin a series of salmon-fishing vessels. Until now, most Polish Baltic salmon fishing has been done with 7-meter-long beach-type boats. Future salmon fishing will be conducted mostly by cooperative fishermen; private fishermen may continue their traditional fishery but will not be supported by the government.

Catches Fluctuated

Catches by all countries fishing in the Baltic fluctuated between 2,000 (1958) and 3,700 metric tons (1964). The 1966 catch of 2,907 tons was made mostly by Danes (1,659 tons). Poland landed only 116 tons in 1966; her catches never exceeded 350 tons (1964).

Salmon & Salmon-Trout

Salmon ('Salmo salar') are fished in winter and spring by Danish, Swedish, and German fishermen in the Southern Baltic, to which they migrate from Swedish waters.

The Poles have stocked salmon trout ('Salmo trutta') extensively, the second most important Baltic salmon-like species; it originates in Polish rivers. Two salmon-trout hatcheries have been built. ('Polish Maritime News')

HUNGARY

EXPANDS FISH-POND PRODUCTION

Hungary plans to increase production of pond fish to make more animal protein available at relatively low cost. The aim is to increase annual fish consumption to 5 kg. (11 lbs.) per person by 1980, in 1968; it was 2.55 kg. (5.6 lbs.).

Asks UN Help

To achieve this, Hungary has asked the United Nations Development Program (Special Fund) to help her improve research and training facilities in fish culture.

Hungary also is increasing production of grains required for fish feeding. ('World Food Program News,' Jan.-Feb. 1970.)

CZECHOSLOVAKIA

FISH CULTURE TRENDS

The first Czechoslovak experiments on carp culture in ponds fed with warm-water effluents from power plants were conducted in 1968-1969. Breeding was hastened by one month compared with normal pond conditions.

At water temperature of 25-30° C. (77-86° F.) and fed granulated feeds, 1 to 1+ year-old common carp in cages gained about 1,500 kilograms/hectare in 3 months; the average weight per fish at harvesting was 1 kilogram.

The research is aimed at achieving mass production of carp fingerlings.

Ducks & Carp

The university raised ducks for a short period to see whether this intensive fertilization would increase production of carp fry. Carp larvae were released into ponds after duck rearing ended. After 25 days, fry production was considerably more than in control ponds.

The university is now trying to increase production of carp yearlings through optimum combination of fertilization, feeding, and population density. ('FAO Fish Culture Bulletin')

ICELAND

CAPELIN FISHING SEASON LOOKS GOOD

As of mid-March, the capelin catch totaled 110,000 metric tons. Already, 1970 is Iceland's third best capelin year (1969: 171,000 and 1966: 125,000 tons).

Several weeks of fishing remained before season ended (traditionally early April).

Capelin is used exclusively for fish meal and oil. (U.S. Embassy, Reykjavik, Mar. 17.)

EAST GERMANS & SOVIETS

COOPERATE IN APPLYING COMPUTER TECHNOLOGY TO FISHERIES

A conference between Soviet and East German computer specialists in Rostock (E. Germany) last year concerned problems of computer techniques applied to fisheries. Joint research is aimed at improving control of fishing-vessel operations and devising mathematical and arithmetical models for shipboard computers. Models for tactical and strategic fishing control also are being studied.

The Soviets and E. Germans would like to solve at sea: general economic data analysis (without computers); optimum correlation between catch, production, and processing capability of vessels; optimum deployment of vessels (by mathematical programming and games theory).

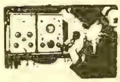
Marine Biological Research

The 2 countries also plan to apply mathematical methods and computers to marine biological research: devise mathematical models to forecast yields and catch, design experimental population dynamics models to determine stocks of individual species, and to forecast commercial fish concentrations from biotic and abiotic factors.

The 2 parties are developing a unified system of collecting, storing, and exchanging commercial fishery data according to a unified mathematical processing technique. They also are developing standard symbols for block diagrams and information processing, as well as a standard computer language. ('Rybnoe Khoziaistvo,' 1969.)

System to Control Whole Fleet

The Soviet Caspian Fisheries Administration installed data-processing computer in August 1969. The Soviet Fisheries Ministry is working on an automatic data-control system that will make it possible to control the operations of the entire Soviet fishing fleet.



LATIN AMERICA

PERU

FISH-MEAL PRODUCTION & EXPORTS DECLINED IN 1969

In 1969, fish meal supplies in Peru--world's major supplier and leading competitor for U.S. exports of soybean meal--declined 519,700 metric tons. This equaled crude protein content of 35.9 million bushels of soybeans. The decline produced sharp increase in prices and exports fell 427,600 tons--equal to 29.5 million bushels of soybeans.

In 1969, supplies were 2 million tons and exports 1.7 million tons.

Last 4 Months Crucial

In 1969, 257,700 tons (83% of decline in production) and 389,600 tons (91% of decline in exports) occurred in last 4 months of fishing season, which began Sept. 1, 1969; it reflected reduced catches of anchovy.

Stocks during 1969 dwindled from over 490,000 tons on May 1 to less than 50,000 tons on Sept. 1.

Prices Rose

In 1969, average monthly prices--cost, insurance, freight (c.i.f.) European ports--rose sharply from low of about $137 a metric ton in January to nearly $228 a ton in November. The 1969 annual average price of $177 a ton was markedly above 1968's $134 average, the highest since 1966.

Prices have declined significantly since Jan. 1970 as catch improved and stocks increased. On March 5, prices were $175 a ton.

8.5 Million Metric Tons

Virtually all of Peru's fish meal is produced from anchovies, which are subject to seasonal catch limits. The 1969/70 fishing season quota is 8.5 million metric tons; last season's was 10 million tons. If achieved, it could produce 1.6 million tons of meal.

Exports to U.S. & Canada Fell

Exports to U.S. and Canada declined 361,400 tons in 1969; this is crude protein equivalent of 25 million bushels of soybeans. This decline and reduced exports to other Western Hemisphere nations accounted for 96% of total decline.

Peru's Fish Meal Exports

	1968		1969	
United States and Canada	550.9	26.4	189.5	11.4
South America	143.4	6.9	103.7	6.3
West Germany	396.9	19.1	384.2	23.2
Other Western Europe	556.0	26.7	595.5	36.0
Eastern Europe	278.1	13.3	267.5	16.2
Japan and all others	157.9	7.6	115.2	6.9
Total	2,083.2	100.0	1,655.6	100.0
Total exports excluding those to Western Hemisphere	1,388.9	66.7	1,362.4	82.3

Exports to Europe Up

Exports to Europe totaled 1.25 million tons, slightly above 1968. West Germany emerged as largest market: 384,200 tons, or over 23% of all Peruvian exports; in 1968, 396,900 tons (18%). West German imports are expected to decline significantly this year; her recent changes in mixed-feed regulations will accentuate import decline. ('Foreign Agriculture,' U.S. Dept. Agric., Mar. 30.)

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FISH MEAL FUTURES UP

Fish meal futures prices have increased sharply, said the 'Wall St. Journal' on April 21. New York fish meal futures prices rose $5 a metric ton, the daily limit. The May 1970 contract was quoted at $205.50. In Hamburg, Germany, fish meal prices rocketed $18 a ton. Supplies for April-June delivery were tagged there at $208, and for July-December shipment at $213.

Demand was sparked by reports that the Peruvian Government has prohibited all further sales of the high-protein livestock and animal feed. According to private sources in Peru, the Government will take over completely the marketing of fish meal.

Action Expected

Apparently, the Peruvian fishing industry and foreign buyers expected the action. As a result, about 750,000 tons were sold for export prior to the ban.

PERU (Contd.):

Some supplies sold for export already have been shipped. Some will be taken from reserve stocks; on April 1, these amounted to 444,000 tons. A year earlier, the stock was 450,000 tons.

Export orders call for shipments as far ahead as December 1970. It is understood Peru will allow shippers to take supplies from new production without any defaults.

MEXICO

FISH PRODUCTION WAS ONLY ECONOMIC SECTOR TO DECLINE IN 1969

Mexico's 1969 fish production was 232,701 metric tons, a drop of 3.1% from 1968. These were preliminary data from Secretary of Industry and Commerce.

Thus, for second consecutive year, fishing was only economic sector to decline.

Ups & Downs

Continuing the trend begun in 1967, shrimp production in 1969 of 32,056 metric tons was a drop of another 11.1%. Anchovy output fell 72.8%. There were gains in oysters (31.7%), grouper (30.4%), and spiny lobsters (up 116.7%).

In industrial products, fish-meal production gained 30.2%, continuing upward trend of recent years and moving toward goal of self-sufficiency in fish meal.

Shrimp No. 4 Export

Shrimp exports in 1969 were worth US$51.8 million, down 4.2%. This was a smaller decline than in 1968. It is explained by generally higher prices in the U.S., which took most of these exports.

Because of high prices, shrimp remained No. 4 in exports after cotton, sugar, and coffee. (Reg. Fish. Attaché, U.S. Embassy, Mex., Apr. 11.)

CUBA

BUYS ITALIAN-BUILT REFRIGERATED FISH CARRIER-MOTHERSHIPS

Cuba has acquired 2 sister carrier-motherships, 'Oceano Pacifico' and 'Oceano Indico'. Built in La Spezia, they are the largest, fastest, most modern and best-equipped vessels of Cuba's high-seas fishing fleet (Flota Cubana de Pesca). In November 1969, vessels were transporting catches from trawlers and tuna fishing vessels in Atlantic. Oceano Pacifico was deployed off Equatorial Africa.

The Vessels

The vessels are: 6,651 GRT; length overall 140.5 meters; breadth 17.8 meters; 10,500-hp. engine; cruising speed 20 knots an hour fully loaded. Eight have refrigerated holds and have a total capacity of 8,350 cubic meters. Temperatures of holds can be thermostatically controlled down to -20° C. (-4° F.).

Equipment

Equipment includes radar (48-mile range), automatic pilot, radiogoniometer (direction finder), echo-sounder (range to 300 fathoms), 1-kilowatt transmitter, and an automatic alarm system. Crew's quarters, with dining, living, study and recreation rooms, are said to "resemble hotel accommodations." ("Granma")

PANAMA

FISHERY PRODUCTS WERE 10.6% OF ALL EXPORTS

Panama's fishery exports (fish meal and shrimp) were 10.6% of total exports during Apr.-Sept. 1969.

Total shrimp exports were 2,440 metric tons worth US$5.6 million; fish meal exports were 1,569 metric tons worth US$202,000. (U.S. Embassy, Panama, Mar. 17.)

ASIA

JAPAN

TUNA FLEET SIZE DECLINES BUT GROSS TONNAGE RISES

In 1969, the gross tonnage of large Japanese tuna vessels over 300 tons, and of motherships, declined about 7,000 tons from 1968. The tonnage of vessels in the 210-300-ton category increased. ('Suisan Tsushin,' Mar. 10.)

Tuna Fleet 1968-69

Vessel Size	1969 No. Vessels	1969 Gross Tons	1968 No. Vessels	1968 Gross Tons
	Vessels Engaged Exclusively in Tuna Fishery			
Under 120	240	24,435	318	31,865
120-210	285	53,197	263	48,450
210-300	435	115,950	381	100,464
Over 300	201	78,327	203	79,891
	1,161	271,909	1,165	260,670
	Vessels Engaged Seasonally			
	122	11,023	125	11,002
	Distant-water Motherships			
Motherships	35	34,633	37	39,898
Portable boats[1/]	70		86	
	Vessels Engaged in Coastal Tuna Fishery			
	1,634	71,234	1,671	69,082
Grand Total[1/]	2,952	388,799	2,998	380,652

1/Portable boats carried by motherships are not included in grand total.
Source: Second Ocean Section, Fisheries Agency.

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ONLY YELLOWFIN TUNA SEINER IN E. PACIFIC FAILS AGAIN

After losing her skiff, the 500-gross-ton 'Hakuryu Maru No. 55', Japan's only seiner in the 1970 eastern Pacific yellowfin tuna fishery, sailed for home. She began fishing in early January and had landed a disappointing 100 tons of yellowfin. It was her second unsuccessful try in the eastern Pacific purse-seine fishery.

She'll Try Again in 1971

In 1969, she and 3 other Japanese seiners experienced a disastrous failure in that fishery. The Hakuryu Maru is scheduled to undergo extensive gear modifications in preparation for a third try next year. ('Suisan Tsushin,' Mar. 27.)

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TUNA LONGLINE CATCH RATE IS DECLINING

The hook rate in the tuna longline fishery during 1969 generally declined from 1968. This was reported by the Japan National Federation of Tuna Fishery Cooperative Associations (NIKKATSUREN).

Its study was based on 100,000 sets, or about 6 months' longline fishing effort.

Catches in 3 Oceans

The catch per set in 1969 was 1.7 metric tons in the Pacific; 2.2 tons in Atlantic; and 1.6 tons in Indian Ocean. The 1969 catch per set in Pacific was about 1968 level, but in the Atlantic and Indian Oceans the rate was 20-30% below 1968.

The outlook for 1970 is that longline catch may decline further. It is believed that tuna landings have declined in proportion to increase in fishing effort of South Korean and Taiwanese fleets. ('Minato Shimbun,' Mar. 12.)

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VESSEL COMPLETES TUNA SURVEY IN SOUTH ATLANTIC

The Japanese tuna longliner 'Azuma Maru No. 37' (314 gross tons) returned to Tokyo on Mar. 15, 1970, after an 11-month government-subsidized, tuna-resource survey in the South Atlantic.

The vessel caught 311 metric tons of fish: 37% albacore, 27% big-eyed, 24% swordfish, 15 tons southern bluefin (400 fish), and others.

Best Fishing Grounds

The best fishing grounds were near 35° S. latitude and 45° W. longitude, where good big-eyed catches were made. Swordfish were taken near 36° S.-37° S. latitudes and 50° W.-52° W. longitudes.

Blackfin Tuna Caught

The catch also included 2-3 tons of Atlantic blackfin tuna, which contain much oil and are likely to bring good price on Japanese fresh-fish market.

JAPAN (Contd.):

Another Cruise

In April, the Azuma Maru was scheduled to depart on another cruise, for which the Government budgeted about $177,800. ('Katsuo-maguro Tsushin,' Mar. 17.)

* * *

TO INCREASE SKIPJACK TUNA FISHING EFFORT

The Japanese Fisheries Agency is focusing on development of skipjack tuna resources. It is developing survey plans. Despite opinion of some scientists that there is an overabundance of skipjack, the annual catch is only around 200,000 metric tons.

1969 Catch 20.3 Billion Lbs.

The greater Japanese catch in 1969--20.3 billion pounds--was due primarily to increased landings of Alaska pollock. But the pollock catch cannot be expected to continue increasing, so the Agency is eyeing skipjack to boost production further. Exploratory purse-seine cruises are being scheduled for this year in the southwest Pacific north of New Zealand, and in the mid-eastern Pacific. About US$861,000 has been allocated for fiscal year 1970 (April 1970-March 1971).

The Agency is considering initial surveys off Palau (U.S. Trust Territory of the Pacific) and off northwest Australia. ('Shin Suisan Shimbun Sokuho,' Mar. 10.)

* * *

EXPECT IMPROVEMENT IN SHRIMP MARKET, IMPORTS DOWN

Japanese imports of frozen shrimp in 1969 reached a record of nearly 49,000 metric tons, although the domestic shrimp market continued sluggish. Since Jan. 1, 1970, the market has shown signs of recovering; cold-storage holdings have decreased gradually. However, since the shrimp situation in Japan has not yet stabilized, the trade journal 'Suisan Keizai Shimbun' polled about 30 major firms on the present state and outlook for the shrimp business.

Survey Results

The responses generally were:

(1) No sharp uptrend in market conditions during first 6 months but, in view of present firm movement, market should improve gradually; (2) the quantity of shrimp imports depends on price, among other factors, but optimum level is around 40,000-45,000 metric tons a year; (3) promising shrimp grounds are off southeast Asian countries (Philippines and Indonesia), and off west Africa; and (4) consumer pack is an effective way to increase demand, and packing product at source of supply is preferable to repacking in Japan.

Imports Down

Japanese imports of frozen shrimp during January 1970 totaled 3,113 metric tons valued at about US$7.94 million, down sharply from Dec. 1969 imports of 4,306 metric tons worth $11.1 million. Jan. 1970 imports were contracted during Nov. and Dec. 1969, when the Japanese market was weak. ('Suisancho Nippo,' Feb. 17 & 28.)

* * *

SALMON FISHING IN JAPAN SEA STARTED MARCH 1

Japanese salmon fishing in the Japan Sea started on March 1. This fishery and the North Pacific salmon fishery are controlled by the Japan-USSR Northwest Pacific Fisheries Convention. Vessels must report location and catch each day to patrol boats of Japanese Fisheries Agency.

Large Fleet Operates

About 760 vessels from eight Japanese prefectures were expected to operate. This leads to complications in radio communication. In 1970, at least three radio bands will be used to ease communications problems. ('Minato Shimbun,' Feb. 25.)

* * *

TRAWL FLEETS LEAVE FOR EASTERN BERING SEA

Three trawl fleets departed Japan in late February for the eastern Bering Sea to produce minced fish meat (surimi), fish meal, frozen fish, and fish oil and solubles. The fleet is expected to operate there until late September. ('Suisancho Nippo,' Feb. 23.)

Their production plans are:

Fleet	Surimi	Meal	Frozen Fish	Oil	Solubles
	(Metric Tons)				
'Gyokuei Maru'	7,000	22,000	1,500	2,000	0
'Mineshima Maru'	15,000	20,000	6,500	1,800	2,000
'Shikishima Maru'	15,000	15,000	3,000	1,400	0
Total	37,000	57,000	11,000	5,200	2,000

THAILAND

BANGKOK UNIVERSITY TRAINS LAOTIAN FISH-CULTURE SPECIALISTS

Since 1967, the College of Fisheries of Kasetsart Unversity, Bangkok, Thailand, has been training Laotians in fish culture under a program sponsored by U.S. Operations Mission (USOM) in Thailand.

So far, 16 Laotians have received 4 weeks' training, and participated in study tours and field work under the guidance of Thailand's Department of Fisheries.

3 Fish-Culture Stations

Three fish-culture stations were established in Laos in 1966--in Vientiane, Luangpravang, and Pakse Provinces. They have successfully bred the common carp introduced from Thailand. Fingerlings are distributed to interested farmers. There is now considerable interest among farmers to culture fish.

By 1971, the 3 stations may produce annually 2.8 million fingerlings and 65 to 70 tons of edible fish. (FAO Fish Culture Bulletin')

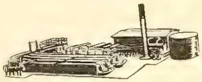
TAIWAN

MARINE FISH-CULTURE LABORATORY BUILT

A marine fish-culture laboratory has been erected at Tungkang in southern Taiwan under a research project financed by the Rockefeller Foundation. The buildings include a research laboratory, storage building, and a dormitory. Concrete ponds with circulating sea water are under construction.

Shrimp & Grey Mullet

The work of the laboratory is directed mainly toward the biology and culture of shrimp, and the induced spawning of grey mullet, Mugil cephalus. ('FAO Fish Culture Bulletin')



SOUTH VIETNAM

SAIGON FISH MARKET IN OPERATION

The recently opened Saigon Fish Market is Vietnam's newest and largest wholesale fish-marketing facility. Built with U.S. funds, the modern US$2,360,000 structure will help reorganize South Vietnam's traditional fish-marketing system.

The Fish Market

The complex consists of a landing wharf, market building, offices, cold-storage rooms, and paved approach roads. About $65,000 additional funds were used for a parking area and supplementary facilities. (U.S. Embassy, Saigon, Feb. 14.)

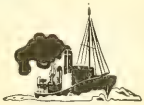
SOUTH KOREA

DEEP-SEA FLEET SHOWS STRONG GROWTH

The deep-sea fishing fleet of the Republic of Korea (South Korea), though increasing steadily over the past few years, suffered a small setback during second half of 1969. On July 1, 1969, it included 209 vessels (over 63,000 gross tons). By Jan. 1, 1970, only 1 vessel had been added, but total gross tonnage had decreased to 56,600 tons. Net gain for 1969 was 20 vessels (10,300 gross tons), a growth rate of 22%, one of the world's fastest.

1 Firm Liquidated

Much of the decrease between July and December 1969 was due to the liquidation of the Shin Hung Fisheries Company. The company had entered 17 vessels (13,560 tons) in Northeast Pacific high-seas fishing in summer 1969. Apparently operations were financially unsuccessful and the company, with no vessels in January 1970, merged with Sam Yang Company.



SOUTH PACIFIC

AUSTRALIA

SHRIMP CATCH ROSE IN 1969

The 1969 shrimp catch by trawlers in northern Australia has been estimated at 9.5 million lbs., live weight--more than double 1968's 4.5 million lbs. The official 1969 total could reach 10 million lbs. The record catch was made by 350 trawlers--100 more than in 1968.

Northern Territory

Production in Northern Territory is now emerging as one of Australia's major shrimp fishing areas; 3 trawlers took an estimated 7 million lbs., compared with only 200,000 lbs. in 1968.

Arafura Sea Most Productive

International waters in Arafura Sea, the most productive grounds, yielded 2.4 million lbs. of shrimp. Trawlers in Arnhemland-Gove area caught 2 million lbs.; in Melville Island grounds, 1.3 million lbs.

Queensland

Queensland grounds north of Townsville and in the Gulf of Carpentaria produced 2.5 million lbs. (1.5 million lbs. from Karumba-Weipa area in Gulf). In 1968, these eastern Gulf grounds produced 4.4 million lbs.

Species

Of 9.5 million lbs. of shrimp caught in northern Australia in 1969, 7.1 million lbs. were 'bananas', 1.4 million lbs. 'tigers', and 500,000 lbs. 'endeavours'.

Dec.-Jan. Fall Off

During December and January, catches by northern trawlers dropped off. Many boats were laid up for overhaul to prepare for 1970 season expected in March.

Above-average rain, particularly in Darwin-Cape York Peninsula coastal strip, has raised hopes of good 1970 season in Gulf of Carpentaria.

Northern Territory Activity

In Northern Territory, 60-70 trawlers were expected to operate. Three shore-based factories have been established--at Groote Eylandt, Katherine, and Darwin. Construction of a fourth new processing plant at Darwin, in advanced state, is for joint Australian-Japanese enterprise.

This company has four 70-ft. trawlers under construction in Australia and expected to be delivered in this season.

Seven fishing companies (three joint ventures) will be operating fleets in waters adjacent to Northern Territory and in international waters.

Queensland East Coast

On Queensland east coast, trawlers were waiting in late January for wet season to end before proceeding to shrimp grounds in north and in Gulf of Carpentaria. ('Australian Fisheries,' Feb. 1970.)

FOOD FISH FACTS

TUNA, ALBACORE
(Thunnus alalunga)

Tuna, one of mankind's most ancient and honored foods, were pursued by fishermen hundreds of years before the time of Christ. Ancient Greeks referred to tuna as "thunnos" and they had an intense taste and admiration for these fish. Their admiration was evidenced in verse and decorating themes of that era.

In the still undiscovered New World, ancient Incas and other civilizations were also harvesting tuna along the coasts of Peru and other South American coasts along the Pacific Ocean. Their two-man reed boats, used in searching for tuna, were almost unsinkable.

In the United States, over a billion cans of tuna are consumed annually.

DESCRIPTION AND HABITAT: There are four kinds of tuna: albacore, yellowfin, bluefin, and skipjack. All four belong to a large family of fish which includes the mackerels and bonitos. The members of this family are similar in that they travel in schools and are among the most rapid swimmers of all fish. Nautical engineers have described the contours of these fish as being perfect for passage through the water with the least resistance. The bodies are streamlined and smooth, and the fins, set in grooves on the bodies, offer little resistance as the fish glide through the water.

ALBACORE (Thunnus alalunga), vary from other tuna in flavor and in the whiteness of the flesh. They are also known as "longfins" and can be recognized by long, sabre-sharp pectoral fins. They are further distinguished by the metallic steely-blue color on the tops and sides of the body and a silvery color on the bottom side, as well as by the absence of stripes. The usual weight of albacore is between 10 and 60 pounds; however, the maximum recorded weight is 93 pounds. Albacore range from Southern California to mid-Mexican waters, sometimes going as far north as Puget Sound in the late summer.

YELLOWFIN (Thunnus albacares), probably the favorite of the tuna fishing fleet, are light-fleshed. They are considered one of the most commercially valuable of the four, and are also popular as game fish. Yellowfin describes these fish as they are distinguished by elongated, yellowish dorsal and anal fins, and yellowish coloring on the sides. They vary in weight from 30 to 150 pounds; however, fish from 40 to 100 pounds are considered choicest for canning. Yellowfin tuna are found from the Gulf of California south to the waters off northern Chile.

BLUEFIN (Thunnus thynnus), sometimes called horse mackerel, have light flesh and vary in commercial weight from 15 to 80 pounds. Bluefin tuna have a history as a game fish that goes back to Greek and Roman times. They are distinguished by the deep blue or green color on the tops and sides of the body. Unlike most fishes, the high metabolic rate of the bluefin tuna maintains a body temperature warmer than the water. Bluefin are found from Alaska to lower California; however, this species is sometimes found in the Atlantic Ocean.

(Continued following page)

SKIPJACK (Katsuwonus pelamis), are also known as striped tuna. They have light flesh and are distinguished by parallel black to dusky stripes on the lower sides of the body. Skipjack tuna are dark metallic blue on the tops and sides, shading to a silvery color on the bottom surfaces. They are the smallest of the four tunas, weighing from 4 to 24 pounds. Skipjack are found in tropical waters similar to the yellowfin.

Fishing for Tuna: At one time tuna were taken by pole and line fishing from the famed tuna clippers. Now, however, most of the tuna industry has converted to the more efficient purse seines. This change was made possible because of the introduction of nylon seines and the development of power blocks to handle the great nets. Purse seining has many advantages; the voyages are shorter, the need for bait has been eliminated, and the hazard to the fishermen is lessened. The tuna are transferred to refrigerated holds where immediate freezing of the catch occurs. Thus the fish are fresh upon reaching the canning and processing plants.

Conservation: In the early 1960's it became apparent that the stocks of Pacific yellowfin tuna had reached their maximum sustainable harvest. In 1966 this tuna came under effective regulation on the recommendation of the Inter-American Tropical Tuna Commission. An effort began to increase the harvest of underutilized species of tuna. Fortunately, the skipjack population and perhaps those of the temperate tunas appear not to be fully harvested. The Fishery-Oceanography Center of the Bureau of Commercial Fisheries, the IATTC, and other agencies are now involved in research designed to increase the take of these tunas through discovery of new fishing grounds, and increased knowledge of the week-to-week movements of the fish.

Uses of Tuna: Tuna supplies a rich source of protein, vitamins, and minerals. It is easily digested, and can be used as it comes from the can or combined with other foods. It is economical because there is no waste in the compactly packed and compressed cans. Although the packs are labeled white meat or light meat, they can be used interchangeably. It is available in solid-pack, chunk-style, or grated; and comes in $3\frac{1}{4}$ to $3\frac{1}{2}$, $6\frac{1}{2}$ to 7, $9\frac{1}{4}$, and $12\frac{1}{2}$ to 13 ounce cans.

(National Marketing Services Office, BCF, U.S. Dept. of the Interior, 100 E. Ohio St., Rm. 526, Chicago, Illinois 60611.)

TUNA -- CANNED CONVENIENCE FOR BUSY DAYS

Tuna does it again! That versatile performer, always ready and reasonable, stars again in a recipe that is just right for leisurely entertaining. Tuna, everybody's finny favorite, goes to a picnic or wears a party dress with equal ease and a minimum of effort. Crusty-Tuna-Bean Bake, a new Bureau of Commercial Fisheries recipe, spells good eating any time of year but is especially appropriate when the homemaker is short of time.

In this easy recipe, the tuna is blended with mushroom soup, bread crumbs, eggs, and onion to make a tuna crust. The green beans, plus pimiento and dill weed for flavoring variety, make the filling; and shredded cheddar cheese crowns the top. Baked in a moderate oven until thoroughly heated and the cheese is bubbly, this tasty casserole is ready to serve. This casserole may be prepared a day ahead and refrigerated until baking time.

Tuna is one of the greatest of all protein foods and also supplies vitamins and minerals in abundance. There is no waste in the compactly packed and compressed cans which assures 100 percent value to the consumer. The tuna industry had the homemaker's convenience in mind in choosing its three different pack styles. Solid-pack tuna is great for salads; chunk-style is just right for casseroles or skillet dishes; and grated or flaked tuna's small bits are ready for sandwiches or dips. Tuna is available in cans for individual servings ($3\frac{1}{4}$ to $3\frac{1}{2}$ ounces); enough for two $6\frac{1}{2}$ to 7 ounces); medium-sized families ($9\frac{1}{4}$ ounces); and larger families ($12\frac{1}{2}$ to 13 ounces).

CRUSTY TUNA-BEAN BAKE

4 cans ($6\frac{1}{2}$ or 7 ounces each) tuna
2 cans ($10\frac{1}{2}$ ounces each condensed cream of mushroom soup
$\frac{2}{3}$ cup dry bread crumbs
$\frac{1}{2}$ cup finely chopped onion
4 eggs, beaten
$\frac{1}{2}$ teaspoon salt
$\frac{1}{8}$ teaspoon pepper

2 packages (9 ounces each) frozen cut green beans
$\frac{1}{4}$ cup diced pimiento
$\frac{1}{2}$ teaspoon dill weed
$\frac{1}{8}$ teaspoon pepper
1 cup shredded sharp cheddar cheese
Paprika

Drain and flake tuna. Mix tuna with $\frac{1}{2}$ cup soup, dry bread crumbs, onion, eggs, salt, and pepper. Line a well-greased baking dish, 13 by 9 by 2 inches, with tuna mixture letting the mixture extend up the sides of the dish. Cook beans according to directions on package, omitting butter or margarine. Combine beans, remaining soup, pimiento, dill weed, and pepper. Pour bean mixture into tuna lining and spread evenly. Place cheese around edge of bean mixture. Sprinkle cheese with paprika. Bake in a moderate oven 350° F., for 30 to 45 minutes. Makes 12 servings.

Tuna Cheesies, Tuna Nuggets, Tuna Puffs, and Tuna Tomato Teasers are just four of 26 tempting seafood recipes found in Nautical Notions For Nibbling, Fishery Market Development Series No. 10. For your copy, send 45¢ to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

(National Marketing Services Office, BCF, U.S. Department of the Interior, 100 East Ohio Street, Rm. 526, Chicago, Illinois 60611.)

BCF PUTS SNAP IN SNAPPER

Up until a few months ago, if Mrs. Housewife, U.S.A., wished to prepare red snapper for her table, she had to fillet or steak the fish in her kitchen. Although the fishing industry would have delighted in providing a ready-to-cook item, the fish would not cooperate. It seems that even with the best of care a few weeks of frozen storage would bring about a reaction in the flesh causing it to turn brown.

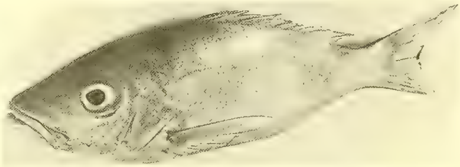


Fig. 1 - The distinctive red snapper, a popular gourmet fish throughout the U.S., is now available frozen through a new process developed by BCF technologists.

The BCF Technological Laboratory in Seattle was aware of this problem. If it could be solved, a tremendous new retail market for red snapper would be created. Snapper has long been known as a gourmet dish, such as baked red snapper with sour cream stuffing--or as quick-and-easy broiled fillet with lemon butter sauce.

The Research

The laboratory staff felt that the browning of the flesh was due to chemical processes taking place even at frozen storage temperature. In this day of new food-manufacturing processes, there are easily applied, safe additives that may be used to combat undesirable changes.

Fig. 2 - Two red snapper fillets were kept in storage for the same period of time. The smaller fillet was treated with the new BCF process; the larger fillet was not treated and shows oxidation and browning.

Sifting among the 20 or so available additives was a formidable task. Some were eliminated out of hand as not being at all useful or not suitable to the process. An even dozen were chosen as promising. These were applied either by dipping the fillet into a solution, or by injecting the fish with it. Also used were two methods of packaging the frozen product--a heavy glaze, or a package from which air could be eliminated entirely or replaced with an inert gas.

After two years of testing, the laboratory found a way of delaying or preventing the darkening of color. Dipping the fish fillets or steaks in a weak solution of TDP (thiodipropionic acid) and freezing in an air-free package would allow high-quality frozen storage for at least 12 months. The new product was taste-tested by 100 families and given an excellent report.

News of the breakthrough was communicated to the fishing community and food processors. Judging from the enthusiasm with which the process was greeted, we may expect to see ready-to-eat snapper in the frozen-food section of the retail market very soon. (Source: National Marketing Services Office, BCF, U. S. Department of the Interior, 100 East Ohio Street, Rm. 526, Chicago, Illinois 60611.)

SAVORY HALIBUT

North Pacific halibut has long been a favorite food for good eating. This largest member of the curious-looking flatfish family, and one of the tastiest of all fish, is taken along the continental shelf and slope of the North Pacific adjacent to Alaska, British Columbia, and Washington State. An excellent source of high-quality protein, vitamins, and minerals, halibut steaks are also a favorite with dieters because of the low sodium and fat content. The flesh is white, firm, and tender; and its mild satisfying flavor adapts readily to many preparation methods.

Savory Halibut, a BCF recipe, presents the halibut in a zippy, sour cream-green onion sauce with just a touch of basil. Topped with Parmesan cheese just before baking, the final touch is a few minutes under the broiler--just enough for the sour cream mixture and the cheese to turn golden brown and bubbly. This easily prepared recipe will be a favorite that you will want to serve often. Fortunately for halibut fanciers, North Pacific halibut steaks are available fresh or frozen the year round. So go ahead and indulge your fancy.

SAVORY HALIBUT

- 2 pounds halibut steaks, fresh or frozen
- 1 cup sour cream
- $\frac{1}{2}$ cup sliced green onion
- 1 teaspoon salt
- $\frac{1}{4}$ teaspoon basil
- $\frac{1}{4}$ teaspoon white pepper
- $\frac{1}{4}$ cup grated Parmesan cheese

Thaw frozen steaks. Remove skin and bones and cut into 6 portions. Place fish in a single layer in a well-greased baking dish, 12 x 8 x 2 inches. Combine remaining ingredients except Parmesan cheese. Pour sauce over fish. Sprinkle with Parmesan cheese. Bake in a moderate oven, 350° F., for 20 to 25 minutes or until fish flake easily when tested with a fork. To brown, place fish in the broiler about 3 inches from source of heat and broil 4 to 5 minutes or until lightly browned and bubbly. Makes 6 servings.

Washington State has so many tasty fish and shellfish to share with the nation, we want to tell you about her brand new "Marine Fish Cookbook." The 39-page booklet has recipes for sole and flounder, rockfish, cod, sturgeon, albacore (tuna), smelt, and shad as well as halibut. The 9-page section on halibut contains recipes from the National Fishermen and Wives, Inc.--and who could know more about cooking halibut than the wife of a halibut fisherman? The book costs 50¢ and is available from the State of Washington Department of Fisheries, General Administration Building, Olympia, Washington 98501. A companion booklet, "Shellfish Cookbook," is available from the same source and the cost is 25¢.

(National Marketing Services Office, BCF U.S. Department of the Interior, 100 East Ohio St., Rm. 526, Chicago, Ill. 60611.)

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BACK COVER: Maine sardines. (R.K. Brigham)

COMMERCIAL FISHERIES *Review*

VOL 32, NO. 6

JUNE 1970

COVER: Landing a large yellowfin tuna off St. Vincent Island, B.W.I.
(A. C. Jones, BCF TABL Miami)

COMMERCIAL FISHERIES

Review

A comprehensive view of United States and foreign fishing industries--including catch, processing, marketing, research, and legislation--prepared by the Bureau of Commercial Fisheries.

FISHERMEN'S MEMORIAL--GLOUCESTER, MASS.

Managing Editor: Edward Edelsberg

Production: Jean Zalevsky
Alma Greene

The Bureau of Commercial Fisheries and The Bureau of Sport Fisheries and Wildlife make up The Fish and Wildlife Service of The United States Department of the Interior.

Throughout this book, the initials BCF stand for the Bureau of Commercial Fisheries.

Address correspondence and requests to: Commercial Fisheries Review, 1801 North Moore Street, Room 200, Arlington, Va. 22209. Telephone: Area Code 703 - 557-4246.

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CONTENTS

(R. K. Brigham)

NIXON PROPOSES WORLD TREATY TO SHARE SEABED RESOURCES

On May 23, President Nixon issued the following statement on U.S. Oceans Policy:

The nations of the world are now facing decisions of momentous importance to man's use of the oceans for decades ahead. At issue is whether the oceans will be used rationally and equitably and for the benefit of mankind or whether they will become an arena of unrestrained exploitation and conflicting jurisdictional claims in which even the most advantaged states will be losers.

The issue arises now--and with urgency--because nations have grown increasingly conscious of the wealth to be exploited from the seabeds and throughout the waters above, and because they are also becoming apprehensive about ecological hazards of unregulated use of the oceans and seabeds. The stark fact is that the law of the sea is inadequate to meet the needs of modern technology and the concerns of the international community. If it is not modernized multilaterally, unilateral action and international conflict are inevitable.

This is the time then for all nations to set about resolving the basic issues of the future regime for the oceans--and to resolve it in a way that redounds to the general benefit in the era of intensive exploitation that lies ahead. The United States as a major maritime power and a leader in ocean technology to unlock the riches of the ocean has a special responsibility to move this effort forward.

Therefore, I am today proposing that all nations adopt as soon as possible a treaty under which they would renounce all national claims over the natural resources of the seabed beyond the point where the high seas reach a depth of 200 meters (218.8 yards) and would agree to regard these resources as the common heritage of mankind.

The treaty should establish an international regime for the exploitation of seabed resources beyond this limit. The regime should provide for the collection of substantial mineral royalties to be used for international community purposes, particularly economic assistance to developing countries. It should also establish general rules to prevent unreasonable interference with other uses of the ocean, to protect the ocean from pollution, to assure the integrity of the investment necessary for such exploitation, and to provide for peaceful and compulsory settlement of disputes.

I propose two types of machinery for authorizing exploitation of seabed resources beyond a depth of 200 meters.

First, I propose that coastal nations act as trustees for the international community in an international trusteeship zone comprised of the continental margins beyond a depth of 200 meters off their coasts. In return, each coastal state would receive a share of the international revenues from the zone in which it acts as trustee and could impose additional taxes if these were deemed desirable.

As a second step, agreed international machinery would authorize and regulate exploration and use of seabed resources beyond the continental margins.

The United States will introduce specific proposals at the next meeting of the United Nations Seabeds Committee to carry out these objectives.

Although I hope agreement on such steps can be reached quickly, the negotiations of such a complex treaty may take some time. I do not, however, believe it is either necessary or desirable to try to halt exploration and exploitation of the seabeds beyond a depth of 200 meters during the negotiating process.

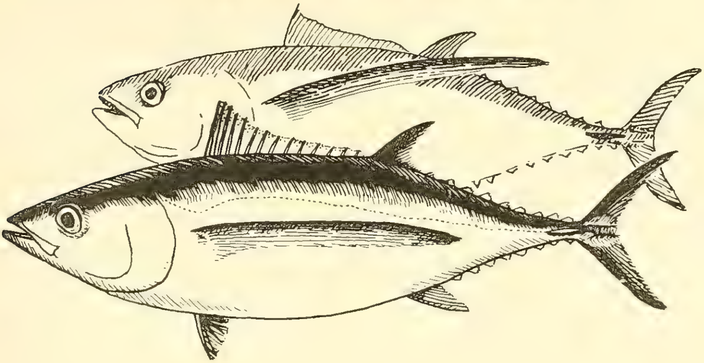
Accordingly, I call on other nations to join the United States in an interim policy. I suggest that all permits for exploration and exploitation of the seabeds beyond 200 meters be issued subject to the international regime to be agreed upon. The regime should accordingly include due protection for the integrity of investments made in the interim period. A substantial portion of the revenues derived by a state from exploitation beyond 200 meters during this interim period should be turned over to an appropriate international development agency for assistance to developing countries. I would plan to seek appropriate Congressional action to make such funds available as soon as a sufficient number of other states also indicate their willingness to join this interim policy.

I will propose necessary changes in the domestic import and tax laws and regulations of the United States to assure that our own laws and regulations do not discriminate against U.S. nationals operating in the trusteeship zone off our coast or under the authority of the international machinery to be established.

It is equally important to assure unfettered and harmonious use of the oceans as an avenue of commerce and transportation, and as a source of food. For this reason the United States is currently engaged with other states in an effort to obtain a new law of the sea treaty. This treaty would establish a 12-mile limit for territorial seas and provide for free transit through international straits. It would also accommodate the problems of developing countries and other nations regarding the conservation and use of the living resources of the high seas.

I believe that these proposals are essential to the interests of all nations, rich and poor, coastal and landlocked, regardless of their political systems. If they result in international agreements, we can save over two-thirds of the earth's surface from national conflict and rivalry, protect it from pollution, and put it to use for the benefit of all. This would be a fitting achievement for this 25th anniversary year of the United Nations.

INFORMATION FOR PACIFIC ALBACORE FISHING MAY BE BEST EVER



Albacore fishermen, buyers, processors, and other interested parties have been notified that advisory information to the albacore fishing industry this season promises to be the best on record. It will include "a forecast of the outlook for the 1970 season, daily broadcasts of albacore information over marine radio bands, temperature charts, fish bulletins, and early and late season scouting and survey cruises."

The information results from the cooperation of BCF Fishery-Oceanography Center at La Jolla, Calif., Oregon State University (OSU), Navy Fleet Numerical Weather Central at Monterey, Fish Commission of Oregon, California Department of Fish and Game, Washington Department of Fisheries, U.S. Weather Bureau, NASA, and albacore fishermen, buyers, and processors.

BCF Issues Forecast

A forecast of the outlook for the 1970 albacore season was issued by BCF in early June. It includes short-term projections of albacore distribution, oceanographic and atmospheric trends, and landings. Much environmental information used by BCF in albacore forecasting operations is made available through cooperation with the Navy at Monterey.

BCF and OSU Albacore Central are cooperating closely in daily broadcast over radio station WWD, licensed to BCF and located on campus of Scripps Institution of Oceanography at La Jolla, and Astoria Marine Operator (KFX, 2598 Khz). Broadcasts include latest albacore information from research vessels, cooperating fishing vessels, and unloading station operators. Broadcasts contain sea-surface temperature and other oceanographic and weather information that may be useful to albacore fishermen.

15-Day Temperature Charts

BCF is continuing decade-old practice of issuing 15-day sea-surface temperature charts from April 15 to October 31, or until season ends, for area roughly between central Baja California and Vancouver Island out to 135° W. A fish bulletin is issued with each temperature chart. This began about June 15 and will continue to end of season.

These bulletins include: information on oceanographic and atmospheric trends, locations of productive fishing areas, changes in market and unloading conditions that may affect effort.

Also, BCF is publishing a 30-day chart showing barometric pressure and wind direction and speed for the previous 30 days; and a chart showing 10-year average barometric pressure and winds for that month.

In addition, OSU Albacore Central again is issuing fish bulletins and sea-surface temperature charts. These charts concentrate on small-scale features along Oregon coast out to 200 nautical miles as information becomes available. These probably will not be issued as often as last summer's weekly. BCF and OSU temperature charts and fish bulletins are bulk-mailed to fish-buying stations and others for hand distribution to fishermen. BCF and OSU have exchanged bulk-mailing lists to extend advisory information to more fishermen.

Calif. & Oregon Waters Best Scouted

This season, California and Oregon waters are best-scouted for albacore of any recent year. BCF's research vessel 'David Starr Jordan' sailed on June 22 from San Diego southwesterly to about 150 miles offshore. It is proceeding northwesterly to vicinity of San Juan Seamount, and then north up coasts of California and Oregon in waters of favorable temperature, probably about 150 miles off-shore. This track is flexible. It will be altered if necessary depending on early-June conditions. The cruise will end on July 3 in Newport, Oregon. Jordan will sail on for other studies.

Trolling During Cruise

Trolling for albacore during daylight is being carried out along entire track of scouting cruise. Each day's fishing begins where it stopped the day before. The thermo-salinograph is operating continuously. Information on mixed layer depth is obtained from XBT drops. Other oceanographic observations are made at night, including midwater trawl and zooplankton hauls. These will be used to obtain estimates of potential albacore forage; subsurface salinity and temperature observations are being made.

Jordan also will cruise in October to study where albacore exit the Pacific coast fishery--and what environmental condition accompany decay of albacore season.

Oregon Fish Commission Cruise

The Fish Commission of Oregon plans a 10-day charter cruise to scout for albacore in waters of favorable temperature off Oregon starting about July 1 aboard F/V 'Sunrise'. Between June 19 and July 3, Oregon State University research vessels 'Yaquina' and 'Cayuse' are occupying hydrographic survey lines off Oregon out to about 200 miles. Vessels will troll for albacore during daylight when in favorable water temperatures.

OSU Cruises

Oregon State University also plans additional albacore oceanography cruises on Cayuse off Oregon: July 27-Aug. 2, Aug. 7-12, Aug. 25-Sept. 1, and Sept. 8-14.

OSU will coordinate series of remote-sensing overflights by Coast Guard, Air Force, and NASA aircraft off Oregon and Washington. These flights will examine sea-surface temperature and water color patterns. Information collected will be included in daily messages and periodic bulletins. All fish reports from scouting vessels, negative as well as positive, will be incorporated into daily albacore advisory broadcasts over WWD and Astoria Marine Operator. The Jordan also will transmit her fishing reports to interested boats over normal fishing-boat frequencies. Her call letters are WTDK.

Everybody's Help Needed

The success of the cooperative albacore advisory program depends on the input of timely, first-hand information from fishermen at sea, dock operators, and processors. Insufficient information restricts quality and timeliness of the advisory materials.

Fishermen have been asked to aid the research programs that seek to learn more about the "distribution, abundance and availability of albacore tuna in the northeast Pacific Ocean." Satisfactory measurement of the biological aspects of the albacore tuna populations and the effects of varying economic conditions have lagged far behind progress in monitoring and understanding the environment. Little progress has been made in estimating year-class strength, apparent fish abundance, and fishing effort for albacore. The fishermen can help by keeping logbook records.

'ALBATROSS IV' SURVEYS GROUNDFISH OFF ATLANTIC COAST

BCF's Albatross IV has completed its annual spring groundfish survey from western Nova Scotia to Cape Hatteras, North Carolina. A "quick appraisal of the unprocessed field logs"--compared to spring 1969's--"indicates an expected further drop in haddock abundance on Georges Bank."

On the optimistic side, catches of young silver hake in Southern New England were "definitely greater" than in fall 1969. The fall 1969 catch of young silver hake also was considerably higher than fall 1968 catch. This indicates the hake population should increase in the near future.

New Stations Occupied

In addition to the standard survey stations on Georges Bank, 2 more series of stations were occupied to monitor progress of haddock spawning. The area closed to commercial fishing was included.

Maturity stages of haddock were examined. By mid-April, spawning was well along on Georges Bank--but had not yet begun on Browns Bank.

COAST GUARD-BCF ICNAF RESEARCH CRUISE UNDERWAY

On May 19, USCGC 'Rockaway' departed Norfolk, Va., to conduct an oceanographic survey of coastal waters between Nova Scotia and Cape Hatteras, N.C. It will end June 14. It is eighth in a series to support fishery research program of International Commission for Northwest Atlantic Fisheries (ICNAF).

International Program

This cooperative undertaking involves study of offshore fishery resources fished by U.S. and other member nations. The aim of the international program is to seek an understanding of natural fluctuations in abundance of commercial fishes and to assess effects of fishing.

BCF Biological Laboratory, Woods Hole, Mass., is coordinating U.S. efforts.

SURVEY TEMPERATURE IN ATLANTIC & EASTERN GULF OF MEXICO

The U.S. Coast Guard Oceanographic Unit extended its Airborne Radiation Thermometer (ART) coverage into Gulf of Mexico during late April-early May 1970 to support EGMEX-70 surveys.

EGMEX is a combined, long-range program of Federal, state, and local oceanographic facilities to study eastern Gulf of Mexico.

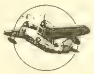
During EGMEX-70, scientists and technicians are studying the Gulf Loop Current.

Loop Important

The Gulf Loop Current, a branch of the Yucatan Current, interests marine scientists and sport and commercial fishermen because of its influence on fish distribution. It enters the Gulf of Mexico through the Yucatan Straits, flows north towards Louisiana, bends east towards Panama City, then south along Florida's west coast to the Straits of Florida; there, it joins the eastward-flowing Florida Current.

Monthly ART Flights

The Coast Guard conducts monthly ART flights on U.S. East Coast from Cape Cod to Miami, Florida. Monthly charts depicting surface temperature contours and marine-animal observations are mailed to fishermen, universities, and government agencies on request from: Oceanographic Unit, Bldg. 159-E, Navy Yard Annex, Washington, D.C. 20390.



NEW ENGLAND FISHING FUTURE LOOKS GOOD TO BANK OFFICER

Allen P. Keith Jr., waterfront loan officer for the Merchants National Bank of New Bedford, Mass., says the future of the New England commercial fishing industry looks good to him. "People have to eat, And as long as they do, New England fishermen will be able to sell all the fresh fish they can catch. Fishing isn't an easy business, it never was, but you can still make a doggone good living at it."

Mr. Keith's views appeared in the April 1970 New England Marine Resources leaflet. His bank probably handles more fishing boat mortgages than any other bank in New England. He has specialized in them for nearly 7 years and knows the local fishery intimately.

Foreign Competition

He emphasizes that he does not underrate competition from foreign fleets, but he maintains that "we still have the fresh fish market, and fresh fish will always be preferred. That's what keeps New Bedford going. Our fleet can sell everything they bring in."

Boats & Men Aging

He worries about aging men and boats. "It's too bad that more young men are not following in their dad's footsteps, because once a man goes into fishing, he rarely leaves it."

The age of most commercial fishing vessels is an even greater problem--one that can never be solved without great government aid, he says. He points out that 80% of boats fishing out of New Bedford are "overage"; the situation is even more critical in Gloucester.

Painful Economics

The figures explain why. To replace an overage \$30,000 vessel today would cost around \$150,000. Private dollars cannot handle the modernization of entire fleets, Keith points out. He sees U.S. subsidies as necessary to keep industry going.

He and others feel that insurance rates on fishing vessels must be lowered. A boat owner has to pay \$8,000 to \$10,000 a year in insurance before he even brings in his first catch.

His bank handles many loans that are insurance loans. It will finance them up to 75%; for many fishermen, this is a lifesaver.

Boat Mortgage Loans

A larger proportion of his business is in boat mortgage loans. The average one is for a \$150,000 vessel. Interest runs between $8\frac{1}{2}$ and 9%. In the first three months of 1970, the bank has had 20 such loan applications; 6 were accepted.

The bank has standards for accepting or refusing a mortgage application. The most frequent refusal is for age of boat. After 7 years, Keith points out, there is always danger of engine trouble, which is expensive. A new engine costs \$40,000 to \$50,000; installation costs another \$8-10,000. Putting a new engine in an old boat is throwing good money after bad, the bank believes. It is reluctant to lend money for a secondhand boat.

Size and design of vessel also are important. The bank won't touch a boat under 65 feet because it would not be practical for winter fishing. And year-round use is a necessity if it is to be profitable.

Design also influences bank's decision: "A boat that can't be converted easily from one kind of fishing to another just isn't efficient."

To get a boat mortgage loan from his bank, the applicant's home port must be New Bedford. His boat must be documented there and buy its supplies there, though it may go afield to fish, if necessary. Keith says, "my job is to finance the port of New Bedford."

Personal Criteria

Among personal criteria of loan applicant on which bank makes its decision are age, experience, and character. The youngest captain for whom Keith wrote a loan was 25. Before the bank lends a man money to go into fishing for himself, it wants him to show "a few year's experience, either as a captain or a mate, and to show some indication that he's a 'producer'."

Three mainstays of fishing industry: skilled hands and nylon net. Average age of fishermen continues to rise as too few youths choose the sea. Nylon makes possible large nets and large catches. (Photo: Rex Gary Schmidt)

However, the percentage of capital the applicant must put up that is his own money does not influence the bank's decision. The length of mortgage varies from 3 to 5 years on a secondhand boat to 7 years on a new one to 10 years on a subsidy vessel.

Keith Offers Advice

For would-be fishing boat owners, Keith offers other useful tips. "Go to a good, reputable bank for your loan and be sure you go with a concrete, worked-out plan to show them. Very few banks do as much boat mortgaging as we do; they're not familiar with the fishing industry and they won't even listen to you if you don't have a firm program to show them."

He also advises anyone planning to acquire a boat to incorporate before he does so. "If you own it as an individual," he explains, and something goes wrong, you can lose your car and everything else you own."

It is also advisable to apply for a mortgage before starting to build. Government mortgage insurance should be applied for while boat is still in planning stage. It costs 1% of mortgage and diminishes proportionately as mortgage is paid.

Ordinarily, the bank does not loan money to fishermen for working capital. But Keith says this isn't a severe handicap because credit for equipment and supplies usually is readily available.

Keith's most valuable advice to young men going into commercial fishing is: "Be adaptable. Don't make up your mind you're going to do just one kind of fishing and have your boat built for that. I know of one new boat that can lobster, crab, seine, bottom trawl and midwater trawl, and she is easy to convert from one kind of fishing to another. That means she is one hundred per cent usable." This same boat, Keith adds, has not suffered, as many in the fleet have, from haddock shortage. It is simply converted to seining for herring, which is immensely popular in Europe, but almost entirely fished out in the North Sea. "They can't fill their foreign orders," he says.

"The fishing industry isn't standing still," Keith concludes. "As long as you keep diversifying, you have some place to go."

'BOWERS' EXPLORES FOR SCALLOP OFF FLORIDA'S EAST COAST

BCF's exploratory fishing vessel George M. Bowers arrived at St. Simons Island, Georgia, on April 27 after 21 days of scallop exploration off Florida's east coast. It was the second in a series of scallop-stock assessments using the Remote Underwater Fisheries Assessment System (RUFAS). The vessel is part of the BCF Exploratory Fishing and Gear Research Base in Pascagoula, Miss.

Cruise Purposes

The cruise's principal objectives were to "evaluate the current calico scallop occurrence in the area; locate areas of highest yield potential; provide demonstrations of survey equipment, monitoring procedures and sample dredging operations for industry observers, and to further evaluate the modified survey equipment's capabilities in the time available."

15 Transects

15 transects were run in an easterly or westerly direction covering 156 miles. Transects were established on major loran lines and were run between the 15 and 25 fathom curve. The loran lines covered were from 3H7-1700 (east of Malibar, Florida) to 3H7-3200 (northeast of St. Augustine, Florida).

Bottom visibility with TV camera was exceptionally good. It exceeded 20 feet on many transects. On only one transect (3H7-2200) was visibility less than 5 feet.

Heaviest Concentrations

Preliminary evaluation of the video tapes indicates heaviest scallop concentrations on this survey were off Cape Kennedy between 3H7-2100 and 3H7-2400 along 19 to 25 fathom curves. Scattered scallops were observed on most other transects. For the most part, scallops were settled individually in small conical depressions in sandy substrate--or were lying singularly or in small groupings at bottom of furrows crossing transects at northwest-southeast direction. When 2650 feet of 35 mm film are processed, a more detailed evaluation will be possible.

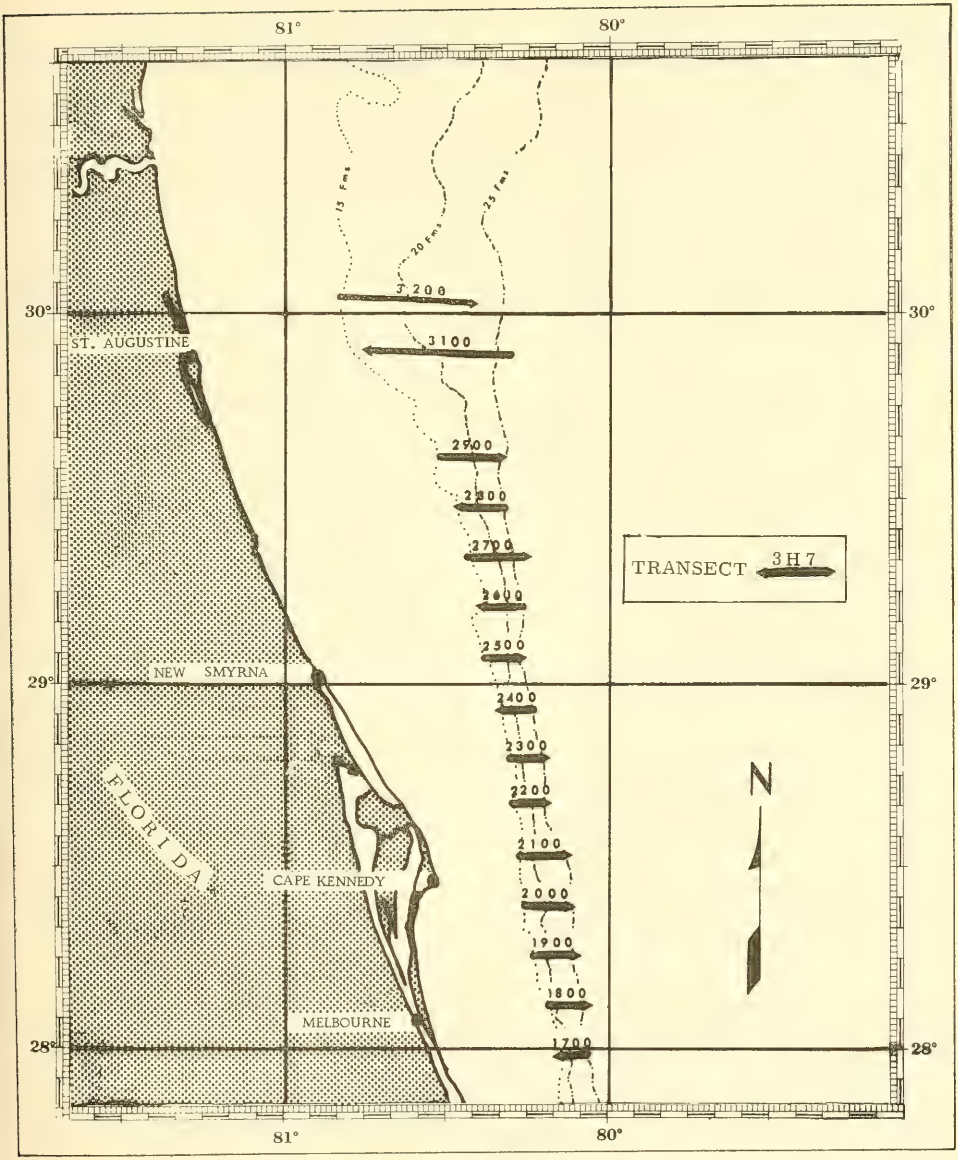
Sled System Improved

The sled system showed marked improvements over 1969 fall survey. Numerous modifications provided increased maneuverability and improved visual observation. As facility was gained on launch and recovery techniques, procedures became routine, with no noticeable strain to system.

During the day, television monitoring of the sea floor was done without artificial lighting. Two night-time transects, however, required dysprosium light; at times this gave a pronounced back-scattering effect that obscured video image. It was found that guiding the sled very close to the substrate greatly reduced this problem.

A one-day RUFAS demonstration was provided for four industry observers; fishing information and assistance were provided two scallop vessels.

(Map following page.)



R/V George M. Bowers, Cruise No. 90, April 7-27, 1970.

HAKE CATCH IN PUGET SOUND ABOUT 8 MILLION POUNDS

Landings of hake from Puget Sound (Wash.) were about 8 million pounds by the end of April. From October through December 1969, the fishery was in Saratoga Passage, where 600,000 pounds were caught.

From January through April 1970, the fishery operated in Port Susan and produced 7,400,000 pounds.

Monthly landings were:

	Pounds Landed
Oct. (1969)	134,000
Nov.	370,000
Dec.	100,000
Jan. (1970)	190,000
Feb.	1,922,000
Mar.	3,863,000
Apr.	1,454,000
	8,033,000

One or two vessels planned to continue fishing as long as they made successful catches. Normally, the fishery in Puget Sound ends by mid-May.

'SEATTLE' LANDS LARGEST BLACKCOD CATCH

On May 6, the M/V Seattle landed 24,432 pounds of blackcod using the BCF-modified king crab pots. This was the Seattle's largest catch. It was made during a 9-day trip. The vessel began pot fishing trials for blackcod in November 1969.

About two-thirds the catch were large fish: over 5 pounds, heads off and gutted. These were sold for about 28 cents a pound; the smaller fish for about 14 cents.

EDA AIDS FISHERIES IN WASHINGTON

The Economic Development Administration (EDA) has approved a $24,900 grant to help continue a program to train workers for the fishing industry in Pacific County, Washington. The funds will be used to help pay administrative costs for a year.

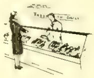
Training Center

Chinook, Wash., is establishing a skill-training center to qualify young people for jobs in commercial and sport fishing and related industries. In addition to marine skills, the program includes conservation courses to increase the area's supply of fish and shellfish.

The 13 students who have completed courses have been employed in the local fishing industry. The program now has 36 students.

BCF CONDUCTS SEAFOOD SEMINAR FOR REFORMATORY YOUTHS

BCF Seattle personnel conducted a retail seafood seminar for meatcutter trainees at the State of Washington Monroe Reformatory. When released, each young man who participated in the seminar will be offered a job as a meatcutter (and seafood counter man) in a retail market.



TEST PROFITABILITY OF FARMING SHRIMP IN SALTWATER PONDS

An attempt to test the profitability of farming shrimp in saltwater ponds in the Coastal Plains Region of eastern U.S. will start soon near Dale, South Carolina. It will be conducted by Walter F. Lubkin Jr. of Beaufort, S.C., who wants to put to commercial use the aquaculture techniques developed by research biologists.

This was reported by the Coastal Plains Regional Commission (CPRC), a U.S. partnership with Georgia, S. Carolina and N. Carolina. It is sponsoring this one-year economic feasibility demonstration under a guarantee-against-loss agreement. Job will be conducted with the technical assistance and supervision of biologists of the Division of Commercial Fisheries, South Carolina Department of Wildlife Resources.

Brown and white shrimp have been selected for cultivation because research at Bears Bluff Laboratory in South Carolina and elsewhere has shown these species adaptable to impounded conditions. Also, they are available locally and have high market value.

Shrimp No. 1 in Value

Shrimp is the most valuable of all seafood species harvested in the Coastal Plains Region. In recent years, the demand for shrimp (and price per pound) has been increasing much faster than supply. Between 1967 and 1969, shrimp harvested in Coastal Plains Region of South Carolina, Georgia, and North Carolina jumped from 16 million pounds to 22 million pounds; its value doubled--from $6.5 million to $13 million. Although the U.S. consumes about $400 million of shrimp a year, only half is caught by U.S. fishing fleet.

Commission Goal

Successful application of aquaculture techniques to cultivation of brown and white shrimp would increase Region's share of shrimp market. It would create more jobs and income.

The Coastal Plains Regional Commission seeks "to induce orderly, accelerated economic growth in 159 Coastal Plains counties" of the 3 states. CPRC's goal is to close its region's income gap with the rest of the U.S. "by creating favorable conditions for private investment through a planned program of economic development."

BCF FILM ON ENVIRONMENT HONORED

'The Biologist and the Boy' has won for BCF a certificate of "creative excellence" from the U.S. Industrial Film Festival. It is one of two films on pollution produced by BCF's Elliot A. Macklow, Chief, Audio-Visual Services, in cooperation with the 5 Gulf States.

Nationwide Distribution

The film was recently renamed 'Crisis on the Coasts'. It will be distributed to theaters through United Artists: in New York City area on May 29, in San Francisco and Washington, D.C., in June, and later nationally.

FISH AND WILDLIFE SERVICE EXPANDS ALASKAN ROLE

The Department of the Interior's Fish and Wildlife Service (FWS) is expanding its work in Alaska, Secretary Hickel has announced. This recognizes the State's wildlife and fisheries resources--largest in the Nation--and the need for effective State-Federal cooperation to conserve them, Mr. Hickel said.

BCF has established a fisheries center at Kodiak. A Navy facility is being renovated to house research and office personnel. Located there also will be BCF's Alaska Associate Regional Director for Fisheries, who will supervise BCF research programs throughout the State.

Sport Fisheries Bureau Expands

An Area Office for the Bureau of Sport Fisheries and Wildlife (BSFW) will be established in Anchorage, effective July 1, 1970. It will coordinate and direct BSFW's efforts in Alaska to protect and enhance the important sport fish and wildlife populations.

Charles H. Meacham, FWS Commissioner, said: "Economic changes, population growth and natural resources development have created increasing problems which require additional effort in Alaska. A particular advantage in having an Alaska Area Office is the greater facility for direction and coordination of future BSFW programs and planning with the Alaska Department of Fish and Game. BSFW will now have in Alaska an office with decision-making capability to serve State agencies and the general public."

TAGGED FISH SORTED AUTOMATICALLY

A device to detect and sort out adult migrating salmon that were tagged as fingerlings with coded magnetic wire tags has been operating successfully since late April 1970 in an Ice Harbor Dam Fishway on the Columbia River. By May 14, the device had detected and segregated 109 tagged fish.

LABS COMPARE THEIR ANALYSES OF INSECTICIDE RESIDUES

Several laboratories analyzing insecticide residues in the Great Lakes are participating in an interlaboratory quality-control check sponsored by BCF.

Trout & Salmon Sampled

A lake trout and a coho salmon from Lake Michigan were ground and frozen. Samples were shipped to the laboratories to be tested for insecticide residues. The results will be compared. If there are differences, methods will be checked to determine the reason--and corrections made to insure standard results.

ARMY ENGINEERS TO WEIGH ENVIRONMENT MORE

U.S. Army regulations governing permits for work in navigable waterways will give greater emphasis to environmental values. This was announced May 19.

The impact on the public of the proposed work will be evaluated to include such factors as fish and wildlife, water quality, economics, conservation, esthetics, recreation, water supply, flood damage prevention, ecosystems, and, in general, the needs and welfare of the people, as well as navigation.

FIRST WORLD FISH STANDARD DISTRIBUTED FOR ADOPTION

On April 1, 1970, the Directors-General of the Food and Agriculture Organization and the World Health Organization transmitted to U.S. State Department the first of a series of recommended international food standards for acceptance by member and associate member nations. Among the standards are an International Standard for Canned Pacific Salmon, an International General Standard for Labeling Prepackaged Foods, and International Tolerance for Pesticide Residues.

Ocean-going vessels are used to transport Alaska's fishery products. Seward. (J. M. Olson)

'OREGON' SAMPLES RESOURCES NEAR PROPOSED S.E. ALASKA INDUSTRIAL COMPLEX

The R/V Oregon completed on April 18 the first of several scheduled quarterly cruises in Berners Bay, Southeastern Alaska, "to determine the occurrence and abundance of current and potentially valuable fish and shellfish resources" that may be affected by a proposed plywood-paper industry in Berners Bay.

The vessel is part of BCF's Exploratory Fishing and Gear Research Base in Juneau.

Fishing Gear

The Oregon used:

- A Gulf-of-Mexico-type, 40-ft. shrimp trawl
- Twelve (12) 6' by 6' by 30" king crab pots
- Four (4) standard (42") Dungeness pots
- Four (4) longline strings of 3 Herculite-covered shrimp traps (18" by 18" by 30")
- $1\frac{1}{4}$" stretched mesh monofilament gillnet, $1\frac{1}{3}$ fathoms deep by 10 fathoms long

5 Trawl Hauls

Five trawl hauls were made, three within Berners Bay and two in Lynn Canal, immediately adjacent (chart). Hauls were 30 minutes long in 42-82 fathoms within the bay, and 158 to 163 fathoms in Lynn Canal.

Species varied more in trawl catches than in other gear. Commercially important species occurring in highest abundance were sablefish and golden crab in Lynn Canal, hauls 3 and 4, and starry flounder in Slate Creek Bight, haul 5.

King Crab Pots

Thirty king crab pots were set, all within bay, in 28 to 111 fathoms. All pots were fished 24 hours, except 19-24, which were fished 48 hours. Tanner crab was dominant species; catches ranged from 1 (Pot 5) to 19 (Pot 17); only one female was captured.

Pots Caught All Halibut

All 32 halibut were captured in king crab pots: 4 in Pot 16, and largest (14.93 kg) in Pot 8. Most halibut were alive and in good condition, except those in pots fished 48 hours. In those, several halibut had been reduced to skin and bones by amphipods.

Golden Crab

Golden crab were taken in two king crab pots: 4 males and one female in Pot 22 and 3 males in Pot 24. Only one king crab was taken, a 3.39 kg male in Pot 2.

Shrimp Sampling Fails

Sampling for shrimp with traps was unsuccessful. Bottom locations where spot shrimp might be encountered were so precipitous that gear could not be set. Alternate locations caught only snails and amphipods.

Dungeness Crab Pots

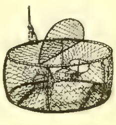
Dungeness crab pots were set in Echo Cove, Slate Creek Bight, and off mouth of Berners River. Pot 3 captured 16 male Dungeness crab and Pot 4 captured 8 males and one female; these were set near mouth of Echo Cove in 10 to 12 feet. One Dungeness crab was taken in Pot 1 set at head of Echo Cove in 40 feet. Yellowfin sole and spider crab were only other organisms taken in Dungeness pots.

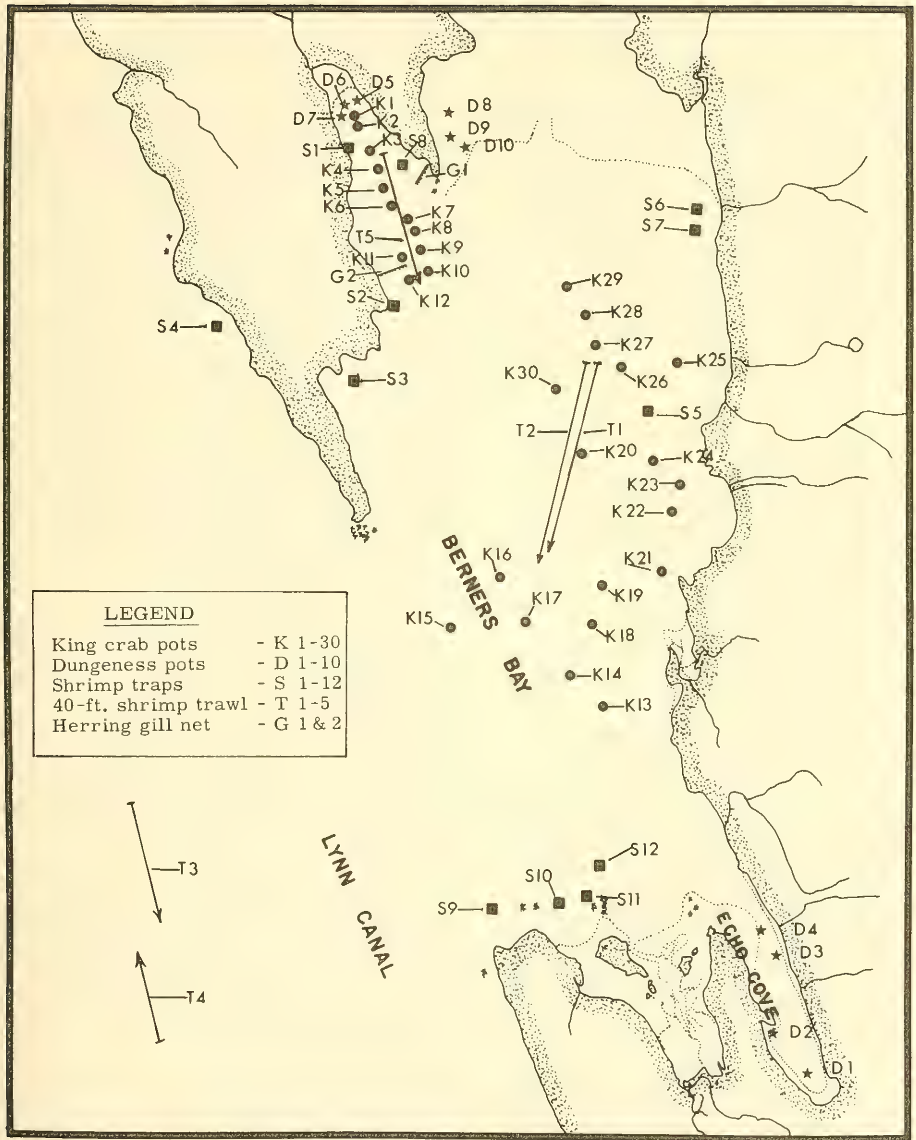
Gillnets Yield Herring

Two gillnet sets in Slate Creek Bight produced 9 herring and 2 capelin.

For further information contact: Base Director, BCF Exploratory Fishing and Gear Research Base, P. O. Box 1668, Juneau, Alaska 99801.

(Map following page.)





R/V Oregon Cruise 70-1 gear locations.

'COBB' SURVEYS CLAMS IN SOUTHEASTERN ALASKA

BCF's research vessel John N. Cobb returned to Seattle, Wash., on April 16 after a 32-day subtidal clam survey in southeastern Alaska. The survey was conducted jointly with BCF's Juneau base.

Cruise objectives were to: "locate and delineate clam beds in selected areas in southeastern Alaska, evaluate the effectiveness of a modified east coast hydraulic clam dredge, and collect clam samples for the Bureau's Ketchikan Technological Laboratory for paralytic shellfish poisoning and the meat yield studies."

Area of Operation

The Cobb surveyed Pleasant Island and Mud Bay in Icy Strait, Neka Bay in Port Frederick, Tebenkof Bay off Chatham Straits, Duncan Canal in Kupreanof Island, Cape Fanshaw at junction of Stephens Passage and Frederick Sound, Mole Harbor and Windfall Harbor on Seymour Canal, Taku Harbor on Stephens Passage, and Funter Bay off Lynn Canal.

Gear

A 2,250-pound, east-coast hydraulic clam dredge was used. Its sides consisted of $\frac{7}{16}$-inch rods spaced $1\frac{5}{8}$ inches apart, and the aftercage with a $1\frac{3}{4}$ by $1\frac{3}{4}$-inch steel screen. The bottom panel of cod end was constructed of 2-inch hog rings; the top panel was $3\frac{1}{2}$-inch (stretched mesh) nylon webbing.

A diesel engine supplied water to dredge via a 6-inch-diameter hose 285 feet long. It was run at 1,550 r.p.m. and developed a hydraulic pressure of 80 p.s.i. The water was distributed through the main hydraulic manifold. This contained 7 cutting jets and 3 washout jets. The cutting jets were special brass nozzles producing a flat spray; the washout jets were $\frac{3}{4}$-inch pipe nipples.

Two interchangeable blades were used: a narrow 18-inch blade, and a wider 36-inch blade.

The dredge was towed with a 2-inch, twisted, three-strand polypropylene line 260 feet long. It was connected at lowest point of attachment next to runners at front of dredge.

Methods

In each bay and inlet, at least one haul was made. The position and duration of each haul and the number of hauls in an area depended on: space available for maneuvering vessel while setting and retrieving gear, the bottom depth, bottom contour, nature of substrate, and number of clams captured. Haul duration varied from 5 to 15 minutes. Each haul catch was enumerated by species.

During the first part of cruise, scuba divers observed trenches cut by dredge, inspected bottom substrate, collected clam samples, and estimated clams missed by dredge. Unfortunately, a diving accident suspended these diving operations.

Samples of each haul were retained and frozen for BCF's Ketchikan Technology Laboratory. Samples were taken from intertidal zone in most areas where dredging was conducted. These will be tested also for paralytic shellfish poisoning.

Results

In most areas, "the dredge would become plugged with mud, rocks, boulders, water-soaked wood, or a combination of these items." The only two productive areas were Pleasant Island and Tebenkof Bay. Pleasant Island is in Icy Strait at northern end of Chichagof Island. A communication or power cable passes through middle of Pleasant Island grounds; however, there is enough area and depth to fish dredge on either side of cable.

Ten hauls were made next to Pleasant Island on southwest side of cable in 6 to 8 fathoms. The narrow blade, set to dig 14 inches, was used in these hauls, except Number 30. The dredge had trouble clearing itself of mud and worm tubes. When the wider blade, set to dig 10 inches, was used, the dredge filled with mud and anchored itself.

The Catches

Butter clams, Alaska surf clams, and cockles occurred in almost all hauls. Of all clams, the percentages of each of these species were 22, 25, and 10, respectively.

Catch rates of clams varied significantly by haul. The highest of butter clams, which ranged 2.6 to 4.4 inches in height, was 58 clams per 15-minute haul.

The largest catch rate of Alaska surf clam, which ranged from 1.8 to 5.9 inches in height, was 54 clams per 15 minutes of towing. Cockles, ranging from 2 to 4.6 inches wide, were taken in the dredge at rate up to 17 clams per 15 minutes of towing.

Narrow & Wide Blades

On northeast side of cable area, 17 hauls were made in $5\frac{1}{2}$ to 12 fathoms: 6 with narrow blade set to dig 14 inches; 11 with wide blade set to dig 10 inches.

When using narrow blade, vessel had to be taken out of gear to slow it. This indicated narrow blade was not digging into bottom. However, the wide blade seemed to dig well; with full throttle, the Cobb moved the dredge only $\frac{1}{10}$ mile in 15 minutes.

Another indicator was the catch. Cockles, which are known to be near top of substrate, comprised 43% of catch when narrow blade was used. The largest catch of cockles in a 15-minute haul was 15 clams 2.3 to 4.2 inches wide.

When wide blade was used, the Alaska surf clam, which lies deeper in the substrate, dominated the catch: 90% of total.

Catch rates were as high as 345 clams per haul. About 90 clams made a bushel; their heights ranged from 1.9 to 5.6 inches.

Tebenkof Bay

The bay is located on Kuiu Island and faces Chatham Strait. It includes 3 smaller bays: Thelis, Elena, and Petrof. Thelis, relatively deep, was unproductive. The dredge normally was clogged with rocks and mud.

In Elena and Petrof, 9 hauls were made at 4 to $13\frac{1}{2}$ fathoms. The bent-nosed clam was only clam taken in abundance. Catch rates varied from 17 to 343 clams per 10 minutes of hauling. Specimens ranged from 1.5 to 4.5 inches in height. About 340 clams made up a bushel. The bottom in these two bays apparently is quite soft because there was no resistance on dredge, and it cleared itself very well.

For further information contact: A. T. Pruter, Acting Base Director, Exploratory Fishing and Gear Research Base, 2725 Montlake Blvd. East, Seattle, Wash. 98102. (Phone: 583-7729)

ALASKA'S KODIAK IS LEADING U.S. HALIBUT PORT

Kodiak continues as the leading U.S. halibut port: this season, to May 15, landings were 1,223,000 pounds (dressed weight). This is 73% greater than landings at Petersburg, Alaska, and more than triple Seattle (Wash.) landings. However, Canada's Prince Rupert is leading Pacific coast: to May 15, halibut landings were 2,184,000.

To May 15, the 1970 North Pacific halibut landings from Areas 2 and 3A at U.S. and Canadian ports were about 6 million pounds--up 62% over same date during 1969 season. The 1970 season opened on April 25, 11 fishing days earlier than May 7, 1969, opening for Areas 2 and 3A, the 2 major production areas.

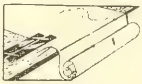
1970 Quotas

The 1970 catch quotas set by International Pacific Halibut Commission for these two areas are 20 million pounds for Area 2 and 30 million pounds for 3A. This is one million pounds less than 1969 quotas.

Preliminary records show total halibut landings at Pacific ports during 1969 season were 58.4 million pounds (dressed weight)--25.1 million pounds taken by U.S. and 33.3 million pounds by Canada.

ALASKAN WATERS WILL BE CHARTED

Six Seattle-based ships of ESSA's Coast and Geodetic Survey (CGS) will chart and map Alaskan waters this year. CGS will gather information needed to prepare up-to-date charts of the waterways leading to ports of Anchorage, Sitka, and Ketchikan; and for detailed maps of the sea bottom of Bering Sea, Norton Sound, and the Gulf of Alaska for exploration and marine studies.



RESEARCHERS PERFECT SURGICAL PROCEDURE FOR FISH

Science will benefit from a fish surgery procedure perfected by researchers of the Bureau of Sport Fisheries and Wildlife (BSFW). The procedure permits scientists to see internally the success or failure of research efforts.

Assistant Secretary Leslie L. Glasgow, who heads Interior's programs for fish, wildlife, and parks, said: "Fish are sensitive indicators of both favorable and harmful elements, and the surgical procedure allows scientists to get first hand views of the effects of the elements on live specimens." The procedure enables researchers to keep fish alive after one or more operations--so they can be used in continuing lab research. More than 98% of the fish operated on recover afterward.

Researchers in medicine, toxicology, pharmacology, veterinary science, and nutrition can benefit from using fish in their experiments, Dr. Glasgow noted.

Background of Research

BSFW researchers developed the technique to inspect damage to fish's diseased organs and to see how therapeutic drugs and special diets help. It is part of the Bureau's research program to develop healthier fish for planting in U.S. waters.

In the late 1940s, Dr. O.H. Robertson of Chicago University pioneered surgery on fish. In the early 1960s, BSFW put together a team headed by Dr. John E. Halver to establish fish surgery as a standard laboratory procedure for test purposes.

By the late 1960s, the technique had been standardized sufficiently for routine use by scientists at BSFW's Western Fish Nutrition Laboratory at Cook, Washington, and its field station at Hagerman, Idaho, The technique helped amass information on fish nutrition, health, and capability of growing or developing in different environments.

In 1968, the technique produced a major success in the cure of hepatoma--a liver cancer in rainbow trout that was threatening to destroy U.S. trout culture. Internal inspection of diseased fish enabled BSFW scientists to isolate a mold in commercial fish feed as the cause. By advising improved preparation and storage procedures in manufacturing the fish food, BSFW scientists eliminated the disease from trout hatcheries.

The Surgical Technique

At the BSFW laboratory, conventional surgical instruments and sutures are used. The fish receive light and deep anesthesia for the operation, which can last 5 minutes to several hours. Special probing tools inspect the vital organs and can remove diseased tissues for special analysis.

Teams of surgeons operate in a special room to which fish are sent on a conveyor. The fish's head is kept immersed to permit gills to extract vital oxygen during the operation; also, skin is kept moist to prevent injury. Special plastic tags are applied to identify each "patient."

Incisions usually are made on the belly side, but other sites are possible. After internal inspection, an antibiotic is applied to prevent infection, sutures are sewn, and the fish is placed in a special postoperative tank for one to several hours. Then it is placed in a special recovery tank; after 3 days, it is able to accept food.

The procedure permits internal inspections at intervals of 3 or more months. So the scientists are able to see changes for better or worse over a considerable period.

Over 10,000 Operations

Over 10,000 operations have been performed at the BSFW laboratory. Less than 2% of fish have died from either trauma or other postoperative complications. Those that recover show only a slight scar and can be operated on again. Primarily rainbow trout have been used, but researchers have been successful too with salmon, carp, and catfish.

BSFW researchers are convinced that proper diet and selective breeding can produce in fish disease resistance, faster growth, and greater tolerance of unfavorable environmental conditions, such as heat. And, as a result of these factors, healthier fish can be grown for planting.

Surgery is performed on fish under hospital conditions to find out how organs are affected by certain diseases. The fish recover.
(Photo: N. Mariana, BSFW)

DRUGS FROM THE SEA

New healing drugs have long been hunted and often found in the most unlikely places. Penicillin originated on the overripe cantaloupe; chloramphenicol, the most effective drug against typhoid fever, originally came from a Venezuelan soil mold. Cephalothin, a new weapon against penicillin-resistant germs, was found near a sewer outlet in the sea off Sardinia.

Although the medicinal properties of some ocean inhabitants have been known for thousands of years, no thorough exploration of the sea as a source of drugs has ever been made.

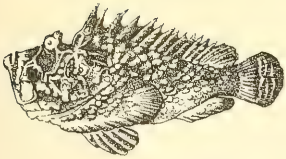
Now a number of researchers are systematically seining the oceans with definite expectations that the next generation of drug products may be derived from the natural organisms living there. At least two drug companies, Hoffman-LaRoche and Lederle Laboratories, have undertaken full-scale collecting and research programs. And several universities, including the University of Rhode Island, are involved in investigations of the medicinal properties of various marine organisms.

At Lederle, Dr. J. J. Denton, director of organic chemical research, and Dr. John Webb, head of the laboratory's structure and analysis department, explained some of the objectives of their firm's year-old research program. Its prime aim, they say, is to isolate and evaluate marine plant and animal life in order to develop new therapeutic agents. Previous investigators of the sea were usually looking for a specific pharmacological activity. The present research involves collecting any likely looking specimens and testing them for a variety of properties.

Lederle's collecting is currently centered in the Caribbean, under the direction of its consultant, 66-year-old Dr. Paul R. Burkholder, professor emeritus of Columbia University, famed for his 20-year-old discovery of chloramphenicol. Diving with one or more assistants, Dr. Burkholder, who also teaches at the University of Puerto Rico, has been exploring principally the reefs around the Virgin Islands and Puerto Rico, mostly for corals, sponges, algae, and the bacteria that live in and on them. Whatever is brought up in the collecting sacks is within a few hours dried, frozen or suspended in a preserving liquid like ethanol and shipped to Lederle's Pearl River, New York laboratory for detailed analysis.

This involves obtaining crude extracts which are tested in a variety of ways for biological activity, including antibacterial properties, as well as potency against a wide range of diseases. Promising extracts are purified and separated into individual chemical components. The active components are then identified chemically by various methods, including x-ray crystallography, nuclear magnetic resonance, high resolution mass spectroscopy, etc., to determine accurately their structure for future testing and synthesis. A number of the samples they have received look "extremely promising," the doctors say, but competition in the drug

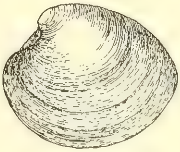
Marine Specimens that show promise as sources of new drugs:



STONEFISH: secretes a potent poison found to reduce blood pressure in animals.

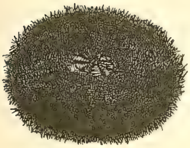
SEA CUCUMBER: an extract from it inhibits tumor growth in mice.

GREEN SPONGE: extracts have been found to have antibiotic capabilities.

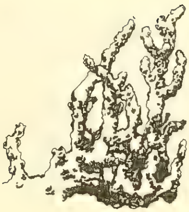


QUAHOG:

and show anti-tumor activity.



SEA URCHIN:



CORALS: among organisms currently collected for testing.

industry being the fierce thing it is, they decline to identify them.

Needless to say, research of this sort is not quickly or inexpensively accomplished. The potential drug must be tested on animals to make sure its germ-killing properties outweigh any possible side effects. Finally, if it has not been abandoned by then, it is considered safe and effective enough to be tested on humans. It may take up to seven years between the time a company finds something it thinks is good and the marketing of it. And an application to the Food and Drug Administration to market a new drug can cost as much as seven million dollars, most of it going to develop the required information.

Talking about the program, Dr. Webb emphasized that Lederle is not planning the large-scale manufacture of drugs derived directly from marine organisms. To attempt to harvest the sea in that way would be impractical and wasteful. Instead, the company gathers small quantities of many materials, hoping to discover from them clues to new varieties of pharmacological substances that can be synthesized in the laboratory. This was the same approach that was used in producing many of the earlier drugs from land sources.

Expensive and complicated as this program is, Lederle, and presumably one or more other companies, feel it is worthwhile because the field of terrestrial plants, from which many drugs have been derived, has been pretty thoroughly picked over in the past 20 years. Marine organisms represent practically virgin territory. Also, Dr. Denton points out, the organisms they are interested in are those of relatively simple structure, which simplifies the task of determining their chemical make-up. "What we plan to do," he says, "is skim the surface and gather up the most easily used organisms. We're not planning to get any more involved than that. We hope that by the time a lot of other people get around to this kind of marine research we will already have been in and out of the sea."

Besides exploring the Caribbean, Lederle plans future underwater investigations of the Pacific, including the Philippine Islands and Australia's Great Barrier Reef. Of the thousands of marine organisms known to contain biotoxic substances, less than one per cent have been examined for biological activity. And of the one per cent studied, only about a dozen have been evaluated to a point where their chemical and pharmacological characteristics are known.

The finds that have been made to date are undoubtedly encouraging: extracts from the green sponge have shown antibiotic capabilities; an extract from a sea cucumber has inhibited the growth of malignant tumors in mice. A poison secreted by the stonefish has been able to reduce blood pressure in animals. Even the common quahog had produced an extract that shows strong anti-tumor activity.

So, if the next skin diver you see has a small mesh bag fastened to his wrist, the chances are he's not just a Sunday snorkeler but a scientist out for big game--the wonder drug of 1980.

(Reprinted from New England Marine Resources Information 11, April 1970.)

TEXAS MARINE RESEARCH STATION IS STEP TOWARD FARMING SEA

The Texas Parks and Wildlife Department has begun a research program "to find a way to increase and use the potential protein production in the sea to meet the increasing world demand for food." The research will be carried out at the Department's new Marine Fisheries Research Station near Palacios on Matagorda Bay. The station is designed to give biologists at least a partially controlled environment for research.

The Research Station

In 1967, the Department bought 40 acres near Well Point on Matagorda Bay because area had good-quality salt and fresh water, was above storm tides, had watertight soil, and utilities readily available. Construction began on a channel, a small-boat harbor, and 21 ponds one-quarter to 4 acres. A water system pumps salt water from the bay and fresh water from a well. The ponds can be drained completely by gravity flow.

Four ponds have dual water systems for circulating seawater; one pond is paved with asphalt to provide a hard surface for oyster culture.

Electrical outlets are available throughout pond area for aeration equipment and recording instruments. Filters can be installed on water lines to prevent introduction of unwanted organisms.

A 3,000-square-foot laboratory building has facilities for chemical and biological analysis, and a wet lab for holding and studying live specimens. Two residences and a storage building also have been built.

What Biologist Seek

The research station can be used for many kinds of studies. It is one of few installations in the world with facilities for adjusting the water's salt content.

The ponds are a large-enough controlled environment to simulate part of the bay. "By observing and analyzing the results of contained studies, biologists hope to learn more about bay populations and the effects of such factors as salinity, temperature, turbidity and water condition on fishery ecology, growth and production."

Present Research

Early research aimed at determining methods for holding fish and shellfish in a controlled and limited marine environment. Present research seeks to determine the importance of ecological factors that affect growth and survival of fish and shellfish; to evaluate mortality by fishing gear and fish tags; and to measure effects of various pollutants on fishery ecology.

Research also will consider the feasibility of cultivating bait shrimp for off-season sale, the artificial propagation and selective breeding of selected species, and development of methods to maintain organisms under conditions conducive to reproduction in artificial habitats.

Research at the station will supplement studies on marine species underway in other Texas estuaries. One such project is the development of a disease-resistant oyster to restore oyster beds devastated recently by a disease caused by a slime mold.

Biologists are seeking disease-resistant oysters to be cultivated in the ponds. They hope the seed for restocking will be obtained from these experiments.

Another basic research objective is to provide foundations for fish and shellfish cultures in manmade environments. There is considerable interest in the practicability of farming or raising shrimp, fish, and oysters in manmade ponds. Research could solve, or at least get around, biological and technical obstacles to profitable farming of fish and shellfish in artificial impoundments.

80,000 Brown Shrimp Stocked

In 1969, more than 80,000 baby brown shrimp were stocked in 9 ponds at rate of 20,000 per acre. These shrimp reached marketable size in 65 days when supplemental feed was applied, but the food conversion (pounds of feed needed to get one pound of shrimp) was poor.

Different rates of growth and survival resulted in ponds receiving same amount of food. This suggests that other factors affected the results. Oysters in the ponds grew rapidly. Survival was high when compared to oysters in Matagorda Bay.

1970 Research

In 1970, the effect of high and low salinity levels on growth of shrimp is being studied to provide basic data for freshwater requirements of Texas bays and estuaries. The researchers monitor closely the water chemistry and physical factors within each pond during experiments.

Researchers also are studying growth and survival of redfish, speckled trout, and southern flounder in other ponds.

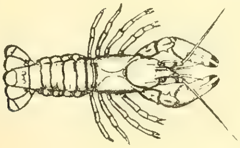
Preliminary findings in the projects have been encouraging. Biologists are confident that resulting data can be applied to setting up a sound management program for some Texas marine resources. This information could provide foundation for raising seafood in man-made ponds.

BCF biologists periodically sample shrimp grown in $\frac{1}{16}$-acre ponds at Galveston, Texas.

CRAWFISH FARMING A TRICKY BUSINESS, SAYS TEXAS AGENCY

Crawfish farming is possible in Texas, advises the State's Parks and Wildlife Department. "But before you look up the recipe for etouffe, bisque or some other cajun culinary treat, consider the difficulties."

Crawfish, resistant to management, are vulnerable to fish and other predators. They spend much of their life in deep underwater burrows, and require for survival a fairly stable body of water with vegetation. They tend to be cannibalistic under some circumstances.



Pays off in Louisiana

Marion Toole, inland fisheries coordinator, says these and other problems have kept crawfish farming from getting much of a start in Texas. It has paid off in Louisiana, where it can be considered an industry. Much of the Louisiana catch is made from swampy areas and rice fields, rather than on "farms."

How to Do It

"To 'farm' the tasty crustaceans, a controlled water supply is needed--a lake that can be drained easily. The reservoir should be drained dry by March to eliminate all fish and other aquatic life from the basin. The pond should remain dry long enough for some vegetation to grow." The field should be flooded in May. The water supply should be stable enough to prevent a sudden water drop that could damage the crawfish.

If these crawfish were in the impoundment before draining, it might not be necessary to stock the reservoir. However, about 15 pounds per acre sometimes are helpful. After stocking, the water level should be maintained for about three weeks. Then it should be lowered slowly during the next weeks. This allows the female crawfish to burrow into the mud.

During the summer, the female lays eggs and attaches them to appendages on the underside of her tail.

The pond should be flooded during September to furnish growing space for the young. When the juvenile crawfish scatter and begin to grow, the prime considerations are availability of vegetation and oxygen in the water.

"With good management and a little luck," the Texas agency notes, "a good harvest will be the result in mid-winter, beginning around Christmas and continuing through February or March."

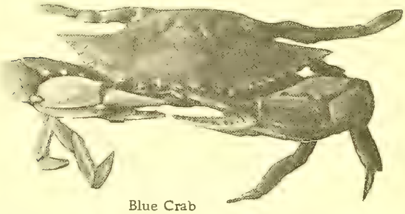
Start Small

New crawfish farmers are advised to start small. First determine if the crop will respond to the particular habitat established in the impoundments.

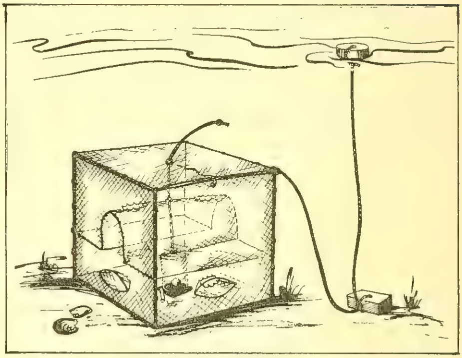
The crawfish can be harvested by seining, which is sometimes difficult, or by special baited traps. The farmer can trap the crustaceans himself, or adopt the Louisiana procedure of farming out the job to others on a fee or percentage basis.

1970 CHESAPEAKE BLUE CRAB CATCH PREDICTION IS LOWERED

The Chesapeake Bay catch of blue crab for the 12 months ending August 1970 is expected to fall short of the predicted 100 million pounds, reports W.A. Van Engel of the Virginia Institute of Marine Science (VIMS).



Blue Crab



Typical Chesapeake Bay crab pot.

The prediction of 100 million pounds was made in 1969 from estimates of young crabs. Crabs hatched in summer 1968 first appeared on Virginia and Maryland nursery grounds in October 1968. During 1969 they were found in greater numbers than ever before.

VIMS scientists believe that unusual weather during last summer and winter reduced blue crab stocks.

Unfavorable Weather

Crabs have been scarce in the rivers during routine winter and spring surveys. This confirmed fears that freshwater runoff in early August and after Hurricane Camille in late August 1969, and the cold winter, brought about salinity and temperature conditions that many crabs could not tolerate.

Crabs in the James and York rivers were hit hardest by Camille, so crab pot fishermen are likely to find fewer this summer in these rivers than in other years, including 1968 and 1969. Adult female crabs (sooks) will be very scarce. Most available crabs will be large and fat jimmies (males).

Less damage to crab stocks should have occurred in other Virginia rivers and farther up the bay, says Van Engel.

Problems Ahead

The market for crab meat appears good. Crab fishermen are anxious to work, but production of fresh crab meat has been slowed by scarcity of pickers in some houses.

The longer outlook contains more problems. Crab supplies in Virginia from September 1970 through August 1971 are expected to be lower than the previous 10-year average. Van Engel concludes that the 1969 hatch of crabs appears from present surveys to have been light. It is expected to produce a small crab catch: similar to the below-average landings of 1968 and the first two-thirds of 1969.

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ANNUAL RIVER HERRING CATCH BY FOREIGN FLEETS ESTIMATED

Jackson Davis

For the third year, the USSR and Poland have sent fleets of more than 100 trawlers to fish for mackerel and herring off the Mid-Atlantic coast from Cape Hatteras, North Carolina, to Ocean City, Maryland. From information obtained on Coast Guard surveillance flights, in cooperation with the Bureau of Commercial Fisheries (BCF), it has been determined that the number of Soviet vessels has fluctuated between 10 to 110 trawlers, and the size of the Polish fleet has averaged about 10 trawlers during 1970. In 1969, the combined fleet numbered about 150 vessels; in 1968, about 100. Prior to 1968, the foreign fleet fished north of Maryland, for the most part, and only 10 to 30 vessels worked off the Virginia Capes.

Virginia finfishermen have expressed concern about the effects of these harvesting activities on the success of their own fishing operations.

A Visit to Fleet

Under BCF auspices, a 9-man party of Americans, including the author, boarded a Soviet factory ship off the Virginia Capes to talk with the fleet commander, V.A. Zakharov, and his deputies. The commander indicated that the average daily catch of his SRT-class vessels (145-foot side trawlers) was 2 tons of mackerel and 2 tons of herring--a total of 4 tons per vessel per day. He did not state the average daily catch of the larger side trawlers and stern trawlers.

About 30% of the herring catch was sea herring (Clupea harengus), also called Labrador herring, and the remaining 70% (2800 pounds per vessel per day) was river herring.

1970 Catch Estimate

If the average daily catch is multiplied by the number of vessels reported operating, an estimate of the smallest probable catch is obtained. Thus, the 1970 catch of river herring by the Soviet fleet probably is not less than 12 million pounds; that of the smaller Polish fleet probably not less than 3 million pounds. Because we do not know the catch-rate of the larger vessels, we are unable to calculate a more accurate estimate at this time. However, our observations of the foreign fleet at sea lead us to guess that their catch of river herring does not exceed 30 million pounds.

Where Caught

These 15 to 30 million pounds were caught south of 38° 30' N latitude (Ocean City, Maryland) and, therefore, represent fish that might have spawned in tributaries of Chesapeake Bay and in other streams up the coast. To put the oceanic harvest by foreign fleets in perspective, one should realize that the annual landings of river herring in Virginia have averaged around 30 million pounds in the last few years.

The Virginia Institute of Marine Science has been collecting data on the ages and spawning history of river herring in the James, York, Rappahannock, and Potomac rivers since 1965. This information is now being interpreted to determine the influence of the foreign fishery on herring stocks. Results will be announced in future issues of the Bulletin.

Dr. Davis is Head, Ichthyology Dept., Virginia Institute of Marine Science (VIMS). Article appeared in 'Bulletin,' May 15, 1970.

FOREIGN FISHING OFF U.S. IN APRIL 1970

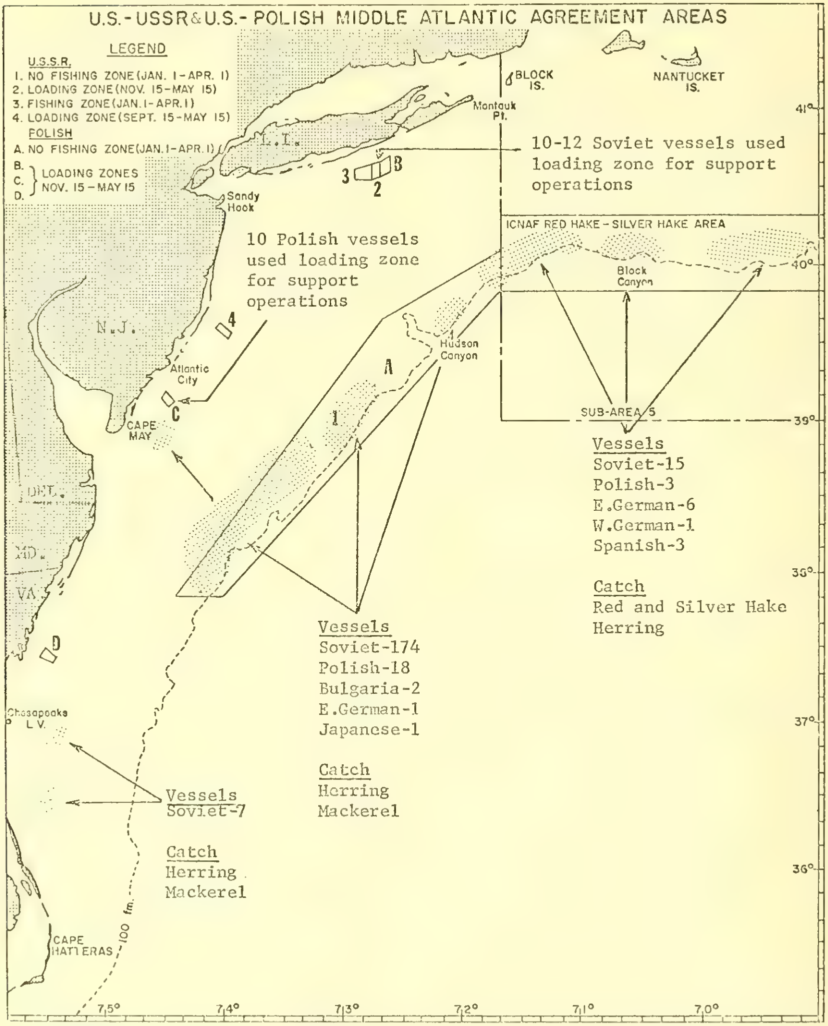

Fig. 1 - Foreign-flag vessels fishing off southern New England and Georges Bank, April 1970 (shows no. of vessels and species fished).

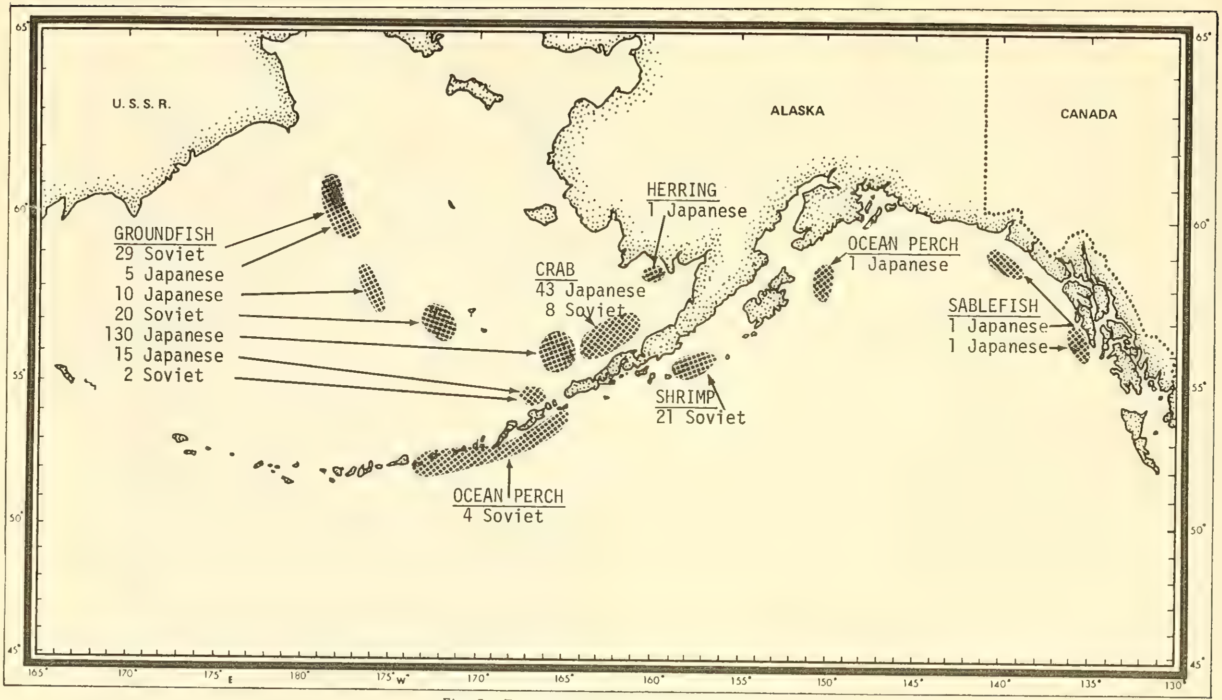

Fig. 2 - Foreign fishing off Alaska, April 1970.

RECORD SALES OF FISHING & HUNTING LICENSES IN 1969

U.S. sportsmen spent \$183 million for licenses, tags, permits, and stamps in 1969 to fish and hunt. It was \$14.5 million more than in 1968. This was reported by the Bureau of Sport Fisheries and Wildlife, U.S. Department of the Interior.

In 1969, fishing-license holders were a record 24,076,148--up 1,015,851 over 1968. They spent \$87,500,774 for licenses--\$7.5 million above 1968. License sales do not reflect accurately the number of fishermen because: (1) in several States, sportsmen buy separate licenses, stamps, permits, or tags for different species of fish; (2) most States do not require several age groups to buy licenses; (3) most coastal States do not require licenses for saltwater fishing; and (4) some persons fish in more than one State and are counted more than once.

Controlled Harvest Essential

Dr. Leslie L. Glasgow, Assistant Secretary of the Interior for Fish and Wildlife and Parks, said that in most instances the controlled harvest of fish and game is essential to balance them with their food supply--and to prevent major die-offs from starvation and diseases. He emphasized that fish and game replenish their kind annually. In many years, many fish and game produce surpluses their habitat cannot support.

Dr. Glasgow noted: "Controlled harvests are a sensible and practical means of keeping fish and game populations in balance with their environment so that they can continue to be healthy and productive."

State fish and game departments certify the number of paid fishing-license holders to the U.S. Bureau of Sport Fisheries and Wildlife. In turn, the Bureau uses the data in distributing Federal Aid in Restoration funds to the 50 States.

(Photo: W.F. Kubichek, Bureau of Sport Fisheries & Wildlife)

EXPERIMENTAL SABLEFISH FISHING OFF SAN DIEGO, CALIFORNIA

Charles F. Phleger   Andrew Soutar
Nils Schultz   Erich Duffrin

We feel that our results showing such high sablefish populations in the deep waters off this area are well worthy of the commercial fisherman's attention. Much interest in this work has been shown here, not only by oceanographers at Scripps and at the Bureau of Commercial Fisheries, but by a number of commercial fishermen on the coast.

We have found free-vehicle gear to be remarkably successful in fishing these deep bottom fish. We feel that commercial fishermen everywhere should be aware of its usefulness. The technique allows great flexibility. It can be used to catch deep-water fish anywhere in the world.

Free-vehicle fishing techniques have been modified and tested successfully in a survey of the benthopelagic sablefish, Anoplopoma fimbria, off San Diego and the offshore islands. Plastic elliptical traps have been placed in series on vertical set lines with or without hooks. Short-term releases (3-4 hours) can be as effective as longer-term releases (8-14 hours) in areas with high populations of fish. Sablefish numbers were extensive in almost all areas monitored between depths of 250 and 500 fathoms; maximum yields were obtained at 500 fathoms. The average hookline yield from all stations was 0.24 fish per hook (range: 0.00-0.75 fish per hook); the average trap yield from all stations was 4.4 fish per trap (range: 0-12 fish per trap).

Our results provide evidence that sablefish populations are extensive off San Diego and the offshore islands. These fish represent an underfished resource in this area. We feel that they can be fished economically through some form of free-vehicle technique.

The sablefish (or black cod, seatrout, skilfish, beshow, coalfish, butterfish, candlefish), Anoplopoma fimbria, has been fished commercially by civilized man on the western coast of North America since the middle of the nineteenth century (Pacific Marine Fisheries Commission, 1954). The fishery, extending from Southern California (Newport Beach) to Alaska, has mostly been a secondary product of the Pacific coast halibut fishery, along with ling cod (Ophiodon elongatus) and red cod (Sebastodes ruberrimus). It is of special importance during the winter closed season for halibut (Thompson, 1941). It is fished by longline gear and otter or balloon trawls (Phillips, 1958).

The sablefish market is mostly for fish in the smoked or kippered form. The market for fresh fish is limited because the flesh is quite oily. According to Dolev and Olcutt (1965), sablefish oil is highly stable (no detectable rancidity at 50° C. over five months). The triglycerides are characterized by less polyunsaturated fatty acids than most marine

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oils. Smaller sablefish often are filleted and sold fresh; larger ones are frozen and smoked. As early as 1910, the smoked form of these fish was marketed as barbecued Alaska black cod, a very popular restaurant item. Sablefish was the most important smoked fish product prepared in California in the 1930s; all of it was produced in San Francisco (Croker, 1936). The salted product was especially useful in the sale of beer in saloons.

Collected In 100-800 Fathoms

Sablefish are most commonly collected by Scripps Institution of Oceanography ichthyologists off San Diego between depths of 100 and 800 fathoms. They are a common benthopelagic fish in this area (Marine Vertebrate Cruise Data, Scripps Institution of Oceanography). They have been photographed as deep as 656 fathoms by the Marine Life Research Group at Scripps (Walter Schmidt, personal communication) on the San Clemente rift slope. Phillips (1958) gives 200-400 fathoms as the depth range during winter and early spring spawning season. After spawning, the fish are found in shallower depths, about 100-175 fathoms. The most extensive surface run of these deep-dwelling fish occurred in the region of the municipal pier in Monterey, California, where fishermen landed about 110 tons from the pier during 15 days (Cox, 1948). Sablefish eggs are pelagic and free floating and have been collected near the surface (Clemens and Wilby, 1946). The larvae and young are also collected near the surface as well as farther out to sea than is expected from the adult distribution. Brock (1940) describes morphological differences between the young and adults. He speculates that the large pectoral fins in the young (about one-third the body length) might aid in flotation. They reduce to one-tenth the body length in the adult.

Extensive intermingling of sablefish stock off North America does not occur (Pacific Marine Fisheries Commission, 1954). Tagging data demonstrate that most fish do not migrate more than 30 miles from the point of release. There are at least four major stocks on the Pacific coast which do not intermingle to any significant extent.

Sablefish Trawl Landings

According to Orcutt (1969), annual sablefish trawl landings in California of recent years have averaged slightly more than 2,000,000 lbs. Total California landings of sablefish between 1963 and 1967, and the mean price per lb. during these years, are shown in Table 1. Orcutt states that this resource could stand harvest of at least four to five million pounds more each year. Interestingly enough, the fishery has never extended to San Diego; reports often give the southern limit as north of San Diego. Generally, it is thought to extend from northern Baja California to the Bering Sea, with a greater concentration in the northern part of the range. The fish are not abundant south of Monterey, California (Phillips, 1958).

Table 1 - Sablefish landings and shipments, 1963-1967, landings in lbs. round weight. (From California Department of Fish and Game, Bulls. Nos. 129, 132, 135, 138, 144.)

Eureka	637,937	1,136,677	1,554,968	1,588,892	2,300,577
San Francisco	840,564	826,330	683,292	1,031,522	474,786
Monterey	271,226	410,717	570,905	593,831	1,021,201
Santa Barbara	57,436	88,215	53,140	1,658	1,610
Los Angeles	348	926	1,245	16	-0-
San Diego	1,838	587	-0-	20	-0-
Total	1,809,349	2,463,452	2,863,550	3,215,939	3,798,493
Mean Price Per lb.	.054	.066	.070	.072	.083

METHODS AND MATERIALS

The free-vehicle fishing technique that we have used in this study is illustrated in Fig. 1. The term free-vehicle means that the fishing gear is completely released from the fishing vessel, whereupon it sinks and rests upon the bottom to attract fish for a variable length of time. After this time, a release mechanism breaks the connection between the fishing assembly and weights, and the gear floats back to the surface leaving the weights on the bottom. It may be located by a number of techniques, including radios, radar screens, bright flags, and blinking lights.

Launching is best accomplished by trailing the gear out behind the boat, which moves

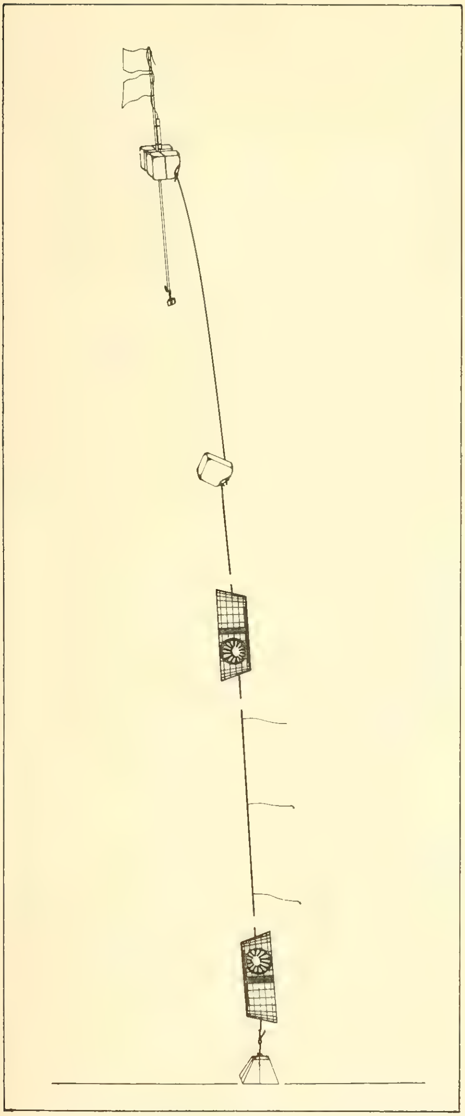

Fig. 1 - Free vehicle fishing gear; schematic diagram. Top shows plastic mast supported by isopar-filled jerry jugs with radio and flags. Fifty feet of handling line connects to secondary float, below which are traps and setline. Free vehicle is held on the bottom by a 60 lb. weight. The release is located between the lower trap and weight.

ahead at a slow speed. Floats and mast are placed in the water first, after which the secondary float, hookline and/or traps are paid out. Finally, the release device and weights are dropped in, and the whole assembly then sinks to the bottom.

The mast assembly includes a mast, bright flags, stabilizing weight, floats, and radio plus antenna. The mast itself consists of a 12-foot length of plastic pipe, one inch in diameter. We have found that plastic is much less subject to breakage than wood, and it is less expensive than hollow metal tubes that have been used. The flags, usually bright yellow or international orange, are attached near the top of the mast. The stabilizing weight, 4 pounds of lead, is attached at the bottom of the mast to help keep it upright while floating at the surface. Two floats are clamped to the mast at its center point. Further stabilization of the mast assembly is achieved by clamping the floats tightly. This aids in equipment recovery since the mast stands erect in the water. Previous experience with loosely attached floats caused problems, despite the pressure of a stabilizing weight, because the mast would not be upright in the water. In strong winds and heavy seas, mast assemblies would lie almost horizontal in the water, making visual sighting nearly impossible.

The Float

A float consists of a plastic 5-gallon carboy container filled with a lightweight oil. Isopar-M, a vehicle oil manufactured by Humble Oil and Refining Co., has been used successfully. A single 5-gallon container provides 11 lbs. of buoyancy at the surface. It is an odorless, relatively high boiling (172° F.), isoparaffinic solvent, with unusually low skin-irritation effects. Spillage on clothes leaves no stain mark. Compressibility data (tabulated at 32° F.) show a decrease in volume of 1.2% at 2,000 p.s.i. and 5.5% at 10,000 p.s.i. Cost is $0.23 per gallon from a tank car, and $0.62 per gallon if ordered in a 55-gallon drum. We feel that Isopar-M is preferable to gasoline as a float material because fammability is reduced. If gasoline is used, occasional leaks in floats while operating in rough seas can be very hazardous.

The return of the free vehicle to the surface is signaled by a one-watt radio transmitter. This radio operating at citizen band frequencies (27 mega-hertz) is able to transmit its signal up to 10 miles. Since the radio is coupled to a pressure-activated switch, battery power is conserved, and the radio may operate for a day or longer. The free vehicle is located with a radio direction finder (RDF). Standard RDF units are not able to sense a direction because of their power and frequency. A high-sensitivity portable unit, or a large directional citizens band antenna, must be used.

A handling line (50 ft. long) is attached to the two floats, with a third float attached to the other end. This expedites hauling the mast assembly aboard before the fishing gear is encountered. The vertical set line is situated below the third float. This can consist of 30-60 hooks (8-0 or 9-0) spaced about 1- or 2-meter intervals on plastic leaders (a foot or 2 long), a hookline with a trap above and below hooks (see fig. 1), or a string of traps in series. We have used successfully 8 traps spaced at intervals of 8-10 feet.

Elliptical Traps

Elliptical traps have proved excellent for catching fish and bottom creatures. These traps are manufactured by Fathoms Plus, a San Diego company, and have the following advantages over traditional metal lobster traps: (1) they are made of black plastic and so are impervious to water, rust, electrolysis, rot, and marine borers; (2) they can be rested in stable stacks to conserve space aboard boat; and (3) as organisms sense the bait, they constantly move closer to it from any direction. The trap is made from high-density polyethylene and measures 40" by 3" by 14". The bait containers (12" by 4.5") can be removed from traps and stored separately.

A release mechanism is located between bottom hook or trap and weights. We have used 2 types of releases made of magnesium: wire-plier and magnesium-rod.

The wire-plier type is excellent for short-term sets (3 to 5 hours). The pliers are suspended from set line (fig. 2), and a short piece of $\frac{1}{16}$" magnesium wire is clamped between the two handles. This keeps pliers shut, so the weights can be suspended from other end. When the wire dissolves, the pliers spring open--releasing the weights on the bottom. A spring insures that the pliers will open. The pliers are recovered and must be acid soaked or sanded after immersion to clean the metal surface; this acts as an electron acceptor.

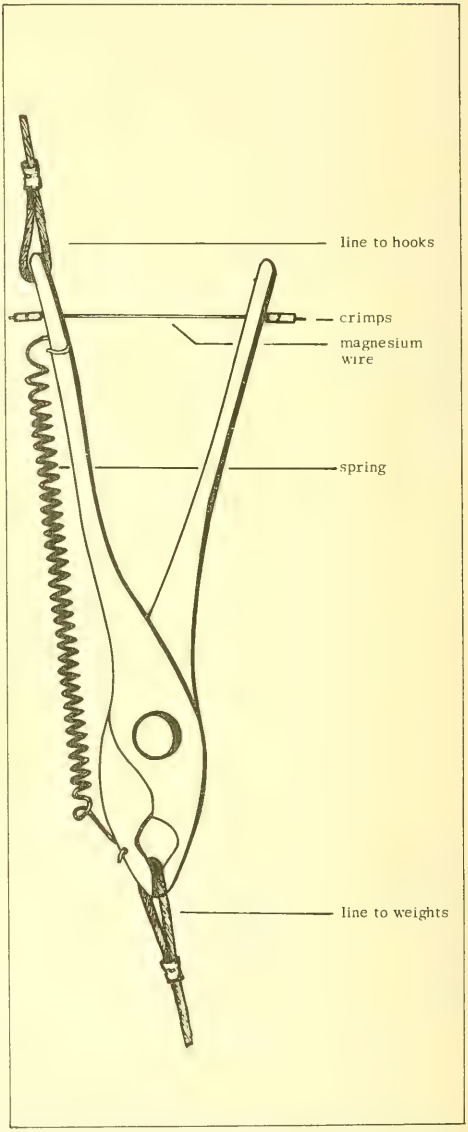

Fig. 2 - Scale diagram of wire-plier release mechanism. Magnesium wire is $\frac{1}{16}$ inch diameter. When it dissolves in seawater, the spring insures that the pliers will snap open to release the weights.

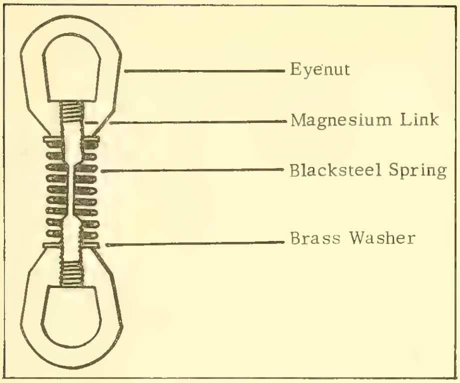

Fig. 3 - Diagram of magnesium rod release mechanism (from Schick, et al., 1968). Setline is attached to upper eyenut and weights attached to lower eyenut. A no. 68 black finish steel spring $1\frac{3}{4}$" length) is used with two $\frac{3}{8}$" brass washers. Galvanized eyenuts (or black steel) with $\frac{3}{8}$" thread diameter are used. A $\frac{3}{8}$" diameter magnesium rod alloy AZ31B is used. Length of rod is $2\frac{1}{2}$" and length of narrow center portion is 1".

The magnesium rod or link (fig. 3) is useful, but these are more time consuming to construct than wire-plier. A magnesium rod is turned on a lathe to desired diameter. Rod strength considerations usually limit this to 0.125 inch, which takes 8 hours to dissolve. Thus, this technique cannot be used for short terms. Two eyenuts are attached to the rod. A black steel spring, situated between eyenuts, acts as an electron acceptor. The weights are attached to one eyenut, the setline to the other. When the magnesium dissolves, the weights are released.

Since the weights are left on the bottom, almost anything can be used that will effectively sink the gear. We often use 80-lb. concrete blocks, or 40-lb. scrap metal blocks. However, concrete loses more weight than metal in the water.

Current laws of California's Fish and Game Code do not prohibit the use of the release mechanism in conjunction with setlines. However, fish traps are prohibited.

RESULTS

Fourteen stations were surveyed (fig. 4) during this study. Eight were in region of San Diego, extending from north of La Jolla to Los Coronados Islands. Stations 9-11 were east of San Clemente Island; station 12 south of Santa Catalina Island; station 13 on San Juan seamount, about 200 miles west of San Diego; and station 14 was one-half mile east of north end of Guadalupe Island, Mexico. Three free vehicles were lowered at each station with varying amounts of hooks, traps, and bottom times. The depths surveyed ranged from 290 to 500 fathoms. Excepting San Juan seamount and Guadalupe Island, the only fish caught at all stations were sablefish.

Stations 1-4 were at 350 fathoms; no traps were used. The vertical set-lines (30 hooks per line) yielded more fish per hook the farther south the station was. The northernmost station (1) yielded 0.03 fish per hook; the southernmost station (4) 0.26 fish per hook (Table 2). The average weight also increased from north to south--from 2.5 lbs. to 4.4 lbs.--as did average standard length, 478 mm. to 600 mm.

Table 2 - Vertical set line results from stations 1-4. These stations extend from 32°59' NL to 32°49' NL along the 350 fathoms contour line.

Stations:	1	2	3	4
Sablefish Per Hook:	0.03	0.00	0.10	0.26
Average Weight:	2.5 lbs.	0.00	2.6	4.4
Average Length:	478 mm.	0	523	600

Stations 5 and 6, at 32° 42' NL off Point Loma, San Diego, were at 290 and 340 fathoms, respectively. Vertical set lines with a trap between hookline and release were used. The results show a greater yield of fish per hook and per trap at 340 fathoms (Table 3). At 290 fathoms, the average number of sablefish per hook was 0.10; at 340 fathoms, 0.37 fish per hook. Trap yields increased from 1.7 to 2.2 fish per trap. Although weight of fish on

Table 3 - Results from stations 5 and 6; both situated at 32°42' NL off Point Loma, San Diego.

	Station 5 (290 fathoms)		Station 6 (340 fathoms)	
	Vertical Set Lines	Traps	Vertical Set Lines	Traps
Sablefish Per Hook:	0.10		0.37	
Sablefish Per Trap:		1.7		2.2
Average Weight:	3.75 lbs.	4.3 lbs.	4.5 lbs.	4.2 lbs.
Average Length:	489 mm.	537 mm.	539 mm.	538 mm.

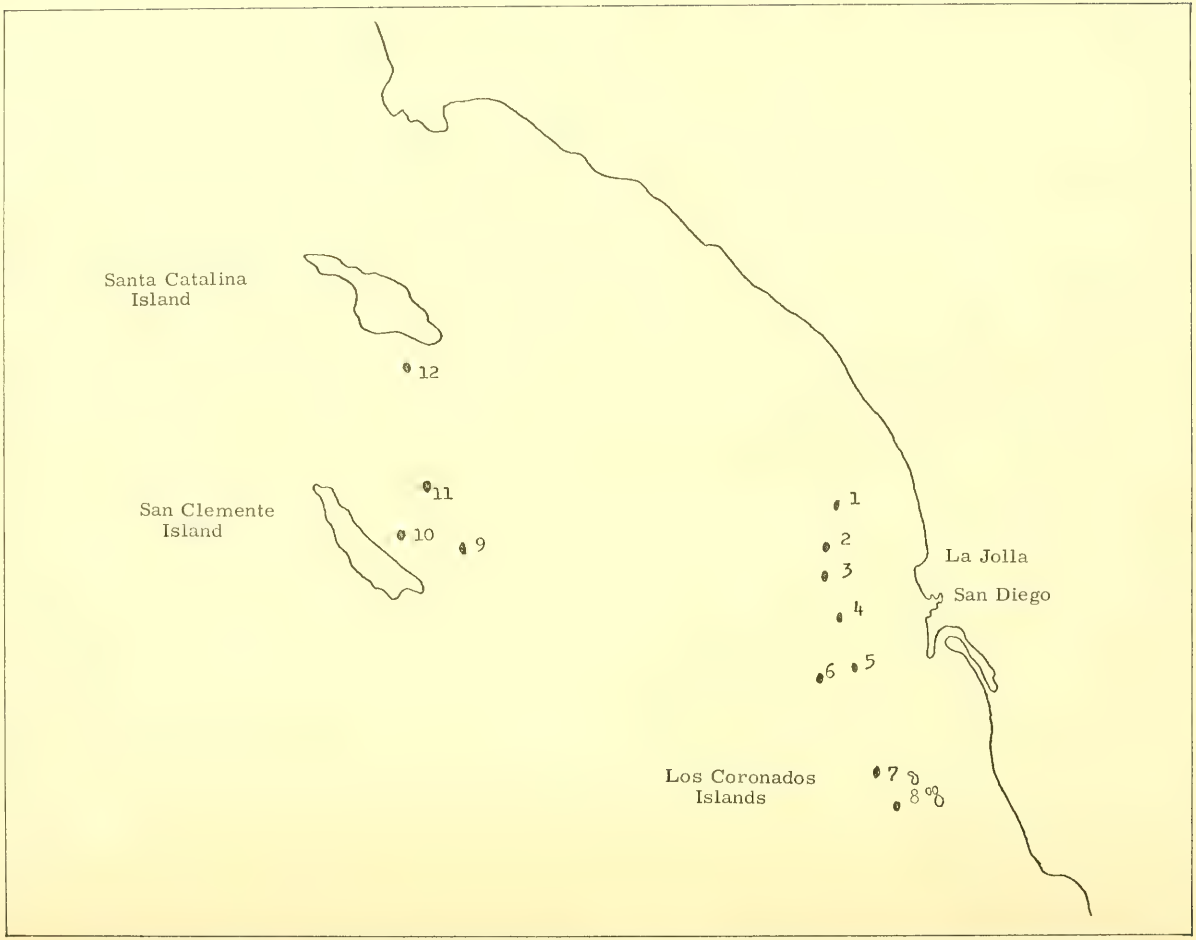

Fig. 4 - Map of sablefish study area. Stations not shown include San Juan Seamount (sta. 13, 500 fathoms) and Guadelupe Island (sta. 14, 500 fathoms).

hooklines was greater at 340 fathoms by an average of 0.25 lb., average weight of trapped fish was about the same, 4.3 lbs. and 4.2 lbs.

Stations 7 and 8 were on the 500 fathoms contour line, west of Los Coronados Islands. These stations were surveyed using release times of 3, 8, and 14 hours on hooklines. A vertical set consisting only of 8 traps spaced in series on the line at 10-foot intervals was also tested on a 14-hour release at station 8. The yields of sablefish at these stations were considerably higher than results at stations 1-6. At station 8, the 14-hour release yielded 0.75 fish per hook, whereas the 8-hour release yielded 0.44 fish per hook (Table 4). At station 7, the 3-hour wire-plier release gave 0.67 fish per hook. Average weights of fish caught on hooklines ranged from 4.4-4.8 lbs., average standard lengths from 531 mm. to 559 mm.

Table 4 - Results from two stations west of the Los Coronados Islands, situated at 500 fathoms. At station 7, eight traps in series were used on a line rather than usual set-line plus combination.

	Station 7	Station 8		
	Vertical Set Lines	Vertical Set Lines	Vertical Set Lines	Traps (8)
Release Time:	3 hrs.	8 hrs.	14 hrs.	14 hrs.
Sablefish Per Hook:	0.67	0.44	0.75	
Sablefish Per Trap:				5.3
Average Weight:	4.8 lbs.	4.8	4.4	5.4
Average Length:	538 mm.	559	531	586

Fish in the traps had a larger average weight, 5.4 lbs., and average standard length, 586 mm. The average number of fish per trap was 5.3. The distribution of fish in the traps from bottom trap (No. 1) to top trap (No. 8) was: No. 1, 7 fish; No. 2, 11 fish; No. 3, 3 fish; No. 4, 3 fish; No. 5, 6 fish; No. 6, 5 fish; No. 7, 3 fish; No. 8, 4 fish. Although fish entered all traps, the greatest yields were in bottom two traps.

Stations 9, 10, and 11 were located east of San Clemente Island at 500 fathoms. These stations were surveyed using 8-, 3-, 3-hour releases, respectively. At the two short-term stations (10 and 11), one trap was between set-line and release. No traps were used on the set lines at station 9, but a string of 8 traps in series was used. At station 9, with 8-hour release, the set-lines yielded 0.64 fish per hook; average weight was 4.8 lbs. and average standard length 537 mm. (Table 5). The set-line yields at stations 10 and 11 with 3-hour releases were 0.13 and 0.07, respectively. The weights and standard lengths were similar to station 9. The bottom traps at stations 10 and 11 proved quite effective, in contrast with low hook line yields, with average of 8 and 5 fish per trap. The 8-trap series at station 9 averaged 3.1 fish per trap. The distribution of fish in traps from bottom (No. 1) to top (No. 8) was: No. 1, 4 fish; No. 2, 8 fish; No. 3, 3 fish; No. 4, 3 fish; No. 5, 4 fish; No. 6, 3 fish; No. 7, 1 fish; No. 8, 1 fish. More fish were caught in lower traps than in higher traps. In contrast to results at Los Coronados Islands, fish in traps did not have greater weight or length. Sixty of the sablefish caught on hooks or in traps were chosen at random for sexing: 19 were males, and 41 females (8 gravid).

Table 5 - Results from 3 stations located east of San Clemente Island at 500 fathoms. At stations 10 and 11, vertical set lines plus one bottom trap were used. At Station 9, an 8-trap combination was used in addition to vertical set lines.

	Station 9		Station 10		Station 11	
	Vertical Set Lines	Traps (8)	Vertical Set Lines	Traps (1)	Vertical Set Lines	Traps (1)
Release Time:	8 hrs.		3 hrs.		3 hrs.	
Sablefish Per Hook:	0.64		0.13		0.07	
Sablefish Per Trap:		3.1		8		5
Average Weight:	4.8 lbs.	4.5 lbs.	5.5 lbs.	4.5 lbs.	4.3 lbs.	4.5
Average Length:	537 mm.	535 mm.	565 mm.	537 mm.	514 mm.	530 mm.

Two vertical set-lines with 30 hooks--and one trapline with 3 traps spaced 5, 35, and 65 feet from the bottom on the line--were used at station 12, located at 500 fathoms south of Santa Catalina Island. The trap yield (5.7 fish per trap, Table 6) contrasted markedly with set-line yield (0.03 fish per hook). As usual, fewer fish were trapped at top of trap line. Four fish were trapped in lowest trap, 12 in middle trap, and one fish in top trap. At San Juan seamount, a single setline trap combination was used on a 3-hour release, where the trap was between hookline and release mechanism. Only one sablefish was caught on the set-line, while 2 were caught in traps (Table 6). Twelve Pacific rattails (Coryphaenoides acrolepis) were caught on hooks at this station. They were spread evenly between bottom and top hooks. The Guadalupe Island station, sampled at 500 fathoms, yielded one Pacific rattail on a hookline, and no sablefish.

Table 6 - Results from station 12, south of Santa Catalina Island at 500 fathoms, and station 13, on San Juan seamount at 500 fathoms.

	Santa Catalina Island		San Juan Seamount	
	Vertical Set Lines	Traps (3)	Vertical Set Lines	Trap (1)
Release Time:	8 hrs.	8 hrs.	3 hrs.	3 hrs.
Sablefish Per Hook:	0.03		0.03	
Sablefish Per Trap:		5.7		2.0
Average Weight:	4.5 lbs.	4.4 lbs.	9.0 lbs.	13.0
Average Length	529 mm.	535 mm.	652 mm.	728 mm.

DISCUSSION

A considerable sablefish population exists off San Diego and the offshore islands. It is interesting that only sablefish were caught at depths examined in this study, 290-500 fathoms. No other fish were encountered on the gear used; the exception was Pacific rattails at San Juan seamount and Guadalupe Island, which do not qualify as being anywhere near San Diego. The average yield on all hooklines lowered at stations 1-12 was 0.24 fish per hook. This figure is calculated without consideration of time on bottom, depth of capture, or geographical location. Maximum hook yields were obtained at stations 6-9 (0.37 to 0.75 fish per hook), located at 350 fathoms off Point Loma, San Diego, and at 500 fathoms off Los Coronados and San Clemente Islands. The average trap yield from all stations where traps were tested (stations 5, 6, and 8-12) was 4.4 fish per trap. This figure is calculated without respect to release time, position of traps on line, depth of capture, or geographical location. Maximum trap yields (5-8 fish per trap) were obtained at station 8 and 10-12. The majority of high trap yields did not occur at stations where high hook yields occurred.

Small Fish

Sablefish caught in this study were small fish by comparison with northern populations. The Seattle, Washington, sablefish fishery defines a small fish as average weight of 6.5 lbs., and large fish as average weight of 12 lbs. Average weights of the San Diego sablefish usually were 4 to 5 lbs. At stations 4-12, average weights were 3.75 to 5.5 lbs. from both hooklines and traps. At stations 1-3, the yields were too low (0.03 and 0.10) to attach any significance to smaller average weights (2.5 and 2.6 lbs.). From a marketing standpoint, the fact that these fish are small might be an advantage because small fish can be sold fresh as well as smoked. Large fish usually are sold only in smoked form.

Depth Important

Depth is probably a very important factor to consider in choosing the best area to fish for sablefish. Philipps (1958) gave the depth range as 200-400 fathoms, when the fish are not spawning, but this is for the northern fishery. We fished between 290 and 500 fathoms and found a maximum yield at 500 fathoms. Data collected off La Jolla and San Diego (Tables 2 and 3) show relatively low yields for 290-350 fathoms (0.00-0.37 fish per hook). The yield increases off San Diego from 290 fathoms (0.10 fish per hook and 1.7 fish per trap) to 340 fathoms (0.37 fish per hook and 2.2 fish per trap). The highest yields were obtained off Los Coronados Islands and San Clemente Island at 500 fathoms (0.64-0.75 fish per hook). These fish must congregate in deeper water the farther south they are found. We fished no deeper than 500 fathoms. Perhaps considerable aggregations will also be common at depths greater than 500 fathoms.

The release time can be varied considerably in free-vehicle fishing. This can be done to suit the fishermen's schedule, or it can be done to maximize yield as a function of time.

Our data from stations 7 and 8 (Table 4) serve to illustrate the latter point. At station 8, the yield was almost doubled with a 14-hour release (0.75 fish per hook) versus an 8-hour release (0.44 fish per hook). At station 7, however, an extremely high fish yield (0.67 fish per hook) was obtained in 3 hours. Three-hour release times did not give such high yields at stations 10 and 11, perhaps due to a more sparsely distributed fish population.

Although we only used 3-14 hour release times, there exist new devices that are quite accurate from 30 minutes to 30 days. An endless amount of flexibility is thus possible to the fisherman with an already tight schedule.

Elliptical Traps

The elliptical traps were built specifically to catch lobsters on the bottom. The fact that they successfully catch sablefish above the bottom proves they also work well as fish traps. At some stations, the traps functioned much better than the hooks. For instance, at station 12, off Santa Catalina Island, the hook yield was 0.03 fish per hook, whereas 3 traps spaced in series at the same station yielded 5.7 fish per trap. Twelve sablefish were caught in middle trap (35 feet off bottom), with an average weight of 4.4 lbs.--revealing the potential of free-vehicle trap fishing.

Traps have additional advantages. They provide a cage to protect the fish from predators. The blue shark (Prionace glanca) often fouls up hooklines at the surface, but it cannot eat fish in the traps. Sealions also enjoy eating sablefish off the hooklines. Traps might be best for especially long release times (greater than one day) because fish seem to live longer in the traps than on the hooks. More living fish are present in the traps than on the hooklines when hauled aboard the ship. For long bottom times, an automatic bait delivery device can be built to provide a continual fish lure, perhaps used together with blinking underwater lights. Large traps (25' by 25' by 25', or bigger) can be constructed of plastic and left on the bottom for a week or more--or these can be timed to return to surface whenever fisherman is conveniently in area.

Free-Vehicle Fishing

Free-vehicle fishing can be profitable. Hookline and trapline data obtained in this study may be extrapolated to illustrate. At station 7, for instance, 0.67 fish per hook was obtained on a 3-hour release. If two men in a 20-foot skiff were equipped with 8 free vehicles, 60 hooks per line, they would haul in considerable sablefish at this station during an 8-hour work day. It takes 15-20 minutes to pay out a setline, so the lines would start popping up shortly after the men had finished paying them out. At an average of 4.8 lbs. per fish at this station, 16 sets might yield 3,100 lbs. of fish. Before leaving, the 2 men could put down 8 sets on 14-hour releases with 8 traps on each set. At station 8, we obtained 5.3 fish per trap with average weight of 5.4 lbs. These could be retrieved in the morning, yielding 1,800 lbs. of fish. This fishing rate would result in a maximum return of 2,500 lbs. of fish per man per day. Using the prices given in Table 1, the return would be between $125 to $200 per man per day.

Best marketing of sablefish probably can be obtained by smoking these fish. We have tested palatability of smoked San Diego sablefish and found great enthusiasm for the product. Many people consider it superior to smoked salmon. Sample platters of this delicacy disappeared rapidly in local saloons.

Acknowledgments

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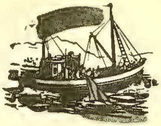

THE ATLANTIC ALBACORE FISHERY

Grant L. Beardsley Jr.

The albacore, Thunnus alalunga, is one of the world's most sought-after tunas. It is also one of the most valuable: in 1969, exvessel prices for albacore landed on the west coast of the United States were around $450 a short ton; yellowfin tuna brought about $330, and premium skipjack tuna $280. More than half of all albacore landed in the world is consumed in the United States. However, U.S. production does not meet the demand. The deficit is filled with imports of over 100,000 tons annually (fig. 1).

Albacore rarely form compact surface schools, so purse seines, which have become the primary gear used by U.S. fishermen for yellowfin and skipjack tunas, are not suitable for catching albacore. They are caught on the surface primarily with live bait and by trolling; larger fish living well beneath the surface are taken by longlines.

Japanese Began in 1956

In 1956, the Japanese began exploratory longline fishing in the Atlantic Ocean. They set approximately 131,000 hooks and caught over 1,000 albacore. From this inauspicious start they rapidly expanded their fishing effort until, in 1964, Japanese vessels fished over most of the North and South Atlantic Oceans between 40° N. and 40° S. They set almost 100 million hooks, and caught over 2 million albacore.

Before 1964, the Japanese fished primarily for yellowfin tuna but, in that year, reacting to rapidly declining catch rates, they shifted their fishing to good albacore areas. In recent years, declining catch rates for both species have forced the Japanese to cut back their effort in the Atlantic. In 1967, for example, they set slightly over 30 million hooks compared to almost 100 million in 1964 (from approximately 160 vessels). However, this decrease in effort probably has been counterbalanced by a rapid increase in longline fishing by China (Taiwan), Cuba, Panama, South Korea, and Venezuela. Recent estimates place the number of vessels operating in the Atlantic from those countries at 100 to 150, but their catching efficiency is probably below that of the Japanese.

Bay of Biscay Albacore

The only other fishery for albacore in the Atlantic is the surface fishery in the Bay of Biscay; the French and Spanish land about 40,000 tons annually. This fishery begins in May or June and extends through October, or occasionally into November; best fishing is in July and August. Fishing is with trolling lines or live bait. Trolling boats are 30 to 75 feet long and are manned by crews of 6 to 12 men. Each boat fishes 9 to 10 lines and trolls at about 6 knots. Three to 4 tons a day are considered an excellent catch.

Albacore caught in the Bay of Biscay are small compared to those captured by longlines. A 15- to 20-pound albacore is classified as large in the surface fishery; 45 pounds is the average size of albacore taken by longliners in the Atlantic. The few albacore caught in equatorial waters are normally very large, often averaging 65 pounds.

Picture of Albacore Abundance

Detailed statistics on catch and effort of the Japanese longline fleet are available from publications of the Fisheries Agency of Japan and the Nankai Regional Fisheries Research Laboratory. Analyses of these data have produced a clear picture of the distribution and relative apparent abundance of albacore in the Atlantic Ocean.

The average number of albacore caught per 100 hooks set was calculated for each 5° square of latitude and longitude in the Atlantic by totaling the number of albacore caught in a given square in a given month, multiplying by 100, and dividing by the number of hooks fished in that square during the same period. This number was used to indicate concentrations.

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TABL Contribution No. 155.

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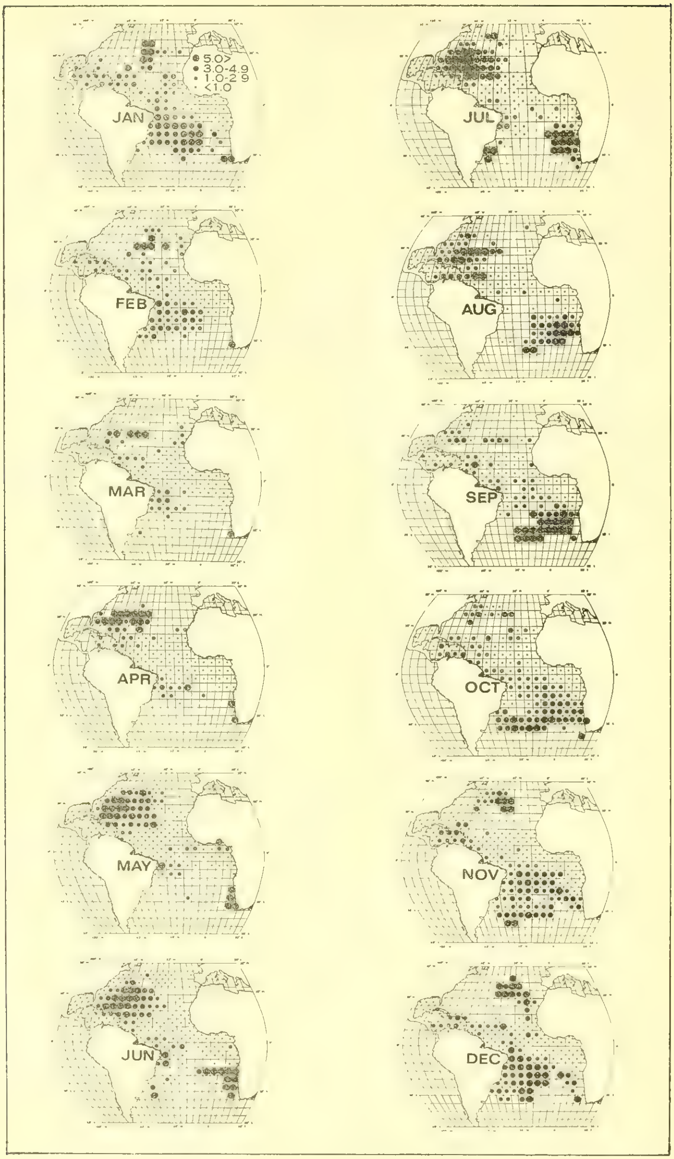


Fig. 1 - World tuna catch and U.S. albacore catch and consumption 1964 through 1968.

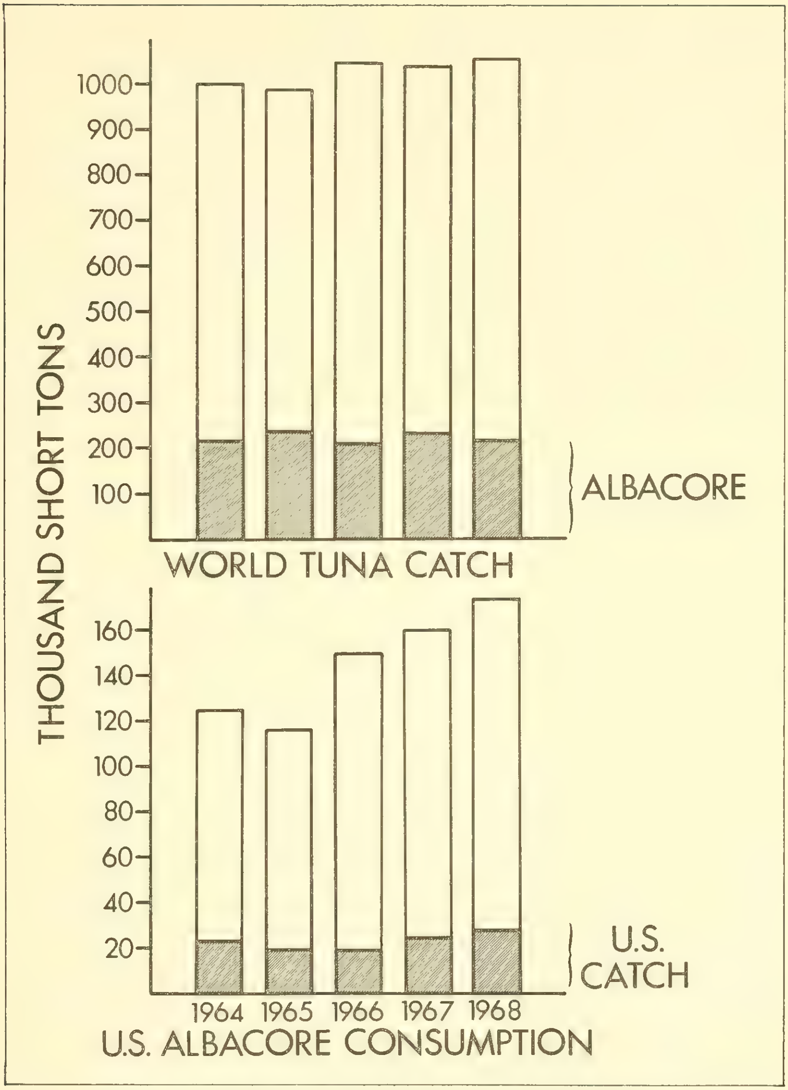


Fig. 2 - Distribution of average monthly catch rates (number of albacore per 100 hooks) for albacore from Japanese Atlantic longline fishery, 1956-1967.

In summer, albacore are concentrated over a broad area on the western side of the North Atlantic (fig. 2). Probably spawning takes place in this period. Japanese researchers reported capturing albacore larvae in the western tropical Atlantic in June; scientists of the BCF Tropical Atlantic Biological Laboratory in Miami have caught albacore larvae in plankton tows in the Florida Current off Miami in May and June.

2 Groups in August

The large summer concentration of albacore appears to divide into two groups in August. Although catch rates are low throughout the North Atlantic in September and October--making distributions difficult to determine--it appears that one group moves northeast, the other south into the Caribbean. In winter, catch rates are high in the central North Atlantic between 30° N. and 45° N.

Albacore caught by longlines in the central North Atlantic in winter often average as little as 25 pounds; those caught in the Caribbean and tropical Atlantic rarely average less than 45 pounds, and often as much as 65 pounds. It is likely that the small albacore found in the Bay of Biscay in summer move offshore in fall and winter and are recruited to the longline fishery; this accounts for the small average size of albacore caught in the central North Atlantic in winter.

In South Atlantic

Albacore movements in the South Atlantic appear to be almost a mirror image of those in the North Atlantic (fig. 2). The fish are abundant over most of the western half of the South Atlantic in summer (Dec.-Feb.). Spawning probably takes place at this time since albacore larvae have been captured off the Brazilian coast between 10° S. and 30° S. in February. In winter (June-Aug.), the Japanese find the best fishing off Angola and Southwest Africa. Some albacore, however, do not make the migration in fall from Brazil to the West African coast. The Japanese discovered excellent fishing in winter off the southern coast of Brazil in 1961. They have expanded their fishing in that area in recent years with good results. In September, albacore move west and slightly south in a migration back to their summer grounds in the western South Atlantic.

A relatively small area off the coast of South and Southwest Africa provides excellent longline fishing for albacore almost year round. In the winter, both small and large albacore are present, but in summer the large albacore apparently leave the area and only small fish are available. The small albacore found off the southern tip of Africa probably are recruits to the South Atlantic longline fishery. There is no surface fishery for albacore off South and Southwest Africa, although large numbers of albacore have been sighted at the surface. It seems likely that a fishery by troll or live bait similar to those on the west coast of the United States and in the Bay of Biscay would be successful in this area. If the effort were comparable, it would be reasonable to forecast landings similar to those of the Bay of Biscay fishery. This South Atlantic area is fished heavily by longliners from China (Taiwan), Japan, and South Korea. Catch rates of albacore have remained consistently high, while catch rates for albacore were declining elsewhere. There is also evidence of considerable movement of small albacore between the South Atlantic and Indian Oceans.

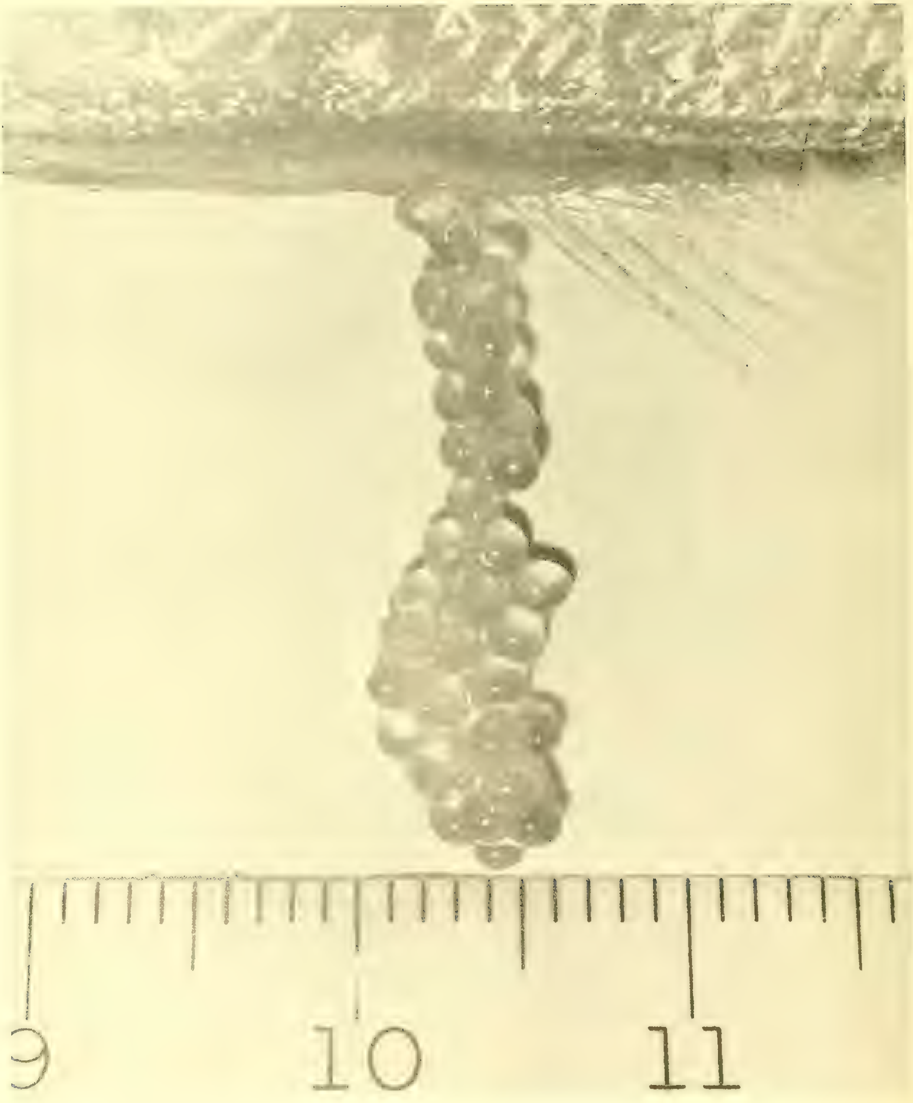
Albacore populations in the North and South Atlantic appear to be separate. There is probably little intermingling across the equator. It is possible, however, that in warm equatorial waters albacore descend below the depths commonly fished by longline gear; hence estimates of abundance in this area may not be comparable to those in other areas.

Are Stocks Fully Exploited?

At present, it is not clear whether the Atlantic albacore stocks are being fully exploited. Studies are under way at the BCF Tropical Atlantic Biological Laboratory to determine optimum yields for the albacore stocks in the North and South Atlantic. A 50 percent decrease in albacore catch by the Japanese in 1967 cannot be considered a decrease in albacore populations--rather, it resulted from a decided lessening of their fishing effort. Undoubtedly the rapid expansion of fishing by the Chinese and Koreans in 1968 and 1969 will reveal catch totals for albacore comparable to pre-1967 levels.

French biologists are presently collecting and analyzing data from the Bay of Biscay fishery to determine migrational patterns, the effects of fishing, and optimum yields from the surface fishery. These studies are important because the small albacore in the Bay of Biscay fishery undoubtedly are the recruits to the North Atlantic longline fishery.

The one region that might produce a significant contribution to an increased albacore catch in the Atlantic seems to be the waters off South and Southwest Africa. Apparently large numbers of albacore are available on the surface there, but no surface fishery exists.



Cluster of eggs stripped from ripe Pacific saury (scale is in millimeters).
(Photo: R. C. Counts & A. M. Vrooman, BCF, La Jolla, Calif.)

SEASONAL AND GEOGRAPHIC CHARACTERISTICS OF FISHERY RESOURCES

California Current Region--II. Pacific Saury

David Kramer and Paul E. Smith

This is the second in a series of reports[1] in which we are describing characteristics of the fishery resources in the California Current region, emphasizing predictions of the times and localities of adult fish spawning and suggesting the potential for production of the spawning resources. We did this for the jack mackerel (Kramer and Smith, 1970) and will now do the same for the Pacific saury.[2]

Data of the California Cooperative Oceanic Fisheries Investigations (CalCOFI) indicate that major centers of the spawning populations of the Pacific saury can first be located in January in a relatively small area about 150-200 miles offshore from southern California and northern Baja California.

A major center of spawning is where 20 percent or greater occurrence of saury eggs is found in standard plankton hauls--fig. 1. In February and March, the centers of spawning spread inshore and northward to Point Conception and, in April, May and June, to San Francisco. Although eggs may be found as far south as Magdelena Bay, the major spawning centers seldom extend much farther than northern Baja California.

It can be assumed from egg data and visual observations (Smith, Ahlstrom, and Casey, 1970) that the saury ranges at least from southern Baja California to the Gulf of Alaska. The CalCOFI pattern does not delimit saury spawning (fig. 1). But a survey by BCF's Honolulu Laboratory in spring 1956 (fig. 2) and the NORPAC survey in late summer (August) 1955 (fig. 3) showed that spawning extends at least to 180° W. longitude. Smith, Ahlstrom, and Casey have stated that spawning probably occurs completely across the Pacific. From data for 2 months of peak spawning--April and May--Smith, Ahlstrom, and Casey estimated the spawning resource at about 500,000 tons in the CalCOFI area. The 2 peak months were used for this estimate because the unusual spawning behavior of the saury introduces two sources of error in the estimate of the size of this resource: First, the saury is a repetitive spawner in 2-month intervals during the year (Hatanaka, 1956). Thus, if eggs are sampled continually it is most likely that the same populations may be repetitively sampled and overestimated. Second, saury eggs are adhesive and often collected in clumps of 20 or more; this diminishes the precision of sampling because the eggs are not independently distributed. Saury eggs found outside the pattern, as noted above, indicate that there may be as much spawning out of the pattern as in it--and thus would increase the estimate of resource size possibly by an equal amount.

Smith, Ahlstrom, and Casey pointed out that the saury is not likely to be available to the fisherman in the CalCOFI survey pattern during its spawning cycle. Their data from visual observations during spawning and non-spawning periods indicate that the saury might be most available during September through December and, most likely, in the areas from San Diego to northern California and Oregon--with the maximum numbers 40 miles and more offshore. Novikov and Kulikov (1966), in their account of Russian surveys off the west coast of North America, reported that the most dense concentrations of adult saury were between latitudes 42°18' and 44°22' in August, October, and November at water temperature 54°-55° F. (12.5-13.5° C.).

The authors are Fishery Biologists, BCF Fishery-Oceanography Center, La Jolla, California.

[1] These are introductions to existing and forthcoming comprehensive reports and analyses based on more than 20 years of intensive research by the CalCOFI--founded in 1949 to determine the reasons for the decline of the sardine resource.

[2] Organizations, area of investigations, and treatment of the data were presented in the report on jack mackerel.

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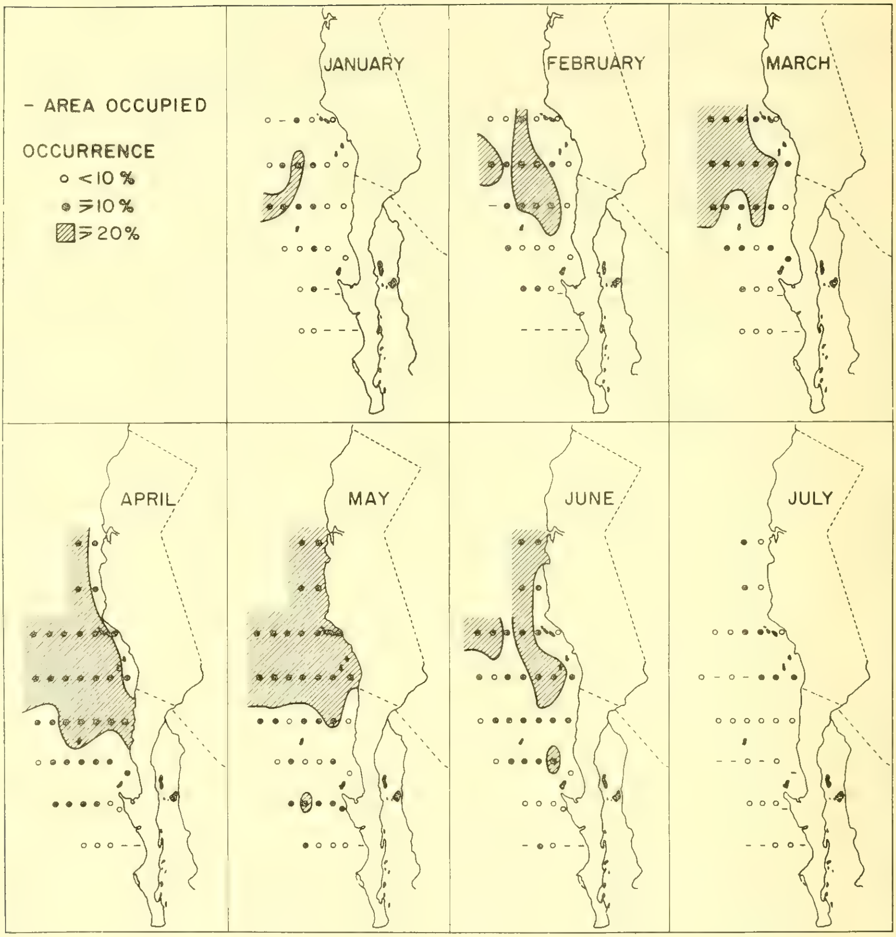

Fig. 1 - Percent occurrence of saury eggs in 1951-60 on the survey pattern of the California Cooperative Oceanic Fisheries Investigations (CalCOFI)--see figure 2.

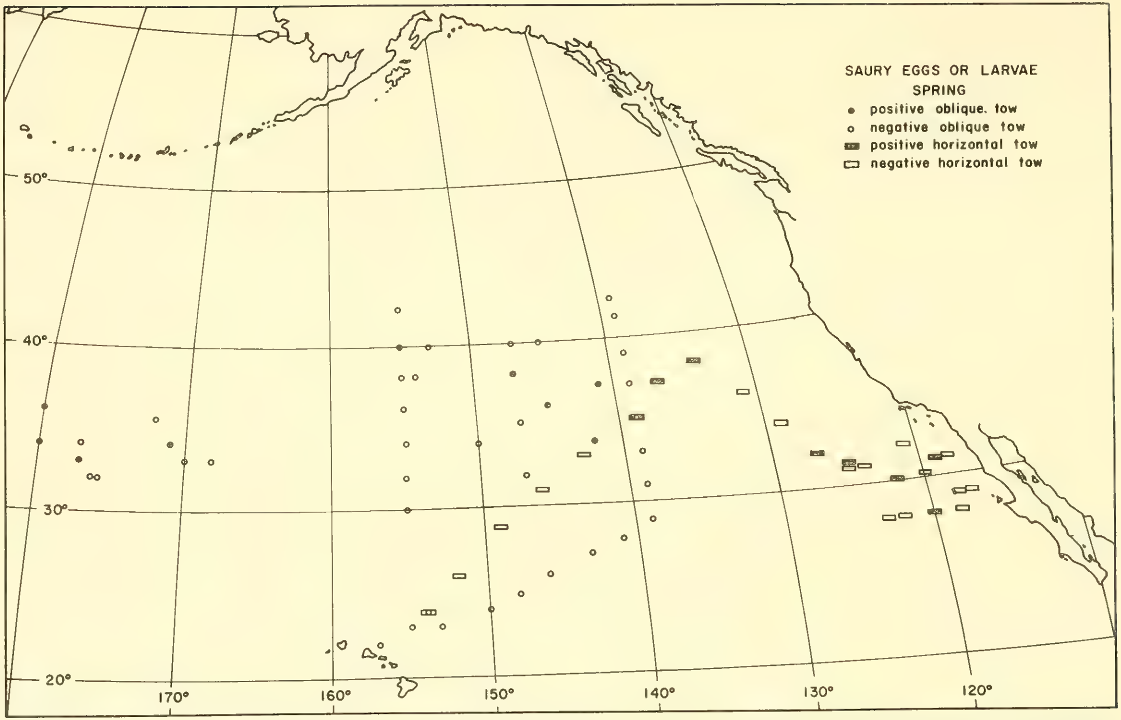

Fig. 2 - Distribution of saury eggs or larvae from survey by the BCF Honolulu Laboratory in the spring of 1956 (figure 4a of Smith, Ahlstrom, and Casey, in press).

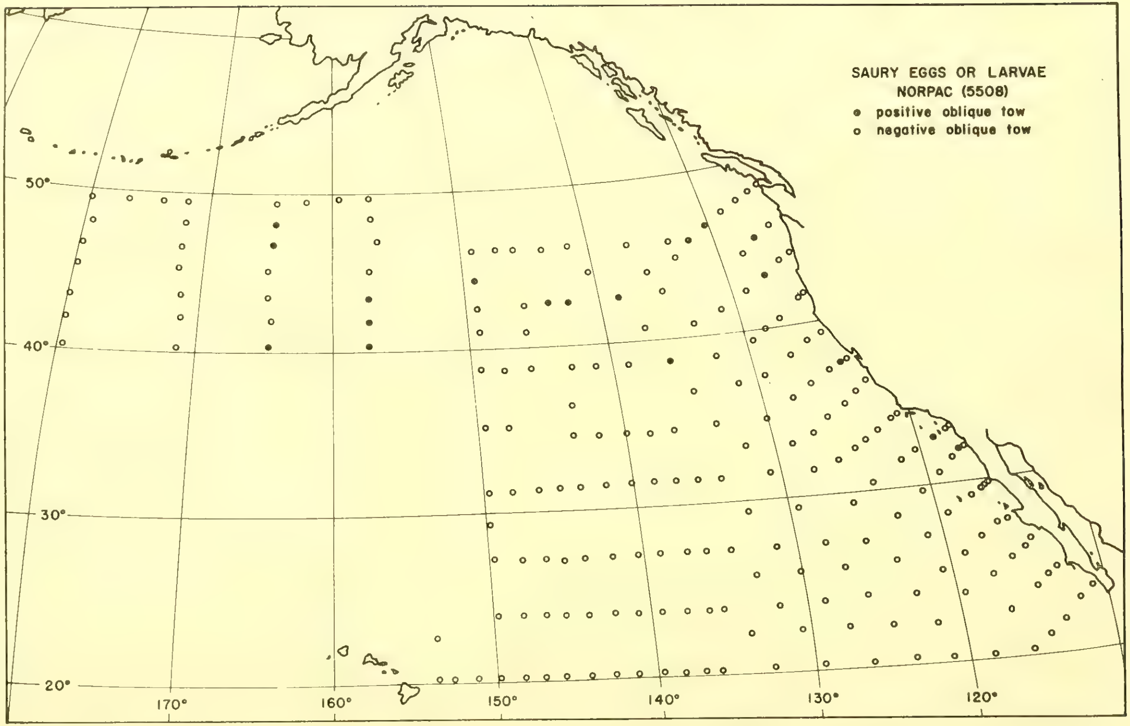

Fig. 3 - Distribution of saury eggs or larvae from NORPAC survey in late summer, August 1955 (figure 3 of Smith, Ahlstrom, and Casey, in press).

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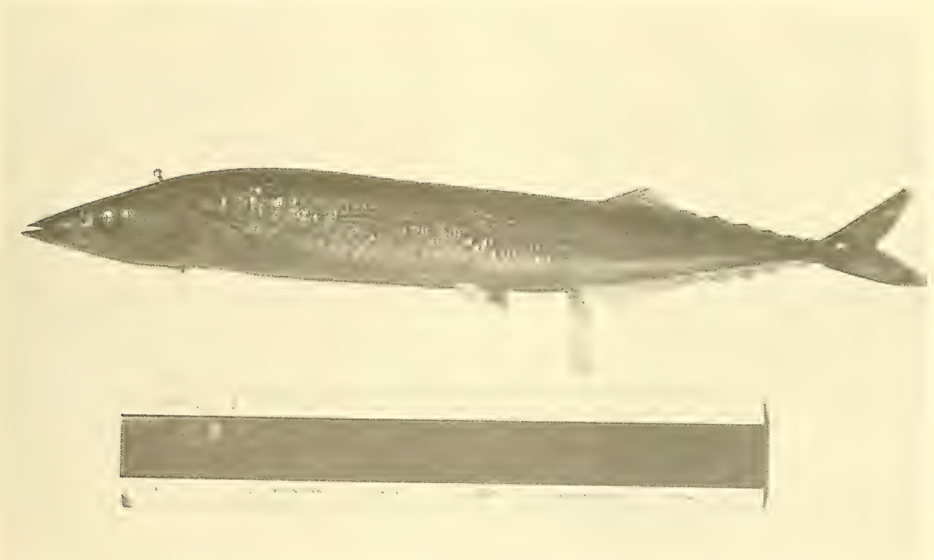

Pacific saury--stripped, showing cluster of eggs (about 9 inches fork length or 22 cm. standard length).
(Photo: R. C. Counts & A. M. Vrooman, BCF, La Jolla, Calif.)

INTERNATIONAL

CANADA & U.S. AGREE ON RECIPROCAL FISHING

On April 24, 1970, Canada and the U.S. concluded an Agreement on Reciprocal Fishing Privileges. It was signed for Canada by Dr. A. W. H. Needler, Deputy Minister, Department of Fisheries and Forestry, and for U.S. by Ambassador Donald L. McKernan, Special Assistant for Fisheries and Wildlife, Department of State.

Amb. McKernan was in Ottawa for the annual meeting of the Inter-American Tropical Tuna Commission. ('Department of External Affairs,' Canada, Apr. 24.)

COMMON MARKET SETS 1970 IMPORT QUOTAS FOR TUNA AND COD

The following import tariff quotas have been established by The European Communities (Common Market) for fishery products in 1970: 53,000 metric tons of fresh, refrigerated, or frozen whole, headless, or sliced tuna intended for canning. Final 1969 quota was 65,000 tons.

Cod: 34,000 tons of whole, headless, or sliced, salted, pickled, or dried. Final 1969 quota was 39,500 tons. (U.S. Mission to EC, Brussels, Apr. 28.)

AUTOMATED PLATFORM WOULD CUT FISHING COSTS, BCF EXPERT SAYS

An automated fishing platform to catch and process fish virtually without fishermen was proposed to an FAO meeting as a way of exploiting coastal fisheries, which are otherwise uneconomic.

The suggestion was contained in a paper prepared by E. F. Klima of BCF Exploratory Fishing and Gear Research Base, Pascagoula, Mississippi, for the FAO technical conference on fish finding, purse seining, and aimed trawling held in Reykjavik, Iceland, May 24-30.

Klima cited the problem of steadily rising fishing costs and the need to catch more fish to meet growing world needs.

The Platform

His automated platform would be equipped with underwater lights anchored in the depths to tentlike, submerged, rafts. The lights, moving upwards in sequence, would lure the fish below to a pump intake. They would be kept together by an electrical field.

Once aboard, the catch would be reduced to fishmeal and oils. These would be stored in "Piggy-back" containers for retrieval at weekly intervals by motherships or helicopters. This method, said Mr. Klima, would allow small industrial fish to be caught for less than half the current cost.

Lights Used For Years

Lights have been used for many years in commercial fishing. BCF scientists at Pascagoula have used them for the past 10 years to attract herringlike fish for use as tuna bait in Gulf of Mexico and Atlantic Ocean. In 1966, submerged lights attached to a fish pump were used along lesser Antilles in the Caribbean for sampling pelagic fish; at one point, catch rates reached a peak of 900 to 1,800 fish pumped per minute.

USSR

In USSR, in recent years, sprat in Caspian Sea and saury in Sea of Okhotsk have been harvested with lights, fish pumps, and nets.

Other experiments have demonstrated that fish can be concentrated for catching by using pulsed, direct-current electricity--and that small submerged rafts can attract large concentrations of coastal pelagic fish.

These results, Klima added, show possibility of building and using automated platforms--using a combination of lights and submerged rafts--to catch small pelagic species for industrial purposes.

Plans for building a platform are under way at Pascagoula, Klima revealed.

△△△△△△△

COMPUTER CAN SPEED FISHERMEN TRAINING, SAYS BRITISH EXPERT

Fishing training could be speeded through use of a 'computerized simulator' that would reproduce actual operations and situations aboard fishing vessels. This was theme of a paper prepared for FAO's Technical Conference on Fish Finding, Purse Seining and Aimed Trawling held in Reykjavik, Iceland, May 24-30.

The paper was written by R. Bennett, Industrial Development Unit, British White Fish Authority in Hull. He discussed need for improved education and training to keep abreast of advances in fishing technology during past 15-20 years. He warned of growing gap between technology and training. Most fishermen still must rely on hard-won experience.

Training Simulator

A training simulator would enable trainees to "fish" on an imitation fishing ground, or several grounds, under "actual" conditions. All navigational and fishing aids normally found on a fishing vessel would be built into the simulator; it would be based on a digital computer with a library of tapes. Each trainee would occupy a cubicle with its own set of instruments. He would maneuver the vessel and gear as though he were in an actual fishing situation.

The system could be programmed to provide trainees with options and alternatives that can arise even in a single day's operation. They would have choice: spend time changing a trawl to suit a possibly short-term behavior of fish, or keep fishing with same trawl at reduced catch rate, or move to another ground.

Trainees could compete to see who gets best "catch."

Study Development of Simulator

Bennett says that the White Fish Authority is studying development of such a simulator over the next 2-3 years. The Norwegian Fisheries College has begun similar work. The main limitation is high cost of constructing a system that can reproduce faithfully all situations and variables in fishing.

The increasingly complex equipment and techniques in fishing are forcing a change in attitudes in fishermen's training, FAO states. It is no longer feasible economically to have skippers learn how to use new instruments at sea. Simulators help to teach some aspects of fishing on shore in a shorter time and more cheaply, as Bennett indicated.

In recent years, trawling and purse-seining techniques have been affected profoundly by developments in fish-finding equipment, such as echo sounders, sonar and netsonde. This equipment has paved way for midwater trawling, aimed bottom trawling, and purse seining for deep-swimming schools. At same time, hydraulic equipment for handling heavy gear with big catches have come into use. This eliminated old restrictions on size of gear and catches that could be handled. It opened new and important fisheries.

BERNARD SKUD HEADS HALIBUT COMMISSION INVESTIGATIONS

Bernard E. Skud, for past 10 years director of BCF's laboratory at Boothbay Harbor, Maine, was named Director of Investigations for International Pacific Halibut Commission on May 19. He succeeds F. Howard Bell, who retires July 4 after 45 years. Mr. Skud will take over in late summer.

Skud served BCF 20 years. His immediate fields of research have been population dynamics, marine biology, and estuarine ecology. He has served as scientific advisor to International Commission for Northwest Atlantic Fisheries.

Market place of Rach Gia, S. Vietnam, major fishing port on Gulf of Thailand. (Keith Brouillard)

SOUTH VIETNAM: A FISHERY DEVELOPMENT SURVEY

Keith D. Brouillard

During January-April 1970, a general survey of the fisheries of South Vietnam was conducted at the request of the United States Agency for International Development (USAID). A summary of the findings and the recommendations is the basis of this report.

The gross national product (GNP) of South Vietnam has been increasing slowly over the past five years. At constant 1960 prices, the GNP increased from 107.6 billion piasters in 1965 to 122.4 billion in 1969. In current prices, however, the GNP for 1965 was 114.7 billion piasters; for 1969, 532 billion piasters. Current prices reflect the severe economic problems confronting South Vietnam--particularly inflation.

Fishery production has been satisfactory from the standpoint of total landings--especially during wartime. In 1965, production was 375,000 metric tons; in 1969, 463,800 metric tons. The use of motorized vessels increased from 12,240 in 1965 to 39,000 in 1969. Increased production under adverse conditions is the result of the motorization program begun on a major scale in 1965.

Several major problems confront the fishing industry and limit its expansion and the availability of fish to the consumer: lack of modern landing facilities, transportation units, refrigerated equipment, and modern fishing vessels. In addition, the military buildup has taken many highly skilled fishermen from the fleets.

GENERAL ECONOMY

The status of the general economy must be considered when discussing possible means of improving the contribution of any segment of it: in this paper, fisheries. Adequate data are available on the economy to indicate the problems affecting fishery development.

The current exchange rate of 118 piasters per U.S. dollar is unrealistic. Imports are undervalued and exports overvalued. For fisheries, this situation is both bad and good. The export of fishery products under the current exchange rate is not possible. For example, the current Saigon wholesale price for shrimp is the equivalent of something over $2 per pound, heads off. On the other hand, the cost of modern equipment needed to develop the fisheries is available at a reasonable piaster cost. However, imports are subject to controls and the availability of foreign exchange. These limit modernization of the fishing industry.

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Inflation

The inflationary factors affect fishing and other industries. The data in Table 1 are an indication of inflationary development. An optimistic projection made by USAID for the economy in 1970 contains an inflationary factor of 20% to 30%; this limits further the prospects for development of an export market. Fortunately, the domestic price of fish has kept pace with the general economy--permitting continued production of fish without undue monetary harm to the fishing industry.

Table 1 - Republic of Vietnam Expenditures on Gross National Product (Billions of Piasters)

	1964	1965	1966	1967[a]	1968[a]	1969[a]
I. CURRENT PRICES						
Private consumption	92.4	109.1	177.0	286.0	334.0	428.0
Public consumption	25.0	32.5	52.9	75.3	88.0	115.0
Gross capital formation	12.6	17.1	34.5	40.0	40.0	45.0
Exports[b]	7.8	12.0	30.5	33.7	34.0	40.0
Less Imports[b]	-23.0	-28.6	-76.0	-110.7	-102.0	-121.0
Net factor income from abroad	- .5	2.6	17.4	20.0	20.0	25.0
GNP	114.3	114.7	236.2	344.3	414.0	532.0
II. CONSTANT 1960 PRICES	1964	1965	1966	1967[a]	1968[a]	1969[a]
Private consumption	76.4	77.9	77.6	87.5	80.7	84.8
Public consumption	21.6	24.9	33.9	38.0	42.4	49.3
Gross capital formation	11.0	13.4	19.5	18.0	18.0	17.8
Exports[b]	7.4	9.9	15.4	20.2	12.0	11.6
Less Imports[a]	-17.1	-20.4	-45.5	-56.8	-48.6	-48.2
Net factor income from abroad	- .4	1.9	8.3	6.5	7.2	7.2
GNP	98.8	107.6	109.1	113.3	111.8	122.4

a/Provisional
b/Goods and services except investment income at effective exchange rate.
Source: National Bank of Vietnam (February 1970 Revision)

When you consider the problems facing S. Vietnam, it is not surprising that inflation has caused economic difficulties. What is somewhat surprising is that the problems are not more severe. When the level of hostilities is lessened, or the war ends, the Government will have to make difficult political decisions if export markets are to be developed. Either an export subsidy or devaluation appears necessary to expand exports, including fishery products.

GENERAL FISHERY SITUATION

The latest complete fishery statistics are for 1969. Table 2 presents the general fishery situation for 1963 through 1969. There appears to be steady growth. However, certain factors affecting production are not apparent. Production in 1968 was affected adversely by the Tet and post-Tet offensives of the Viet Cong. There is little doubt that production was reduced in some provinces; and the marketing problems created by deteriorating security may have restrained production in some areas.

Army Takes Fishermen

There are other problems: the lack of skilled fishermen and closure to fishing of certain areas of the coast due to security problems. No data are available on age structure of the fishing population; however, observations and discussions with provincial fishery directors indicated that the active fishing community consists primarily of boys and old men, plus some women. The more

Table 2 - Summary of Fishery Statistics, Vietnam, 1963-1969

Item	1963	1964	1965	1966	1967	1968	1969
Fishermen (No.)	243,390	245,520	243,500	253,770	270,408	272,300	277,100
Fishing Boats (No.):							
Motorized	9,220	9,710	12,240	16,770	23,195	29,968	39,001
Nonmotorized	44,530	46,760	46,240	48,380	52,995	47,991	42,955
Catch (Metric tons):							
Marine fish	299,340	314,000	289,000	287,450	319,500	321,645	355,488
Freshwater fish	49,900	52,000	57,000	64,710	59,500	51,045	63,673
Crustaceans, mollusks	29,430	31,000	29,000	28,340	31,700	37,310	44,683
Processed Products:							
Dried (Metric tons)	18,370	19,410	17,500	16,000	15,000	20,205	20,769
Cured (Metric tons)	31,370	32,170	28,100	30,500	35,024	24,830	30,242
Canned (Metric tons)	234	215	232	205	185	100	20
Fish sauce (1,000 liters)	60,000	63,000	57,000	59,000	61,000	59,000	60,850

Source: Directorate of Fisheries, Republic of Vietnam.

active and stronger fishermen, who would normally operate the boats are, for the most part, in the military services. The current fleet is not operating at highest efficiency.

Closed Coastal Areas

The closure of coastal areas existed through 1968 and 1969. Recently, some restrictions have been lifted. Further relief can be expected if security continues to improve. The opening of coastal areas will be an important factor in production by smaller boats--those limited in ability to fish in non-daylight hours. This would include majority of boats, but not necessarily major part of production capability. The larger and more efficient vessels are affected to a limited degree by the coastal closures, but they are able to continue production outside those areas. It is not possible, therefore, to determine the overall impact on total production resulting from the closures, but they have been a restraint.

No Deep-Water Ports

In general, there are no deep-water ports for the fishing fleet, so greater use of larger modern vessels is limited. Currently, the traditional boats land during high tides at many points on the coast. The one exception is the port of Saigon, where large vessels can land.

Fishing-port development plans should cover two general categories: 1) ports suitable for improvements that would benefit existing fleet; 2) ports with potential for development as deep-water ports for large modern fishing vessels.

No Cold-Storage Facilities

There are no cold-storage facilities at any major coastal fishing ports. In some areas, there is a severe shortage of ice. This boosts ice prices and limits its use. Fortunately, the Vietnamese are skilled in producing fish sauce. They make use of all fish produced and thus solve problem of preservation. Nonetheless, additional supplies of fresh fish are needed. The lack of cold-storage facilities, other than those recently constructed in Saigon, has hampered fishermen's ability to meet that need.

Catch Value

No statistics are available on production by species, or prices, so it is not possible to place an accurate value on production. The species used for fresh consumption probably average 80 piasters per kilo paid to the fishermen, while fish used for fish sauce are lower priced. If an overall exvessel price of 60 piasters per kilo is used as basis for determining catch value, it would exceed 27 billion piasters for 1969, roughly 5% of gross national product. However, the price used is arbitrary, and accuracy of production statistics is questionable.

More Motorized Vessels

The most significant factor in Table 2 is rapid expansion in use of motorized vessels. Production has been maintained and, to some degree, increased as result of motorization program. The 1968 Tet offensive and draft of skilled fishermen tended to negate effect of motorization program. Unfortunately, the program may be creating problems by increasing the effectiveness of vessels operating in limited geographic areas and on limited resources--thereby reducing yield and possibly resulting in overfishing.

POTENTIAL PROBLEMS

Solutions to many problems facing fishery development are not readily determined, but some potential problems should be pointed out.

Production

Fishing effort is concentrated in a narrow belt of sea from the beach to approximately 20 kilometers off shore. In some areas, the inshore fishery is limited by security restrictions but, in general, the zone begins at the beach. Even with relatively inefficient units, their sheer number is placing tremendous pressure on existing resources.

Strangely enough, there are a few resources in the heavily exploited area that do not appear severely pressured, primarily because of the gear used. Examples are the lobster and shrimp populations along some areas. In general, however, fishery resources are heavily exploited.

Caution should be exercised in expanding fishing effort within the exploited zone. Preliminary studies should be made on catch per unit of effort and estimates of populations. It does not appear that the offshore fisheries will have problems of overexploitation in the near future--assuming foreign fleets do not expand operations.

Vessels

About 12 large vessels fish off shore and land catches in Saigon. Most of these vessels are used pair trawlers purchased from Japan. If such purchases continue, there is a serious danger that the limited foreign reserves will be wasted. Investments would produce some profit in immediate future but would not be satisfactory for competing with foreign fleets or new imported vessels operating in the same waters.

South Vietnam should seriously consider limiting funds to buy used vessels and insist on investing in new, efficient vessels. Ideally, the Government should encourage the use of domestic facilities to construct new fishing vessels. This would save some foreign exchange and develop broader base of expertise in marine construction.

Transportation

At present, it is not possible to use the railroad or highways from Da Nang to Saigon to transport perishable foods. When the war ends, this situation will be corrected to some degree, and highway conditions improve. However, transportation of fishery products will not be reliable in the near future. Only a few transportation units are available for movement of perishable products. No refrigerated trucks are available. There appears to be no need to transport fish from northern areas to Delta area. Rather than expand efforts to move fish in a north-south direction, efforts should be directed toward movement inland, or to develop an exportable product.

Marketing

The distribution and marketing of fishery products will remain a problem. At present, the coastal areas seem to have adequate supplies to meet nutritional needs, albeit at high prices, if based on official rate of exchange. However, the upland areas lack adequate supplies. It may be years before their needs can be met.

Lack of transportation and export market may result in relatively limited market. The fishing industry may receive declining returns on investment if production increases substantially. This may not be entirely bad because consumer might benefit somewhat. But it does make possible a situation where middlemen can manipulate prices with relative ease.

Perhaps the most irritating problem that can be expected to continue is the power of the middlemen. One of the major reasons why they have not been eliminated from the marketing system is the simple fact that they perform a service no one else is prepared to perform. They collect enough fish from small fishermen scattered over a wide area to get economic transportation rates to the markets. They lend money with no collateral or formal agreements. So far, all suggestions to change the system have either been ineffective or unrealistic.

Fishermen pay a high price for these services, but no one else but middleman is prepared to perform similar services. Until efficient and convenient landing facilities and easy credit are available, middlemen will continue to play major role.

One bright spot in the picture is the possible establishment of a competing marketing system by owners of the large fishing vessels now beginning operation. The owners have capital, or can obtain it, to establish cold storages for orderly marketing of their catch. It would become possible then to divert some production of small units through marketing channel established by larger operating units. The change would reduce significantly the middleman's influence.

Competition

Because statistics are lacking, it is nearly impossible to project the possible demand for fish compared with demand for other protein foods. Studies have been made of Saigon market. There appears to be a relationship between price of fish and price of other animal protein food on any given day. Apparently a large supply of chickens or hogs on the local market causes a rapid reduction in fish price, assuming normal supplies of fish are available. On the other hand, a heavy supply of fish tends to reduce price of chicken and pork, but not to the same degree as the reverse situation.

Foreign Trade

At present, no surplus of fishery products exists that could be exported under the present price structure and official exchange rates. A potential exists, particularly for such luxury items as shrimp and lobster. However, no facilities exist for processing fishery products at landing sites. Any exported fishery product must compete on the world market in price and quality.

For example, new shrimp grounds are being developed off South America's coast. Current estimates of potential production indicate area could be a major producer. Experienced shrimp fishermen and processors are investing in that area; therefore, it may be assumed that the product will meet world standards in quality and price. Under current conditions in Vietnam, it does not appear possible that an acceptable product could be produced, even if product were competitive in price.

Other fishery products may be exportable--red snapper and other finfish. The same conditions apply to these products: they must compete. There is an apparent abundance of red snapper in the South China Sea. No estimates are available on potential production, but the Directorate of Fisheries has estimated that in Rach Gia it could reach 200 to 300 metric tons per month with existing units of production, if the incentive existed. Red snapper is not considered a highly desirable species in Vietnam. It is doubtful, however, that the product would be competitive on world market under existing conditions.

Imports

Some canned fish are imported. Much fish meal is imported: about 2,865 metric tons in 1968, and a predicted 1972 level of 10,000 metric tons. There has been a strong interest in Vietnam to produce fish meal and canned fish primarily for domestic consumption, but also for exporting canned fish. Under current conditions, it is unrealistic to consider such products for export.

There are no can-making facilities in Vietnam; all cans are imported. The current estimated price of fish in Vietnam is at least \$500 U.S. per metric ton--unrealistic to can for export, especially with likely species: anchovy, sardines, squid, and mackerel.

If estimated price at producer's level is about right, production of fish meal is impossible if world prices are guideline. Limitations on fish-meal production could change if 2 events happened: a significant devaluation of piaster, and if Government determined import substitution was so important that heavy subsidies would be granted fish-meal industry. Both factors have much political significance for Government. It is difficult to predict what it would do.

Other Problems

The following potential problems are significant to affect long-run development of the fishing industry.

International Considerations:

In recent years, efforts have been made to define more clearly the rights of coastal fishing nations. Currently, resources of the continental shelf are reserved to the coastal fishing nation if such resources meet the criteria established by 1958 Geneva Convention on the Continental Shelf. From observations made of the various species landed in Vietnam, there does not appear to be a large production of resources that would be protected by the Convention; however, such resources may be available but not exploited.

It is possible that new principles of international law will be developed in the near future that would protect coastal fisheries; however, such changes usually include provisions for historic rights of fishing nations. Vietnam should follow closely developments in international law that may affect fishery development. If necessary, she should participate actively in international conferences that deal with rights of coastal fishing nations to insure that her industry will be adequately protected and have opportunity to expand operations. Foreign fleets may intrude on continental shelf of Vietnam in areas not now exploited.

Cooperatives:

Most recommendations for fisheries of less-developed countries include development of cooperatives in agriculture and in fisheries. Here, these institutions are presented as problems rather than solutions. On paper, there are many fishery cooperatives. Few are operating. Fewer still perform any effective function that benefits the fishermen. For all practical purposes, cooperatives have been established to purchase fuel, ice, and motors--but none to market fish.

Also, discussions with provincial fishery directors and fishermen left impression that membership in the cooperative is a disadvantage to fishermen. For example, the Rach Gia cooperative appears managed by the same businessmen who control the availability of ice and are major purchasers and transporters of fish. A study in late 1969 and early 1970 by contractors revealed that the cost of shipping fish through Rach Gia cooperative exceeded costs of similar shipment through private broker.

As a second example, the Phan Thiet cooperative serves as a source of motors and other supplies, but loans to fishermen for major purchases using funds available to cooperative from Agricultural Development Bank are at a rate double that charged by the Bank. Bank loans to cooperative are 3%; fishermen pay cooperative 6%. It is normal for a cooperative to charge a higher rate of interest to cover costs, but double is extreme. Secondly, fishermen landing catch at market's cooperative area are required to pay all taxes and other charges applicable to fish landings; in Phan Thiet, over 12% of catch value. While all fishermen are subject to such levies, the difficulty in collecting the charges results in a lower rate of real cost for most fishermen. In other words, fishermen landing in the area of the cooperative are charged at a higher real rate than other fishermen. It would appear, therefore, that in the two ports where an effort was made to obtain information on cooperatives, there are definite disadvantages to being a cooperative member.

While the normal answer to forming effective cooperatives is to institute a program of training for cooperative managers, discussions with USAID personnel indicated such a program has not been effective. The shortage of trained personnel makes the skill obtained through training in management of cooperatives a highly priced commodity; therefore, personnel completing the training have found it more profitable to enter private business than to manage cooperatives.

An immediate solution is not apparent. Government regulation is no answer because Vietnam does not have sufficient skilled personnel to manage and police cooperatives. Direct Government control has been ineffective where it has been attempted. Perhaps the only answer is patience and training. Eventually, effective purchasing and marketing cooperative may be formed. This goal seems a long way off.

Military Activities:

Military activities have the highest priority. However, the consequences of some should be considered seriously from viewpoint of long-term recovery of the national economy. In particular, the program of defoliation could have serious short- and long-term effects on the fisheries. An intensive program of defoliation in the area of estuaries, or where chemical runoff would enter the estuaries, could have an immediate effect through destruction of immature marine life using the area as a nursery. Detrimental long-term effects could come from a drastic change in the ecology of the area through destruction of trees and ground cover. These factors should be given serious consideration in any program of defoliation. The application of chemicals should be limited to areas where absolutely necessary.

RECOMMENDATIONS

1. Efforts should be made to assist the small fishermen in increasing their income. The use of such gear as baited hoop nets and shrimp pots, both easily fabricated from available materials, should increase catch of lobster and shrimp.

2. The insulation of fishing boats and transportation units should be given high priority.

3. The USAID Fishery Advisor should be sent publications and reports on latest developments in fisheries. This information should be passed on to Vietnamese counterparts.

4. Specialists in refrigeration, fishing equipment and methods, fishing product processing and packing, international trade in fishery products, sanitation, and marine

biology should be made available on a temporary-duty basis for service in Vietnam.

5. The Government of Vietnam should facilitate construction of cold-storage facilities by the private sector.

6. Port development for the fishing industry should be given high priority.

7. Transportation facilities for fishery products must be increased, either through domestic fabrication of refrigerated equipment or through import of such equipment.

8. Domestic construction of modern fishing vessels should be encouraged.

9. The Government should plan development of exports of some fishery products, even to extent of earmarking products for export rather than for domestic consumption.

10. The existing program of reducing restrictions on fishing areas should continue.

11. Consideration should be given to implementing regulations that prohibit fishing by large modern vessels in coastal zone presently worked by existing fleet. Vessels licensed to fish for shrimp should be exempted, but strict controls should be placed on where they may fish.

12. The collection of fishery statistics should be expanded to include landed and wholesale prices, landings by species, sizes of vessels, number of ice plants, production of ice, and number of transportation units. Additional useful statistics should be collected.

13. The training of Vietnamese, including women, in the technical aspects of fisheries should be expanded.

(See photo spread pages 64-66.)

RACH GIA: THE MARKET PLACE

Fig. 1 - Shrimp Sellers.

Fig. 2 - Clams for sale.

Fig. 3 - Red Snappers.

Fig. 4 - Preparing fish for Nouc Nam (fish sauce).

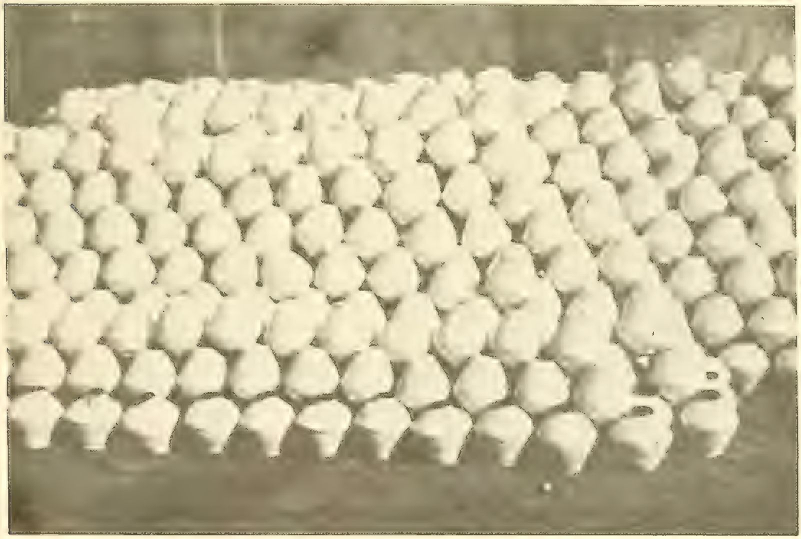


Fig. 5 - Clay jars for Nouc Nam.

Fig. 6 - A Fishery Problem: Unloading fish by hand at low tide (Vung Tau).

Fig. 7 - Typical construction methods for popular type of fishing boat (Phan Thiet).
(All Photos: Keith Brouillard)

ASIA

JAPAN

SUMMER ALBACORE TUNA FISHERY STARTS SLOWLY

The 1970 Japanese summer albacore tuna fishery has started much later than in normal years. This is due to the slow northward movement of the Kuroshio current.

Since early April, small, sporadic catches have been made off Japan. But most pole-and-line vessels hesitate to switch to albacore fishing; these are still concentrating on skipjack in more southerly waters, where fishing continues good.

Prices Up 20%

At the end of April, the price for summer albacore was quoted at exvessel US$655 a short ton--about 20% above last year's early season $544. Practically all landings were being bought by domestic tuna packers. ('Suisan Tsushin,' Apr. 28.)

* * *

ALBACORE TUNA BRINGS HIGH PRICES

About 20 metric tons of pole-caught albacore tuna landed in mid-April at Yaizu, Japan, sold for exvessel US$600-630 a short ton for fish 24-37 pounds each.

The albacore were caught off Bonin Islands, where about 20 live-bait boats were fishing. Some boats take 4-5 tons on good days. But fishing is generally poor because the albacore are too deep for pole-and-line fishing. ('Katsuo-maguro Tsushin,' Apr. 15.)

* * *

ALBACORE TUNA EXPORT PRICE SPIRALS

Japanese frozen round albacore prices for direct export to U.S., steady since 2nd-half 1969 were quoted at a high of f.o.b. US$630-645 a short ton. This is equivalent to about $675-690 a short ton, c. & f., U.S. west coast delivery.

Why Prices Spiral

Japanese trading firms attribute spiraling prices to poor U.S. albacore fishing in 1969, and to slow start of Atlantic fishery off Angola this year.

Japanese export prices for direct yellowfin (gilled & gutted) shipments to U.S. in mid-April were quoted at around $560 a short ton, c. & f. ('Suisancho Nippo,' Apr. 18.)

* * *

TUNA FISHERY VENTURE IN WEST INDIES IS STABLE

The Japanese cold-storage firm Nippon Reizo established a tuna base on Saint Martin Island, Netherlands Antilles (West Indies) in 1963. It now reports stable operations.

The enterprise is managed by Curacao Pioneering Co., which is capitalized at US$ 283,000, a local firm wholly owned by Nippon Reizo. It has a 1,000-ton-capacity cold storage and a 1,100-gross-ton freezership anchored offshore.

Buys From 15-20 Vessels

The base annually purchases from 15-20 longliners, operated mostly by South Korean and Taiwanese nationals, around 8,000 tons of tuna for export to U.S. During past several years, the Saint Martin venture has yielded annually a 5% dividend to stockholders. Of over 40 Japanese fishing firms abroad, it is one of 10 operating profitably. ('Suisan Tsushin,' Apr. 14.)

* * *

1969 EXPORTS OF MARINE PRODUCTS DROPPED 1.2% FROM 1968

In 1969, the value of Japanese marine-product exports was US$346,769,000--down 1.2% from 1968's $350,633,000. In 1967, these exports fell markedly (9.1%) for first time. However, exports in 1968 increased 7.5% over 1967.

Frozen-Fish Exports Fell

The 1969 decrease was due to decreases in frozen fish: yellowfin tuna down $9.94 million, other tuna down $1.05 million, and molluscs down $1.71 million, and canned products (salmon down $20.24 million, and crab). Decline in the exports of salmon and crab fell

JAPAN (Contd.):

Exports of Marine Products

	1969	1968	Percent 1969/1968
	US$1,000		
Fresh and frozen	85,999.6	90,703.3	94.7
Dried or salted	12,093.5	8,922.7	135.5
Canned and bottled	178,283.2	185,869.4	95.9
Aquatic oils and fats	5,068.8	3,806.6	133.1
Pearls	48,639.7	46,802.4	103.9
Kanten	4,480.1	4,816.8	91.5
Other	12,204.8	9,712.1	126.4
TOTAL	346,769.7	350,633.3	98.8

because international restrictions were strengthened. The decline resulted from strong domestic demand.

Dried or salted products, aquatic oil, and other marine products increased over 1968; pearls remained unchanged. ('Suisancho Nippo,' Mar. 5.)

* * *

U. S. TUNA IMPORTS DROPPED IN 1969

In 1969, the U.S. imported from Japan 156,245 short tons of fresh and frozen tuna. This included loins and discs but excluded tuna deliveries to American Samoa. It was somewhat less than in 1968, reports the Japan External Trade Organization.

Imports Down

Imports from Japan declined sharply from 1968. They totaled (1968 figures in parentheses): 75,544 tons (96,482 tons), consisting of albacore 43,068 tons (37,869 tons), other tuna 31,411 tons (54,991 tons), and loins and discs 1,065 tons (3,622 tons).

Why Decline

The decline in imports from Japan is attributed to: (1) reduced landings of albacore and other tuna by Japanese fleet; (2) vigorous tuna demand in Japan; and (3) sharply reduced Japanese tuna sales to U.S. because of numerous claims by U.S. packers for yellowfin shipments in late 1968.

U.S. Demand Up

Although shipments from Japan declined, the U.S. demand for imported tuna rose sharply in 1969. This pushed up prices for U.S. domestic catch and imports.

Albacore prices for imports from Japan rose from US$515 a short ton, c. & f., in January 1969 to $565 in June. It continued upward thereafter, reaching $625 a ton in January 1970. ('Suisan Tsushin,' Apr. 18.)

* * *

HAS 397,279 FISHING VESSELS

On Dec. 31, 1968, Japan had 397,379 fishing vessels totaling 2,415,420 gross tons (including fresh-water vessels), according to Fishing Vessel Section of Fisheries Agency. This is a decrease of 723 from 1967, but a rise in tonnage of 39,909 tons.

Type of Vessel	Number	Total Gross Tons
Powered vessels (subject to registration)	253,544	2,315,130
Nonpowered vessels over one ton (subject to registration)	11,426	20,931
Nonpowered vessels under one ton (exempt from registration)	132,309	79,359
TOTAL	397,279	2,415,420

During past 10 years, number and gross tonnage of powered fishing vessels increased. Nonpowered vessels decreased: in 1968, 40% in number and 50% in gross tons from 229,893 and 212,536 gross tons in 1958. Gross tonnage for powered fishing vessels exceeded that for nonpowered vessels in 1962, and the number was exceeded in 1964. ('Suisancho Nippo,' Mar. 4.)

* * *

REDUCES TRAWL OPERATIONS OFF U.S EAST COAST

In April 1970, only 6 Japanese vessels were off the U.S. east coast near New York; in early Dec. 1969, there had been 14, fishing primarily for squid. Eight had returned to Las Palmas, Canary Island, because squid dropped off and small, lean butterfish and deep-sea smelts increased in the catch.

The 6 trawlers were scheduled to leave the area around mid-May. Later, about 6 trawlers will return to fish herring from Aug. or Sept. until end of 1970. The 6 include the 'Sekishu Maru' (997 gross tons) which fished throughout 1969 off U.S. east coast.

Squid Catches

The Japanese squid catches off U.S. east coast since Dec. 1969 were estimated at

JAPAN (Contd.):

13,000 metric tons. These were sold to European countries at prices averaging around US$500 a metric ton for deliveries to Las Palmas.

Spain Plans Squid Fishing

Spain is the largest buyer of these Japanese-caught squid. Reportedly she plans sending trawlers to squid grounds off New York next season. Although scale of planned Spanish operation is not known, the Japanese feel increased squid production and possible marketing of inferior product will affect adversely their 1971 European sales. ('Suisan Tsushin,' April 15.)

* * *

FINDS BOTTOMFISH ABUNDANT OFF ARGENTINA

The Japanese government-operated research vessel 'Kaiyo Maru' (2,500 gross tons) recently conducted in Tokyo an exhibit and taste sampling of her trawl catches off Argentina in 50-1,120 meters. Her 45-day resource survey lasted from Dec. 10, 1969-Jan. 26, 1970.

Main Species Caught

About 42% of the catch was southern cod, 24% merluza (hake), 8% decora (phonetic), plus other bottomfish species.

Southern cod resemble pollock. They are delicious if cooked immediately, but become dry and unsuitable for home cooking if frozen very long.

Merluza are most abundant in shallow waters about 50 meters. Argentina annually harvests around 150,000 tons, 60% processed into fish meal, and some exported frozen to the U.S.

Decora are called merluza-decora in Argentina and are used in fish meal. They are good food fish. They were caught at 150-200 meters.

Region Offers Promise

The abundance of bottomfish off Argentina suggests that southwest Atlantic can be developed into productive fishing grounds for Japanese "surimi" (minced meat) factoryship operations. ('Suisan Tsushin,' Apr. 15.)

* * *

TUNA LONGLINERS HAVE EXTRA LOW-TEMPERATURE FREEZERS

Two 314-gross-ton tuna longliners under construction at the Kanasashi and Miho Shipyards in Japan will have a freezing system capable of reducing temperatures to -60° C. (-76° F.). The vessels also will be equipped with four two-phase compressors capable of lowering the hold temperatures to -55° C. (-67° F.).

Construction cost of each vessel is about 185 million yen (US$514,000).

To Fish Bluefin Tuna

Scheduled for completion in mid-May 1970, the longliners will be sent to the South Pacific bluefin tuna grounds. ('Suisancho Nippo,' Mar. 30.)

* * *

PRICES STEADY FOR SQUID & OTHER W. AFRICAN TRAWL CATCHES

The Japanese market for "monko" squid and octopus taken off west Africa (near Spanish Sahara and Mauritania) is reported steady. Demand for large squid by restaurants continues strong.

The market for red sea bream caught off west Africa is weakening as spring demand tapers off.

Mid-April Prices

In mid-April, dockside prices (converted to US$/short ton) were: "Monko" squid: extra large (4-5 count 53-lb. box) and large (6-8 count: $1,512-1,522; medium (9-12 count) $1,469; small (13-20 count) $1,419; extra small (over 61 count) $630-781.

Octopus: extra large (1-3 count/53-lb. box) $474; large (4-5 count) $663; medium (6-7 count) $766; small (8-10 count) $713; extra small (over 41 count) $441.

JAPAN (Contd.):

Red sea bream: extra large (1-22 count 44-lb. box) $554; large (23-29 count) $580; medium (30-39 count) $605; medium-small (40-49 count) $554; extra small (70-99 count) $252. ('Suisan Tsushin,' Apr. 21.)

* * *

CANNED MACKEREL EXPORTS TO U.S. ARE INCREASING

Japanese canned mackerel exports to the U.S. are rising. Particularly sharp increases were noted in Feb. and March. Sales to one major U.S. west coast packer were over 70,000 cases (1-lb. talls, 48s) since Jan. 1970.

Trading firms are actively promoting their own brands in the U.S. If upward trend continues, canned mackerel exports to the U.S. in 1970 will approach one million cases. This would make U.S. a very important market, second to the Philippines.

1966 A Milestone

Exports to the U.S. first attracted attention in 1966, when poor mackerel fishing in California stimulated increased shipments from Japan that reached 450,000 cases. However, sales competition among Japanese trading firms later blunted U.S. buying interest; in 1967, sales plummeted to 180,000 cases.

The loss was regained gradually. Sales rose to 320,000 cases in 1968, and to 400,000 cases in 1969--approaching 1966 level.

Export Prices Up

Recent Japanese export prices for shipments to the U.S. are about 28 cents a case more than January 1970. They are reported around US$4.72 a case (48 1-lb. tall cans), exwarehouse, for natural pack. ('Suisan Tsushin,' Apr. 22.)

* * *

JAPAN & SOVIETS SIGN 1-YEAR CRAB AGREEMENT

Japan and the Soviet Union signed in Moscow on April 7 a 1-year crab agreement. The talks had begun on Feb. 9.

Under the agreement, the number of Japanese crab vessels and the 1970 season in the northwest Pacific are the same as last year, but the catch quota has been reduced somewhat.

A 15% reduction in Japanese king crab quota off western Kamchatka nullifies the long-term bilateral agreement concluded earlier whereby Japan was allotted a 216,000-case ($\frac{1}{2}$-lb. 48s) quota.

Fishing regulations by area for the Japanese fleet are (figures within parentheses are for 1969):

1. Off western Kamchatka: king crabs--183,000 cases (216,000 cases) by 4 fleets; "Ibara" crabs--765,000 crabs (900,000) by 2 fleets.

2. Western Bering Sea: tanner crabs--11.35 million crabs (13 million) by 42 vessels. Of that quantity, 2 million (6.5 million) to be taken off Cape Olyutorski and 9.35 million (6.5 million) east of Cape Navarin.

3. Off eastern Sakhalin Island: "Abura" (oil) crabs--600,000 crabs by 6 vessels, with a 10% allowance for mixed catches of king and tanner crabs; tanner crabs--17 million crabs (19 million) by 39 vessels.

4. Off Nijoiwa: 1.64 million "kegani" (hair) crabs by 14 vessels, same as 1969.

5. Triangle area: 600,000 king crabs, 1.3 million hair crabs and 910,000 "Hanasaki" king crabs by 37 vessels; same as 1969. ('Suisan Tsushin', Apr. 9, 'Minato Shimbun,' Apr. 8.)

* * *

BRAZIL'S 200-MILE SEA LIMIT MAY HURT JAPANESE FISHING

Brazil's extension of her territorial-sea limit from 12 to 200 miles on March 25, 1970, is expected to affect adversely Japanese shrimp and tuna longline fishing off that country. At present, 72 Japanese shrimp trawlers based in the Guianas harvest one-third of their catches off Brazil during March to September. In 1968, they took 1,888 metric tons of shrimp; in 1969, 2,501 tons.

Licensing for Foreigners Unknown

The Brazilian Government has not mentioned any licensing standards for foreign

JAPAN (Contd.):

vessels. If foreign vessels are excluded from the claimed waters, Japanese shrimp fishermen will suffer severely. The U.S. and other nationals also are shrimping off Brazil.

On April 6, the Japanese South American Shrimp Association petitioned the Fisheries Agency and the Foreign Office for help. The Foreign Office was reported planning to file a protest with Brazil. ('Minato Shimbun', Apr. 6.)

* * *

NORTH PACIFIC WHALE OIL SOLD

The sale of whale oil from the 1970 operation in the North Pacific, which began in May, has been contracted for export and domestic markets.

Export sales of 5,000-8,000 metric tons of fin-whale oil were contracted at US$230 a metric ton, c.i.f., delivery Rotterdam; 4,000 tons of sperm-whale oil at $262 a ton, delivery Rotterdam and New York City. All fin-whale oil exports are to European users, such as Unilever. U.S. firms bought 3,000 tons of sperm-whale oil.

Japanese Market

Sales of sperm-whale oil to Japanese domestic firms were at $258 a ton, but actual price comes to $269 when payment conditions are included. Sales of fin-whale oil to Japanese firms were expected to be concluded shortly after mid-April. ('Suisan Tsushin,' Apr. 11 & 16.)

TAIWAN

1969 CATCH ROSE 5.6%

Taiwan's 1969 catch of 560,783 metric tons was 5.6% above 1968. Production from fish culture increased only 0.8% due to typhoon flooding summer 1969, which caused heavy losses in fish pounds.

The 1970 target is 632,000 tons, which may be considered optimistic. In 1969, only 23,000 tons of fishing vessels were constructed; the goal was about 33,000 gross tons. The number of vessels operating in 1970 will be smaller than planned; it will be difficult to reach goal.

Exports Up

Fishery exports were US$44,700,000 in 1969. This figure differs from US$12 million figure of Foreign Trade Bureau, Republic of China. The latter includes only exports from Taiwan, and not exports from overseas ports; these were US$32,000,000, a large increase over 1968.

Artificial Spawning

The experiment in artificial propagation of grey mullet at Tungkang was a complete success. On Feb. 5, 90 fingerlings, 42 days old, still survived from thousands used. The average length reached 3 cm. They were planted at this size in fish ponds to grow to adulthood. This is result of 5 years of experiments. In 1969, only 2 fingerlings survived; they were 30 days old and measured 1.1 cm.

Another batch of about 300 fingerlings, each about 2 cm. long, is still in rearing ponds at Tungkang. What remains to be done is refinement of technique to produce fingerlings on a large scale to supply fish farmers.

World Bank Loans

The World Bank has made 2 loans: The first, in 1963, was US$7.8 million for three 1,000-ton boats and thirteen 300-ton tuna longliners. The construction was awarded to a Japanese shipyard after world-wide bidding. Construction was completed in 1965.

A second loan of US$7 million was made in 1968 to build twenty 250-ton vessels. The construction was awarded to a Korean shipyard. Work began in Dec. 1968. Due to reorganization and strikes, construction was not completed until early 1970. Nineteen vessels have been delivered to Taiwan; one is being refitted in Japan.

Asian Development Bank

A loan of US$10 million was approved to build forty 250-ton tuna vessels. Applications for only 35 boats were received by Taiwan Fisheries Bureau. Many applicants intend to withdraw. Each will forfeit a deposit of NT$250,000 (US$6,300). (T. P. Chen, Chief, Fisheries Division, Joint Commission on Rural Reconstruction.)

MAY DEVELOP NEW TRAWL FISHERY IN W. LAKE ONTARIO

Canada may establish a profitable trawl fishery for smelt and alewives in Lake Ontario's western end. The new fishery would not interfere with present fishing operations.

The Lake Erie trawler "Leona Charles," chartered by provincial government, made consistently good catches during past winter off Toronto and Hamilton: individual half-hour hauls up to 8 tons.

For Humans & Animals

The catches provide large smelt for human consumption, small smelt for mink feed, and alewives for processing into petfood. Sorting is done by hand. It is hoped that mechanical sorters, which now grade by size, can be modified to separate species. This would reduce labor costs and prevent much tedious work.

Gill Nets Safe

Lake Ontario's traditional gill-net fishery is carried out only in the lake's eastern end, so there will be no danger of bottom trawls damaging the delicate gill nets.

Smelt have been popular for many years, but Lake Ontario alewives have had no commercial value, although they contribute to diet of more valuable fish species. In many resort areas of Lake Ontario, they have been considered a nuisance because there is usually a summer "die-off". Vast numbers of dead alewives are washed onto the beaches. ('Canadian Dept. of Fisheries and Forestry', Apr. 23.)

* * *

IMPORTS OF CANNED TUNA UP, FROZEN TUNA DOWN

In 1969, Canadian canned-tuna imports were 3,834 short tons worth US$3,957,000. This was rise of 4% in quantity and 19% in value above 1968, according to Japan External Trade Promotion Organization.

Purchases from Japan were 3,116 tons, over 80% of Canada's canned-tuna imports. These were mostly canned white-meat tuna packed under buyer's label, although imports of solid and chunk light-meat tuna packs have been increasing lately.

Cuba Exports to Canada

Cuba also exports canned white meat and some canned light-meat tuna to Canada. Cuba may become a greater supplier because her product is lower priced, and quality is improving under technical assistance.

Prices Rising

Canned tuna prices in Canada generally are rising. For Japanese canned solid white meat tuna, retail prices for 7-oz. can range from 43-47 Canadian cents (39-41 cents in 1968) to 52-57 cents (45-48 cents in 1968). The 13-oz. solid white meat tuna are being sold for $1.05 a can. The Cuban 7-oz. can retails for 29 cents a can for both solid white and solid light meat tuna.

Frozen Tuna Imports

In 1969, Canada's frozen tuna imports were 1,793 short tons worth $801,000, a sharp drop from 1968's 5,201 tons worth $2,426,000. Shipments from Japan are 90% of imports. These have remained fairly stable during past two years. Purchases from Cuba have dipped sharply, and Mauritius Island and Malaysia, important suppliers in earlier years, sold none.

2 Major Canneries

Canada has two major tuna canneries packing mostly albacore, which is in great demand. However, albacore fishery is poor, so those packers face a lack of raw material. Since 1968, they have sought supplies abroad. ('Suisan Tsushin,' Apr. 20.)

EUROPE

NORWAY

FISHING INDUSTRY WAS PROSPEROUS IN 1969

On the average, 1969 was a prosperous year for the Norwegian fishing industry. Although total landings fell 15% to 2.2 million metric tons exvessel value reached US$147 million (up [illegible]%) and export earnings $237 million (up 7.2%).

Why Value Rose

The 1969 increases in value reflected the compound effect of 2 factors: generally higher product prices, and the processing of an increased proportion of the catch into higher-priced products. These were more frozen fish fillets, canned fish, and klippfish; less fish meal and oil.

Cod Up, Herring Down

The cod fisheries yielded 274,000 tons, the second highest recorded. The pattern of supply of raw fish for the reduction industry was drastically altered in 1969. Landings of herring dropped more than 500,000 from 1968--to only 205,000 tons--because of the almost-complete failures of winter herring and fat herring fisheries; North Sea herring landings fell over 50%.

Fish Reduction Down 20%

The fish reduction industry processed 1.6 million tons of fish--20% less than in 1968. It used mainly other species of densely shoaling fish: mackerel, capelin, and Norway pout.

State Support Steady

State support to the fisheries, including purchases of stockfish from producers/exporters, was $37 million, practically the 1968 level. (U.S. Embassy, Oslo, May 6.)

* * *

BULK CARRIER TO BECOME FISH-MEAL FACTORYSHIP

A former Swedish bulk carrier purchased by Norglobal A/S, Tromsø, Norway, will be reconstructed into a floating fish-meal factory at Nyland Shipyard in Oslo. The vessel is 584 feet long, 78 wide, and 45 feet deep. She is registered at 18,362 gross tons and 26,100 tons deadweight. The factoryship is expected to be ready by July. The first expedition will be off Africa.

Process 3,000 Tons Daily

A/S Myrens Verksted in Bergen, Norway, will deliver factory machinery designed to process daily about 3,000 tons of raw material--equal to 600 metric tons of fish meal. The raw material will be delivered from 12-15 modern purse seiners. The expedition will accommodate 200 men. The project is an investment of about US$14 million.

3 Production Lines

The ship will have 3 fish-meal production lines. Greatest automation and maximum space use were stressed. The ship will be equipped with 4 positions to load raw material from vessels at total capacity of 800 tons an hour.

The raw material will run past fully automatic scales that register net raw material received. The raw-material bins are self-trimming, with facilities steered from deck to empty raw material.

The transport systems contain regulated feeding apparatus leading raw material to 4 indirect boilers, then past strainer facilities to 3 double-screw presses. The boilers have variable speed to make maximum use of raw materials. The drying plants to process meal are specially constructed for ship installation.

Storage for 2 Days' Work

After first grinding process, meal is run through a pellet plant and transported to storage tanks. Pellets can be discharged directly to transport vessels at sea. The oil separator plant and liquid presses operate automatically. At full production, the ship has a raw-material storage capacity for 2 days' operation; she can store about 10,000 tons of pellets, and about 5,000 tons of fish oil. ('Fiskets Gang,' Mar. 12.)

DENMARK

SALMON BOAT CONVERTED TO SHRIMP FACTORYSHIP

A former salmon trawler, the 'Greenland', is being reconstructed in Esbjerg, Denmark, into a floating shrimp factory, the first of its kind in the world. The ship originally was purchased in Cuxhaven by Director Sørensen of Esbjerg. She underwent extensive reconstruction for salmon operations off Greenland.

Fishing off Greenland was satisfactory, but Sørensen decided there were too many vessels in the area and that the vessel could be used to explore other N. Atlantic riches.

The Greenland still will be able to perform as a salmon vessel.

U.S. Shrimp-Peeling Machine

She will be equipped with a U.S. shrimp-peeling machine. The machine is capable of peeling 6 tons of shrimp in 20 hours. Normally, shrimp are peeled by Greenlandic women, who can peel 3 kilograms of whole, raw shrimp in one hour. The new machine can peel as much as 100 women peel during a normal workday.

A factory expert will oversee the new machinery. After peeling, the shrimp will be frozen onboard. Further processing--to boil and pack the shrimp--will take place in Denmark.

Ice Masses Delay Season

Assuming timely receipt of the machinery from the U.S., the Greenland was scheduled to begin operations about May 1. The shrimp season normally begins in May. However, due to large ice masses in Disko Bay, where the vessel will operate, the season has been delayed. ('Vestkysten,' Apr. 9.)

FRANCE

IMPORTED MANY JAPANESE FISHERY PRODUCTS IN 1969

French imports of Japanese fishery products in 1969 have been reported by the Japan External Trade Organization:

Frozen Tuna: 995 metric tons (922 tons in 1968). The Japanese product was nearly 80% of total French imports in 1969, which amounted to 1,197 tons (2,439 tons in 1968).

Canned Salmon: 794 metric tons, over 50% of French canned-salmon imports of 1,330 tons. Purchases from Japan in 1969 declined 50% from 1968. The Soviet Union has increased its canned salmon sales to France since 1968. In 1969, these surpassed (in volume and value) shipments from Canada, Japan's former chief competitor in France.

Japanese Shipments Fall

Canned Crab and Shrimp: Bought 852 metric tons from Japan, mostly canned king crab. Compared with 1968, shipments from Japan declined 50% in quantity but rose 20% in value; this reflected sharp rise in price. However, high price has sharply reduced retail sales in France. It is feared market for Japanese product may collapse.

Canned Mackerel: Imports from Japan were 253 metric tons, down slightly from 1968. ('Suisan Tsushin,' Apr. 21.)

USSR

SOVIET CANNED KING CRAB IN JAPAN

Canned king crab packed in the Soviet Union began to appear in Japan in late Feb. 1970. The product was imported by Tokyo Maruichi Shoji, a leading importer of Soviet marine products. It is being sold in various parts of Japan under Soviet labels 'Chatka' and 'Ako'.

One leading Tokyo department store is selling Chatka, a quality pack, for US$1.94 a can ($\frac{1}{2}$-pound pack), the same price as that for Japanese factoryship production. Some supermarkets are promoting sales at low prices of $1.33-1.38 a can.

Also Soviet Competition Elsewhere

Apparently, the Soviets are exploiting opportunity provided by Expo-70 to penetrate Japanese market. Japanese packers, who face Soviet competition in the U.S., France, and elsewhere, now are confronted with an aggressive sales offensive in Japan. Hereafter, market prices will be largely influenced by the movement of the Soviet product. ('Suisab Tsushin,' Apr. 13.)

SOUTH PACIFIC

AUSTRALIA

CONTINENTAL SHELF ACT BECAME EFFECTIVE APRIL 15

Australia's Continental Shelf (Living Natural Resources) Act of 1968 became effective April 15, 1970. J. D. Anthony, Minister for Primary Industries, said Australia was extending her control over the living natural resources of the Continental Shelf in accordance with international law.

He noted that the Pearl Fisheries Act in the early 1950s had helped develop international law in this field. However, it applied only to pearl shell and three other marine organisms.

The Act of 1968 relates to Continental Shelf living natural resources as defined in 1958 Convention.

What Act Covers

The Act applies to marine organisms including many sedentary species, such as corals, sea anemones, sea pens, sponges, sea urchins, beche-de-mer, sea lilies (have scientific not commercial value); molluscs, including mother-of-pearl, giant clams, oysters, mussels, and other bivalves, abalone, trochus, green snail, and other similar gastropod molluscs, chitons, and seaweeds.

This list could be extended later, in accordance with conservation needs, to include other living natural resources covered by the Convention.

Also Covers Foreign Nationals

Mr. Anthony said the Act applied also to foreign nationals. After April 15, 1970, it became an offense to take these organisms without a license from specified parts of the Continental Shelf and the External Territories. The Government intends that the resources be protected particularly from foreign fishermen. They will be prevented from taking clams or other specified organisms from the shelf near the Great Barrier Reef.

Licensing

The Government did not intend that foreign fishing vessels be licensed. Australian fishermen and vessels must be licensed if they fish for these organisms for commercial purposes. Tourists and other noncommercial persons would not need licenses. However, they would have to obey management rules (closed seasons or minimum sizes) that may be introduced.

The Government is considering a complete ban on taking certain molluscs near the Great Barrier Reef.

Stiff Penalties

The Act provides stiff penalties for unlicensed commercial taking of sedentary organisms: from fines up to $1,000 and, at Court's discretion, forfeiture of the vessel, equipment, and sedentary organisms taken illegally. Additional penalties are provided for offenses by foreigners. ('Australian Fisheries,' Mar. 1970.)

* * *

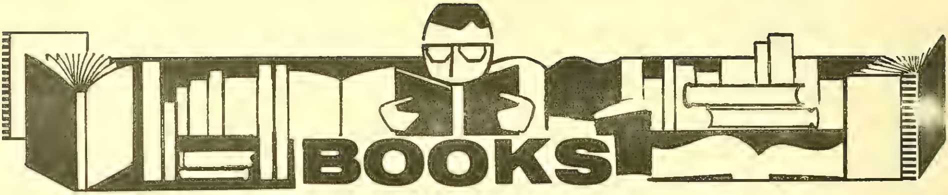
NEW SHRIMP PROJECT ANNOUNCED

The Australian Cabinet last year approved funds for shrimp explorations from New South Wales-Queensland border around Australia's northern coasts; then, up into Gulf of Papua and down to latitude 19° S. in W. Australia.

J. S. Hynd, a marine biologist, was appointed project leader. B.V. Hamon, a senior physical oceanographer, is organizing oceanographic and environmental aspects. The project is centered at Cronulla, New South Wales; there are several field laboratories.

The Program

The first part is concerned with shrimp stocks, the second with relations between those stocks and their environment. The third part, not yet undertaken, aims to develop gear. ('Australian Fisheries,' Mar. 1970.)



MARINE SCIENCE

"Marine Science Affairs--Selecting Priority Programs." Annual Report of the President to the Congress on Marine Resources and Engineering Development, 284 pp., April 1970. Can be obtained from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. $1.50.

Enactment of Marine Resources and Engineering Development Act of June 17, 1966, increased Federal attention to marine science affairs. In accordance with Act's provisions, the President reports to Congress each year "on the state of the Nation's marine sciences programs, describing the activities and accomplishments of the Federal departments and agencies, evaluating these accomplishments, and setting forth recommendations as to future policies, programs, and funding."

During 1969, the Marine Sciences Council moved from identification of "critical Government-wide marine science issues" to development of priority program to meet U.S. needs. The Report presents these priorities:

--A U.S. policy and grants to encourage States to improve planning and managing of their coastal areas.

--Marine research that is "essential to wise use" of the coastal environment.

--Lake-restoration programs to restore quality of "seriously damaged national waters, including the Great Lakes."

--Arctic environmental research "to permit fuller rational use of the Arctic region."

--The International Decade of Ocean Exploration. This is "a cooperative program with coordinated research, surveys and data sharing leading to mutually beneficial understanding of the world ocean."

--Expansion of program to develop oceanographic and atmospheric buoys for productive use by several agancies in a broad program.

--Research and development to cut operating costs of merchant ships.

AQUICULTURE

'Marine Aquiculture,' edited by William J. McNeil. Selected papers from Conference on Marine Aquiculture, Newport, Oregon, May 23, 24, 1968. Corvallis: Oregon State University Press, 1970, 172 pages, $6.

The book describes the hopes for increasing the yield of cultured marine organisms and the obstacles to achieving this. Ten scientists summarize research in fish nutrition, genetics, and other subjects.

Roy A. Young discusses the projected need for food in the "future overpopulated world." He concentrates on the role controlled populations of marine fish and shellfish might play in meeting this need. James E. Shelbourne reports the progress in marine fish cultivation in Britain. He notes the long period of preliminary work needed to establish hatching and rearing facilities for sole and plaice. But he shows that the results have been encouraging.

Energy costs and nutrition--basic to any aquiculture that progresses beyond the empirical stage--are treated in separate articles by J.R. Brett and J.E. Halver. R.C. Simon emphasizes the opportunities to apply genetic principles to improve cultured stocks. L.R. Donaldson discloses the results of years of selective breeding of trout and salmon. He shows the relatively quick responses that can be obtained in growth and fecundity.

Technology can have an impact on aquiculture. The impact can be accidental--through use or change of resources vital to aquiculture--or can be planned into the culture operations. There are articles on fisheries engineering by Milo Bell and on thermal enrichment by T. A. Gaucher.

The contribution by C.J. Sindermann on diseases in marine aquiculture "raises a flag of warning." Gathering marine animals in concentrations necessary for intensive culture often has resulted in outbreaks of disease. He notes necessity of learning as much as possible about the pathogens.

In "Economic Obstacles to Marine Development," Anthony Scott indicates lack of demand for aquiculture products except luxury items and common carp. He outlines conditions for successful aquiculture operation.

The book is an introduction to marine aquiculture that often probes deeper than introductory phase. The literature cited at the end of each article is useful.

SCIENTIST'S WATERY WORLD

Three paperbacks discussing oceanography and ocean charting now are available, reports the books' sponsor, the U. S. Naval Oceanographic Office (NOO):

1. "Science and the Sea, Vol. II" ($1)

2. "Spheroidal Geodesics, Reference System and Local Geometry" ($1.75)

3. "The Water Planet" ($1)

Available from Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.

1. "Science and the Sea" has 10 articles: a chapter on distribution of discolored waters--how concentrated forms of marine life change oceans from green or blue to brown, red, and yellow. A chapter on geological oceanography deals with undersea rock and sediment structuring. One entitled "Navigational Hints" features information on piloting boats and ships. Another, "Survival at Sea," tells what to do in a mishap. "Collisions--1969" discusses four ship accidents.

Except for chapter on energy of ocean waves, the book was written by NOO personnel.

2. "Spheroidal Geodesics" would appeal primarily to navigators, mathematicians, and geographers. Geodetics is science of correctly locating objects, including islands and ships, on world's spheroidal surface. Book was written by P. D. Thomas, staff mathematician.

3. "The Water Planet" describes what oceanographers and surveyors do at sea and in their land-based laboratories. Written and edited for NOO as recruitment publication, it has many illustrations.

It is aimed primarily at students and describes scientists' efforts to learn more about the ocean's physical nature--its geology, chemistry, physics, and biology--in a brief, easy-to-understand style.

The book features an illustrated description of efforts by marine biologists to learn how certain species or marine animals use nature-provided sonar systems either to communicate with each other or to locate food in dark waters. It has information on sea floor geology: how ocean surveyors explore invisible rock structures, many covered by water and concealed by sediment mud. It looks into ocean chemistry through a short, illustrated paragraph on the wide variety of minerals that can be found in a cubic mile of ocean water.

It describes ocean-related careers--for example, how engineering techniques have put the scientist in the sea. It tells how to get started in an oceanographic career.

FPC BIBLIOGRAPHY

All references to fish protein concentrate (FPC) research for the last 30 years have been compiled in a bibliography by the Library of Congress. The bibliography, sponsored by the BCF National Center for Fish Protein Concentrate, contains 300 abstracted references.

It can be obtained from Clearing House for Federal Scientific and Technical Information, Sills Bldg., 5285 Port Royal Rd., Springfield, Va., 22151, for $3. A second bibliography covering fishmeal will follow.

LAW OF SEA

"The Law of the Sea." National Policy Recommendations. Proceedings of the Fourth Annual Conference of the Law of the Sea Institute, June 23-June 26, 1969. The University of Rhode Island, Kingston, R.I. Edited by Lewis M. Alexander, 533 pages, mimeographed. Available from the Institute for $7.50.

The book contains the following papers and panel discussions:

- 'Our Nation and the Sea: A comment on the Proposed Legal-Political Framework for the Development of Submarine Mineral Resources,' by E.D. Brown

Regimes of the Deep-Seabed

- 'The Oceans and Foreign Policy: Laissez-Faire or a Stronger National Purpose?' by Victor Basiuk
- 'The Marine Commission's Deep-Seabed Proposals--A Political Analysis,' by Robert L. Friedheim
- 'Oil Interests in the Deep-Seabed,' by Thomas F. Gaskell
- 'Proposed Regimes for Exploration and Exploitation of the Deep-Seabed,' by George Miron
- 'Some Thoughts on an International Regime and Administrating Agency for the Seabed and Ocean Floor Beyond the Limits of National Jurisdiction,' by W. Langeraar

The Continental Shelf. Considerations of the Marine Science Commission Recommendations.

- 'Recommendations on the Limits of the Continental Shelf and Related Matters,' by Ian Brownlie
- 'Limits of National Jurisdiction Over Natural Resources of the Ocean Bottom,' by Hollis D. Hedberg

Regimes of the Continental Shelf

- 'Some Dimensions of Defense Interest in The Legal Delimitations of the Continental Shelf,' by Norman V. Brechner
- 'The Continental Shelf and the Public Interest,' by Thomas A. Clingan Jr.
- 'An Oceanographer's View of the Law of the Sea,' by K.O. Emery
- 'International and Domestic Managerial Regimes for Coastal, Continental Shelf and Deep-Ocean Mining Activities,' by L.F.E. Goldie
- 'The Seaward Limit of the Continental Shelf,' by Roger Denorme

International Fisheries: Consideration of the Marine Science Commission Recommendations

- 'Marine Science Commission Recommendations on International Fisheries Organizations,' by J.L. Kask
- 'Critique: Fisheries Management Provisions in the Commission Report,' by P.A. Larkin

International Fisheries Regimes

- 'International Fishery Regimes,' by Donald L. McKernan

Science and International Organization

- 'Freedom of Scientific Inquiry,' by William L. Sullivan Jr.
- 'International Organizations for Marine Science--An Eclectic Model,' by Daniel S. Cheever
- 'Report on Jurisdictional, Administrative, and Technical Problems Related to the Establishment of California and Other State Coastal and Offshore Boundaries,' by F.J. Hortig

Ocean Strategy for U.S.

- 'The Ocean Regime of the Real World,' by Wilbert M. Chapman

Contributed Papers

- 'A Framework Towards a Seabed Regime,' by L.R. Heselton Jr.
- 'The United States, Chile, Ecuador and Peru: Some Reflections on the 1969 Report of the Commission on Marine Science, Engineering and Resources, by Thomas Wolff
- 'The Malta Plan and the United Nations,' by Eugene Brooks
- 'Applications of Mathematical Economics in Marine Resources Research,' by Clifford S. Russell

THE FOLLOWING PUBLICATIONS OF THE DEPARTMENT OF INTERIOR, FISH & WILDLIFE SERVICE, ARE AVAILABLE FROM DIVISION OF PUBLICATIONS, BCF, 1801 N. MOORE ST., ARLINGTON, VIRGINIA 22209:

LAKE ERIE

"A Brief History of Commercial Fishing in Lake Erie," by V.C. Applegate and H.D. Van Meter, Fishery Leaflet 630, pp. 1-27, April 1970.

"Salient features of the development of the industry from about 1815 to 1968, changes in fishing gears and methods, changes in the kinds and abundance of fishes caught, and the attendant effects of disappearing species on the stability of the fishery are described. The history and present status of the walleye, yellow perch, and eight other fishes, still taken in commercial quantities, are presented in more detail and are considered in the context of their effect on the current moribund state of the U.S. fishery. Past and present contributions of Lake Erie's tributaries and northerly connecting waters to the fishery are outlined briefly. The 'outlook' for the fishery under present conditions of selective overfishing for high-value species, excessive pollution, ineffective and uncoordinated regulation, and antiquated methods of handling, processing, and marketing fish are discussed, and possible solutions to these problems are suggested."

MOTION PICTURES

'Fishery Motion Pictures,' Fishery Leaflet 629, pp. 1-28, May 1970. Leaflet lists commercial fishery motion pictures produced and distributed by BCF. It tells how to borrow prints without charge (except return postage).

BCF films provide conservation education, consumer information, and technical training. Each year millions of persons see the films in classrooms, on TV, in civic and religious programs, at sportsmen's meetings. The films also stimulate demand for U.S.-produced fishery products.

FWS PUBLICATIONS

Fishery Leaflet Nos. 597 and 628 are listings of available fishery bulletins of the U.S. Fish and Wildlife Service.

Fishery Bulletins are technical reports on scientific investigations of fishery biology.

SCREENING FISH

"Diversion and Collection of Juvenile Fish with Traveling Screens," by Daniel W. Bates, Fishery Leaflet 633, pp. 1-6, March 1970.

"A horizontal traveling screen, suitable for screening fish or debris from powerplant water intakes or irrigation diversions, was designed and operated by the Bureau of Commercial Fisheries during 1965-69. The structure consisted of a vertically hung, endless belt of wire-cloth screen panels, flush with the face of the water intake structure or at an angle to the direction of flow.

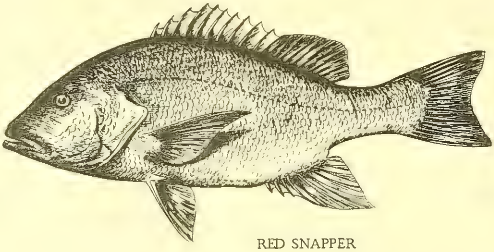
"Field tests in different water approach velocities, with the screen traveling at various rates, proved that such a facility can be operated efficiently. The horizontal traveling screen . . . should contribute materially to the development of an efficient, relatively low-cost diversion facility for fish and debris."

Mr. Bates states that biologists and engineers have been trying for many years to develop an efficient method to safeguard juvenile fish exposed to hydroelectric or irrigation developments in rivers. They studied the possibility of deflecting these migrating fish from their normal paths to alternate routes. Numerous methods were examined: bands of rising bubbles, curtains of hanging chains, electrical stimuli, lights, louvers, sound, and water jets. These methods were never completely reliable.

In 1965, a new approach promised to overcome disadvantages of fish-guiding or deflection devices. Development of the horizontal traveling screen provided many practical solutions to the problems of fish diversion. The leaflet lists its advantages.

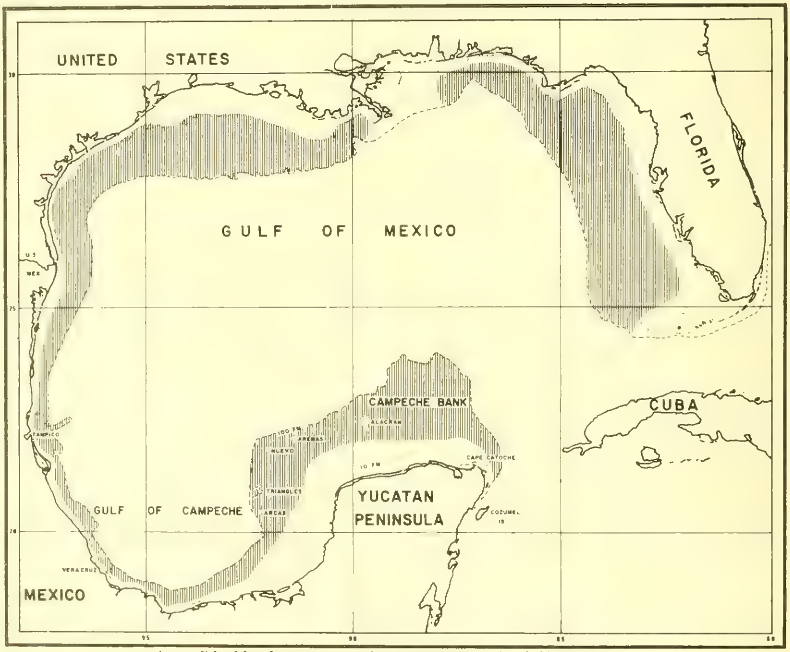
Large illustrations tell the brief story.

FOOD FISH FACTS



RED SNAPPER

The red snapper is one of the most delicious deep sea delicacies on the market. Most are caught in the Gulf of Mexico and landed in Florida where the red snapper industry is centered. Many modern fishing vessels range more than 400 miles from home, to the coasts of Yucatan and Honduras, for their catches.



Areas fished by the commercial snapper fleet in the Gulf of Mexico.

(Continued following page)

DESCRIPTION

The red snapper, as its name implies, is brilliant red in color and is one of the most colorful fish in a seafood market display case. It ranges in size up to 30 pounds in weight and $2\frac{1}{2}$ feet in length.

HABITAT

Although very little is known about the life history of the red snapper, commercial fishermen have learned that concentrations of snapper are usually found over certain types of bottom. Irregular hard bottom formations of rock and limestone covered with live coral and grass, called lumps or gullies, are especially preferred by snapper. Fish schools are usually located several feet off the bottom of these areas, where food material brought in by eddying currents settles out. Fishermen believe that the red snapper stays in shallow water during the summer months and moves offshore again as fall arrives. It is believed that the snappers spawn in deep water during the fall.

SNAPPER FISHING

Snappers are taken in water several hundred feet deep, and most of the catch is still made with hook and line. For several years, however, fishery research vessels operating out of BCF's Exploratory Fishing and Gear Research Base in Pascagoula, Mississippi, have sought to develop new and better fishing methods to improve the effectiveness of the fishing fleet. The Research Base is testing the effectiveness of a modified otter trawl, a large, flattened, cone-shaped net of nylon which is dragged along the ocean floor.

Improvements in electronic gear have also helped the fishermen. In early years fishermen relied almost entirely on trial and error navigation to locate fishing grounds. Hard bottom areas were often difficult to locate, and many hours were spent searching. As early as 1953, BCF tested a fish finder which utilized electronics to show the bottom composition and fish present under the boat. Today, depth sounding devices and fish finders are being used with great success in the fishery. One of these recorders graphically portrays the seabed, its consistency, and the fish concentrations on or above the bottom. With this instrument fishermen can locate gullies and lumps and actually distinguish between hard and soft bottoms. Fishermen have little difficulty in locating and staying over fishable bottoms.

USE OF RED SNAPPER

Red snapper is available year round in all parts of the country. Its meat is juicy, white, and of fine flavor. Red snapper is sold in several market forms including fresh dressed, fresh fillets, frozen fillets, and frozen portions. It can be served broiled, baked, steamed, or boiled in a host of imaginative ways which add even more appeal to this deep sea delicacy.

SNAPPER IS DAPPER WITH A SIMPLE SAUCE

Although we cherish the old, tried and true recipes that have won acclaim over the years, it's exciting when we discover something utterly new and different. Why not be adventuresome and soar into the 1970s with some bright new ideas for preparing seafoods? BCF has thoroughly tested and found delicious a totally new approach to preparing everyone's favorite seafood, red snapper. In this recipe, Dapper Snapper, the snapper is baked in a quick and easy sauce that is made from gravy mix, of all things! The sauce is highlighted with a tang of lemon, and a lively base of chopped onion placed under the fillets further accents the taste. Just 20 to 25 minutes in the oven is all the time needed to flake the fish and blend the flavors, and this imaginative entree is ready to garnish with almonds and green pepper bits and serve.

Red snapper has long been considered one of the most delicious deep-sea delicacies on the market. Its brilliant coloring and attractive appearance is only exceeded by the juicy, white, fine-flavored flesh. Most of the snapper on the market is caught in the Gulf of Mexico and landed in Florida. Because of today's fast, modern transportation, this delicacy is available in most areas of the United States.

It is sold in several market forms including fresh dressed, fresh fillets, frozen fillets, and frozen portions. Red snapper's tender, delicate flesh adapts readily to a host of imaginative preparation methods and is equally good broiled, baked or poached. Dapper Snapper offers a new flavor sensation that we think you'll like; why not try it today!

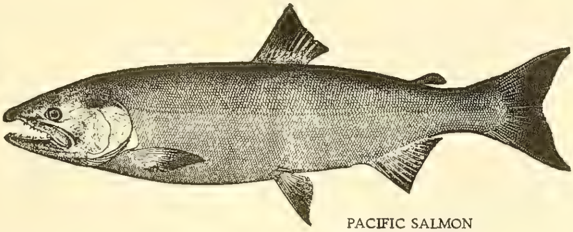
Many other exciting ways to prepare Florida's deep-sea bounty are contained in a colorful booklet, Florida Fish Recipes. Red Snapper Floridian, Spicy Red Snapper, and Baked Red Snapper With Sour Cream Stuffing are just a few; this booklet also has many tasty ideas for mackerel, shrimp, lobster, crab, oysters, catfish, grouper, and mullet. For your copy, send 35¢ to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, and ask for Florida Fish Recipes (I 49.49/2:1).

DAPPER SNAPPER

- 2 pounds snapper fillets or other fish fillets, fresh or frozen
- $\frac{1}{4}$ cup chopped onion
- 1 package ($\frac{5}{8}$ to $\frac{7}{8}$ ounce) brown gravy mix
- 1 tablespoon olive oil
- 1 teaspoon lemon juice
- 1 teaspoon salt
- Dash pepper
- $\frac{1}{4}$ cup sliced almonds
- $\frac{1}{4}$ cup chopped green pepper

Thaw frozen fillets. Skin fillets. Cut fillets into 6 portions. Sprinkle onion in a well-greased dish, 13 by 9 by 2 inches. Place fish, skinned side down, on onion. Prepare brown gravy mix according to package directions. Add oil, lemon juice, salt, and pepper. Pour gravy over fish. Bake in a moderate oven, 350° F., for 20 to 25 minutes or until fish flake easily when tested with a fork. Garnish with almonds and green pepper. Makes 6 servings. (National Marketing Service Office, BCF, U.S. Department of the Interior, 100 East Ohio Street, Room 526, Chicago, Illinois 60611.)

FOOD FISH FACTS



PACIFIC SALMON
(Oncorhynchus species)

Salmon has nourished the human race since ancient times. Pliny, the Roman scholar, wrote in 77 A.D. that "the river salmon is preferred to all fish that swim the sea." Salmo is still preferred by many people today. The fact that canned salmon is 100 percent edible, easy to store and use, as well as being high in nutritional values, makes it one of the most can-venient items on the market.

DESCRIPTION

There are five species of Pacific salmon which occur in North American waters. They are:

1. Chinook salmon, also known as king salmon, is the largest of the five species, averaging around 20 pounds. A typical Chinook has silvery sides and a bluish-green back marked with small dark spots. The flesh of the Chinook is very rich in oil, breaks into large flakes, and ranges in color from deep salmon to almost white. It is especially good in salads.

2. Sockeye or red salmon averages about 2 feet in length and 3 to 5 pounds in weight. The males, when spawning, assume a colorful attire with a bright red body and a green head. The flesh is deep salmon in color, firm-textured, has considerable oil, and breaks into medium-sized flakes, making it suitable for salads or other dishes where richness and color are important. The annual pack of canned sockeye is usually the most valuable.

3. Pink salmon, also known as humpback salmon because of the appearance of the males during spawning, is common to Alaska but is found as far south as Oregon. Pink salmon, named for its paler flesh, ranges in weight from 3 to 6 pounds. It is especially good in entrees, soups, and sandwiches.

4. Coho or silver salmon, a favorite with fishermen, weighs from 6 to 12 pounds and is from 2 to 3 feet in length. The flesh is deep salmon, but lighter than sockeye. Coho breaks into large flakes and is equally good in all recipes or as it comes from the can. Coho salmon have recently been planted in the Great Lakes and have shown tremendous promise as a fish for sportsmen.

5. Chum salmon, also known as keta or calico salmon, migrate in the autumn and are the last Pacific salmon to run the rivers. They reach an average length up to 3 feet and weigh about 10 pounds. The flesh is lighter in color than the other species and has less oil. It is especially suitable for casseroles or other cooked dishes where color is not important. Commercially, chum salmon is the least expensive.

(Continued following page.)

HABITAT

Pacific salmon spend most of their lives in the ocean. When mature, they return to spawn in their stream of origin. Some go a short distance upstream or just above tidewater to spawn, others go as much as 2,000 miles upstream. All die after spawning. Months later the new generation emerges from the gravel. Some of the young make their way downstream immediately, others remain in fresh water for a year or two. Streams must have high-quality, well-oxygenated, cool water for salmon to survive. Pacific salmon range from Monterey Bay, California, to Alaska.

SALMON FISHING

Salmon are usually caught commercially in the ocean or in the river mouths as they begin their spawning runs. During the spawning run the salmon does not eat. Nature has provided the adults with an abundance of fats and oils for the long, rugged journey. The salmon are therefore in their prime. There are many methods used to catch salmon, but the most common are purse seining, trolling, and gill netting. Once caught, salmon are dressed and iced and are either brought directly to the cannery or transferred to cannery tenders which bring them in for processing. Much care is exercised to see that quality is maintained.

CONSERVATION

Although dams, pollution, overfishing, and other factors have reduced the numbers of salmon, it is still one of the most valuable fishery resources in the United States. BCF and the State convervation agencies are working together to enhance and protect the remaining salmon resources. Research on salmon behavior patterns and survival and the influences of environment provides an understanding of the fluctuations in abundance of salmon stocks. Research is also directed toward providing safe passage for migratory fishes at water-use projects, such as hydroelectric and flood-control dams and irrigation systems.

In the critical international North Pacific fishery, unique research tools have been developed to distinguish Asiatic from North American stocks of salmon and determine their distribution. The basic aim of all fishery research is to ensure the wise use of a renewable resource.

USES OF SALMON

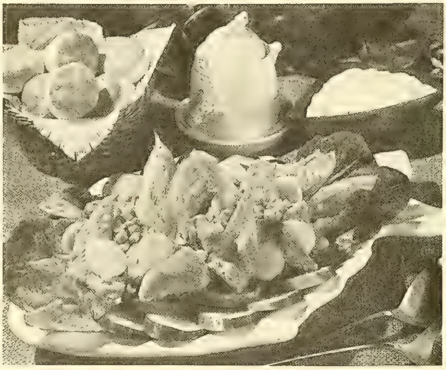
Salmon is packed mainly in three different types of cans: 1. The one-pound tall and the one-pound flat, each containing two cups and serving four; 2. The half-pound flat contains one cup and serves two; 3. The "quarter-pound flat" can containing $3\frac{3}{4}$ ounces, is less common, and serves one. Because canned salmon is ideal for large scale cooking in restaurants, hospitals, institutions, etc., special four-pound cans are packed for this purpose.

Whole salmon is sold fresh or frozen for baking or barbecuing. Salmon steaks are available as are a wide range of specialty products. (Source: National Marketing Services Office, BCF, U.S. Dept. of the Interior, 100 E. Ohio, Room 526, Chicago, Ill. 60611.)

A 16-page, full-color booklet featuring salmon is available free from the Canned Salmon Institute, Pier 89, Seattle, Washington 98119. Ask for "Quick and Easy Ways With Salmon."

CAN-VENIENT SALMON SCORES AGAIN

Kids are playing baseball in the vacant lot, teen-agers are bicycling in the park, college students are strolling on campus or philosophizing on the library steps, Dad is out of the office jogging, and Mom--what is Mom doing? Mom is trying to think of a way to get out of the kitchen! Take heart, Mom, there is a way out, and the answer is seafoods! Any season is right for protein-rich, quickly prepared and cooked fish and shellfish. Especially appropriate, however, when Mom is in a hurry and wants out of the kitchen, is that versatile product, canned salmon.



Canned salmon is a fish for all seasons and truly a treat for mankind. Ready at the flick of a can-opener, canned salmon is savory, satisfying, and summery. It's also saving of those valuable commodities--time and money. There is no waste in a can of salmon. It is 100 percent edible, and even the soft, tiny bones add enjoyment and crunchy goodness. Nutritionists suggest that the entire contents in a can of salmon be used. Canned salmon adapts to many preparation methods, hot or cold, and may be eaten as it comes from the can or used in gourmet entrees.

Canned salmon varies in color from reddish to pink according to the type of salmon canned. The color helps to determine the price; the redder varieties are more expensive and have a little more oil content than the pink. All canned salmon is nutritious, however, regardless of color. Consumer-sized cans available at the market include: one-pound containing two cups and serving four; one-half pound containing one cup and serving two; and quarter-pound containing $3\frac{3}{4}$ ounces and serving one.

"Salmon, either whole, steaked, or canned, provides complete protein. It is also a good source of iodine, phosphorus, and vitamins A, D, and the B group," says Phil Roedel, Director, BCF, U.S. Department of the Interior. Take A Can Of Salmon has 22 tasty recipes ranging from appetizers to elegant entrees. For your copy, send 25¢ to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, and ask for Take A Can of Salmon, Circular No. 60.

CRUNCHY SALMON SALAD

1 can (16 ounces) salmon
Salad greens
Sliced water chestnuts
Chopped peanuts
Curry Dressing

Drain salmon and reserve liquid. Remove skin and bones. Break salmon into large pieces. Arrange salmon on salad greens. Garnish with water chestnuts and peanuts. Serve with Curry Dressing. Makes 6 servings.

CURRY DRESSING

$\frac{3}{4}$ cup mayonnaise or salad dressing
$\frac{1}{2}$ cup sliced green onion
$\frac{1}{3}$ cup chopped green pepper
2 tablespoons salmon liquid
1 tablespoon soy sauce
1 teaspoon curry powder
$\frac{1}{8}$ teaspoon ground ginger

Combine all ingredients. Chill. Makes approximately 12 cups dressing.

(National Marketing Services Office, BCF, U.S. Department of the Interior, 100 East Ohio Street, Room 526, Chicago, Illinois 60611.)

KING CRAB KRUNCH--ALASKA SPECIALTY

The Pacific coast offers great seafoods, and many of them come from Alaska, the 49th and biggest State, a land of superlatives and surprises. Superlative not only describes Alaska, it is the best word to describe one of Alaska's famous products, the king of crabs. Caught in the cold waters of the Bering Sea off Alaska's rugged coastline, the huge king crabs are processed and packaged on board ship within minutes after being caught.

King Crab Crunch is a Bureau of Commercial Fisheries recipe that allows the homemaker to "go gourmet" with ease and convenience. All ingredients are refrigerator or shelf-ready, planned to save time in preparation. Big, tender, succulent pieces of king crabmeat are mixed with celery and pineapple pieces, then blended and heated together in a chicken broth base. Add toasted slivered almonds and a little lemon juice just before serving over chow mein noodles--then sit back and take time to enjoy this crunchy, delicious seafood recipe. Great for entertaining or a special treat for the family, this king crab specialty offers real nourishment and is bound to be a nifty success every time it is served.

KING CRAB KRUNCH

1 pound king crabmeat, fresh or frozen
1 can ($8\frac{3}{4}$ ounces) crushed pineapple
3 tablespoons butter or margarine
$\frac{1}{2}$ cup thinly sliced celery
2 tablespoons cornstarch
2 cups chicken broth
$\frac{1}{2}$ cup toasted blanched slivered almonds
1 tablespoon lemon juice
1 can (5 ounces) chow mein noodles

Thaw frozen crabmeat. Drain crabmeat. Remove any remaining shell or cartilage. Drain pineapple, reserving liquid. Melt butter in a 10-inch fry pan. Add celery, pineapple, and crabmeat. Cook over low heat for 5 minutes, stirring frequently. Dissolve cornstarch in pineapple juice. Stir into crab mixture. Add chicken broth gradually and cook until thick, stirring constantly. Add almonds and lemon juice. Serve over noodles. Makes 6 servings.

King Crab Krunch is one of 25 mouth-watering, easy-fix recipes planned especially to give you TIME--time to enjoy, time to relax, and time out of the kitchen. Cooking with imagination is so easy to do with 'Time For Seafood,' a full color booklet published by the Bureau of Commercial Fisheries. For your copy send 45¢ to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 and ask for Time For Seafood, Fishery Market Development Series No. 12 (I 49.49/2:12). (National Marketing Services Office, BCF, U.S. Department of the Interior, 100 East Ohio Street, Rm. 526, Chicago, Illinois 60611.)

OYSTERS ARE IN A STEW AGAIN!

Oysters have been pleasing and nourishing mankind for hundreds of years. Coastal Indians enjoyed them in large quantities as evidenced by great piles of oyster shells found along the shorelines by early settlers. Oysters today are more popular than ever, and the old superstition of eating oysters only in the "R" months has long been disproved. Oysters are good to eat anytime they are available. Fortunately for oyster fanciers they can be enjoyed the year around thanks to today's modern freezing and canning processes. Right now, however, these tasty little gems are plentiful and available fresh, sweet, and ready to eat.

Oyster meats are excellent sources of protein, minerals, and vitamins, and they are easily digested. Because of the high mineral content, oysters are often recommended by doctors for patients with anemia. To retain the oyster's delicate flavor never overcook. Oysters should be cooked just long enough to heat through so they will remain plump and tender.

Soup is super--especially when oysters are in the soup. Oysters are delightful prepared in dozens of versatile ways, but now is the season to enjoy them in soups and stews. Poets have said that oyster stew nourishes the soul; whether it does or not is debatable, but we do know that it nourishes the body. Oyster-Mushroom Stew, a Bureau of Commercial Fisheries recipe, has all the goodness of the traditional oyster stew but with a modern touch. This recipe combines the succulent oysters with milk and canned cream of mushroom soup for a hurry-up snack, lunch, or first course. A last minute addition of sherry adds a flavor fillip to make this easy combination one you'll repeat again and again. Served with a cling peach salad and your choice of crackers, this Oyster-Mushroom Stew is a boon to today's busy homemakers--ready in minutes, tasty and filling, and bound to satisfy.

OYSTER-MUSHROOM STEW

2 cans (12 ounces each) oysters, fresh or frozen	$\frac{1}{2}$ teaspoon salt
1 can ($10\frac{1}{2}$ ounces) cream of mushroom soup	$\frac{1}{4}$ cup butter or margarine
	1 tablespoon sherry
2 cups oyster liquor and milk	Paprika

Thaw frozen oysters. Drain oysters and reserve liquor. Combine all ingredients except oysters and sherry in a 3-quart saucepan. Heat, stirring occasionally. Add oysters. Heat 3 to 5 minutes longer or until edges of oysters begin to curl. Add sherry. Sprinkle with paprika. Makes 6 servings.

Fishery products from Washington, Oregon, and Alaska offer 38,340 miles of variety, flavor, and imagination. To call attention to these products the United States Department of the Interior's Bureau of Commercial Fisheries, in cooperation with eight fishery agencies in the Pacific Northwest, has produced a new, 32-page, full-color booklet that is chock-full of wonderful ways with seafoods. For your copy of this exciting recipe booklet send 60¢ to the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 and ask for Seafood Moods, Fishery Market Development Series No. 14. (Source: National Marketing Services Office, BCF, U. S. Department of the Interior, 100 East Ohio Street, Rm. 526, Chicago, Illinois 60611.)

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UNITED STATES DEPARTMENT OF THE INTERIOR

Walter J. Hickel, *Secretary*

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Charles H. Meacham, *Commissioner*, U.S. FISH AND WILDLIFE SERVICE

Philip M. Roedel, *Director*, BUREAU OF COMMERCIAL FISHERIES

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States -- now and in the future.

BACK COVER: Alaskan shrimp are transferred from this boat-loaded box to bins at processing plant, where crushed ice will hold them until processed.
(BCF-ALASKA photo: J. M. Olson)