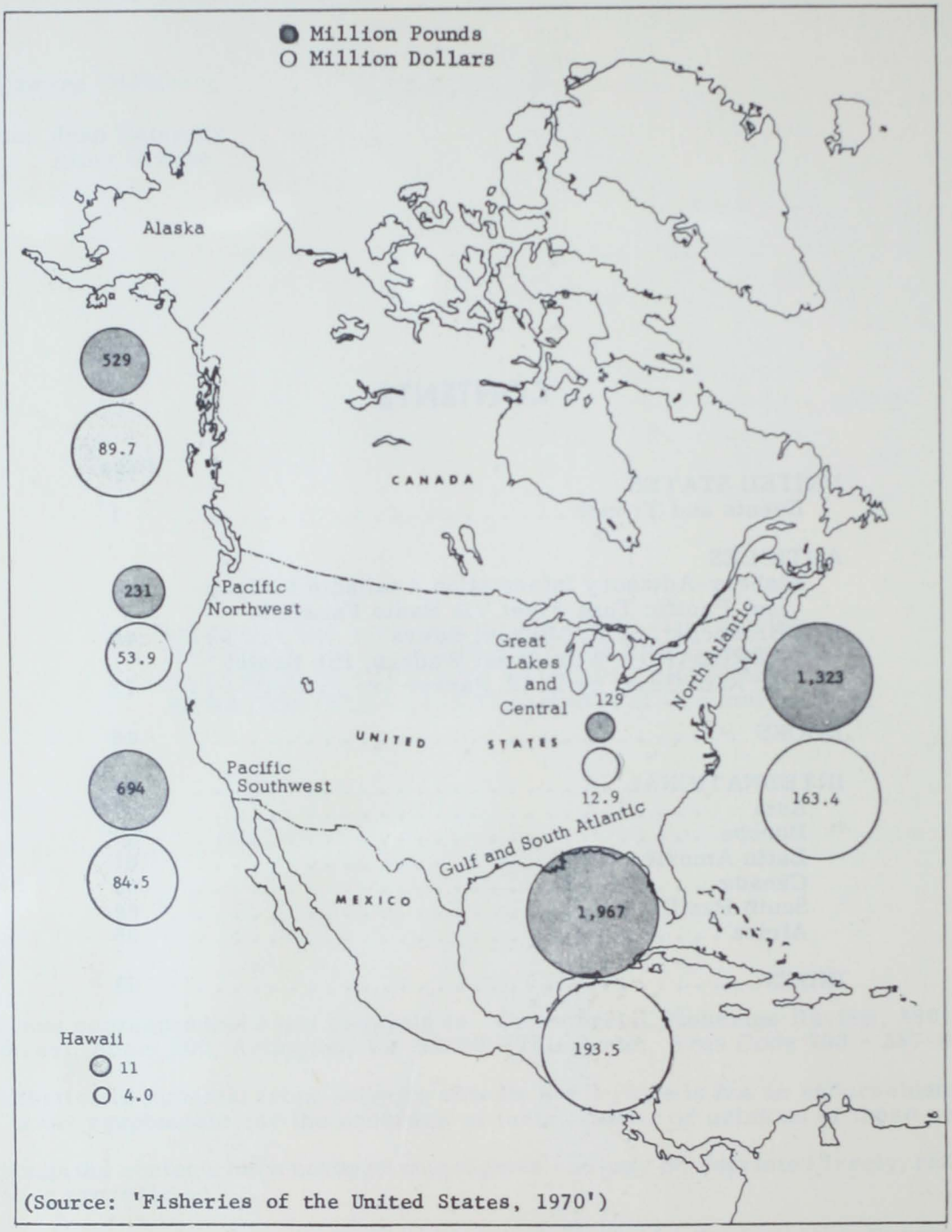
VOLUME & VALUE OF CATCH BY REGIONS 1970



(Source: 'Fisheries of the United States, 1970')

U.S. 1970 CATCH OF FISH & SHELLFISH WAS NEAR 5 BILLION POUNDS

In 1970, U.S. fishermen caught 4,884 million pounds of fish, shellfish, and other aquatic plants and animals. The catch was 591 million pounds, 16%, above 1969; it was the largest since 1962's all-time record 5.4 billion pounds.

The catch brought the fishermen a record income of $602 million. The figure was $83.4 million, 16%, above 1969 and 36% above 1964-68 average.

These data were reported by NMFS Division of Statistics and Market News.

UPS & DOWNS

The fishermen landed record amounts of tuna, Gulf menhaden, California anchovies, shrimp, Dungeness crabs, snow crabs, surf clam meats, northern lobsters, and spiny lobsters.

There were sharp increases in landings of Atlantic menhaden and Pacific salmon.

Also, more Atlantic flounders and blue crab were landed.

Marked declines were registered in catches of Atlantic alewives and haddock.

Somewhat lower were landings of Atlantic cod, bonito, jack mackerel, king crab, sea-scallop meats, and oyster meats.

PROCESSED FISHERY PRODUCTS

The value of U.S.-processed fishery products from domestic and imported raw material was a record $1.7 billion, 15% above 1969.

The canned pack of 46.5 million standard cases was worth $750.7 million; in 1969, $580.8 million.

There were record packs of tuna, shrimp, and animal (pet) food. Recorded, too, was larger production of salmon, crab meat, clam products, and oyster items.

Production of fish sticks and portions was a record 349.4 million pounds worth $155.3 million.

Breaded shrimp production reached 103.1 million pounds worth $109 million.

For the first time, production of industrial fishery products reached $100 million--$15.5 million over 1969.

The fast-growing fish-and-chips franchise chains kept expanding. Processors of fish and shellfish specialty dinners and other packaged fish and shellfish items passed the $460 million mark.

Exports of U.S.-produced fishery products were a record $117.7 million. Record imports exceeded $1 billion.

THE 1970 STORY

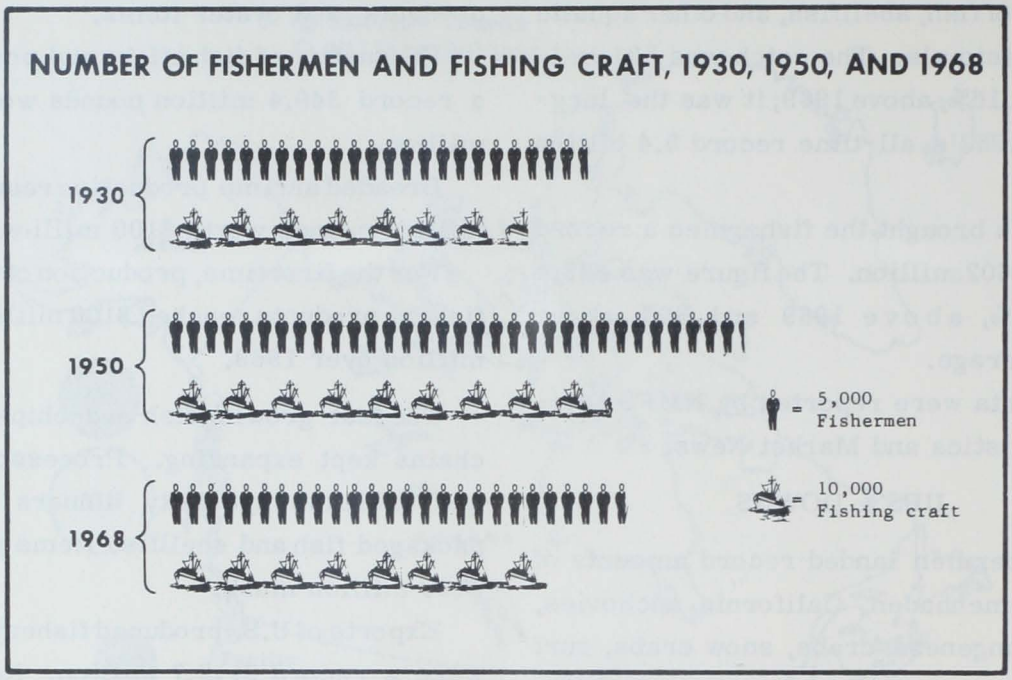
The industry picture at year end was this: pollution of the environment caused some problems; there were high inventories of some frozen products; some declines in the availability of resources resulted from natural causes and heavy fishing.

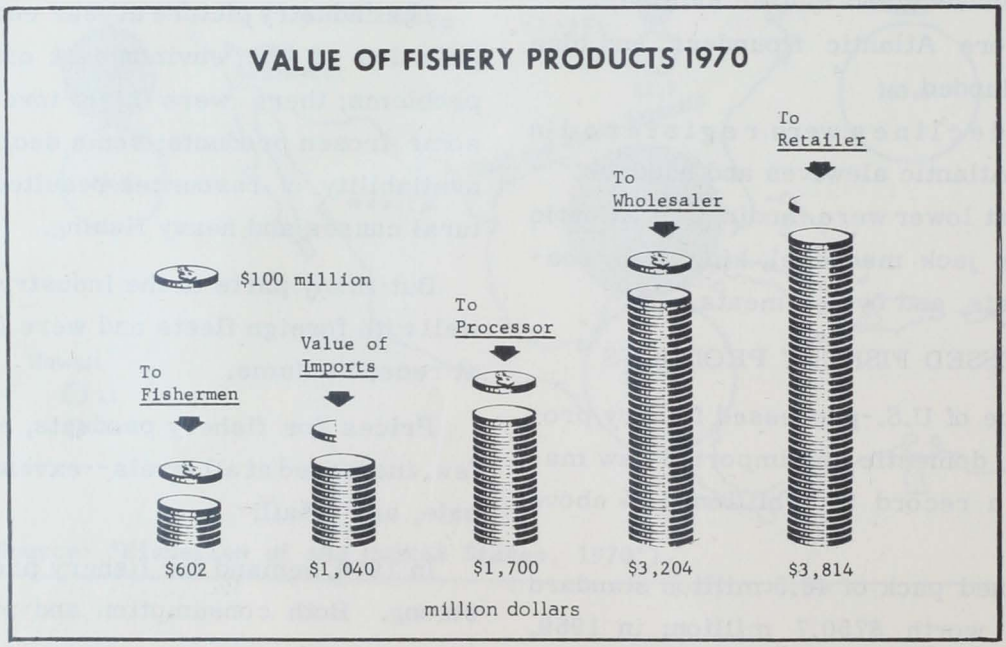
But many parts of the industry competed well with foreign fleets and were functioning at record volume.

Prices for fishery products, excepting a few, increased at all levels--exvessel, wholesale, and retail.

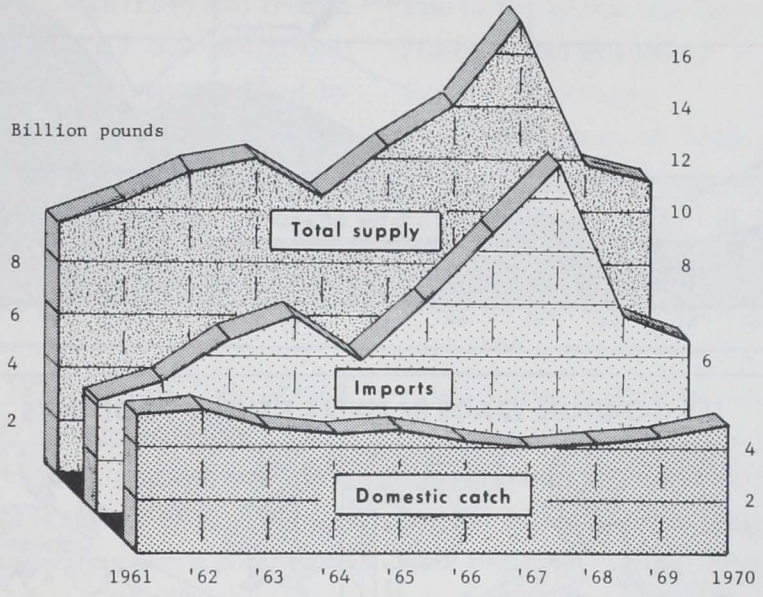
In 1970, demand for fishery products was strong. Both consumption and prices rose.

On the average, Americans ate more fishery products in 1970--11.4 pounds--than in any year since 1953.

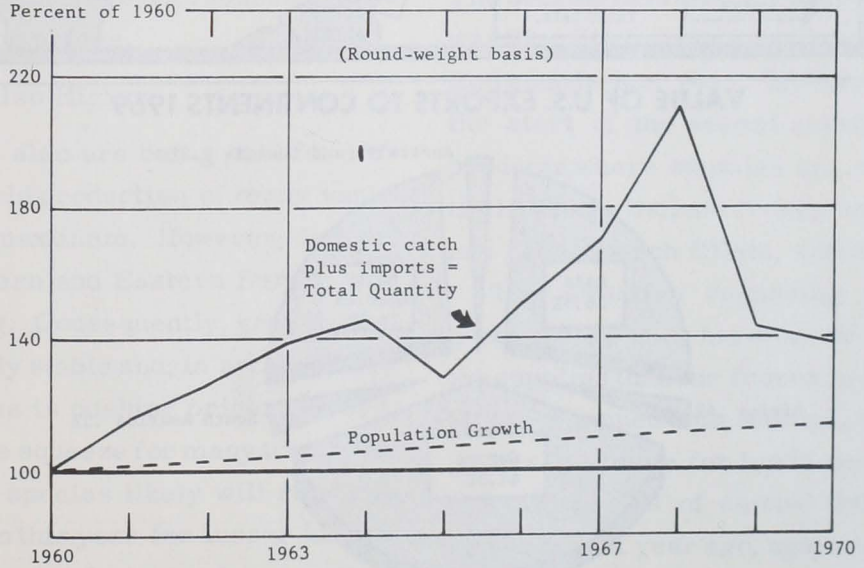

NUMBER OF FISHERMEN AND FISHING CRAFT, 1930, 1950, AND 1968
1930
1950
1968
= 5,000 Fishermen
= 10,000 Fishing craft

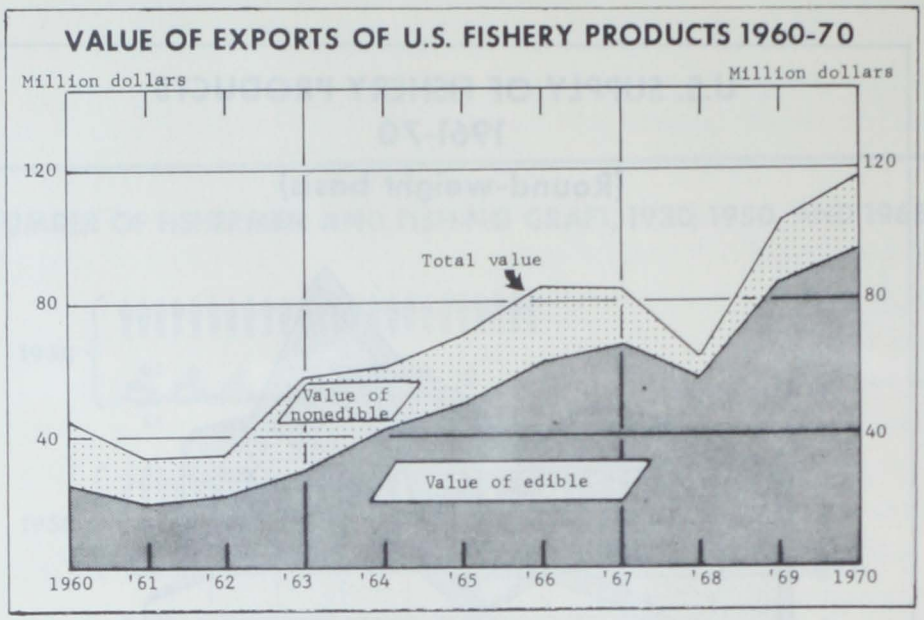

VALUE OF FISHERY PRODUCTS 1970
$100 million
To Fishermen
Value of Imports
To Processor
To Wholesaler
To Retailer
$602
$1,040
$1,700
$3,204
$3,814
million dollars

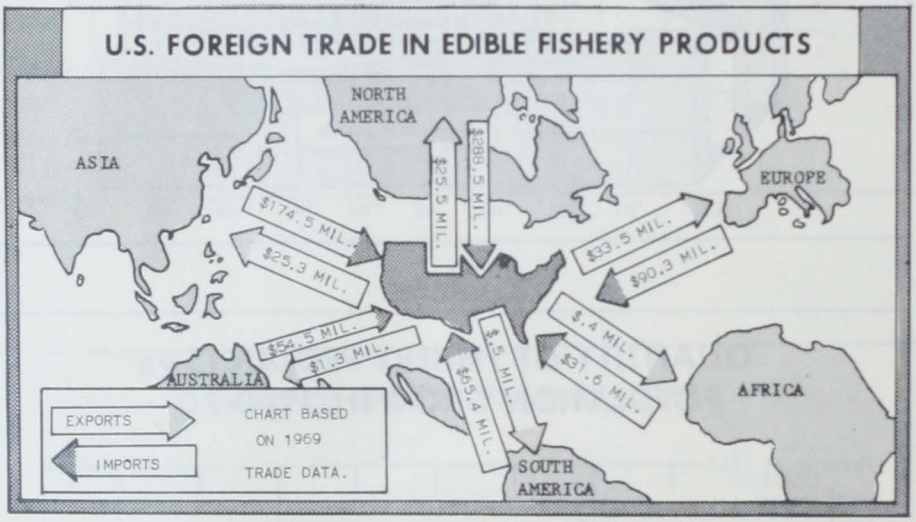
U.S. SUPPLY OF FISHERY PRODUCTS 1961-70 (Round-weight basis)

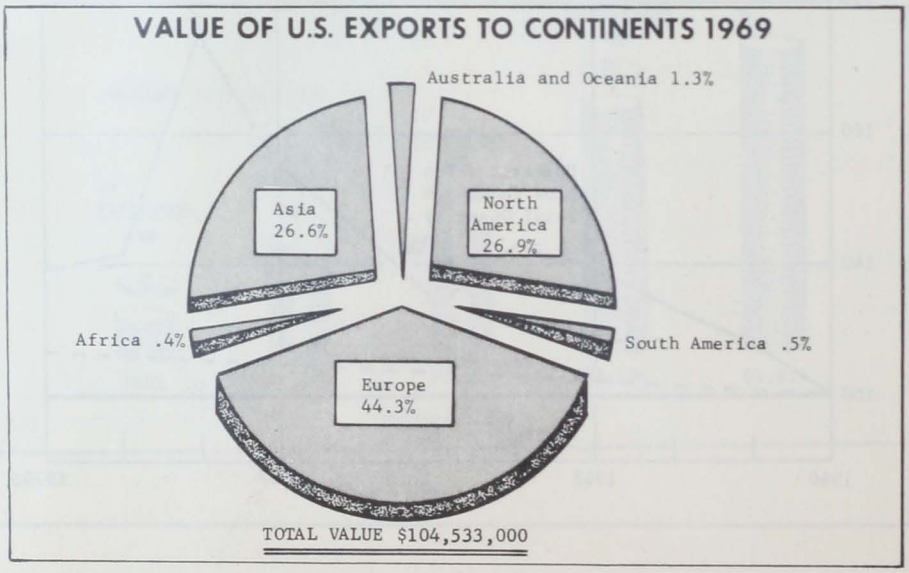


QUANTITY OF FISHERY PRODUCTS vs. POPULATION GROWTH, 1960-70




VALUE OF EXPORTS OF U.S. FISHERY PRODUCTS 1960-70
Million dollars
Million dollars
120
80
40
Total value
Value of nonedible
Value of edible
1960
'61
'62
'63
'64
'65
'66
'67
'68
'69
1970


U.S. FOREIGN TRADE IN EDIBLE FISHERY PRODUCTS
NORTH AMERICA
ASIA
EUROPE
AUSTRALIA
AFRICA
SOUTH AMERICA
$25.5 MIL.
$289.5 MIL.
$174.5 MIL.
$25.3 MIL.
$33.5 MIL.
$90.3 MIL.
$54.5 MIL.
$1.3 MIL.
$.5 MIL.
$65.4 MIL.
$.4 MIL.
$31.6 MIL.
EXPORTS
IMPORTS
CHART BASED ON 1969 TRADE DATA.


VALUE OF U.S. EXPORTS TO CONTINENTS 1969
Australia and Oceania 1.3%
Asia 26.6%
North America 26.9%
Africa .4%
South America .5%
Europe 44.3%
TOTAL VALUE $104,533,000

FISHERY PRODUCTS SITUATION

Donald R. Whitaker
NMFS Division of Current Economic Analysis

In 1970, per-capita consumption of edible fish and shellfish was 11.4 pounds--up from the 11.1 pounds in 1969. Both fresh and frozen and canned products gained 0.2 pound per capita. These gains were partially offset by a 0.1-pound drop for cured products. The net gain of 0.3 pound in 1970 was one of the largest year-to-year increases in several years. The higher consumption of fishery products was even more impressive in light of sharp gains in prices for most items.

In first-quarter 1971, retail fish prices continued their steady upward advance. They advanced 3% from previous quarter and were 12% higher than first-quarter 1970. Higher fish prices reflect not only general increase in prices and rising costs of doing business--but also the sharply higher prices processors are paying for raw fish. Higher raw-material costs account for most of the gains in consumer prices. Prices likely would be higher if marketing margins were not reduced to ease some pressure on prices.

Imported Fish Also Higher

Higher prices also are being paid for imported fish. World production of many varieties is at about maximum. However, demand in the U.S., Western and Eastern Europe, and Japan is growing. Consequently, growing demand on relatively stable and, in some cases, declining supplies is pushing prices upward.

The cost-price squeeze for many traditionally popular fish species likely will result in some substitution this year for lesser known, more abundant, and relatively cheaper varieties of fish. These substitutions are likely to occur first in the school lunch programs, fast-food chains, and in fish and chips outlets. The latter group has been faced with sharply rising menu prices.

Fresh and Frozen

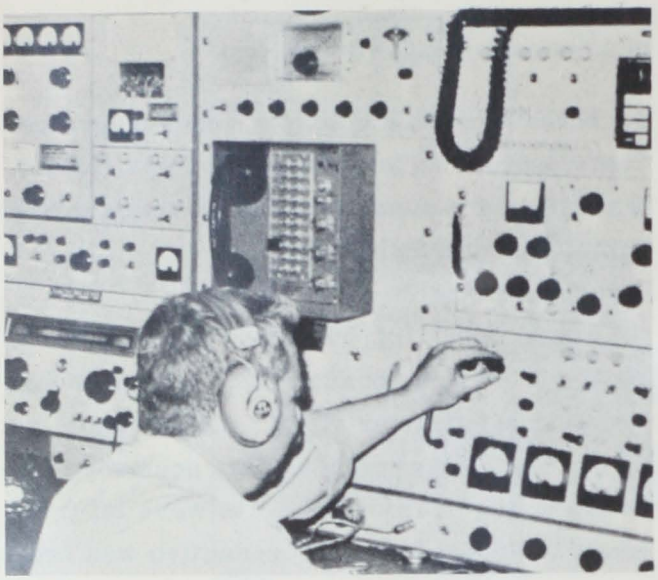
Consumption of fresh and frozen fishery products in first-quarter 1971 was probably below first-quarter 1970. Lower supplies rather than higher prices likely accounted for most of the decline. Imports were off from early 1970, and domestic production was seasonally low in the first quarter.

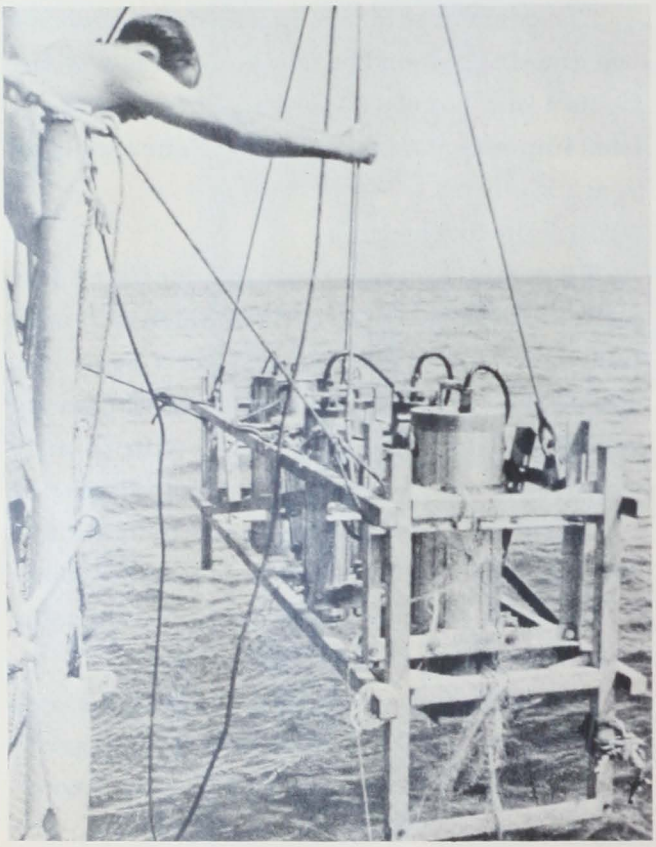
The current shortage in world fish supplies and growing demand in other countries is reflected in a nearly 30-million-pound drop in fish imports during January-February this year.

Decline in Inventories

To partially compensate for declining imports, withdrawals from inventories of frozen fish have been much larger than a year ago. The decline in inventories in the first quarter was 99 million pounds compared with 76 million pounds last year. Inventories on hand at the start of the second quarter indicate few products where supplies are relatively plentiful. These include frozen salmon, flounder and ocean-perch fillets, and whiting.

The situation regarding canned fishery products is somewhat more favorable regarding supplies than for frozen products. Inventories of canned tuna, salmon, and shrimp are generally ample for trade needs. In coming months, prices of canned fish likely will be higher than a year ago, again reflecting rising costs of raw fish. Only Maine sardines are likely to be limited.





(Top) Communication center aboard NOAA National Ocean Survey's newest ship, the 'Researcher'. (Bottom) A deep-sea camera is lowered from NOAA's 'Oceanographer'.

(Top) Readying a plankton sampler. (Bottom) Multisensor package senses salinity, conductivity, temperature, and depth. It relays these measurements to electronic equipment in research ship's oceanographic laboratory.

U.S. ANNOUNCES FIRST FEDERAL PLAN FOR MARINE ENVIRONMENTAL PREDICTION

A comprehensive U.S. program in Marine Environmental Prediction (MAREP) services was announced on April 28 by the Federal Coordinator for MAREP, Dr. Robert M. White, NOOA Administrator.

Its purposes are to integrate all Federal marine environmental monitoring systems, to improve these systems, and to provide better prediction and warning services to people working in the marine environment.

MAREP's Scope

For MAREP purposes, the marine environment is the deep ocean, coastal zone, and Great Lakes. "MAREP includes analyzing and forecasting the physical, chemical, biological, and hydrodynamic states of the ocean and the overlying atmosphere, and their interaction."

Nine Federal agencies will contribute to MAREP services costing an estimated $125.4 million in FY 1971 and $145.2 million in FY 1972.

Commercial ship operators and fishermen are among the primary users of MAREP services. In the past five years, 249 U.S. flag vessels in merchant and fishing categories alone were lost because of flooding caused by storms and other severe environmental conditions. The MAREP system is designed to reduce undue exposure to these conditions by providing timely warning information.

MAREP services for civilians include many in public recreation--bathing, surfing, boating, and sport fishing. The coastal warning system, tide predictions, and radio warnings to boaters are particularly valuable.

MAREP services also are useful for defense purposes.

A basic MAREP service is the program's core. It is composed of "observational or monitoring networks, analysis and forecast centers, telecommunications services, and other facilities maintained by the Federal agency participants." This basic service provides data analyses and forecasts used by the public, government agencies, and by specialized groups.

Cost of the basic service is estimated at $67 million in FY 1971, and nearly $78.2 million in FY 1972.

5 SPECIALIZED SERVICES

Besides the basic service, there are 5 services for specialized users:

- For Maritime Navigation: In addition to NOAA's marine meteorology service, this consists primarily of Coast Guard management and operations of the International Ice Patrol, and Department of Defense sea-ice observations and forecasts in the Arctic and Antarctic.

- For Water-Pollution Control: A large part is the water-quality program of the Environmental Protection Agency (EPA), assisted by Interior's Geological Survey measurements and Transportation's Coast Guard monitoring services.

In FY 1972, plans for service improvement include expansion of monitoring service and research. This will cover monitoring hazardous materials by the Coast Guard; NOAA research in estuarine and coastal-zone physical processes and the ecology of estuarine waters; research by Atomic Energy Commission on radionuclides and their pathways to man, and on effects of waste heat from nuclear-power reactors; EPA's projects in water-quality control technology and in water-quality requirements research; and research by NASA in applying remote-sensing techniques.

• For Fishery Interests: Primarily, this is maintained by NOAA's National Marine Fisheries Service (NMFS). It includes fishery biology surveys and assessment: 1) short term to locate fish concentrations, and 2) developing long-term capability to forecast abundance of classes--and the major environmental changes that influence abundance and distribution (the ecological patterns).

A major new NMFS program--the Marine Resources Monitoring and Assessment Program (MARMAP)--will begin in FY 1972. Its initial estimated cost: $5,147,000.

• For Mineral Exploration: NOAA's Marine Minerals Technology Center is studying ways to develop techniques for predicting the probable effects of marine mining on the environment.

• For Specialized Military Application: The Department of Defense conducts many services. These serve other groups in a limited way--for example, antisubmarine warfare systems.

Fig. 1 - A Sea of Alewives in Burnham Harbor, Michigan. (Photo: Bob Langer, Chicago Sun-Times)

There have been vast die-offs of alewives in the Great Lakes in recent years. Research shows that alewives cannot tolerate excessively cold waters, although they may not die immediately. If water temperature warms rapidly in spring, the added stress of adjusting to it could trigger mass deaths.

The Great Lakes alewife is small. Adults average about $6\frac{1}{2}$ inches and weigh about 2 ounces.

THE GREAT LAKES:
Their Grim Problems Persist

In 1970, nearly half (48%) of fish taken out of the Great Lakes by commercial fishermen were alewives. A pound of alewives brought a fisherman about one penny. The continuing predominance of this extremely low-value fish is a continuing hardship for fishermen.

The fisheries of the Great Lakes never approached the tonnage of the major marine fisheries, but for many years they involved high-value fishes and contributed appreciably to the region's economy.

Despite this decline, the Great Lakes remain vitally important to the whole Nation. A fairly easy drive for about 25% of the population, they offer many recreational opportunities, including sport fishing. How their living resources are managed concerns everyone.

The near-shore waters and the Great Lakes and their adjacent waterfront are among the most valuable in the U.S. They are used for shoreline development, transportation, the recovery and exploitation of living and mineral resources, National defense, waste disposal, wildlife preservation, and recreation.

MAN'S HAND

The Great Lakes reflect their abuse by man. The population crowding the lakes' shores has accelerated the deterioration of water quality. The input of nutrient materials--largely nitrogen and phosphorus from man's activities--has produced eutrophication, the aging of lakes.

Lake Erie has been hit hardest, with lakes Ontario, Michigan, Huron, and Superior following in its wake. Although Lake Erie is not dead, it is far from the body of water people enjoyed 20 years ago. Southern Lake Michigan and parts of Lake Ontario show some Erie symptoms.

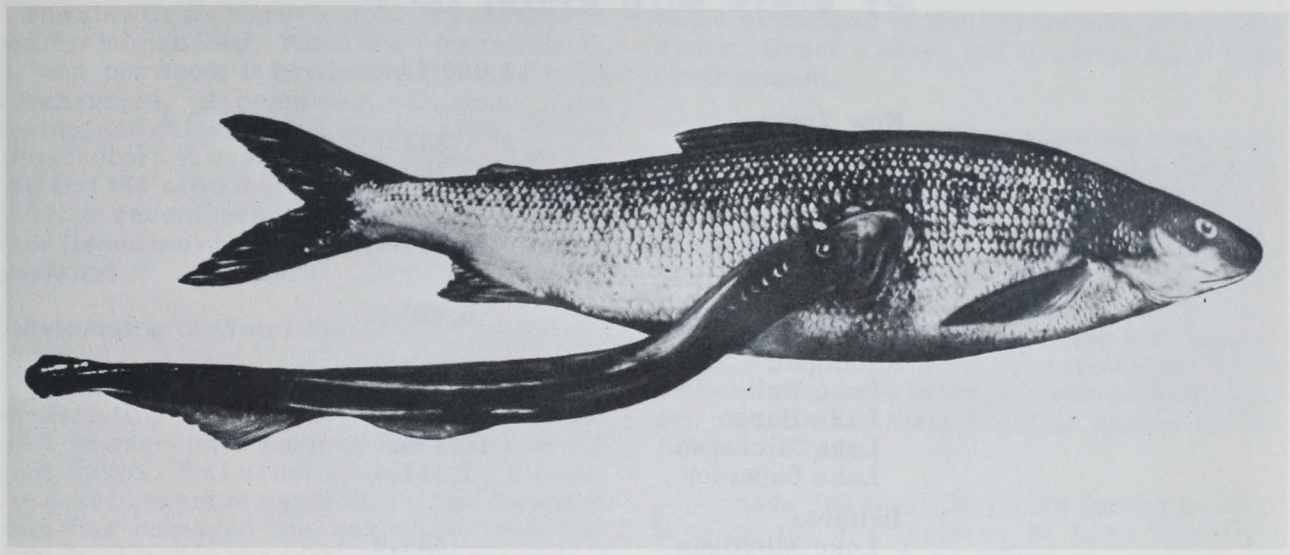


Fig. 2 - Great Lakes whitefish with sea lamprey attached to it.

The fisheries have suffered much from the deterioration of water quality. The annual catch in Lake Erie has not decreased with accelerated eutrophication, but less-desirable species have replaced more-desirable game fish. This came about because spawning and rearing areas had been contaminated or destroyed. Pollutants and sediments changed the bottom fauna, and this altered the food supply of the game fish. Only the fish that could tolerate these changed conditions--the less-desirable species--could thrive.

The radical change in the kinds of fish they caught was bad news to fishermen, and to biologists. The percentage of high-value lake trout, whitefish, blue pike, and walleye declined sharply. The only increases were in low-value species: chubs, carp, yellow perch, and alewives.

THE SEA LAMPREY

The sea lamprey played an important role in damaging the economic productivity of the Great Lakes. The lamprey had been landlocked in Lake Ontario, but the deepening of the Welland Canal between 1913 and 1918--a convenient route around Niagara Falls--gave it entry to the other Great Lakes. Lake Erie's water conditions prevented large destruction of its desirable fishes, but lakes Michigan, Superior, and Huron suffered devastation of some of their most valuable fish stocks. The lamprey nearly wiped out the lake trout and whitefish in lakes Michigan and Superior. The toll of burbot was very high. Lake trout once were worth more than $4 million a year; by the 1960s, they had dropped below $100,000.

WHY DID LAKES DECLINE?

No single reason explains the decline of the Great Lakes fisheries. Even before the sea lamprey appeared, biologists say, the fish life in the Great Lakes was "relatively thin, with fragile and unstable relations among predators and their prey." Also, the biological balance was upset dramatically "by a series of shocks: the introduction of exotic species, some from salt water and some from fresh; man's own selective fishing activities; and the flagrant pollution and misuse of the coastal zones of the Great Lakes."

The biologists say, too, that the Great Lakes are relatively new waters. Fish have not had enough time to become a stable system fully using the lakes' biological capacity--as happens in older waters of comparable size and composition.

Major causes include the physical nature of the Great Lakes, great commercial pressures, and lack of farsighted public policy.

The lamprey invasion had other significant effects. Fishermen put more pressure on the remaining valuable species--with grave effects on these populations and the number of predators. Partly as a result of this pressure, the population of another saltwater fish, long known in Lake Ontario, the alewife, exploded in lakes Huron and Michigan about 1955.

GREAT LAKES COMMERCIAL LANDINGS by State and Lake, 1970

	1,000 Lbs.
New York:	
Lake Ontario	333.0
Lake Erie	200.6
Pennsylvania:	
Lake Erie	505.5
Ohio:	
Lake Erie	8,420.0
Michigan:	
Lake Erie	420.1
Lake Huron	2,410.5
Lake Michigan	16,196.7
Lake Superior	2,141.4
Indiana:	
Lake Michigan	334.6
Illinois:	
Lake Michigan	405.2
Wisconsin:	
Lake Michigan	36,154.2
Lake Superior	1,560.7
Minnesota:	
Lake Superior	1,306.5
	70,589.0
	(70,589,000 pounds)

PERCENTAGE OF 1970 U.S. CATCH BY REGIONS

Gulf States	35%
California	14%
New England & Middle Atlantic	13%
Chesapeake States	13%
Alaska	11%
	86%

The remainder: South Atlantic, Washington, Oregon, Hawaii, and inland waters. Great Lakes and Mississippi River catches combined were 129,000,000 pounds -- 3% of total U.S. catch.

The alewife was unwelcome. It could not be used for human food. When used for fishmeal, oil, and pet food, it brought very little cash to fishermen. It competed with chubs, lake herring, and shiners. But in one area, it was a plus factor: it was excellent forage fish for trout and the coho and chinook salmon introduced in recent years. The success of the latter fishes may be attributable partly to the abundance of alewives.

Deterioration of Water Quality

Vast amounts of industrial wastes and oxygen-depleting organisms fertilized by processed sewage have harmed the fishes of the Great Lakes. Soil erosion caused by the unwise development of agriculture and forested areas has damaged the nearshore environment. Herbicides and pesticides have reached dangerous levels. The relentless pressure by industry and commerce for lake-trout locations has hopelessly damaged the shoreline environment. Fish production declined sharply.

WHAT'S AHEAD FOR THE LAKES?

No one package of recommendations can end these problems. Inevitably, the land-water interface of the Great Lakes will become more congested. Industrial concentration and increasing population in the North Central States will harm the environmental quality in all Great Lakes.

But there is cause for a little optimism. Both government and public have become more conscious of the importance of coastal zones, Great Lakes, and the total American environment.

The sea lamprey's depredations have been virtually arrested. A chemical--the lampricidal agent TFM--has been used successfully in Lake Michigan and Lake Superior to destroy the lamprey during its early development. Two or three parts of TFM in a million parts of water are lethal to the larvae, while not affecting most other fish and aquatic species. Since TFM has been used, lake trout and whitefish have increased substantially and are reclaiming their rightful places in the lakes.

Canada and the U.S. joined forces in controlling the sea lamprey in Lake Superior.. The situation in Lake Michigan permits rehabilitation of valuable predator species. Steelhead are doing well in several areas. Experimental plants of coho salmon in Lake Michigan foreshadow a major new sport fishery and some commercial harvest.

U.S. and State fishery researchers are defining the management problems that have to be resolved before anything close to the "most desirable balance of species and harvesting" can be achieved. This means more than "restoring" the Great Lakes fisheries. Because biological relations were so unstable in the past, it is important to select suitable species and harvesting methods.

Despite these awesome problems, scientists who have studied the Great Lakes say they can make sizable contributions to the public good.

Rehabilitating the Fisheries

The disasters of the past 2 decades have reduced the fisheries to a few men and vessels. So, ironically, it becomes easier to reestablish a commercial fishery in the Great Lakes than it would be in a marine setting. Planners recognize that while reestablishing a fishery it is necessary to balance the commercial and sport efforts and to limit the number of operating units. They believe that gear more efficient than the traditional gill and pound nets and traps would lower operating costs.

The planners recognize that the potential of Great Lakes fisheries in tonnage or value

GREAT LAKES LANDINGS

1897-1908	U.S. landings averaged 102.3 million pounds
1914-1928	85.3 million pounds
1929-1963	Average of only 75.9 million pounds. The 1963 U.S. catch was 55.8 million pounds, the lowest on record.
1966 and 1967	Sharp increase in harvest of alewives, an extremely low-valued species, boosted total. Total landings were held up by large Canadian catches.

is not large. In a list of national fishery priorities, the lakes would offer less promise than many marine fisheries. Yet they are well worth saving.

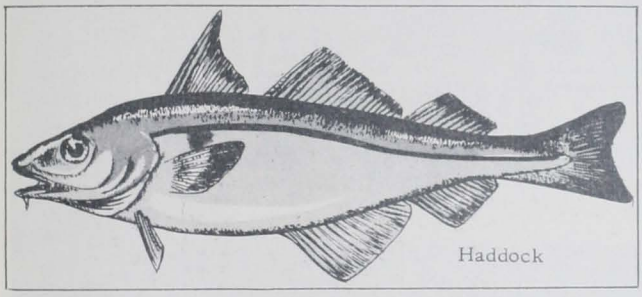
A strong national effort to control pollution now and in the coming years would permit the rehabilitation of most Great Lakes waters.

In its 1969 report, the Commission on Marine Science, Engineering and Resources emphasized the need for "full regionalization [U.S. & Canada] of Great Lakes fisheries program." The Commission stated that any plan to restore Great Lakes would be a tremendous undertaking. Present technology dealing with the freshwater environment is not oriented toward solving problems of Great Lakes magnitude--but marine science is so oriented. Marine science and technology should be used to study restoration of the Great Lakes.

Fig. 3 - Alewife Fishing Craft. (Photo: Bob Williams)

NORTH ATLANTIC HADDOCK STOCKS CONTINUE LOW

Scientists of the NMFS Woods Hole, Mass., Biological Laboratory predict that haddock stocks off New England, now under restrictive international fishery quotas, will remain at present low levels at least through 1973. The very low abundance of spawning stock is seriously reducing the probability of good reproduction.


Haddock

NMFS is responsible for wise use and conservation of marine fish resources.

The international quotas were set by the 15-member-nation International Commission for the Northwest Atlantic Fisheries (ICNAF); the U.S. is an active member.

NMFS Survey Cruises

Estimates of the haddock population size and abundance of juvenile haddock follow groundfish survey cruises aboard the laboratory's research vessel 'Albatross IV'. These have been conducted each spring and fall since 1963. Data for the 1970 cruises, and the 1971 spring survey just completed, indicate no significant change in population size during 1970--the sixth consecutive year of poor reproduction.

ICNAF Quota

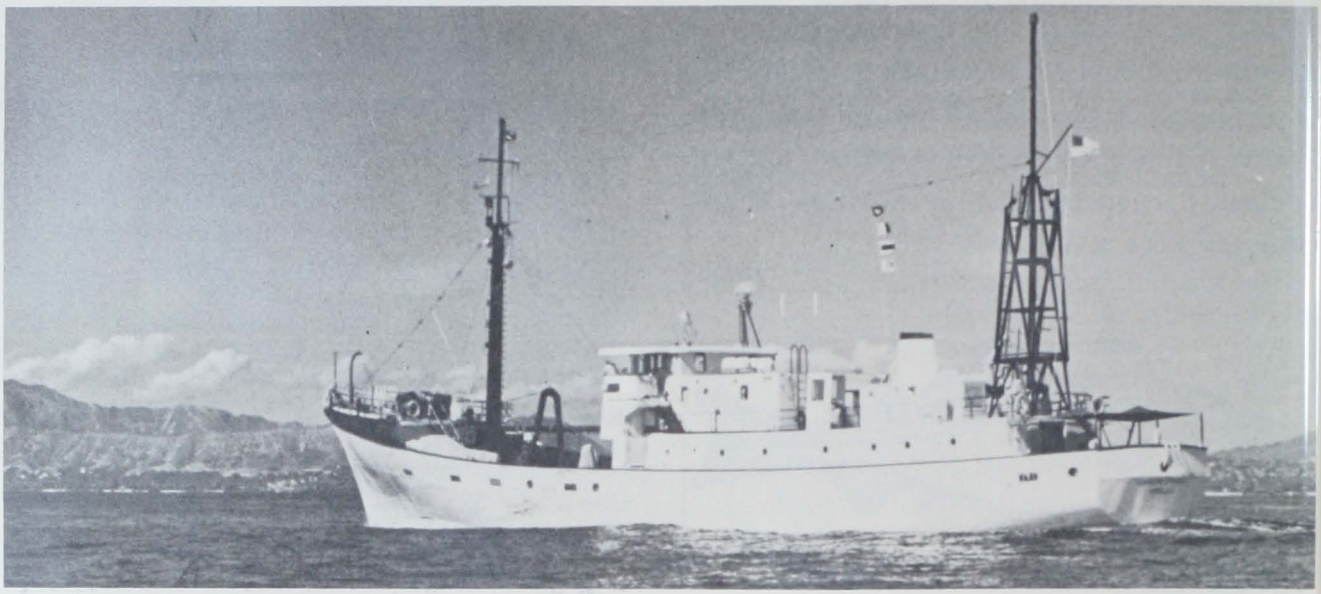
The ICNAF member nations established a 12,000-ton international quota for haddock in New England waters in 1969, effective in 1970. They closed to fishing certain spawning areas during March and April of three calendar years: 1970, 1971, and 1972.

In 1970, 11,660 metric tons, 97% of 12,000-metric-ton international quota, were caught by foreign and U.S. fleets operating off New England. The U.S. fleet landed 9,864 metric tons. These domestic landings compare with a U.S. long-term, pre-1965, average of approximately 50,000 metric tons. Daily landings of haddock declined to 4,500 pounds, an 18% decrease compared to 1969 and the lowest ever observed.

Difficult Period Ahead

Stock-assessment studies have indicated strongly that the 12,000-ton-catch quota through 1971-1972 will not provide for any recovery of haddock stocks. Also, at certain low levels of abundance, there is a direct relationship between size of spawning stock and probability of a successful reproduction. Scientists at the Woods Hole laboratory are concerned that any further reduction in stock size may threaten the continued existence of the haddock species in New England waters.

THERE ARE COMMERCIAL CONCENTRATIONS OF SHRIMP IN HAWAIIAN WATERS



The research vessel Townsend Cromwell

NMFS scientists aboard the 'Townsend Cromwell' have confirmed the existence of commercial concentrations of shrimp in Pailolo Channel between the Hawaiian islands of Molokai and Maui. This was reported by Dr. Frank J. Hester, Area Director of NMFS Hawaii Area Fishery Research Center (HAFRC), when Cromwell returned home after a 47-day cruise in local waters.

Part of the cruise continued the investigations begun by HAFRC 3 years ago. At that time, commercial concentrations of opaelolo, Hawaiian red shrimp, were found in Pailolo Channel, off Molokai's northwest coast and on Penguin Bank's north edge.

One objective of the recent cruise was to check seasonal abundance of shrimp populations. The survey showed no difference in size over the 3-year period, according to fishery biologists Dr. Bruce E. Higgins and Paul J. Struhsaker.

Live specimens were taken for behavioral studies at HAFRC Kewalo Basin facility.

Best Catches

Best catches were made with a Gulf-of-Mexico-type "semi-balloon" shrimp trawl. This produced 324 pounds of shrimp during a series of five 2-hour trawl hauls.

Stern-trawling experiments with a large midwater trawl also were conducted off the Waianae coast.

Performance characteristics of the gear were checked directly by divers who observed and photographed the net in action. Depth-sensing units provided indirect observations on trawl performance in depths beyond the divers' range.

The midwater trawl is an efficient sampler of young tunas and other pelagic fishes, Higgins and Struhsaker reported.

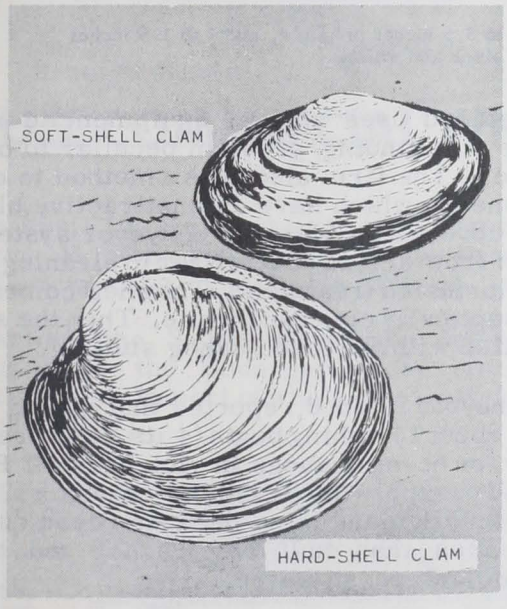
HAFRC scientists are interested especially in the distribution in local waters of the young skipjack tuna, aku, the basis of Hawaii's pole-and-line fishing industry. Assessment of the aku is a current objective of the Honolulu laboratory.

OCEAN QUAHOG BECOMES MORE IMPORTANT AS SURF & BAY CLAMS DWINDLE

Government and industry efforts have encouraged fishermen to become more interested in the ocean quahog, reports the New England Marine Resources Program.

The quahog is native to large parts of the Continental Shelf along the Atlantic Coast from Cape Hatteras, North Carolina, to the Arctic Ocean in depths of 6 to 90 fathoms.

Joseph M. Mendelsohn, research chemist, NMFS Technological Laboratory, Gloucester, Mass., says the offshore species, Arctica islandica, is the best available shellfish resource. This is because overfishing and pollution are diminishing the quahog's popular relatives--the surf and hard-shell clams.



Supplies Decreasing

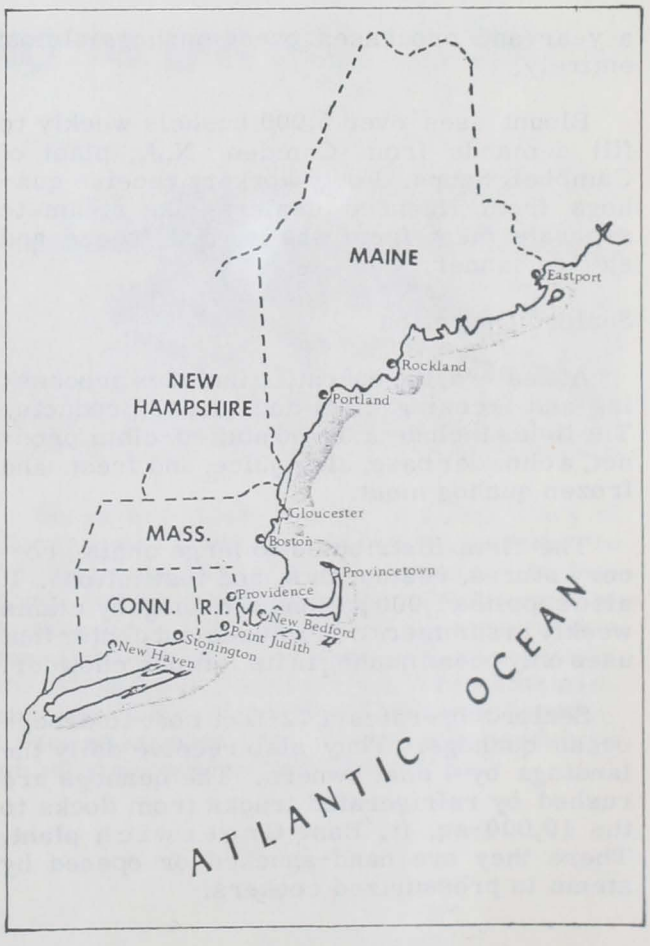
Once thought inexhaustible, resources of hard clams (Mercenaria mercenaria), sea clams (Spisula solidissima) and soft-shell clams (Mya arenaria) are dwindling rapidly; at the same time, demand is increasing constantly.

So food marketers are looking more to the ocean quahog (known too as mahogany quahog or black quahog) as a staple. If this clam is developed fully, it could lead to a steady market for fishermen year round along entire Northeast Atlantic Coast.

Dredging Ocean Quahogs

Rhode Island and nearby Stonington, Connecticut, fishermen are dredging ocean quahogs and landing them at Sakonnet Point, Point Judith, and Stonington. The quahogs are processed at Blount Seafood Corp., Warren, R.I., and at Sealord, Inc., East Greenwich.

Blount's president, Fred Richardson, regrets the disappearance of the bay quahog (hard clam) because of pollution and other reasons. He says: "At one time, Narragansett Bay was the best setting ground in the world for this hard clam, and we derived 76% of our production from this area." Blount now handles only a few thousand bushels of the bay species



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.

a year and processes ocean quahogs almost entirely.

Blount uses over 5,000 bushels weekly to fill demands from Camden, N.J., plant of Campbell Soups. Forty workers receive quahogs from licensed dealers, use steam to separate meat from shells, and freeze and ship to canner.

Sealord Operation

At Sealord, the operation includes processing and freezing clam and quahog products. The items include a baked stuffed-clam product, a chowder base, clam juice, and fresh and frozen quahog meat.

The firm distributes to large chain grocery stores, restaurants, and institutions. It also supplies 1,000 gallons of mahogany clams weekly in summer to an amusement center that uses only ocean quahog in its famous chowder.

Sealord operates a 72-foot boat to dredge ocean quahogs. They also receive daily the landings by 4 boat owners. The quahogs are rushed by refrigerated trucks from docks to the 10,000-sq. ft. East Greenwich plant. There they are hand-shucked or opened by steam in pressurized cookers.

Sealord uses special equipment to overcome a desanding problem peculiar to ocean quahog. The firm also uses a method to clean the shells, which have an unattractive black-skin covering. A 4-step conveyor system is used: from acid to neutralizer to cleaning bath to chlorinated treatment. The shell comes out antiseptically clean and white. Then the shell is filled with Sealord quahog stuffing.

Brayton Seafood reported that during Feb. 1971 about 15 fishing boats (4 its own) dredged daily for ocean quahogs in rich beds off Block Island to supply Rhode Island processors. The firm said demand is up because ocean quahog cost less than half bay quahog and come from clean ocean water.

Estimates of Quahog Crop

NMFS' Mendelsohn says conservative estimates of ocean quahog crop between Cape Hatteras and Canada are 100 to 150 million bushels. Based on world harvest figures, U.S. production could reach sustained annual yield of about 150,000,000 pounds of meats. NMFS is encouraging fishermen and processors to explore possibility of ocean quahog for year-round fishing and processing--particularly in Gloucester-Boston-Cape Cod-Rhode Island areas. NMFS exploratory surveys have

demonstrated that available resources would justify the ventures.

NMFS Gloucester Lab Research

Scientists of NMFS Gloucester Technological Laboratory have shown that ocean quahog can be used in many ways. It can replace bay clam in clam cakes, clam potato cakes, poultry clam stuffing, deviled clams, and Manhattan chowder. The scientists found mahogany to have a "robust" clam flavor. The medicinal or iodine flavor was found only in quahogs that came from beds where the clams feed on a specific alga. This problem can be overcome by not fishing those beds--or by "shallow-water relaying": transferring them to beds that produce clams without this undersirable flavor.

The Gloucester lab has shown that the source of this medicinal flavor is water soluble. Several washings can eliminate it.

Mahogany is harvested closed, so it is harder to shuck. Meat color varies from cream to gray. One processor has method for bleaching it to the more desirable white.

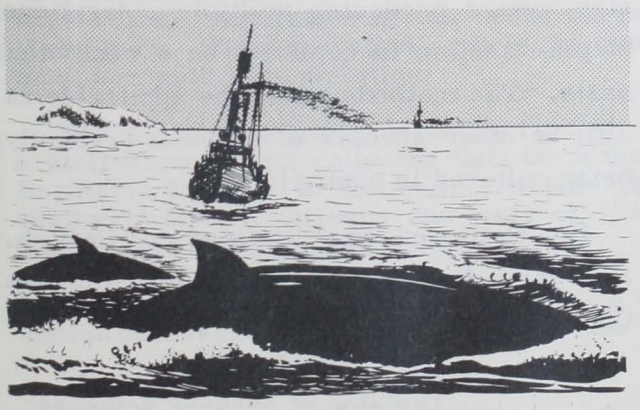
Ocean Quahog Survives Its Family

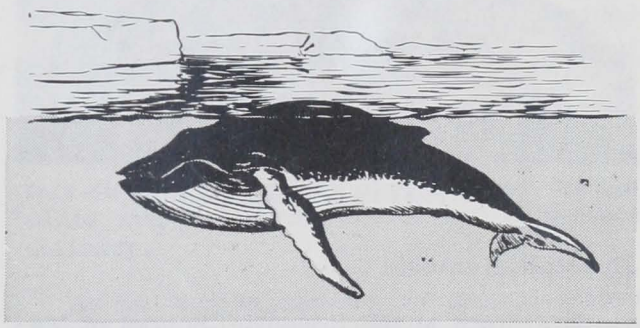
Ocean quahog is the only known surviving species of family Arctididae. This is only one of families in large group of bivalve mollusks. The latter have two opposed shells hinged together at top. At one time, the ocean quahog was thought to be a European species only.

U.S. COMMERCIAL WHALING TO END DEC. 31, 1971

On April 19, Secretary of Commerce Maurice H. Stans reaffirmed his decision to halt U. S. whaling. The date is Dec. 31, 1971.

Earlier, the Secretary of the Interior, acting under the Endangered Species Act, decided to end import of whale products after the end of 1971.

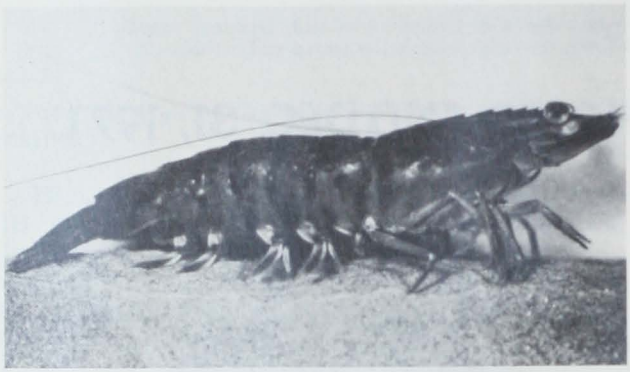




Secretary Stans said: "As Secretary of Commerce, I will do everything possible to soften the impact of this decision on the Nation's one remaining whaling company and its employees. I am directing agencies within the Department of Commerce, specifically the Economic Development Administration and the National Marine Fisheries Service, to see what can be done to alleviate hardships which may result from this action."

INDUCED MATURATION OF OVARIES & OVA IN PINK SHRIMP

Full development of successful mariculture of shrimp, Penaeus spp., will depend in large measure upon control of the entire life cycle of these animals in captivity. Gravid female shrimp collected on the spawning grounds can be induced to spawn, and their fertilized ova can be reared into shrimp of marketable size in captivity. Methods of inducing maturation of ovaries and ova in reared shrimp are now required to provide the necessary year-round control of the reproductive cycle.



Adult pink shrimp--Penaeus duorarum.

Eyestalk Removal

Scientists at the Rosentiel School of Marine and Atmospheric Science, University of Miami, Florida, have used the long-established technique of eyestalk removal as a means of inducing female pink shrimp, Penaeus duorarum Burkenroad, to mature in captivity. The eyestalks of decapod crustaceans contain glands which secrete an ovary-inhibiting hormone. Thus eyestalk removal eliminates the source of this inhibitory hormone and allows maturation to proceed.

Ripe Ovaries in 1-2 Weeks

In a research project directed by Dr. Charles W. Caillouet Jr., Associate Professor, Division of Fishery Sciences, a female pink shrimp developed ripe ovaries containing ripe ova within one to two weeks after bilateral eyestalk removal. Since the eyestalkless females matured in experiments conducted in May, July, and November 1970, Dr. Caillouet feels that maturation can be achieved year-round by eyestalk removal. Maturation was induced in females reared from ova in captivity, as well as in females collected from the spawning grounds. The project was sponsored by Armour and Company and United Brands Company.

Important First Step

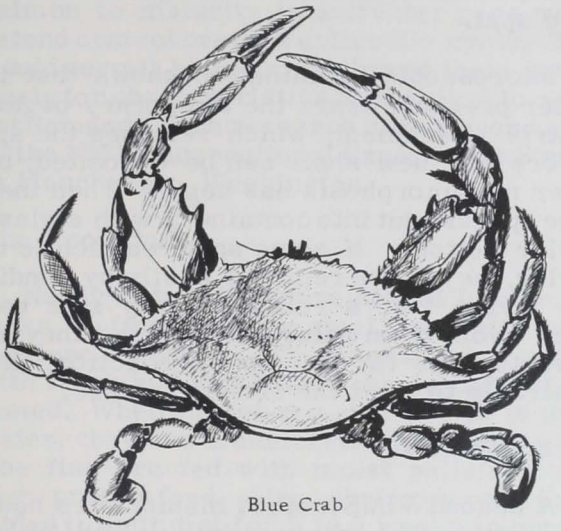
This work represents an important first step toward producing multiple generations of pink shrimp in captivity on a controlled basis. The methods should be applicable as well to other species of Penaeus presently being cultured in captivity.

Dr. Caillouet was assisted by Gary L. Beardsley, Research Assistant, and Nicholas Chitty, Graduate Assistant.

--Dr. C. P. Idyll, Chairman,
Division of Fishery Sciences,
Rosenstiel School of Marine and
Atmospheric Science,
University of Miami,
Miami, Florida 33149

BLUE CRABS ARE SUSCEPTIBLE TO POLLUTION OF SHORELINE

Catches of blue crabs, important to commercial and sport fishermen, may be reduced by industrial and agricultural pollution of the shoreline environment.



Blue Crab

Studies by Eugene Jaworski, Texas A&M University's Department of Geography, have established that blue crabs migrate from one environment within an estuary to another to meet the physiological requirements of their different life cycles.

Jaworski explains: "The low salinity area in the upper reaches of an estuary is a vital one because maturation of the crabs takes place here. This shoreline area is the one most susceptible to pollution."

For a year, he made periodic trips with crab fishermen and collected data from the Barataria Estuary in Louisiana, which is southwest of New Orleans and west of the Mississippi River.

Fishermen were the best source of information on locations of the crabs because fishing patterns reflect the seasonal distribution of commercial-size crab populations. A tagging system was not practical because of the blue crab's molting pattern.

Jaworski identified 3 main subhabitats of the blue crab: the areas where it matures, winters, and spawns.

The Seasons

During winter, crabbing is most successful in the lower, highly saline waters of the estuary. As spring approaches, crab-fishing areas become larger. Water temperatures begin to rise, and adult males and immature juveniles migrate toward lower salinity waters of upper estuary. Pregnant females begin to spawn in the lower estuary and adjacent marine area.

By late March, "sponge crabs," females in process of extruding eggs (protected by law) cause fishermen to abandon high salinity waters of lower estuary.

"The crab population reaches its widest distribution during summer months, and upper estuarine waters yield the highest catch," Jaworski explains.

"Soft-shell" crabs are most numerous in this shallow, shoreline environment. Caught while molting, these crabs are a seafood delicacy.

As fall begins, molting and spawning stop. Females mate after final molting and migrate again toward tidal inlet entrances. Small juvenile blue crabs are in lower estuary and along Gulf. Adult males and large juveniles stay near shoreline until decreasing water temperatures force them back toward lower reaches.

By mid-December, crabbing in the upper estuary ends, and the winter season begins.

VIMS IMPROVES METHODS OF PRODUCING 'CULTCH-FREE' SPAT

A major obstacle to developing seed oysters in commercial hatcheries at reasonable cost has been the expensive washing and handling of bulky oyster and clam shells used as natural cultch. The development of "cultch-free" seed oysters may facilitate a hatchery operation that eliminates the use of shells for cultch and costly washing and handling. Scientists of the Virginia Institute of Marine Science (VIMS) are now concentrating on improving methods for separating spat from artificial substrate at a very early age--and then growing them in trays and tanks without cultch until they are large enough to be planted on beds.

Oysters pass through a free-swimming larval stage for about two weeks. After that, most larval oysters settle to the bottom, extend their fleshy feet, and crawl about seeking suitable substrate to attach themselves.

Producing Cultch-Free Spat

The first successful method developed at VIMS for producing cultch-free spat is based on the natural sequence of changes that begins when the well-developed larval oyster (eyed larva) attaches to a shell or artificial substrate. The method is accomplished when oyster larvae change their structure to become juvenile oysters (spat). The first period when the newly set oyster can be removed easily from the cultch is while the spat is developing gills, and after the food and velum have begun to disappear; it is before sufficient new shell is produced for permanent attachment.

Two VIMS Methods

VIMS has developed one method for growing the spat in relatively clear estuarine areas after removal from substrate. A second method grows them in areas with muddy waters.

In the first method, it is important to remove oyster spat before they become attached permanently. While massive setting of eyed larvae is taking place in the setting trays, a strong stream of river water is applied to a commercial plastic sheet (Mylar) on the bottom surface of the setting tray at 1-to 2-hour intervals. This yields cultch-free spat.

Microscopic examination shows that the water pressure tears the temporary organic matrix attachment, which releases the spat before any new shell can be deposited, but after metamorphosis has begun. Then these free spat are put into containers with a glassy Mylar bottom. If some spat reattach to the Mylar, they can be removed easily by bending the Mylar over a roller. Heavy sets have been avoided on natural cultch, but they are advantageous for free spat production. It is desirable to limit the setting surface.

Second Method

A second VIMS method manipulates newly set oyster spat where siltation and fouling are serious problems. Removal of newly set spat from Mylar sheet is delayed 19 to 21 days. A new setting tray, frames, and tank were designed to manipulate efficiently the setting, growth, and removal of spat. The Mylar sheets on which larvae spat have set are mounted in frames that hold the sheets vertically in the tank to minimize the accumulation of silt and trash around the oyster spat. Untreated river water is circulated to the holding frames, then spills over a ledge into an auxiliary tank.

Study Nursery Techniques

VIMS also is investigating development of nursery techniques or methods of growing cultch-free spat to sizes resistant to predators, such as crabs, fish, drills, and starfish. Unlike clams, oyster spat are unable to reattach or dig into substratum, so they are washed away easily or are covered by silt. The challenge VIMS accepts now is to grow cultch-free spat in trays or ponds to a size suitable for planting in oyster beds.

SALTWATER FARM-RAISED SALMON MARKETING PROGRAM IS BEING TESTED

Salmon have long been an important food resource in the Pacific Northwest. To supplement natural production, Federal and State agencies operate freshwater hatcheries, where young salmon are reared until ready to migrate downstream to the sea. Rearing salmon to maturity in saltwater pens would extend control over the entire life cycle. This would permit biologists to breed them selectively for characteristics best suited to market demand. Such research is being conducted by the NMFS Aquacultural Experiment Station in Manchester, Washington.

The Procedure

Newly hatched fry are placed in circular tanks of fiberglass or steel lined with polyethylene sheeting. The tanks are supplied with fresh and salt water; the salinity is adjusted. When the fish are able to live in saltwater, they are transferred to floating pens. The fish are fed with moist pellets, a wet, high-protein feed. Also, shrimp meal can be added to their diet for 5 to 6 weeks to control the redness of their flesh. This feed is supplemented by naturally occurring plankton and other small forms of sea life carried in with the tidal currents.

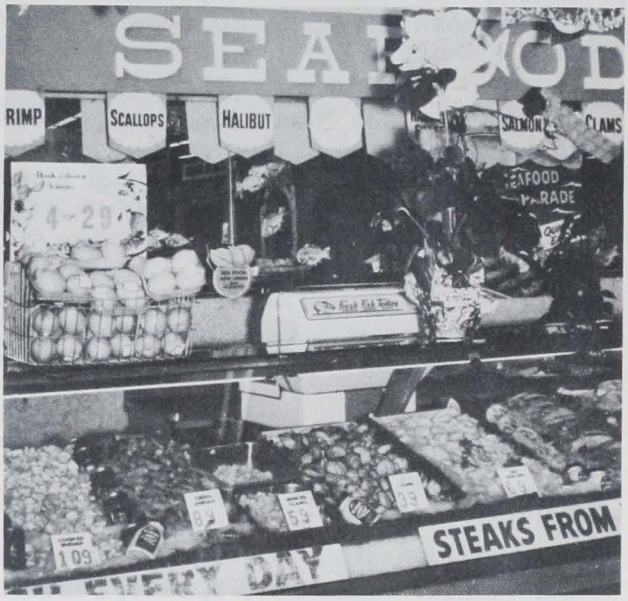
Under such ideal conditions, salmon grow much faster then they do in the natural pattern of extended freshwater life. They are ready for market as trout-sized fish in 18 months or less.

Test-Marketing Underway

The NMFS Marketing specialists are test-marketing these salmon to get public reaction. They are distributing samples to major retailers, wholesalers, and restaurant operators in selected metropolitan cities to determine their interest. They are gathering information on market form desired--dressed head-on, dressed head-off, or boned, the size or sizes preferred, the price acceptable to buyers, and the flesh color preferred (degree of redness).

A Firm's 1972 Plans

In January 1972, Ocean Systems, Inc., a division of Union Carbide, operating under a NOAA Sea Grant, will have 400,000 salmon



The Testing Area

available for market. These fish are being raised with NMFS technical assistance and will be available fresh and/or frozen throughout the year. If this pilot program is successful, the company will raise about 2.5 million fish to be marketed starting January 1973.

Salmon Shipped

Approximately 300 fish have been shipped to Boston, New York, Baltimore, Washington, Tampa, and Minneapolis for distribution by the NMFS Marketing staff to selected potential buyers. Already, the staff has commitments for the sale of about 300,000 pounds. The retail chains are requesting fresh salmon 12 to 16 ounces in the round and/or dressed. The restaurants and distributors that service restaurants are asking for 14 to 16 ounces dressed, and 12 to 14 ounces boned, both fresh and frozen. In July and August, 1,000 more fish will be test-marketed in several restaurants to obtain consumer reaction.

Gus Morel, Acting Chief, Division of Marketing Services, reports that the Seattle seafood firms, and wholesale, restaurant, and retail merchandisers contacted throughout the U.S. are enthusiastic about the salmon they have seen. They are eager to try selling the salmon when they become available in January 1972.

SEA GRANT FOR SALMON CULTURE

The success of NMFS salmon-culture experiments has encouraged a private firm to adapt and expand the system for possible commercial production.

With a $100,000 NOAA Sea Grant, Ocean Systems, Inc., based in Reston, Va., will try to show the feasibility of a commercial-sized pilot operation to raise pan-size salmon from egg to market size in Puget Sound, Wash., enclosures.

NMFS Biological Laboratory, Seattle, Wash., will assist.

The $100,000 will be matched by the firm, plus nearly $160,000 more. The firm's principal investigator for the project is Jon Lindberg.

The project began Nov. 1, 1970, because of the Pacific salmon's spawning cycle and the need to get the best results with summertime cultivation. The firm has bought and installed incubators and hatched 670,000 coho salmon eggs. These were obtained from the Washington State Department of Fisheries. Also, about 400,000 chinook salmon fry of a selected strain were gotten from Dr. Lauren Donaldson, University of Washington. Coho and chinook fry are now in fresh-water ponds.

In late May, the fry will be transferred to floating net pens in the open water of Puget Sound. They will be fed a prepared fish food until they weigh about one-half pound, and then be harvested.

Market conditions will determine harvest time and fish size.

Many Pioneered

Many people prepared the way for this project. Washington State has had salmon hatcheries since 1895. Today, about 30 hatcheries continuously rear 15,000,000 chinook, coho, and chum salmon for release at normal migrating time into salt-water pasturage.

Oregon State University research has shown that fry of several Pacific salmon species may be adapted to sea water before their normal time to exploit the high efficiency of feed conversion in salt-water rearing.

NMFS Seattle laboratories conducted salmon-culturing experiments to reduce pen cultivation to practice. The labs developed a relatively quick method of rearing salmon intensively. Floating pens in flowing tidal water ended many of the problems that obstructed earlier work. These experiments inspired the Ocean Systems project.

3-Phased Project

Ocean Systems project has 3 phases:

Salmon now are being cultured for market;

With aid of NMFS Division of Marketing, there will be test marketing and cost evaluation of the cultured salmon;

Federal, state, and local agencies will be provided information and guidance on aquaculture principles, compatibility with other water uses, and possible changes of fishery laws to permit commercial salmon culture. The results will be made public and may be used.

Coho or Silver Salmon

The coho or silver salmon was chosen "primarily for its resistance to disease, voracious feeding, history in culture experiments, and value as a food fish. The chinook, another highly desirable species, was included to obtain comparative results."

Salmon have several advantages for culture: They are much sought as food, grow rapidly, and their hatchery technology is perhaps most highly developed of any marine fish. Also, Puget Sound's abundant marine resources make possible intensive fish culture, using much clean flowing salt water.

STRAIT OF GEORGIA BOASTS ANNUAL 'PEA SOUP' OF PHYTOPLANKTON

During May, the Strait of Georgia between Vancouver Island and British Columbia explodes into a vast "pea soup" bloom of phytoplankton (microscopic algae). It happens every spring, when mountain snows melt and wash rich nutrients into the icy ocean waters. A month-long expedition sponsored by the National Science Foundation and the Foundation for Ocean Research was on hand for the blooming this May.

Its work is essential to continuing studies on fat metabolism in marine ecological systems by the Scripps Institution of Oceanography, University of California, San Diego.

Marine food-chain research also is planned to seek better understanding of who eats whom and why in the ocean environment.

Copepods End Hibernation

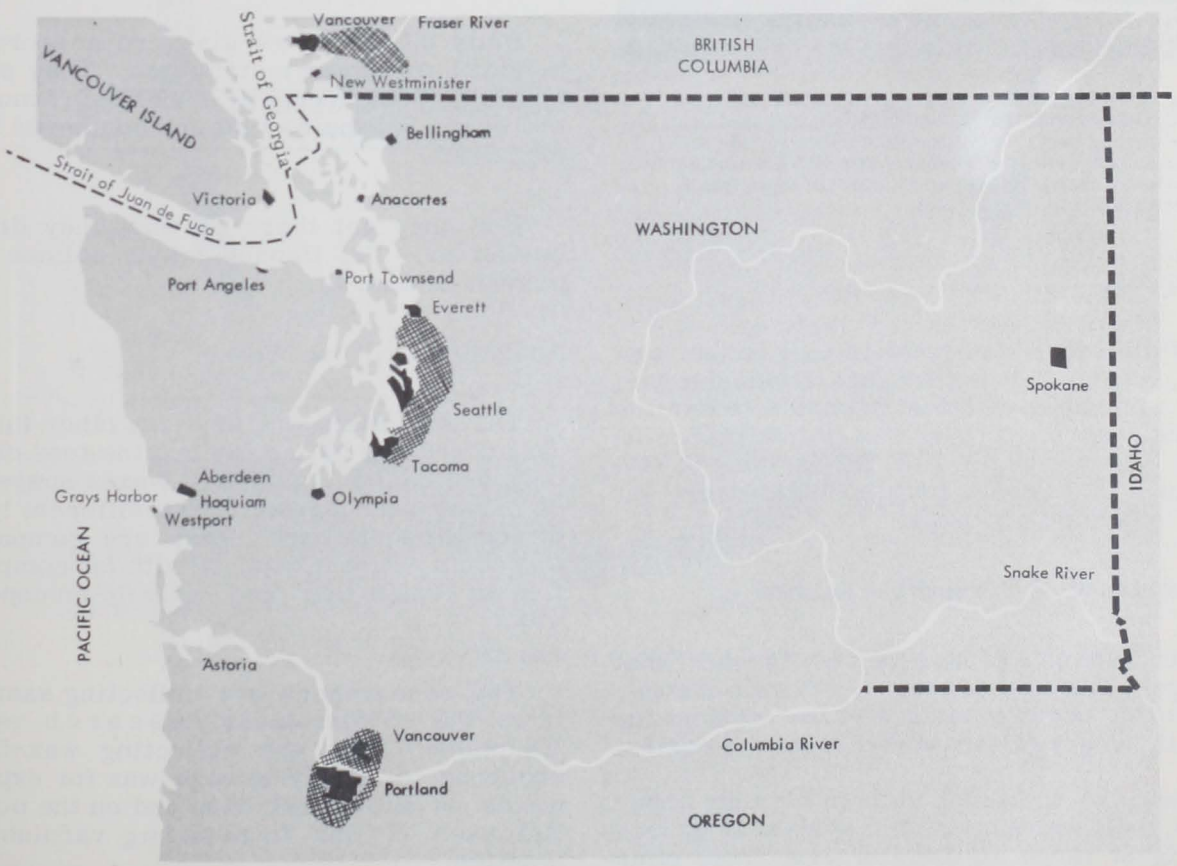
About the time the algae bloom, copepods--tiny, shrimplike marine organisms--end their winter hibernation in the cold, dark waters near the bottom of British Columbia inlets. They rise to within 30 feet of the surface and begin grazing on phytoplankton.

Copepods have interested Dr. A. A. Benson, director of Scripps's Physiological Research Laboratory (and biologist Richard Lee) for the last 3 years. Copepods are the predominant marine animals small enough to consume microscopic algae in the ocean. They are thought to be the first animal link in marine-food chain.

Insects of the Sea

These "insects of the sea" change the extremely polyunsaturated algae fat into polyunsaturated liquid waxes. They store these in oil sacs to be used as reserve energy during periods of starvation.

Up to 50% of the dry body weight of Vancouver copepods is stored liquid wax. This



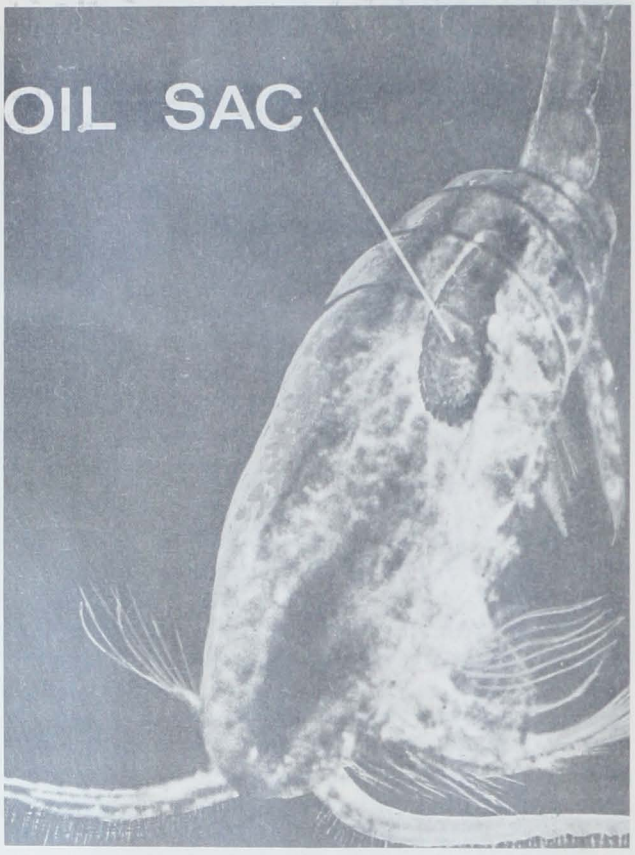


Fig. 1 - Enlarged photo of $\frac{1}{8}$th-inch marine copepod 'Calamus', "insect of the sea." Oil sac is toward rear of its tiny body. Wax is used for energy storage and food supply during periods of starvation and hibernation in long winters. Wax is made from oils of algae that it eats (darker area below sac).

makes them some of the world's waxiest copepods.

While copepods are swimming to the surface, where they eat freshly bloomed algae, baby chum and sockeye salmon are swimming downstream from their river birth places on their way to begin life in the open ocean. About 4 or 5 inches long, the salmon fry eat only wax-rich copepods.

Coincidence of Copepods + Salmon

Dr. Benson's group hopes to discover what triggers this coincidence--the return of copepod to the ocean's surface at the moment the small, hungry salmon arrive from the rivers.

Because the young salmon eat only copepods, their whole metabolic system is geared to digest large amounts of wax. They offer scientists the most specialized example of wax digestion.

Sardines, anchovies, and herring also feed, though not exclusively, on copepods--but these species are difficult to catch in the open ocean. Vast numbers of bay chum and sockeye salmon are easily available when they swim through the Strait of Georgia in May.

Second Animal Link

Salmon fry are the second animal link in the marine food chain. They digest copepod wax and turn it into a fatty alcohol; they convert this into fatty acids. Fatty acids are the common fats that human beings eat.

However, to perform this chemical conversion, fatty aldehyde must be involved in an intermediate stage. So far, no trace has been found in salmon. The scientists plan to look for it in the blood samples from young feeding salmon.

Fatty aldehydes also are a source of mystery in human metabolism. They occur as major components of human heart muscle and brain, but their existence has never been explained.

How they get there or what they do are mysteries. Dr. Benson thinks salmon may provide a clue.

Analyzing Copepod Waxes

The scientists are studying other things. To understand better the marine food chain, they are analyzing copepod waxes suspected of having been derived from different types of algae populations. They are comparing wax composition in copepod with fat composition in fishes that feed actively on copepod wax.

The researchers are collecting samples from the 95-foot ocean research vessel 'Dolphin'. They are collecting wax-filled copepods to isolate enough wax for experiments on animal nutrition and on the potential uses of wax in making varnish and plastics.

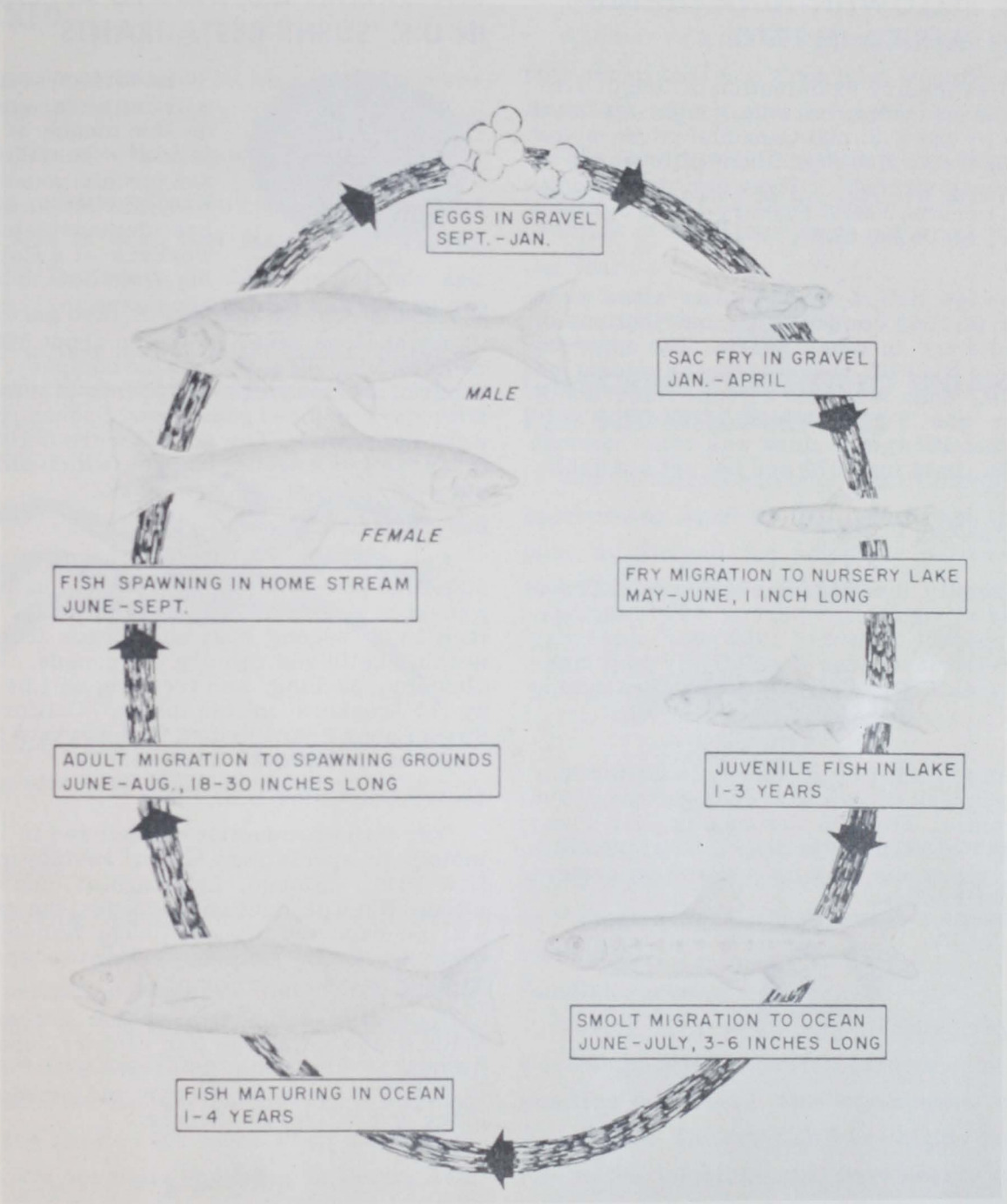


Fig. 2 - Life cycle of ths sockeye salmon.

POOR YELLOWFIN-TUNA FISHING OFF W. AFRICA IN 1970

A preliminary examination of length-frequencies of yellowfin tuna caught off West Africa by the U.S. and Canadian purse-seine fleet has revealed significant differences in year-class strength. The work was done by Dr. W. Lenarz, NMFS Fishery-Oceanography Center, La Jolla, Calif.

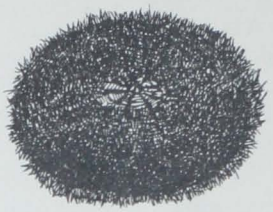
Very few fish of the 1968 year-class were caught in 1969 compared to contributions of the same age in other years. The apparent failure of the 1968 year-class was evident too in 1970. Data from the surface fisheries of France and French-speaking nations also show that 1968 year-class was below normal in 1969. Data for 1970 are not yet available.

Poor Fishing in 1970

Normally, the 1968 year-class would have yielded a significant part of 1970 landings. The apparent failure of 1968 year-class may be an important cause of relatively poor fishing by U.S. fleet in African waters during 1970.

Data from 1970 U.S. fishery indicated that 1969 year-class is much stronger than 1968 year-class. The high variance in year-class strength of Atlantic yellowfin contrasts with relatively stable recruitment in eastern tropical Pacific.

SEA-URCHIN GONADS TO APPEAR IN U.S. 'SUSHI' RESTAURANTS



Sea urchin

Lovers of seafoods will find an unusual one on the menus of U.S. 'sushi' restaurants: sea-urchin gonads. S. Kato of NMFS La Jolla has demonstrated to workers at a California firm how to process gonads for human consumption.

An abalone diver collected about 500 urchins and delivered them to the company. One hundred urchins yielded 11 pounds of gonads--after dark-colored gonads and broken pieces were discarded. The gonads were delivered fresh to a Los Angeles market, which shipped some to Chicago and New York.

800-1000 Lbs./Month

Initial monthly production will be about 800-1000 pounds. One diver and a helper in a boat can pick 1600-2000 urchins a day. Four men in a second boat will crack the sea-urchin shells and remove the gonads. Final cleaning, packing, and freezing will be done by 11 workers in the plant. California's Farm Labor Board helped find workers from ranks of unemployed field workers.

Entire Output for U.S.

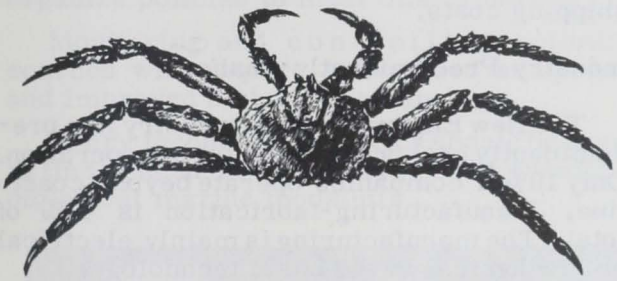
The entire production will be used in U. S., mainly in specialized 'sushi' restaurants in New York, Chicago, Los Angeles, and other cities. When production increases, the gonads will be exported to Japan. The fishery will begin when the company receives special packing trays.

Kato also demonstrated the processing methods to a San Diego fish dealer. Japanese importers are slated to arrive in San Diego in May 1971 to sample product and to negotiate price and delivery schedule.

ALASKA'S KING CRAB RESTRICTIONS RELAXED

Some restrictions in king crabbing were relaxed by the Alaska Board of Fish and Game, reported the 'Kodiak Mirror' on May 8.

The most significant was a change in the legal size of crab that may be taken along Alaskan Peninsula, in Aleutian Islands and the Bering Sea. A uniform $6\frac{1}{2}$-inch minimum king crab now may be taken instead of the 7-inch minimum previously required in most locations.



A closed season for king crabbing in Bering Sea also was established: April 1 through May 31.

Bering Sea

In Bering Sea fishery, shared with Japanese and Soviet fleets, the minimum-size crab permitted domestic fishermen will be $6\frac{1}{4}$ inches during March, June, July, September, and October. This size is a treaty provision. The months during which smaller crab are allowed are those when the foreign fleets are normally operating in Bering Sea.

The change to the smaller crab responds to the requests by king-crab operators during the past few years.

More Crab Pots

Another relaxation was an increase in crab pots permitted from Cook Inlet westward into Aleutians. The limit was raised from 60 to 75.

The previous limit in the eastern Aleutians remains 75 pots; in the western part of the chain, it is 90. There is no pot limit in Bering Sea.

CALIFORNIA CRAYFISH TO FINLAND FOR SCIENTIFIC PURPOSES

The California Fish and Game Commission approved on April 30 the capture and transport to Finland for scientific purposes of 100,000 Lake Tahoe crayfish.

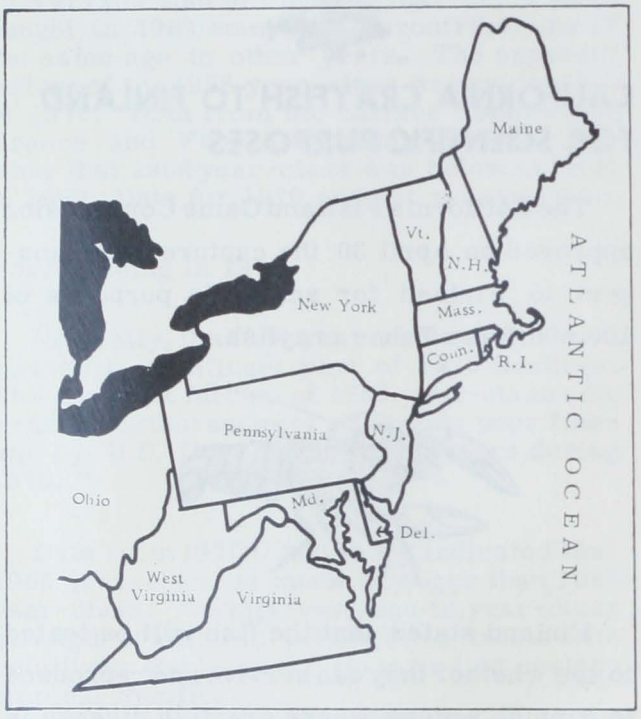
Finland stated that the fish will be tested to see whether they can survive and reproduce in Finnish waters, where crayfish disease is rampant.

Swedish Success

During 1967-1970, Lake Tahoe crayfish were shipped to Sweden for experimental restocking purposes. The experiments were successful. The crayfish were highly resistant to the infections that have nearly wiped out native lake crayfish.

NEW ENGLAND MARINE INDUSTRY MUST IMPROVE TO PROSPER, STUDY SAYS

If New England's marine industries hope to win future U.S. & world markets and allay growing public anxiety about the environment, they will have to improve their operations and originate new products and services. These are the central points of a study by the New England Aquarium of Boston, Mass., and the New England Marine Resources Information Program. W. R. Patterson of the Aquarium directed survey.



The survey focused on marine company. It excluded small fishing firms, local fish-processing and retailing firms, marine retailers, and marina operators. These form a sizable number of workers in marine-related business.

The report is a preliminary analysis of questionnaires sent to 405 regional companies; 131 (32.4%) usable forms were returned.

Patterson estimates there are 345 to 415 such firms in New England employing 110,000 to 130,000 persons. Estimates of sales for these companies ranged from a half-billion dollars to five billion.

FINDINGS

The study revealed that 43.6% of companies answering questionnaire had sales of under one million dollars a year; 2.9% sold over 200 million. Of the sales, 90.25% was in U.S. (38% of this in New England); 9.75% in world markets. Sixty-one of 131 companies reported some international sales.

The companies expected a 90% average increase in world sales in the next 5 years. They cited expanding foreign markets, especially Japan and Europe, need for their products, and their unique services. About 25% of firms have or expect problems because of foreign competition, import duties, and shipping costs.

Industry Predominantly Onshore

The New England marine industry is a predominantly onshore manufacturing operation. Only 10% of companies operate beyond coastline. Manufacturing-fabrication is 47% of total. The manufacturing is mainly electrical or mechanical in the basic technology.

The smaller, more highly specialized firms employing fewer than 50 persons had highest percentage (33%) of technically trained workers. On average, about 10% of all the employes are technically trained.

Sales are mainly to industrial-commercial and government-military customers.

Domestic Sales

The firms are optimistic about domestic sales growth in next 5 years: from 55% (transportation) to 163% (coastal-zone management). The reports cautions that latter sample was probably too small for accurate conclusion.

Companies in electronics-instrumentation, biological equipment-products-services, and research technology-design expect sales improvement.

Questionnnaire Comments

The study evaluates business practices: "The current corporate policies are attempting to follow the guidelines of the past and have not undergone critical reorganization for the next decade."

The report states: "Marine scientists must redirect their research, reestablish their thinking on the usefulness of the sea, and approach all investigations in a more socially related way."

Marine Environment Dominant Theme

Preservation and protection of marine environment will be dominant theme in marine development in next decade, the report predicts. Government aid may fall below industry expectations, so the latter will have to reorganize policies to meet this eventuality.

Monitoring and controlling pollution sources will require low-priced equipment and improved biological technology.

Every technological device should be used to find "cheapest way to harvest the premium biological marine foodstuffs."

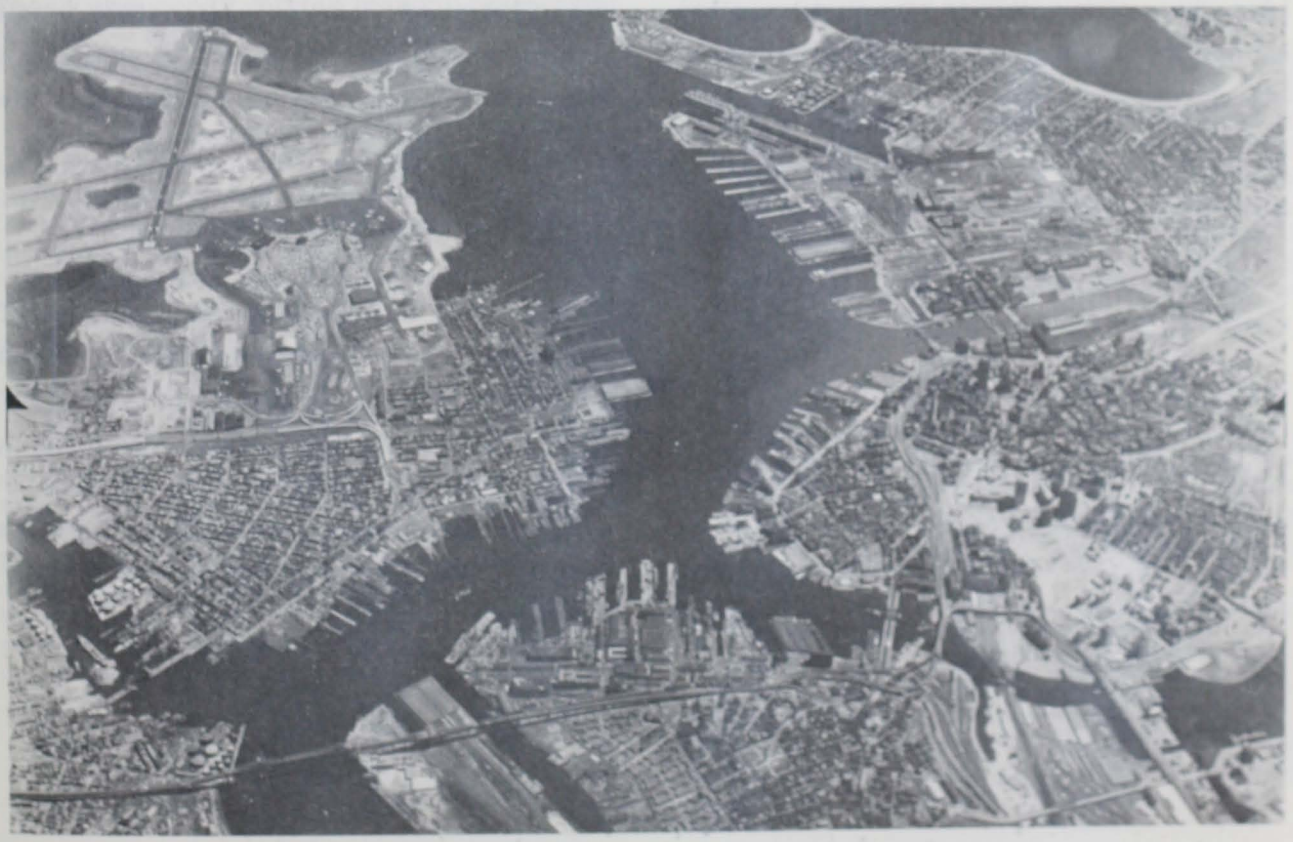
New ways must befound to use the coastal zone for recreation--and new recreational equipment to satisfy expected demand.

State and local governments will seek more control over the environment. The electronic data-processing part of the marine industry will expand with this movement. New ways should be found to gather the information sought.

Marine transport will be used more. This will create demands for hardware and equipment. Better methods to load and unload ships--and to prevent harbor and coastal pollution--will be needed.

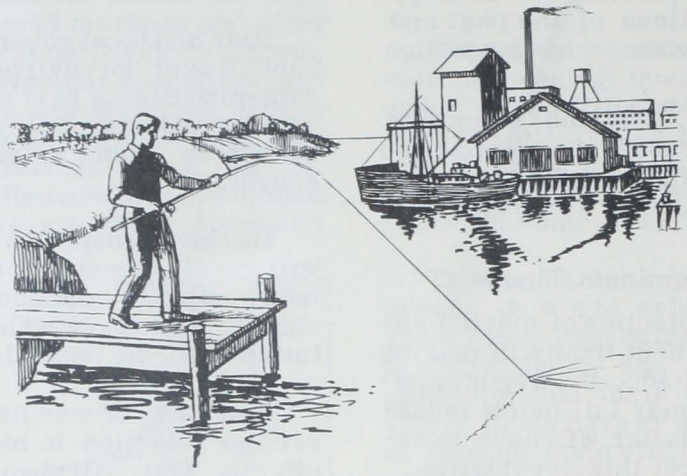
Man's use of marine environment will spur greater attention to biological studies of the effects. This will change "thrust of research and scientific development to more socially oriented programs."

Marine industry must contribute to development of new methods for coastal zone multiuse as state and U.S. land-use policies improve.



BOSTON HARBOR (Mass. Port Authority Photo)

MORE FISHING AND HUNTING LICENSES SOLD



In 1970, fishermen and hunters spent more than $192 million for licenses, tags, permits, and stamps--an increase of $9.3 million over 1969. This was reported by the Fish and Wildlife Service (FWS), U.S. Department of the Interior.

The number of fishing-license holders was a record 24,434,680--358,532 above 1969.

Fishermen spent $90,864,154 for licenses--$3.4 million above 1969.

Not Accurate Indicators

The agency cautioned that license sales are not accurate indicators of actual numbers because: (1) in several states, one sportsman may purchase separate licenses, stamps, permits, or tags for different fish species; (2) most states do not require persons above or below certain ages to buy licenses; (3) most coastal states do not require licenses for salt-water fishing; and (4) some persons fish in more than one state and are counted more than once.

Money For Conservation & Management

State fish and game departments certify the number of paid hunting and fishing license holders to the Fish and Wildlife Service. FWS uses the data--plus the size of State fishing and/or hunting areas--to determine how much money it will add to State funds for fish and wildlife conservation and management.

OCEANOGRAPHY

AUTOMATED DATA-GATHERING SYSTEMS BEING INSTALLED ON NOAA CRAFT

NOAA's National Ocean Survey (NOS) has acted to speed the acquisition of hydrographic survey data and the production of nautical charts. It is installing automated data-acquisition systems on 3 ships and 6 of their auxiliary 25-foot launches at a cost of $497,200.

The agency produces about 2,700,000 nautical charts a year for commercial shipping, small-craft operators, and the military.

Will Speed Charts

The new system was designed by Survey personnel. It will reduce appreciably the two years now required to produce a new chart from beginning of hydrographic surveying to publication of chart.

It should improve effectiveness of data gathering aboard hydrographic survey vessels because it will eliminate human errors. These now occur during manual conversion of data to digital format for later computer processing and chart compilation ashore.

The new systems also will provide for automatic control of vessels and launches over predetermined straight line courses as they conduct hydrographic surveys. This will increase still more the overall effectiveness and efficiency of the data-gathering process.

Significant Advance

The new systems are as much an advance over present manual system as use of echo sounder (sonar) was over methods used in early days of hydrographic surveying. At that time, the lead line was used to determine water depths and bottom characteristics. The development of echo sounding and exact electronic navigational control systems during the past 30 years has significantly improved hydrographic surveying.

NOAA EXPEDITION SEEKS CLUES TO AFRICA-NORTH AMERICA SPLIT

The first complete investigation of an entire ocean's sea floor is being carried out by NOAA scientists aboard NOAA's 'Discoverer'. The 10-week study in April, May, and June centers on a 250-mile-wide, 3,500-mile-long corridor from Cape Hatteras, N.C., to Cap Blanc, Mauritania, in northwest Africa.

The project is directed by NOAA's Atlantic Oceanographic and Meteorological Laboratories (AOML) in Miami, Fla., and by the National Ocean Survey.

The Cape Hatteras-Cap Blanc corridor was selected because many scientists believe it is the path North America and Africa took when they divided and began drifting apart 200 million years ago.

What Scientists Will Do

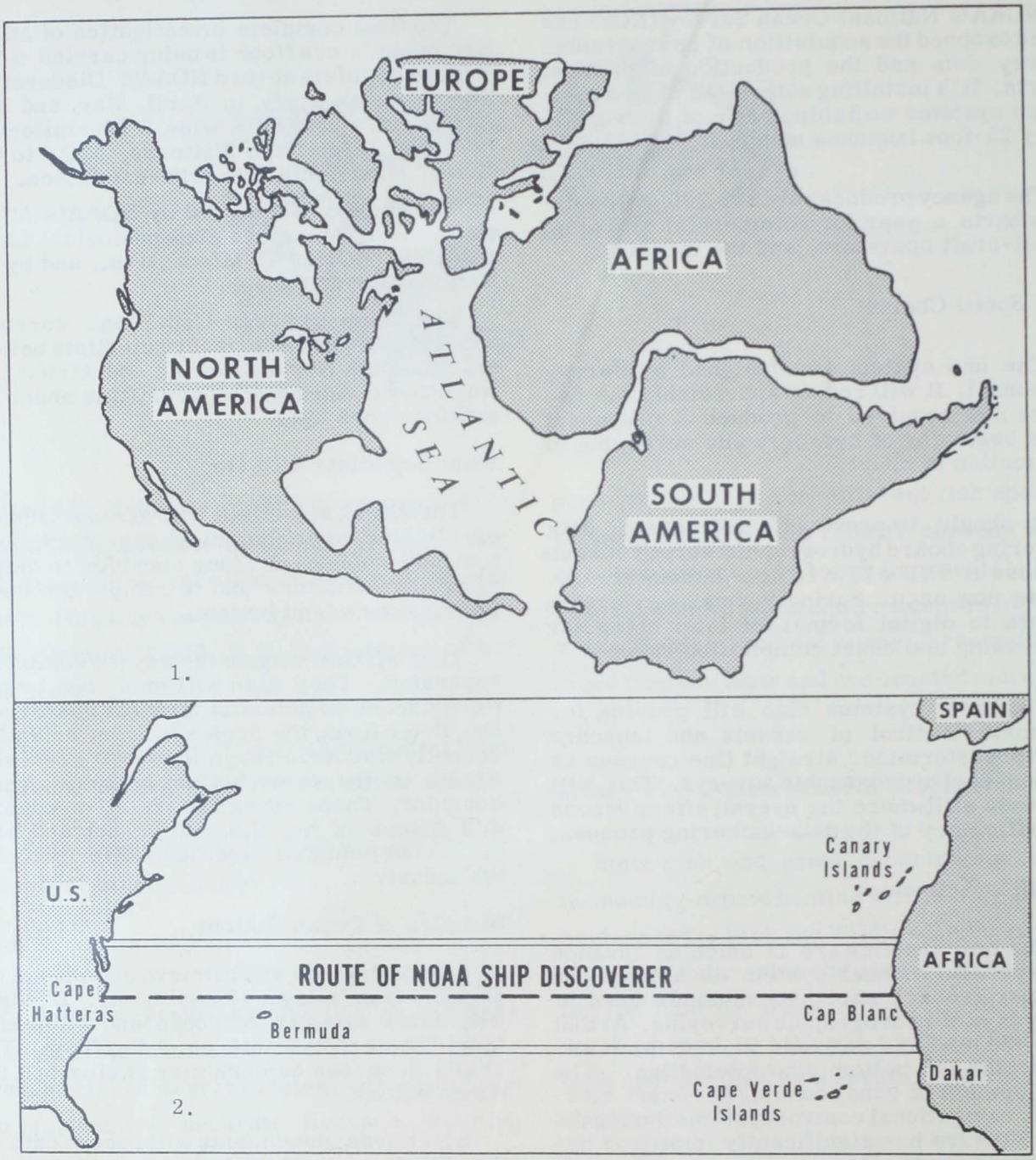
The NOAA scientists will use the Discoverer's electronic equipment to probe the bottom and subbottom along corridor to determine the structure and to sample the rocks forming the ocean bottom.

They will investigate the way the continents separated. They also will study sea bottom for evidence of potential mineral resources. Dr. Peter Rona, the project's chief scientist, recently discovered huge domes off northwest Africa on the ocean bottom within the same corridor. These resemble the oil-producing salt domes of the U.S. gulf coast and have "immense potential significance for petroleum industry."

Samples of Ocean Bottom

Coring devices will retrieve samples of the ocean bottom's layered sediments. Dredges will raise samples of rocks and sediments from chasm-like fractures of the floor. The ship's deep-sea camera may photograph the ocean bottom.

Electronic instruments will record data on the earth's magnetic and gravity fields. These data are useful in interpreting the ocean floor's geological history, evaluating the potential for oil and mineral resources, and for a better understanding of active earthquake zones in the North Atlantic Ocean.



1. Interpretive sketch of North Atlantic Ocean as it may have existed 200 million years ago after continents surrounding it split up and began to drift apart.

2. The 250-mile-wide area across which Cape Hatteras and Cap Blanc may have drifted apart. It is route of NOAA ship Discoverer as she seeks answers to mystery. The ship will spend 10 weeks this spring probing sea bottom between the two continents.

SATELLITE WILL SPEED TRANSMISSION OF WATER DATA

An earth-orbiting satellite will relay streamflow, water quality, and groundwater-level data from monitoring stations to a central records center, according to a plan disclosed in April by the U.S. Geological Survey, Department of the Interior.

A Survey hydrologist, Richard W. Paulson, described an experiment involving 20 hydrologic stations in the Delaware River basin. From these, radio-telemetered data would be picked up and relayed by NASA's first experimental earth-resources technological satellite, ERTS-A, planned for launching in early 1972.

The Plan

Paulson said: "By using the satellite as a data relay system, we believe that we can reduce the time lag between data collection and dissemination to less than 12 hours--compared to present systems with a lag of two weeks to two months." He added that "many of the water data network stations in the Delaware basin are located in relatively remote regions, and have no telemetry hook-up, and the data records are generally collected by hand at weekly intervals."

One data-collection station also will have a landline telemetry hook-up, as well as transmitting via satellite, "thus helping to provide an accurate cross-check of water resource information."

Message Every 90 or 180 Seconds

Paulson explained: "A brief water data message will be broadcast every 90 or 180 seconds from the various monitoring stations in the basin. When the satellite passes within 1,400 miles of the basin the satellite will pick up the data messages from the stations and transmit them to an 'acquisition site' at Greenbelt, Maryland, about every 12 hours.

"This will provide water resources management agencies and officials data at frequent intervals--particularly important at times of water supply or pollution problems.

"As water resources agencies develop the means for managing river basins, the results of this experiment are expected to demonstrate the relative merits of satellite relay of data versus conventional data transmission and to provide a basis for development of operational satellite relay of hydrologic data."

NAVIGATIONAL HAZARDS ALONG NEW JERSEY COAST BEING SURVEYED

NOAA's National Ocean Survey (NOS) began a 6-month search along the New Jersey coast in late April for over 60 reported navigational hazards in the intracoastal waterway between Little Egg Inlet and Cape May. Purpose is to update nautical charts.

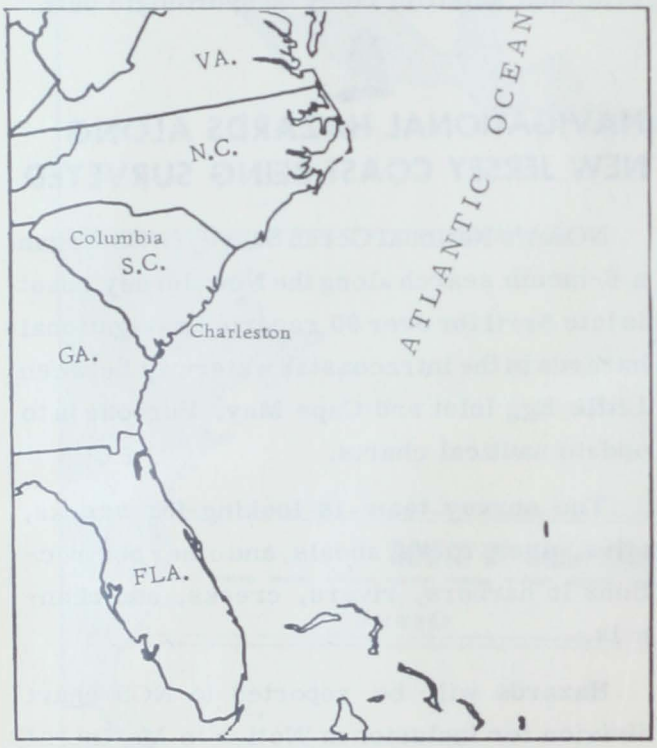
The survey team is looking for wrecks, piles, pipes, rocks, shoals, and other obstructions in harbors, rivers, creeks, and channels.

Hazards will be reported to NOS chart division for inclusion in 'Notice to Mariners' and for correction of 'Small Craft Chart 826-SC' and other charts. The report will cover changes made by dredging, waterfront construction, and natural causes.

STUDY EFFECTS OF DREDGED CHARLESTON HARBOR SEDIMENTS ON MARINE LIFE

A one-year cooperative study on the effects of dredged harbor sediments on the flora and fauna of Charleston Harbor, South Carolina, will be initiated by the NMFS Center for Estuarine and Menhaden Research, Beaufort, N.C., and the Belle W. Baruch Coastal Research Institute, University of South Carolina, Columbia, S.C. The 2 groups were awarded a one-year contract by the U.S. Army Corps of Engineers.

Large amounts of silt and sediment are dredged from Charleston Harbor each year to maintain ship channels. The dredgers face a problem of where to dispose of these sediments. Present plans call for deepening the harbor channels to accommodate large ships. This will increase temporarily the amount of spoil to be disposed. The problem is aggravated by the fact that Charleston Harbor has been polluted for many years by municipal, industrial, and agricultural wastes. These wastes may include concentrations of heavy metals, pesticides, oil, and other organic and inorganic salts that could affect marine and estuarine organisms.



Study Goals

The 1-year study will attempt to determine what effect the resuspension of the sediment, and its associated toxic materials, will have on certain prominent planktonic marine organisms and the young of certain fish. Plankton and larval fish were chosen because they are fundamentally important to the survival of a disturbed ecosystem--and because these stages are most sensitive to environmental disruption. Data from this study could help evaluate any proposed environmental alternation of the waters in Charleston and neighboring localities.

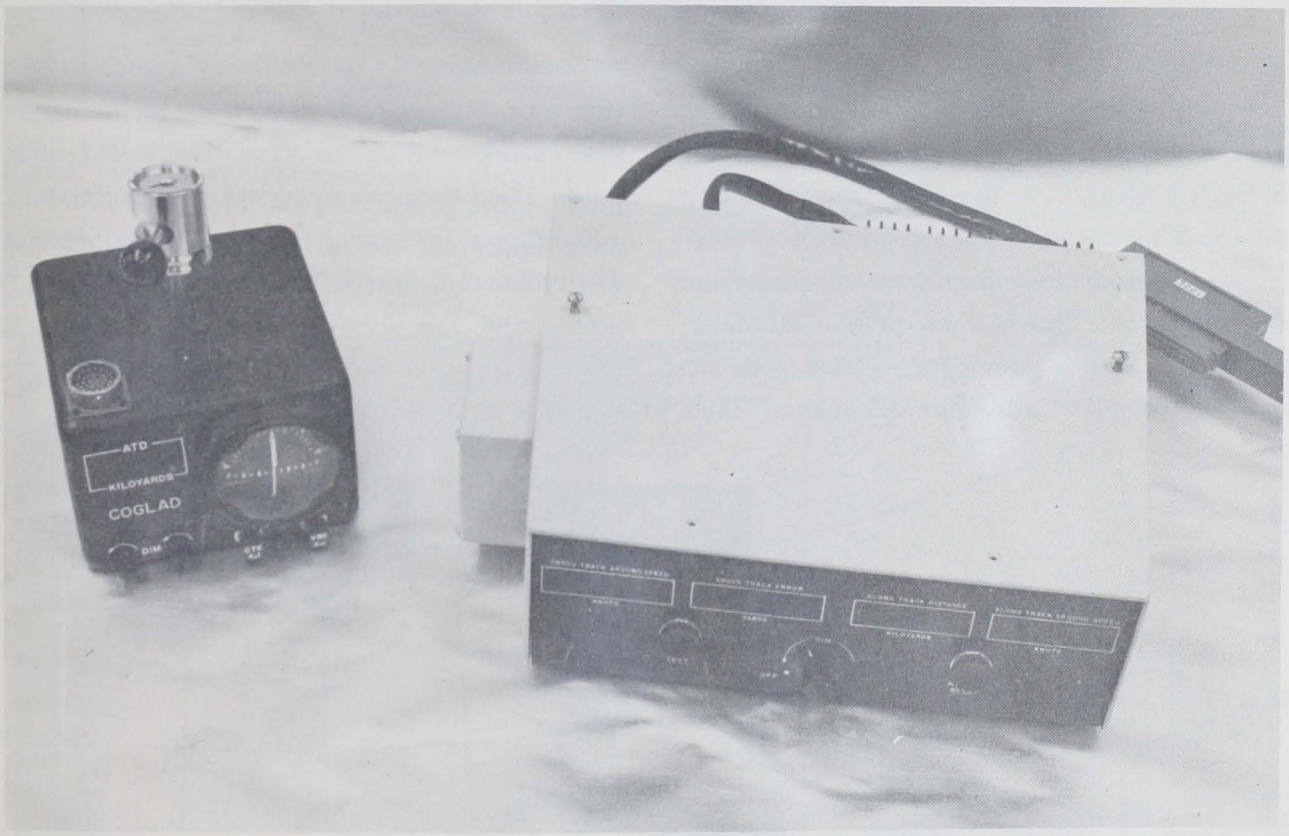
R.T. Whiteleather, Director, NMFS Southeast Region, announced that Dr. F. John Vernberg, Baruch Institute, and Donald E. Hoss, NMFS Laboratory, will direct the study.

A NEW SHIPBOARD NAVIGATION AID

A new shipboard navigation aid processes Loran-C radio signals to provide a heading angle and range to the ship's destination; at the same time, it displays velocity and any cross-track error. The Coast Guard Loran Assist Device (COGLAD) system was developed by The Johns Hopkins Applied Physics Laboratory (APL). In recent tests aboard Coast Guard Cutter 'Acacia' on Lake Huron, APL scientists were able to approach within 10 yards of an ice-concealed buoy using the device.

How It Works

To maintain a true course, the helmsman keeps a needle centered on a meter while a digital display reads out yards to the destination. Relevant navigation information is presented graphically on meters at the helm, and on the COGLAD system in the chart



Helmsman's Navigator

This black box, about the size of a telephone base, tells helmsman aboard a ship exactly where to go and when he has arrived. Top needle in meter indicates if he is going in right direction; bottom needle (both appear as one in photo) lets him know his cross-track error and how much in yards. Oblong window (left) tells distance to destination--and coordinates are fed to Hewlett Packard electronic calculator, which has been programmed to compute navigation figures from Loran-C signals. A "0" comes up in window when craft has reached target point set in calculator.

At right is interface box, which operates Loran signal receiver (not shown) and calculator. The interface unit reads out cross-track error and speed, along-track distance and ground velocity. Knob is for adjusting unit on its stand at helm.

room. Meanwhile, a plotter marks ship's course with a pen on standard navigation chart in real time as vessel proceeds.

Key to System

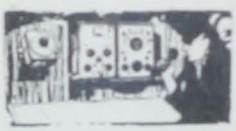
An interface box is the key to shipboard system. It accepts the Loran-C radio navigation signals from a receiver and preprocesses them for programmed computations by a Hewlett-Packard 9100B Electronic Calculator. The interface unit, without modifications, is compact enough to fit directly on top of calculator.

From microsecond time differences in signals received from 3 widely separated Loran transmitters, the programmable calculator determines accurate position of vessel on a rectangular coordinate latitude and longitude grid. This is done instead of adhering to the Loran geometry, which exhibits position on hyperbolic time difference lines.

Once the coordinates of a destination are fed to COGLAD system, the programmable calculator recomputes automatically the heading angle, along-track distance, along-track velocity, cross-track error, and cross-track velocity every $2\frac{1}{2}$ seconds. The plotter marking ship's course on map in real time also is commanded by calculator after being fed the scale of map used and a reference point from which to operate.

System's Advantages

The system is particularly useful in setting out buoys and returning to them, and also can be used to navigate rivers and channels. The Loran-based system offers special advantages in search-and-rescue missions. The recue ship can be directed speedily to any point, and the system can aid the ship to steer a precise pattern for optimum coverage of a search area.



NOAA WILL MAP FLOOD-PRONE ATLANTIC AND GULF COASTAL AREAS

NOAA has announced a storm-evacuation mapping program for flood-prone areas along the Atlantic and Gulf coasts where hurricanes may strike. At times, storms, particularly hurricanes in the Gulf of Mexico and along Atlantic coast, cause extensive tidal flooding of low-lying coastal regions.

The National Weather Service watches these storms very closely. It tries to predict the height of the storm tide. It issues warnings of possible flooding as soon as possible.

Series of Useful Maps

NOAA's National Ocean Survey will prepare maps showing emergency evacuation routes, areas subject to flooding, and elevations that might be "safety islands" for storm evacuees. The maps will show areas of flooding at various heights of storm tide.

The first map will cover the shore area from Mobile, Ala., to New Orleans, La. It is scheduled to be completed June 1.

1,400 DEAD IN 1970 BOATING ACCIDENTS

More than 1,400 persons lost their lives in boating accidents during 1970, reports the annual "Boating Statistics" of the U. S. Coast Guard (USCG). The Commandant of the Coast Guard stated that despite the best efforts of U. S. and State boating safety agencies, and organizations and individuals throughout the U.S., the number of deaths is still rising.

The Commandant added: "We feel that regulations which will be developed after passage of the Federal Boat Safety Act of 1971, now before Congress, will greatly aid us in reversing this trend."

Property Damage Up

Property damage increased by almost two million dollars. Injuries, however, decreased to 780 from 1,004 in 1969. The reported number of accidents also decreased from 4,067 in 1969 to 3,803.

There was an increase of more than 250,000 numbered boats--to 5,128,345--over 1969.