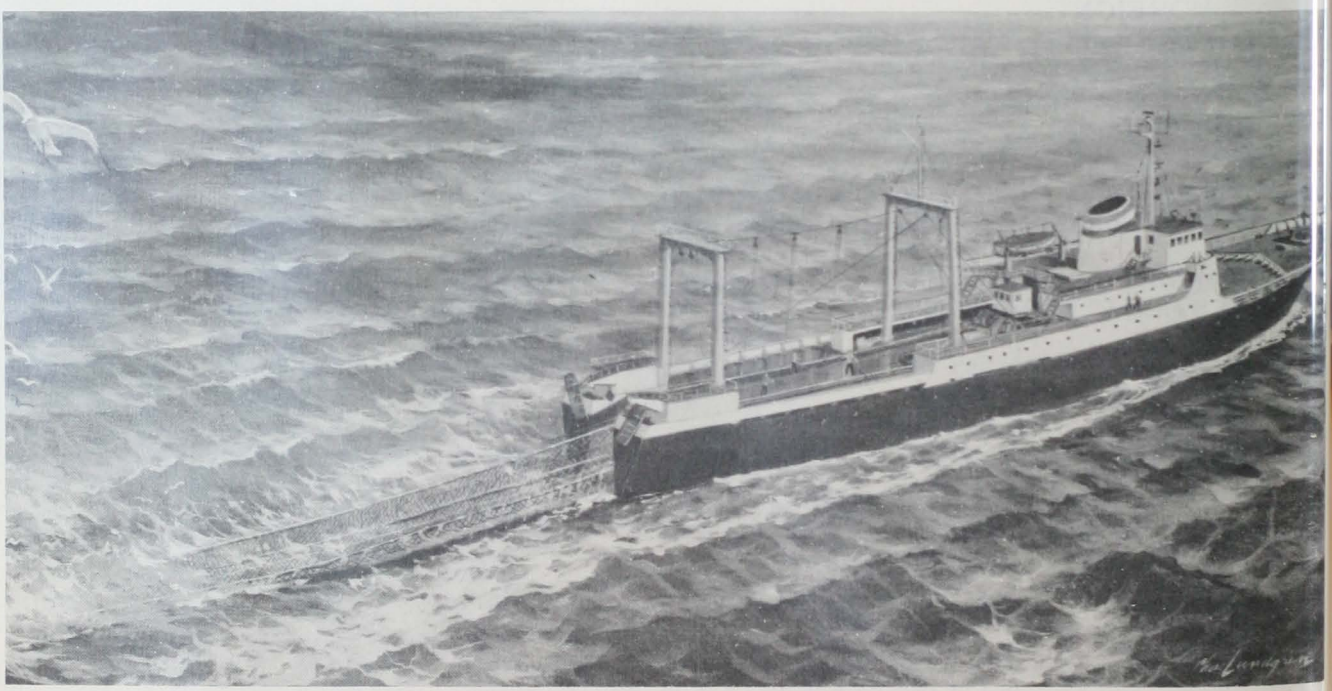
(Photo: J. Puncoch



LARGEST U. S. FISHING VESSEL CHRISTENED IN BALTIMORE

$5 million, 297-foot, 3,120-ton freezer trawler--the SEAFREEZE ATLANTIC--was christened at the Maryland Shipbuilding and Drydock Co. in Baltimore on September 21. Nearly as long as a football field, she will be the largest fishing vessel to fly the U. S. flag and be able to compete with the latest foreign vessels. Her sponsor was Mrs. John A. Volpe, wife of the Massachusetts Governor.

A sistership, the SEAFREEZE PACIFIC, will be christened in December.

Owner of the vessels is American Stern Trawlers, Inc., a subsidiary of American Export Industries. The vessels are being built with the aid of a subsidy provided by the U. S. Department of the Interior under the 1964 Fishing Fleet Improvement Act. BCF administers the subsidy program.

The SEAFREEZE ATLANTIC will be based in Gloucester, Mass., and fish the Grand Banks and off Labrador. The SEAFREEZE PACIFIC will fish off the Pacific Northwest from her West Coast base.

What They Will Do

The vessels will be able to stay at sea 2 months and process their catch. Each can catch, clean, package, and freeze 2 million pounds of fish on one voyage. Assembly-line equipment "will sort, head, gut, wash, fillet and skin the catch from the ocean floor and have it packaged and frozen in a matter of hours." Refrigerated holds will maintain packaged fish at -20° F.

The trawlers are designed to use nearly everything they catch. Inedible or trash fish, and waste from the cleaning process, will be converted to fish meal and fish oils.

Well Equipped for Fishing

Both ships are equipped for both bottom and midwater trawling and can work in bad weather. Sonars will locate and track fish schools and warn of obstructions on the ocean floor. Deck machinery will exert a 20-ton pull on the trawl. Each vessel will carry 6 of the largest nets ever made. The bottom-sweeping net is 600 feet long, 60 feet high, and 120 feet wide.

The Sisterships

The trawlers are powered by 3 General Motors diesel engines generating 3,200 shaft horsepower. They will cruise at 14.4 knots, carry a crew of 56 in air-conditioned cabins, and be able to cover 26,000 miles.

UNITED STATES

U. S. Vessels Make Good Tuna Catches in E. Atlantic

At least 8 U. S. vessels were in the Eastern Atlantic in second-half September making good catches: about half yellowfin, half skipjack. Landing capacity loads at Abidjan, Ivory Coast, Africa, were the seiner "Caribbean," 700 tons of tuna, and the "San Juan," 1,000 tons.

Early in September, the "Nautilus" and "Bold Venture" landed capacity loads at Tema, Ghana (probably total of 1,800 tons).

Yellowfin were reported large: some up to 100 lbs. each.

The Fleet

Total capacity of the 8 vessels is 6,800 tons. With fishing good in the Eastern Atlantic and poor in the Eastern Pacific, more vessels were expected to move into the Atlantic. In 1967, only 3 vessels were there.

Landings were largely transshipped to Puerto Rico.

EDA Aids Fishing Industry

Between August 1965 and June 1968, the Economic Development Administration (EDA) helped finance 48 projects to improve or expand port, harbor, and dock facilities.

Individual projects ranged from a grant of $10,125,000 to finance a wharf and transit shed, and to develop land, back-up land, container yard, and access roads in Oakland, Calif.--to a $2,000 feasibility study on construction of a town dock and marina in Harborside, Town of Brooksville, Maine.

EDA invested $8,402,000--65% of the total cost--in 13 projects developed specifically to benefit the commercial fishing industry.

1968 Import Quota for Tuna Canned in Brine

The quantity of tuna canned in brine th may be imported into the U. S. during 1968 the 11-percent rate of duty is limited 66,985,048 pounds. This is about 3,189,7 standard cases of 48 7-oz. cans. The lin is about 3.6 percent less than the 69,472,2 pounds (about 3,308,200 cases) in 1967; 2 pe cent over 1966's 65,662,200 pounds (abo 3,126,771 cases); 1.4 percent greater than th 66,059,400 pounds (about 3,145,685 cases) 1965; and 10 percent over the 60,911,87 pounds (about 2,900,565 cases) in 1964.

22% Duty Above Limit

Any imports of tuna canned in brine ove the 1968 quota will be dutiable at 22 perce ad valorem under item 112.34, Tariff Sche ules of the U. S.

The 1968 quota is based on the U. S. pac of canned tuna during the preceding calenda year (1967), as reported by the U. S. Fish an Wildlife Service.

First Quarter Imports

U. S. imports of tuna canned in brine du ing Jan. 1-Mar. 30, 1968, were 14,616,67 pounds (about 696,032 standard cases). The are preliminary data of the Bureau of Cu toms, U. S. Treasury Department.

Pair Trawling on Georges Bank Presents Hazard

U. S. fishing vessel captains are bein warned of a hazard connected with pair trawl fishing on Georges Bank by foreign fishin vessels.

Pair trawlers use a single trawl, towin the net between them. In most cases, th vessels have a nylon line running from bo to bow. The trawlers proceed on a paralle

rse about 150 yards apart. Fishermen observe vessels operating this way should ume that they are pair trawlers and avoid ning between them.

Signals Displayed

lthough the recent London Fisheries Po- g Conference agreed to have pair trawl- use the international code signal "T," a white, and blue vertically striped flag ing daylight, and crossed search lights sed ahead of the vessels at night, few if pair trawlers display these signals.

adar should be watched closely during low bility for parallel-course vessels. They ld be pair trawlers.

Seals Discovered Off California

A breeding colony of fur seals (Callorhinus inus) was discovered on San Miguel Island the California coast on July 20 by Dr. hard Peterson, University of California, ta Cruz, and Robert DeLong, Smithsonian itution, Washington, D. C. It is the first firmed record of the northern fur seal eding on any eastern Pacific island other n the Pribilofs.

eding colony of northern fur seals discovered on San Miguel land, about 30 miles off Point Conception, California. (Photo: National Park Service)

e Colony

The colony had about 100 animals, includ- one adult male, about 60 females, and 40 ps. About 35 of the females were checked tags and checkmarks. One had a tag ap- ed on the Commander Islands; 4 or 5 had en tagged on the Pribilof Islands.

Acoustical Workshop Slated for Seattle in November

An Acoustical Workshop will be held at BCF Exploratory Fishing and Gear Research Base in Seattle, Wash., Nov. 25-27. It will be open to the scientific, academic, and industrial communities.

Major emphasis will be placed on equipment, techniques, and applications for acoustically determining species composition and magnitude of living and aquatic resources.

Open House On 'Cobb'

During Nov. 18-22, participants will be able to board BCF's John N. Cobb to see the recently installed Triton acoustical counting system. One of the system's developers, Ron Mitson of Britain's Lowestoft Fisheries, will demonstrate its operation and discuss the procedures.

AEC Aids in Columbia River Thermal Study

The Atomic Energy Commission is joining Interior Department's Federal Water Pollution Control Administration and BCF in a study underway since February to determine whether hot-water discharges are polluting the Columbia River.

The study of the effects of thermal discharges from nuclear power plants and other sources is scheduled for completion in July 1970. One purpose is to find out what effect the heat discharges have on the river's ecology--and particularly the salmon and other fish in this stream.

1970 Report

Representatives of the 3 Federal agencies have agreed on research steps needed to find the effect of temperature on cold-water fish in the Columbia. Each agency has part of the research responsibilities.

"Although the final report to be issued in 1970 will be a team effort of the 3 agencies, the FWPCA has principal responsibility to

complete the final report," Interior Secretary Udall said.

The study also will provide needed information for the mathematical models developed to evaluate and predict temperatures in the Columbia under a variety of conditions.

Biologists and Engineers Discuss Thermal Pollution

About 200 people attended a national symposium on thermal pollution in Nashville, Tenn., Aug. 14-16, cosponsored by the Federal Water Pollution Control Administration and Vanderbilt University. The participants represented electrical utilities, the U. S., States, and universities.

They discussed temperature in the aquatic environment and its relation to "water quality standards, biological requirements, mixing of heat in natural waters, modeling heated water discharges, design of cooling towers, and the economics of cooling water discharges."

Need for Meeting

Observers said that the need for communication between biologists and engineers was evident at the meeting. Biologists are being asked to provide estimates of critical temperatures for aquatic organisms. The estimates will be difficult to get in many cases. And the engineers--to keep waste out of the natural environment--will have to turn to very expensive and relatively untested devices, such as cooling towers.

U. S. Families Asked About Their Seafood Tastes

The first questionnaire in a year-long survey of U. S. seafood-eating habits is scheduled to be distributed in October. BCF awarded a $95,400 contract to Market Facts, Inc., of Chicago, to conduct the survey. Biweekly, a representative sample of U. S. households across the Nation will report the type of fish and shellfish it buys and how it prepares them. This information will be related to size, age, sex, income, and religion of household members, and occupation of household head.

BCF will use this information in its continuing study of factors that influence the eating of fishery products.

Study results will be provided to the fishing industry and processors. The information should help them to better serve the public.

Shad's Return to Susquehanna Is Assessed

A century ago, a man heading for California loaded into the train's baggage car milk cans with live small shad he had taken from New York's Hudson River. When he got to California, he released them into the Sacramento River. Many years later, the descendants of those fish were returned to the Eastern Seaboard and, in 1965, they became part of a Federal-State study to determine whether shad could be restored to the heavily dammed Susquehanna River.

The Report

The study team found that "shad eggs can hatch, larvae can develop, and juveniles can survive and prosper in most of the Susquehanna River." The team's findings are contained in a 60-page booklet recently issued by the Bureau of Sport Fisheries and Wildlife.

The report states that the next questions to be asked are whether enough adult shad with a strong urge to migrate upstream are available, whether the designed fishways would attract fish, and whether adults would move efficiently upstream through reservoirs. "The broad question of the total desirability of installing one or more fishways on the Susquehanna. . .lies with the separate State and Federal agencies."

Power Companies Aided Study

Cooperating in the study were BCF, New York Conservation Department, Pennsylvania Fish Commission, and Maryland Board of Natural Resources.

Power companies contributed $196,500 for the study.

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AQUACULTURE: Its Status and Its Potential

Farming the sea--aquaculture--can make an important contribution to a global war on hunger and to the domestic economy of the United States.

This conclusion is reached by two researchers, Prof. John E. Bardach, University of Michigan, and Dr. John H. Ryther, Woods Hole Oceanographic Institution (Mass.), in their report, "The Status and Potential of Aquaculture." The report was prepared for the American Institute of Biological Sciences under contract to the National Council on Marine Resources and Engineering Development (Marine Sciences Council).

It is published in 2 volumes: Volume I deals particularly with invertebrate and algae culture; Volume II with fish culture.

Prof. Bardach and Dr. Ryther state: "Immediate benefits to the United States arising from expanded practice of aquaculture here would be the increased production of high quality food items now considered luxuries because of limited supplies, and the economic rejuvenation of a sector of the fishing industry (mollusca shellfish) now severely depressed."

The two experts emphasize that the United States has the scientific skills needed to make major contributions to aquaculture--but at present no single agency of the U. S. Government is responsible for coordinating efforts in this field, and private activities too are scattered.

They believe that aquaculture--particularly the highly efficient and productive herbivorous forms--can help to alleviate world hunger. This can be achieved by: applying recent scientific and technological advances to existing practices, particularly in the world's developing countries; fashioning new methods or techniques with the aid of such disciplines as genetics, nutrition, pathology, biology, and engineering; and opening new geographical areas to aquaculture.

The major points of the Bardach-Ryther report are summarized below.

GENERAL PRINCIPLES OF AQUACULTURE

The intensive culture of aquatic organisms--in contrast to capturing them from untended stocks--is carried out in many areas of the world. It is more prevalent and successful in fresh and brackish waters than in the sea itself. But Japan, the USSR, and Great Britain are attempting genuine marine husbanding.

Existing data do not reveal the "world tonnage of fish, invertebrates and aquatic plants produced by such active interference of man in the natural life cycles of the organisms or in the management of their environment." The authors estimate that total tonnage produced by aquaculture may lie between 5% and 10% of total world fish catch. They quote an estimate that, for fresh and brackish water alone, the consistent use of the best techniques could raise fish tonnage produced by aquaculture 3 to 5 times--to around 30 million metric tons. Intensive aquaculture in "waters of full marine salinity is in its very infancy."

Few Fishes Raised

The 25,000 species of fishes form the largest class of vertebrates, but very few of these have been raised by intensive husbandry. Even fewer species have been domesticated like some mammals and birds. And still fewer aquatic invertebrates have been cultured successfully. Yet, the authors state, it is possible today with intensive care to produce "significantly larger amounts of high-grade animal protein per unit of inshore or freshwater surface than on fertile dry land."

"Artificially fed fish (carp) increase in weight 2-2.5 times more than cattle or sheep" in terms of increase per unit weight of animal per unit weight of food consumed. The oysters on 1 acre of sea bottom have access to the food in thousands of acres of water flowing past them. In principle, "a few hundred pounds of beef cattle can be raised in an acre of very good pasture"--but a ton or more of fish and a hundred tons of shellfish may be cultivated in the same aquatic area.

WHICH ORGANISMS TO CULTURE?

The authors examine the biological properties of organisms that would make them most suitable for intensive culture:

- They should reproduce in captivity or semiconfinement--or be easy to manipulate for the purpose of producing offspring. The

Pacific salmon dies after spawning, eliminating the need to keep spawners alive; this makes it easy to handle one stage of the culture operation. If breeding is not easy, the larvae or young should be easily available for gathering.

• "Their eggs or larvae should be hardy and capable of being hatched or reared under controlled conditions."

• The food needs of larvae or young should be satisfied by operations that can increase their natural foods--or they should be able to take prepared feeds from their early stages.

• They should gain weight fast and nourish themselves entirely or partly from foods that are available in abundance and can be supplied to them cheaply--or can be readily produced or increased by man where the cultured species lives.

The authors say there are few aquatic organisms that would not have problems with 1 or more of the 4 qualities; only a handful combine all these attributes.

PROBLEMS OF AQUACULTURE

Several problems are commonly encountered in aquacultural practices:

• The many subtle qualities of the environments--such as temperature, salinity, oxygen, etc.--determine whether an animal or plant will reproduce at all.

For most marine organisms, these conditions are not known exactly. Only in a few cases has it been possible to duplicate the necessary conditions. But these problems are less difficult than they seem at first. Many aquatic, especially marine, organisms produce enormous numbers of eggs and larvae. In some cases, these larvae can be collected from nature before they die in vast numbers and can be raised in culture (e.g., milkfish). However, this practice prevents mass selection for desirable characteristics--the very foundation of animal husbandry--because the parents with these characteristics are not available.

Also easing the problems of aquaculture is a relatively recent practice that already has had far-reaching effects on fish culture: injection of pituitary hormones that ripen the fishes' gonads and allow forced and controlled spawning of species--e.g., grass carp possibly mullet--which had not been pro gated artificially before.

• Unlike higher forms of life, many and most invertebrates have larval fo that bear little resemblance to the a "Culture of such organisms through larval cycle requires basic knowledge, fa ties, and techniques which differ entirely the practices involved in growing the ad Often, rearing the larvae is by far the difficult part of successfully culturing a cies. "For example, the spiny lobster not yet been successfully brought throug 20-25 larval stages in culture."

• "Often the principal objective of ac cultural enterprises is to grow as m organisms in as small a space as possib This crowding produces problems: feed growth, metabolism, behavior, morphol accumulation of toxic wastes in the wa rapid transmission of disease and parasiti and often cannibalism. The last is the m obstacle to the culture of many crustacea notably the American lobster.

AQUACULTURE'S PROGRESS

Despite these difficulties, the auth state, aquaculture has made important pr ress in many parts of the world. The in tive is profit. The species selected luxury foods, bring the highest price t culturist. While this seems inconsistent the goal of easing the world protein defici through aquaculture, it is not necessaril When luxury foods become sufficiently ab ant, they stop being a luxury. A high-pr market may be the initial incentive to cul a species and may justify research and velopment funds.

The important factor, the authors em sice, is not the product's status or ma price. It is production cost in dollars and in protein food. This is one of aquacultu principal problems. The reason is that species in culture, excepting molluscs several fish species, are predominantly c nivores or omnivores 2 or more levels in food chain above the photosynthetic ba Each step up the ladder means a loss of ab 90% in converting food to new animal tiss

This conversion can be done economic where the product is extremely valuable the food may be obtained cheaply. In Denma

example, small herring and trash fish m the North Sea are fed to rainbow trout. apan, shrimp are fed small shellfish, fish, commercially caught shrimp of low mar- value.

The authors report great progress in com- ding land-produced waste foodstuffs, fied with animal proteins and vitamins, cheap and readily available food for s. These practices are sometimes com- able to the mechanized, mass production chickens, fish meal, and other prepared s in the U. S. and Europe. In modernizing chicken industry, the chicken was reduced m a luxury food to an inexpensive, staple, t product.

To achieve the goal of increasing the rld's protein supply, the herbivorous spe- s should be used. They feed at the photo- thetic base of the food chain. There is y one step in the conversion from plant tter to animal flesh. And, in contrast to d forms, they use microscopic plants that ll remain unharvestable and unuseful to n. The ways to increase them above their ural yields--insofar as they are the food animals raised with aquacultural prac- es--are an integral part of aquaculture.

The authors state that "almost staggering ounts of certain shellfish can be produced n with existing techniques." A 1,000- are-mile area--the size of Long Island nd--if ecologically suitable, could produce h year 3 times as much mussel meat as world's total fish catch. The authors point however, that this example is specious ess such areas are available for aquacul- e. "Thus, an evaluation of the potential quaculture must include not only the ecol- of the organism and technical aspects of culture, but also consideration of geo- phic, demographic, sociological, and eco- nic facts as well."

INTENSITY OF AQUACULTURE

To gain estimates of the ranges of flesh oduction from aquaculture, it is more aningful, the authors say, to establish tegories showing the intensity of culture ther than to divide the practices into fresh, ackish, and salt-water practices.

The following are the author's arrange- ent of categories by "ascending intensity" labor and capital input and, by and large, by creasing yields:

- Transplant species from poor to better growing grounds: in Denmark, North Sea plaice to selected fjords; introduce species into new environments along with selected food organisms of these species--as in Soviet Union. ". . . this method of extensive culture shows little economic promise, or has, at best, qualified success, locally."

- Stock hatchery-reared juveniles to augment and replenish natural stock. This is done with various anadromous salmon species. New hatchery techniques give this practice a more favorable cost/benefit ratio.

- Enclosures to retain organisms, or devices on which they are put--either by themselves or after they have been collected: prawns in Malaya, mullets and eels in Adriatic "Valli" culture. The water in the enclosures is not fertilized, nor are the animals fed; mollusc culture and Japan's culture of marine algae are in this category.

- Fertilize ponds or enclosures shut off from the sea: milkfish in Southeast Asia; some carp culture in Northern hemisphere; some Tilapia culture in Africa and Near East; and some shrimp culture in Southeast Asia.

- Enclosures and ponds in which the water is fertilized and more food is supplied to the animals: catfish in U. S., most carp culture in Northern hemisphere, some milkfish and mullet culture, and culture of Chinese carps in China and Far East.

- Enclosures, often cement, in which the animals are raised only by extraneous feed. This compares somewhat with intensive chicken-raising methods in U. S. and Europe. Volume of flow, not surface, is important in this category, which includes: Salmonid--trout and salmon culture in U. S. and Europe, shrimp in Japan, carp and eel in Japan, and experiments with plaice and sole in Great Britain.

YIELDS

Intensive pig farming in developed nations produces around 25 tons of live pigs per man-year; an oyster farmer can raise 40-60 tons (shells excluded) per year. The average Danish trout farm, with 2 or 3 men, produces about 40 tons of trout a year. The sewage ponds of the Bavaria Power Co., near Munich, can product 100 tons of carp from about 200 hectares of water. Three men tend the ponds and fish, so fish production per man-year would exceed 30 tons.

On a well-designed trout farm in Idaho, in the U. S., with enough water, one man may produce over 100 tons of fish a year; if the fish are dressed, production per man falls to 40-50 tons. The revenue per weight unit to the producer "may be reasonably compared to that derived from a weight unit of pig flesh."

Yields also depend on the organism and its position in the aquatic food chain. Algae and those animals that feed directly on the algae--molluscs, milkfish, mullet--generally produce greater yields per unit of area than species at higher trophic (nutrition) levels. This is because of their "ecologic position and their greater efficiency in creating (algae) or utilizing (herbivores) the primary products of organic synthesis."

AQUACULTURE IN A FOOD ECONOMY

It is said that aquaculture deals with luxury foods rather than staples. It is true for certain organisms and certain economic conditions (the U. S., for example). But in land-poor developed countries--Japan and, to some extent, Israel--beef is more expensive than most cultured fish. Land-poor countries, or those with soil-fertility problems and low protein supply, look to aquaculture for some staple proteins: Java with carp and milkfish culture, both Chinas with pond culture, and large parts of Africa with rapidly rising pond culture, mainly for Tilapia.

Even the bare beginning of fish culture--establishing enclosures--often leads to increased output per human unit of effort. Over 5% of Japan's total fish catch comes from coastal areas, where various fish species are allowed to enter as fry or young but cannot leave until they are harvested.

All aquaculture is done for profit, which sometimes is substantial: algae culture in Japan, oyster in Brittany, and trout and catfish in U. S. Where the operation is designed to produce more meat than the family needs, profits can be estimated. They range from 10%-15% on invested capital in low-intensity milkfish culture in Philippines to near 20% with better management in Taiwan's milkfish ponds, to 30% or more on Malayan mixed pig and fish farms. "The situation is comparable in the culturing of aquatic invertebrates."

The authors believe that aquaculture today, with a few minor exceptions, is where agriculture was 50 or more years ago. They go on to examine the potentials for aquaculture expansion through advances in methods and extension of area.

EXPANSION OF AQUACULTURE

Even in Japan, where it is being develop true farming of the sea, with the exception oyster culture, is still in its infancy. However, a trend toward rapid expansion of fish culture is apparent: in 1965, total production of yellowtail in Japan's Inland Sea 65.6 thousand metric tons; over 80% of was from cultures--net-cage-raised fish. 1966, about 20 million young captured were raised in net enclosures floating in sea, while the comparable figure in 1956 about 200,000. Research on controlling spawning of this species is pressed by Japanese government agencies. BCF biologis report recent successful pilot experimen with hatching and rearing of related speci

Brackish and freshwater aquaculture more widely practiced--and also shows wide range of production efficiencies. Raisi milkfish in the Philippines now is done mos without fertilization and/or extraneous fee ing. Annual yields per hectare vary from to 500 kilograms, depending mostly on s but also on grower's efficiency. In Taiwa with less-favorable colder climate, po fertilization, control of competing anima such as insect larvae, and application of so extraneous food have produced annual pe hectare yield of over 2,000 kilograms.

FAO Projection

In 1966, FAO fisheries biologists exami the opportunities of upgrading managen techniques as they apply to very extens semi-intensive, and most intensive meth of fresh and brackish water fish culture. T they made a projection of aquacultural p sibilities. Their estimates range betwee fold and 15-20-fold increase as a possi goal to attain within the next 35 years. T believe that present average production co be raised to those levels with today's be known fish-production techniques.

Aquaculture could be expanded by bring into culture suitable areas not now used. global assessment of these areas has b attempted, but FAO plans to promote it. T use of the entire potential swamp area wo produce a very large yield.

The recent development of hatchery rearing techniques for invertebrates--molluscs, freshwater and marine shrimp--has opened opportunities for aquaculture in undeveloped areas. There, estuaries and coastal lands suitable for pond construction abound, but the major restraining factor is lack of organisms. The most immediate expansion of aquaculture can be achieved by combining hatchery production with low-to-moderate intensity of cultivation practices in such regions."

As techniques improve, it becomes possible to get greater yields from less area. This is taking place in advanced, but land-poor, countries.

The catch of marine fishes has doubled (roughly) in each 10-year period since 1945. The increase was produced with much new technology and the tapping of large virgin resources: Peruvian anchovies and Soviet and Japanese fishing efforts. But ocean fishing has "finite limits," and the authors speculate that comparable large investments in aquaculture "may yield more returns per dollar more quickly than those put into the exploitation of untended stocks."

CHECKS ON AQUACULTURE'S GROWTH

The best control over an aquacultural enterprise is ownership of the area by the operator. Aquaculture also is conducted on public lands (brackish-water fish, oysters) and here leasing arrangements have to be worked out. The U. S. oyster industry, unlike the Japanese and European, is the best illustration. In the U. S., as many oysters are produced from the 185,000 acres of leased beds as from the 4 million acres of public oyster grounds. The average yield from the latter is 1/600 that of intensively cultivated leases in the U. S. and 1/5000 the average yield from Japan's Inland Sea, where all oyster-producing areas are publicly owned but privately controlled.

There are conflicting uses of public lands: for recreation, conservation, subsoil exploitation, aquaculture, etc. How the lands are used should be determined on the basis of benefit-to-cost ratios, where possible. Few such data exist for aquaculture. "The greatest need for pertinent figures exists in developing countries, but even such advanced nations as the USA do not have adequate data about the rentability of aquacultural enterprises, especially in the brackish water realm."

The problem of pollution in aquaculture falls into the same category of checks on aquaculture's development as the conflicting uses of surface areas and the supply of water. Water is a public resource needed for communities and industries--as well as for growing fish and shellfish.

In some developing countries that have aquacultural potential, the economy's private sector cannot promote this method of increasing protein supplies. Government aid is needed.

TECHNICAL CHECKS ON AQUACULTURE

An increase in aquacultural yields depends on upgrading present procedures and on more basic and applied research. To adopt the best-known practices, some legal, political, and organizational curbs must be removed. More research is needed in important areas of biology and technology. The problems of aquacultural biology can be divided into those concerning the animals and those concerning their environment.

Problems of Biology

• Animals that become captives undergo a decrease in environmental stimuli and are subjected to new ones. As a result, reproduction often is impaired. The authors state: "A thorough knowledge of the animal's biology and ecology is necessary before their reproductive functions can be manipulated satisfactorily; in most cases of semi-intensively cultured species this knowledge is not extant and should be sought."

Means should be found to bring about the simultaneous readiness for reproduction of males and females of the species. Often, males produce sperm but females will not release their eggs. Manipulating the environment has been successful here: increasing the water flow while raising or lowering temperature.

With fresh and brackish-water fish, the most important technique is hypophysation--injection or implantation of pituitary gland material from the same or related species. Extension of this work to more species, milkfish and marine species, for example, would produce useful results. U. S. scientists, because of their competence in endocrinology, "could play a strong role here."

• For the many kinds of aquatic organisms that go through several larval stages with selective food habits, an optimal, economically produced food has to be found for each species and often for each larval stage. Engineers and biologists must cooperate on this problem.

• Genetic selection and breeding of desired varieties is an important area. Presently, this approach is possible only with aquatic organisms that propagate under controlled conditions, and whose larvae or young are easy to raise. Among invertebrates, pilot-scale selective breeding has been tried with oysters and shrimp. But only carp and trout have been developed commercially into varieties. Selective breeding may soon be possible with mullet and Tilapia. Little is known about basic fish genetics; the genetics of molluscs, crustaceans, and marine algae is a virgin field. The U.S. is behind other nations in this area.

• The more intensive the aquaculture, the closer together the animals are raised. Disease organisms are transferred more readily. The study of parasite life cycles and disease prevention is an old concern of fish raisers. Most knowledge has developed about carp, trout, and oyster diseases, while parasites that attack other fishes and invertebrates are less well known. The study of parasites and diseases of aquacultural organisms is important where intensive aquaculture is practiced.

Problems of Aquacultural Ecology

• It is possible to increase the yields of water by operations comparable to the use of fertilizers, tilling, etc. Soil science is a vast field, but the amount of corresponding basic information on the interaction of pond, sea, lake, or river bottom with the overlying water is very slight.

"Practically nothing is known of the basic chemical processes that are altered or influenced when one fertilizes brackish waters. . . . Required also is research in the basic chemistry of the water--substrate interface, the circulation of nutrients, their cycles, etc."

• In aquaculture, the nutrition of the cultured animals and the fertilization of the water-substrate complex are closely related. Improving both simultaneously brings optim yields. But, in many cases, natural diets a incompletely known--and the digestive phy iology of invertebrates and herbivorous f has hardly been investigated. Pond-cult practices often are conducted with li understanding of what the animals are eati Basic research in nutrition physiology sho be promoted. To manufacture or obtain ch and adequate diets may mean culturing s aquatic animals as molluscs or insect l vae--and compounding in moist or dry fo plant-based, enriched, artificial diets. "F research for pigs, cattle and domestic f is incomparably more advanced than that f aquatic animals."

• A pond or sea enclosure, in contrast a field, is a 3-dimensional growing spac some animals feed on bottom, some on plan ton in midwater, and others on surface, pe haps on extraneous material. China h combined species using these different fee ing habits. Other countries that tried the produced greater yields than when raisi one species alone. The combined culture fish and crustaceans also raised yields. T raft-culture of shellfish off the bottom, in "truly 3-dimensional environment," produce much greater yields than when convention bottom culture is practiced. These techniqu can be improved.

In marine and brackish water, the cul vator must control those competing speci he does not want--from insect larvae of sma invertebrates to large predators. More a plied research is needed here.

Technology

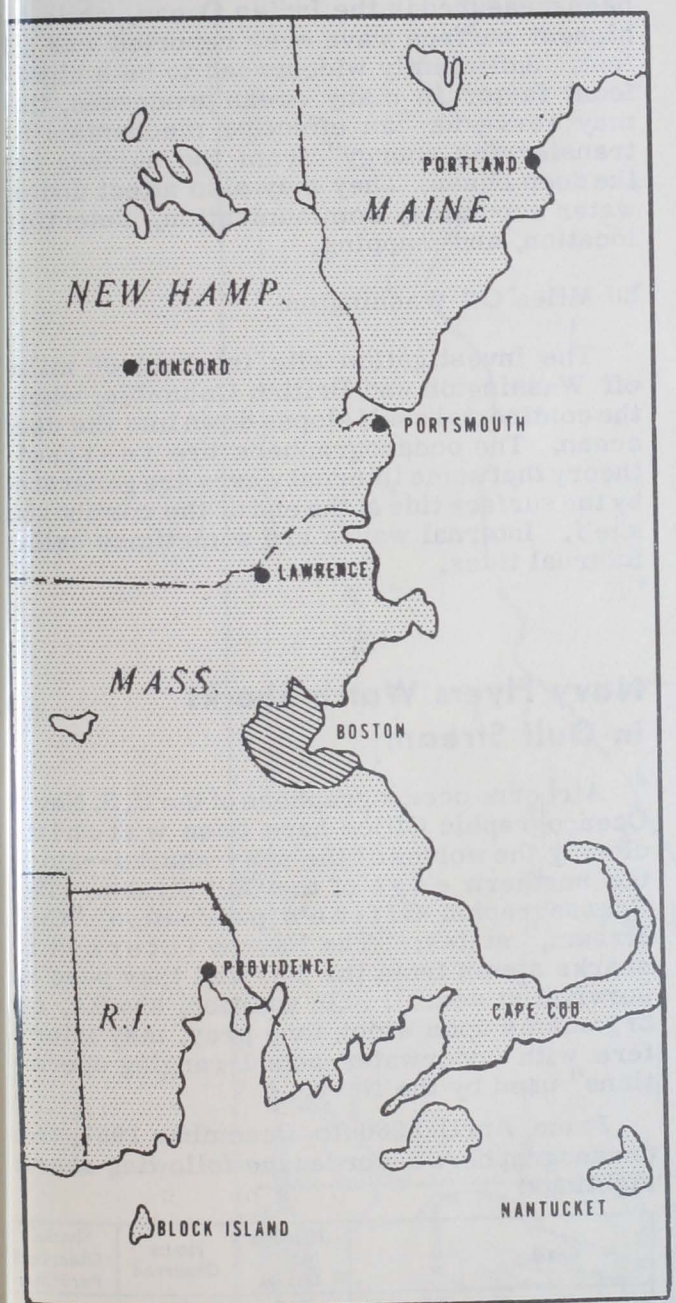
• The advanced nations have great ci engineering capabilities and experience in t economical use of labor-saving devic These skills are needed to build fish-hold structures geared to local soil and water co ditions.

Agriculture was revolutionized by the us of machinery. Aquaculture (excepting pil research plants) is where agriculture w a before machinery was invented. Engineeri design and development must be applied aquaculture's needs. This would raise pr duction per unit of effort--even when it did n raise yields.

OCEANOGRAPHY

Bathymetric Map of Sea Bottom Off New England Being Prepared

The most detailed bathymetric map of the sea bottom off New England is being compiled by cartographers of ESSA's Coast and Geodetic Survey (CGS). It will include the floor of Boston Harbor.



The map will cover the area from Cape Cod, Mass., to Portland, Me., and up to 53 miles seaward off Boston.

The map will cover 6,800 square statute miles of ocean bottom extending from Cape Cod, Mass., to Portland, Maine, and up to 53 miles seaward off Boston.

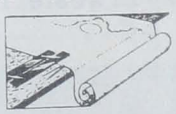
One of Series

It is one of a series planned by CGS for the Continental Shelf, an area about 862,000 square statute miles of submerged land off the U. S. The maps are designed to aid Federal, state, and industrial interests explore and develop the area's resources. Their economic development depends heavily on adequate sea bottom maps; few exist at present.

100 Surveys of Area

The mapping, which will take several months to complete, portrays the sea bottom at 5-meter (17-foot) intervals. The cartographers use depth data represented in more than 100 hydrographic surveys of the area conducted by the ESSA agency over 114 years. The map is expected to be released within a year.

Depths shown will range from a few feet off the coast to over 600 feet about 53 miles east of Boston. The bottom of Boston Harbor will be shown in detail for the first time.



Seek Underwater Obstructions to Delaware Bay

The Coast and Geodetic Survey has begun a two-month search for hazards to navigation in the approaches and entrance to Delaware Bay. The wire drag vessels "Rude" and "Heck," working as a team, will probe for sunken wrecks and other pinnacle-like obstructions in the heavily traveled sea lanes leading into the Bay.

Methods

The vessels will first sweep the anchorage area inside the Bay entrance, with a submerged wire towed between them, and then sweep the approach to the anchorage area and sea lanes. Rude and Heck, the only ships of

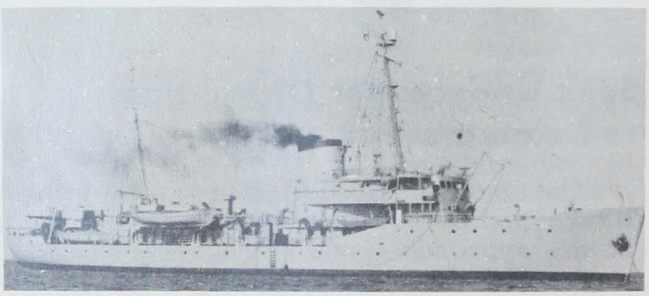
their kind, use a method perfected more than a half-century ago. The steel wire between them, suspended horizontally from surface buoys, is normally towed 35 to 60 feet below the surface. When the wire catches on an underwater obstruction, it tautens, and the surface buoys form a letter V. Exact location of the obstruction and depth over its highest point is then determined.

Search for Navigational Hazards Off Maine, N. J., Maryland

A 4-month investigation is being conducted for navigational hazards in the offshore waters of Maine, New Jersey, and Maryland by the Coast and Geodetic Survey. The task that began in August is to update current nautical charts.

Survey Alaska's Lower Cook Inlet

A hydrographic survey to aid Alaska's economic development is being carried out in Cook Inlet by the Coast and Geodetic Survey's "Pathfinder." It is being made in McNeil Cove and Bruin Bay in western Kamishak Bay, Cook Inlet.



The Pathfinder, one of the larger ocean survey vessels.

The 4-month survey will benefit the increasing marine activity and economic development of Cook Inlet, one of Alaska's important waterways.

Internal Waves Under Study

A 15-day probe of internal waves, mysterious ocean phenomena that cause unusual behavior in underwater sound, is being made by oceanographers of ESSA and the University of Washington.

Internal waves, found in all the world's oceans, are at times larger than surface waves. Internal waves 270 feet high have been measured in the Indian Ocean, while the highest surface wave ever reported was 11 feet. Sufficiently widespread to be a significant factor in many ocean processes, they may serve as "an effective mechanism for transferring energy" from the surface into the deep ocean. They may also affect underwater acoustics, communication, detection, location, and mapping.

80 Miles Off Washington

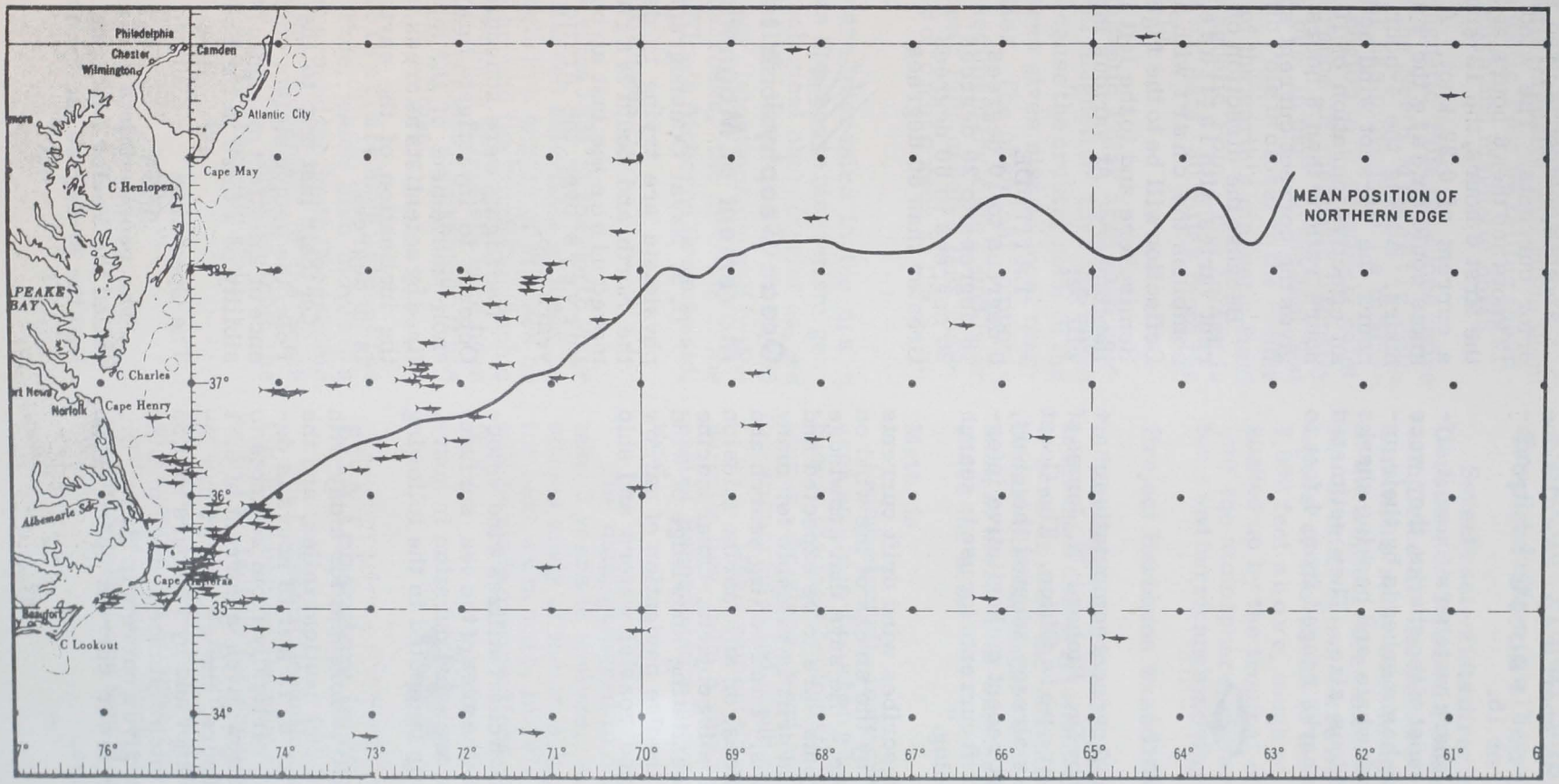
The investigation site is about 80 miles off Washington and British Columbia, where the continental shelf slopes down into the deep ocean. The oceanographers are testing a theory that some internal waves are generated by the surface tide at the end of the continental shelf. Internal waves are sometimes called internal tides.

Navy Flyers Watch Sharks in Gulf Stream

Airborne oceanographers of the U. S. Naval Oceanographic Office have been watching closely the wolves of the sea--sharks--along the northern edge of the Gulf Stream. The Oceanographic Office's publication, "Gulf Stream," states: "The Navy's interest in sharks stems from the threat they pose to survival at sea. . . . In addition, sharks, on organisms upon which they prey, may interfere with underwater sound-ranging operations" used by the Navy.

From April 1966 to December 1967, the oceanographers recorded the following shark sightings:

Season	Number of Sharks	Hours Observed	Sharks Observed Per Hour
Winter (Jan., Feb., March)	45	30	1.5
Spring (April, May, June)	63	43.6	1.4
Summer (July, Aug., Sept.)	140	100	1.4
Fall (Oct., Nov., Dec.)	43	52.7	0.8


Philadelphia
Chester
Wilmington
Camden
Atlantic City
Cape May
C Henlopen
PEAKE BAY
C Charles
Norfolk
Cape Henry
Albemarle Sd
Cape Hatteras
C Lookout
MEAN POSITION OF NORTHERN EDGE
39°
37°
36°
35°
34°
76°
74°
73°
72°
71°
70°
69°
68°
67°
66°
65°
64°
63°
62°
61°

Each symbol on chart represents one sighting--usually a single shark but occasionally up to 10 or 15.

Although the shark watchers found it difficult to identify most of the sharks, they were able to recognize hammerheads by their unusual shape--and whale and basking sharks by their tremendous size. They estimated the majority of sharks ranged from 4 feet to 25 feet.

New Drift Chart

A new wind drift current computation chart has been devised by Dr. Richard W. James of Naval Oceanographic Office. The Coast Guard, which has already adopted the chart, calls it "the most recent authoritative information on wind drift currents for use in search and rescue planning."

Dr. James describes wind drift currents as those caused "by the stress of the wind on the water surface." He says that knowledge of when the currents "are to be expected and with what set and drift is valuable for many marine operations," including search and rescue operations, or any marine mission involving free-floating objects. Other marine operations, necessitating knowledge of wind drift currents, involve navigation of narrow straits or confined coastal waters and ship routing.

How Chart Works

The computation chart utilizes wind velocity in knots, fetch (the area of the sea surface) in nautical miles, and wind duration in hours. Current drift is computed in the following manner:

A 24-knot wind is forecast for a day with a fetch length of 200 nautical miles, and the wind current after 6, 12 and 18 hours is desired. Dropping vertically from 24 knots to the 6-hour duration gives a current of 0.31 knot. After 12 hours, the current has increased to 0.49 knot and by 18 hours to 0.55 knot. Use of the fetch distance instead of wind duration will also give a current in knots. Dr. James says the lower current speed is the correct one to use.

Another method is used to compensate f prior currents. The wind blows 6 hours 12 knots and then 6 hours at 24 knots. Dur the first 6 hours, the 12-knot wind genera a current of 0.22 knot. A wind speed o knots could create the same current i hours. Adding the 4-hour duration to t hours the 24-knot wind actually blows gi an effective duration of 10 hours. Usin hours rather than 6 hours with the 24 k gives the correct current speed of 0.42 k

Because the direction of a wind drift c rent varies with latitude, the Coast Gu combines the chart with a deflection ta Deflection will be to the right in the North Hemisphere and to the left in the South Hemisphere. At various latitudes, deflect will be:

LATITUDE	DEFLECTI
0 degrees to 10 degrees	None
10 degrees to 20 degrees	10 degree
20 degrees to 60 degrees	20 degree
Greater than 60 degrees	30 degree

Ocean Geophysicists to Measure Movement of Magnetic Poles

U. S. Naval Oceanographic Office g physicists are trying to determine ho the North and South Magnetic Poles h moved since the last airborne geomag surveys over the Arctic and Antarct years ago.

Two flights were scheduled in Septem October to investigate this natural phen enon--movement of the magnetic poles, fined by scientists as areas, not points, w the inclination of the earth's magnetic is 90 degrees.

On their last trip to the South Magn Pole, the geophysicists confirmed the ex ence of 2 distinct magnetic poles and the p sibility of a third in the South Polar are

The Operation

The geophysicists will use an instrum called the Vector Airborne Magnetomete find the 90-degree inclinations that mark

polar areas. The magnetometer, which easures magnetic intensity, will guide them the North Magnetic Pole by telling the di- ction of true north and magnetic north.

The South Magnetic Pole produces more gnetism than the North Magnetic Pole, ich since 1831 has moved from a moder- ly disturbed region to a relatively quiet a. The difference in magnetic intensity the 2 poles is due, in part, to the fact that South Magnetic Pole is closer to the center the source of the earth's magnetic field an the North Magnetic Pole. The center is der Southeast Asia, 80 miles from the nter of the earth.

The South Magnetic Polar area also gen- rates more local magnetism than the North agnetic Pole because the crustal rock in the outhern polar area gives rise to local mag- etic abnormalities. The chemical composi- on of crustal sedimentary rock found near e North Magnetic Pole creates less mag- etism than the volcanic rock at the South agnetic Pole.

"Because we are interested in the main agnetic field as opposed to magnetism gen- rated by local geological characteristics, we ill be flying at altitudes of 10,000 to 15,000 eet to eliminate any distortions caused by the agnetism of local rocks," the director of the ceanographic Office's Airborne Branch said.

oles Travel in Ellipses

Observations since 1831 at the North Mag- tic Pole have caused scientists to theorize at the pole travels in a series of ellipses on s circular path around the North Geographic ole. In the 137 years scientists have been atching the magnetic pole's movement, it has et to complete one ellipse.

Since 1841, scientists have watched the outh Magnetic Pole, which also moves in a eries of ellipses around the South Geographic Pole. The circular movement of the South Magnetic Pole is exactly opposite from the ath taken by the North Magnetic Pole.

Barbados Project Studies Tropical Ocean's Top Layers

Seventy scientists directed by Dr. Michael Garstang of Florida State University have completed the Barbados Project, the most ambitious study ever made of the top layers of the tropical ocean and the atmosphere above it. In this region, extending from the top layers of the ocean to the cloud layer about 2,000 feet above, much of the sun's heat, soaked up by the tropical ocean, is released into the atmosphere, powering weather systems and hurricanes moving to other latitudes.

Project Barbados Based

Barbados was chosen as a base because it is the most easterly island in the West Indies. It extends into the Atlantic across the constantly blowing trade winds, which mix latent heat, in the form of water vapor, with the air above the sea.

Methods

Using aircraft, instrument towers, tethered and free-floating balloons, ships and buoys, the meteorologists recorded temperatures, moisture, wind speed and direction, ocean currents, and cloud cover on magnetic tapes. Measurements were made along a 90-mile line, from a ship anchored 60 miles east of Barbados to a buoy anchored 15 miles west.

The data, gathered in only 3 months, will take 5 years to analyze. An even more ambitious study of the area has been scheduled for next summer; in 1970, a sea-air study will be made over portions of Florida and the Gulf.

ESSA Laboratory in Miami

The Coast and Geodetic Survey has opened the Engineering Development Laboratory, a testing facility for oceanographic systems development, in Miami, Florida. The lab, a branch of the Office of Systems Development, will support the Atlantic Oceanographic Laboratories in Miami. Both are part of the Environmental Science Services Administration (ESSA).

The lab uses satellite navigation methods to develop projects related to high-speed charting methods and buoy tracking of ocean currents. It is stationing deep-sea buoy arrays for ocean current, tide, and wave measurements, and for magnetic observations.

Underwater Camera Takes Circular Pictures

Naval Oceanographic Office divers are using a modified underwater camera to take panoramic pictures. The camera films the area a diver would see if he were rotated 350 degrees around his central location. His body prevents the camera from taking a complete 360-degree exposure.

Divers used the camera recently in North Carolina waters to test it as a surveying instrument. Panoramic pictures may help chart the ocean floor by establishing the center of a circle, and by enabling oceanographers to measure dimensions of the terrain within the circle. With distance as the known factor, a diver-surveyor can pinpoint the exact location of any submerged object in the camera's view.

The Camera

The camera, NAVSCAN LO type KE34A, is little more than a foot wide from handle to handle. It can withstand the pressure at 100-foot depths. Packed with 100 feet of 35mm ASA 400 TRI-X film, it can take 75 circular exposures. Each 350-degree negative is 0.85 of an inch wide to 14.7 inches long. The camera has an f-8 to 22 lens and a 1/150 second shutter speed.

New Diving Techniques Used in Cobb Seamount Operation

During the week of October 6-13, a Proje Sea Use team carried out diving operati on Cobb Seamount, a submerged mountain miles off the Washington State coast.

Diving from the research vessel "Oce ographer," the team received special m tures of oxygen-enriched air through life li beneath the ship. At these depths, regu compressed air would have produced "nit gen narcosis," a loss of physical and me capability requiring extended decompres stops for surfacing divers. Increased oxy reduces nitrogen absorption, lengthens b tom time, and eliminates decompress stops. BCF's decompression chamber was board, outfitted to receive the divers for compression, and to reduce air pressu slowly enough to prevent decompression si ness or "bends."

C&GS Research Vessel Christened

The new Coast and Geodetic Survey (C& vessel "Researcher," christened early October in Toledo, Ohio, is the first of a class of compact survey ships.

The 2,800-ton, 278-ft. ship, capabl handling helicopters, is equipped with most highly sophisticated electronic and ientific instruments. She has an underw bow bulb to house deep-finding transd arrays, a 20-ton oceanographic crane signed to launch and retrieve small rese submersibles, the latest navigational weather devices, and can use satellite tems. Completely air-conditioned, she 4,000 feet of enclosed laboratory space accommodations for 18 scientists.

After completion, in 1969, she will con oceanographic surveys in the Atlantic O and the Gulf of Mexico.

oreign Fishing Off U. S. n August

ORTHWEST ATLANTIC

About 213 Soviet, Polish, East and West erman fishing vessels were sighted, 32 wer than in July.

Catches observed on all vessels were only air. Stern trawlers land and store catch be- w decks quickly, reducing the chances of bserving fish on deck. However, many side rawlers, which carry catch on deck until it s discharged to support vessels, have shown nly limited catches. Apparently catch per nit of effort was less than in previous years. atch was principally herring, with some mall haddock, whiting, and mixed ground- ish.

Soviet: An estimated 118 vessels--7 fac- ory stern trawlers, 100 medium side trawl- rs, 2 factory base ships, 7 refrigerated fish ransports, 1 tug, and 1 tanker--fished inten- ively along the 40- and 50-fathom curve round Georges Bank. In early August, large oncentrations spread along the eastern slopes, but by mid-month the fleet shifted west and was northeast of Cultivator Shoals o east of Nantucket Lightship.

Polish: Thirty-five vessels were sighted ishing along the eastern and northern slopes f Georges Bank. This is about double the umber reported in August 1967.

German: Twenty-nine West German and 1 East German vessels fished along the orthern slopes of Georges Bank during the rst 3 weeks. Late in the month, they moved areas just off Cape Cod and Cultivator hoals.

Romanian: The stern trawler "Galati" was sighted in mid-month for the first time this year. She had been sighted in August 1967.

During the third week in August, from 50 to 75 Soviet, Polish, East and West German vessels suddenly moved inshore to fishing grounds 12 to 20 miles southeast of Chatham, Mass., off Cape Cod. After August 23 they moved 25 to 40 miles out from the nearest point of land.

IN GULF OF MEXICO AND OFF SOUTH ATLANTIC

No foreign fishing vessels were sighted south of Cape Hatteras or off Florida. There were unconfirmed reports of a Cuban vessel long-line fishing 55-60 miles south of Grand Isle, La.

OFF CALIFORNIA

One Soviet vessel, the fishery research medium trawler "Ogon," was sighted about 17 miles west of Point Reyes.

OFF PACIFIC NORTHWEST

Forty-eight Soviet vessels, including 4 research or exploratory vessels, were sighted. The greatest effort was made in the hake fishery off Washington. Catches observed being hauled on deck varied from water hauls to 40,000 lbs. Some stern trawlers caught 50-80 metric tons a day.

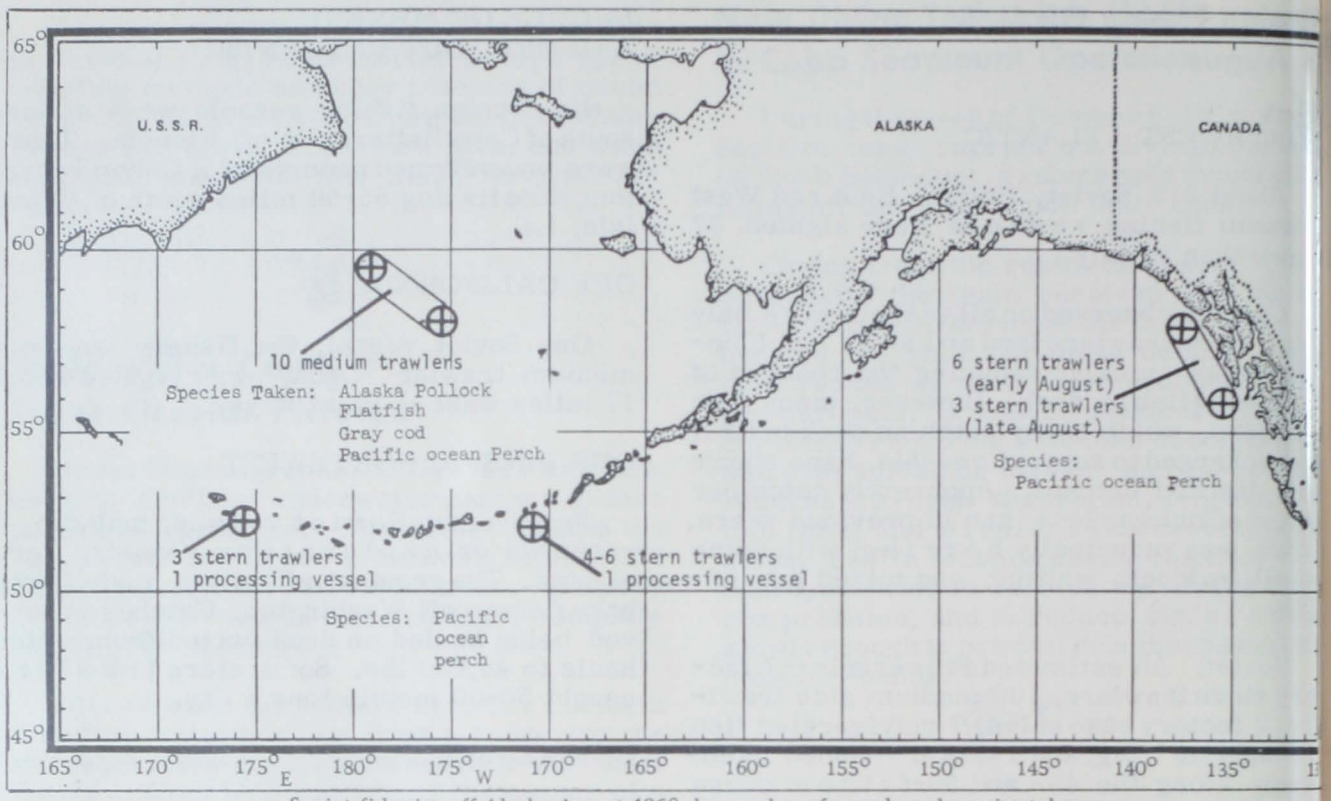
OFF ALASKA

Soviet: Between 21 and 25 fishing vessels were sighted. One processing vessel and 4-6 stern trawlers, south of central Aleutians, and 3 stern trawlers with 1 processing vessel around the Near Islands, fished for Pacific ocean perch. Ten medium trawlers fished for Alaska pollock, flatfish, Pacific ocean perch and gray cod along the Continental Shelf edge in the Bering Sea. A medium research trawler engaged in king crab research in the eastern Bering Sea. A U. S. scientist boarded the vessel for about a week in mid-August.

Japanese: The number of vessels varied between 170 and 180.

Four to 6 stern trawlers fished Pacific ocean perch in the Gulf of Alaska. Six to 18 stern trawlers fished for perch along the Aleutians. The perch fishery in the Bering Sea, along the Continental Shelf edge northwest of the Pribilofs, continued by at least 20 independent stern trawlers in early August decreased by month's end.

In the minced fish meat and fish meal fishery, 3 factoryships and 63 trawlers centered on the Continental Shelf northwest of the Pribilofs, and 2 factoryships with 37 trawlers fished on the Shelf east of Pribilofs.



Soviet fisheries off Alaska August 1968; by number of vessels and species taken.

Two king crab factoryship fleets continued fishing on the Continental Shelf, north of Port Moller, in the eastern Bering Sea. One tanner crab expedition was located about 120 miles northwest of the Pribilofs fishing conical-shaped pots set on a long line.

Two small stern trawlers began fishi on known shrimp grounds near Two-Head Island off southwest Kodiak Island. One w observed hauling aboard a trawl contain about 2 tons of shrimp. Two Japanese ve sels fished for shrimp in the same are summer 1967.

WHAT IS THE "BENDS" AND HOW DO DIVERS BECOME AFFLICTED WITH IT?

High pressure at depth causes some of the nitrogen in a diver's body tissue to dissolve in his blood. If he ascends too rapidly, bubbles will form in the blood and collect in his joints and bone marrow, causing the extremely painful condition known as the "bends." It is not ordinarily fatal unless bubbles collect in the spinal cord or brain, but the pain will continue for several days unless the diver is put under pressure and decompressed gradually; if the condition goes untreated there will be bone damage.

After a long dive, a diver is returned to normal pressure gradually so that nitrogen in the blood may be released through the lungs, avoiding the "bends." ("Questions About The Oceans," U. S. Naval Oceanographic Office.)

STATES

Alaska

1968 SALMON PACK DOUBLES 1967's

By Sept. 1, the 1968 Alaska canned salmon pack was 3.1 million cases--more than double the 1967 pack of 1.4 million cases for the same period, reports BCF Juneau.

Compared with the high 1966 pack of 4 million cases and 1965's 3.3 million, the 1968 pack is considered good. During the past 13 years, the pack has neared or exceeded the 3 million figure 6 times; it averaged about 2.8 million cases. The 3.1 million cases on Sept. 1 is well above the 13-year average. When the final pack figures have been tabulated, the 1968 pack may well be one of the best for this period.

Record Pinks Caught

The 19.6 million pinks caught in southeastern Alaska are more than the number caught in the 1966 season when a record 19,013,825 cases were packed. The small size of the pinks, 2.8 to 3.5 pounds, compared to a normal 4.2 to 4.4 pounds, limited the 1968 pack as of August to 932,281 cases.

Except perhaps for Bristol Bay, BCF Juneau points out, this has been a good year everywhere in Alaska. It should bring the state back to first place among the States in value of landings and fish products produced.

Along with the increase in salmon canning is a record production of salmon caviar. BCF Juneau expects that the value of this byproduct will amount to $16 million--and will rival or perhaps exceed the value of the total U. S.-Canadian halibut catch for 1968. Caviar production has special value because nearly all of it will be exported.

Massachusetts

NEW BOSTON FISH PIER COMPLEX PROPOSED BY PORT AUTHORITY

The Massachusetts Port Authority proposed on September 12 that a $14.6 million Boston Pier complex be built to revitalize the city's declining fish industry. An engineering firm has prepared a feasibility study.

The Port Authority and the engineering consultants said primary causes of the decline were fragmented and old-fashioned operations and lack of understanding of the fresh fish market's potential.

Boston Near Rich Source

Edward J. King, executive director, Massachusetts Port Authority, noted that one of the richest sources of high-quality fresh fish--haddock--exists within 300 miles east of Boston. A potential $100-million fresh-fish market in interior United States is within a day or two's drive to the west of Boston.

Study's Findings

The Fish Pier complex study, sponsored by Port Authority and the Boston Fish Market Corp., stressed the need for more efficient handling of fish from boat to display and auction areas; reduction of damage to fish during processing and handling; tighter controls on auctioneering practices; automated processing operations; consolidation of warehousing and storage facilities; elimination of truck and other traffic congestion; and more extensive use of transportation systems including air and rail; and consolidation of all fish-industry functions and operations in the fish-pier area.

Approval Needed

If the fishing industry goes along with the Authority's proposal, it will be presented to the Authority's membership for consideration.

* * *

Biologists Breed Lobsters Selectively

By John T. Hughes*

After 5 years of research and selective breeding, biologists at the Massachusetts Lobster Hatchery and Research Station, Vineyard Haven, have successfully produced albino and all red colored lobsters.

The North American lobster (Homarus americanus) normally has a dark green shell with small spots of brown, white, yellow, and red. At times rare albino lobsters are caught and also lobsters that are red, blue, or yellow. The biologists at the station believed that the odd colored lobsters could be mated with one another and some of the offspring would carry genetically the odd-color characteristics of the parents.

Early Results

Five years ago lobstermen throughout New England were asked to save all odd-colored lobsters for delivery to the research station. In spring 1965, an all-red male lobster was mated with 2 all-red females. Eggs were extruded the following summer and they hatched in 1967. (From time of copulation until the eggs hatch is about 18 months.) Approximately 50% of the newly hatched fry were all red as the parents, 25% were albino, and 25% were "normal". In spring 1966, the same red male was used to fertilize an all-red female and a lemon-spotted female. T eggs hatched in early summer 1968. Aga some of the fry produced were all red, sor were albino, some yellow spotted, and sor normal. These lobsters are now beyond the tenth molt and almost 2 inches in total lengt

Valuable Research Tool

The biologists feel that stock from thes lobsters will be very valuable as a researc tool. As yet, no suitable lobster tag has bee developed that will remain with a lobste after molting. Therefore, it has not bee possible to follow the migrations or move ments of large numbers of lobsters over period of years. Today's tags are so larg that it is necessary for a lobster to be years old before it can even carry the ta It is felt that these rare colored lobsters c be used as natural tags and studies of the movements can be started as soon as th hatch.

This initial work using selective breedi and choosing desired characteristics sugges to the Massachusetts biologists that it will possible to choose well-proportioned, fas growing parents to produce market-size lob sters in half the 6 years it takes in the wil

*Director, State Lobster Hatchery and Research Station, Vineyard Haven, Mass. 02568.

Florida

ACOUSTIC SIGNALS ATTRACT FISH

"A significant breakthrough in attracting certain species of commercial fish to artificially generated acoustic signals" was announced recently by the University of Miami's Institute of Marine Sciences. The Institute stated: "It is quite possible that, in the near future, commercial fisheries can use the Institute's techniques of attracting fish, coupled with the use of bait as reinforcement, to increase their catches of certain species. This is particularly true of existing snapper and grouper fisheries in the Gulf of Mexico and Caribbean Sea areas."

Tests in Gulf Stream

Institute Professor Joseph D. Richard carried out extensive field tests. These showed clear attraction of considerable numbers of demersal predatory fish to an area, the Gulf Stream, where a submerged sound source transmitted pulsed, low-frequency acoustic signals. The source, an acoustic projector, is mounted on the ocean floor in 2 meters of waters, about 1 mile off Bimini. Prof. Richard observed the fish through an underwater television system. Many of his field tests have been permanently recorded on video tape.

The Species Attracted

Nassau groupers, mutton snappers, margates, yellowtail snappers, yellowfin groupers, and black groupers were attracted to the acoustic stimuli. So were several unidentified species of groupers and snappers. Harpnose sharks, reef sharks, and nurse sharks also responded.

On the other hand, herbivorous reef fishes common to the test area were not attracted.

The signals transmitted in the field tests closely simulated the natural hydrodynamic sounds previously recorded by the Institute when predatory fish were feeding. In addition to the fish inhabiting the test region, these sounds should be attractive to other species with similar feeding habits, the Institute believes.

* * *

BUILDS 'WINDOW ON THE SEA'

A new "window on the sea"--a marine laboratory to send oceanographic research vessels out to study the Gulf and Atlantic--will be opened soon by Florida State University.

At Turkey Point, 40 miles south of Tallahassee, there is a new 180-foot concrete pier. It is capable of accommodating moderate-size research vessels like the 160-foot "Petrel," already in the harbor being converted for oceanographic research. The 65-foot "Tursiops," also being converted in the harbor, will make an initial cruise to the Yucatan Channel area this fall.

Lab Facilities

A research lab and classrooms building, shop building, superintendent's cottage and housing for 16 students will be completed shortly. The laboratory will sponsor studies in biophysics, genetics, meteorology, microbiology, and geology of the local environment and Gulf. Students will spend one day to several weeks in on-the-spot classroom and lab work.

One outstanding feature of the new laboratory is a sea water retrieval, storage, and delivery system. The water is stored in plastic tanks and touches no metal, which is toxic to living sea organisms.

Virginia

HOW TO GROW OYSTERS IN MSX AREAS

Oysters can be grown profitably in areas infested with MSX, reports Dr. Jay D. Andrews, head of the Department of Malacology at the Virginia Institute of Marine Science.

MSX is a microscopic parasite that kills many oysters but is not harmful to humans. It is a protozoan, or one-celled animal, which thrives in areas of high-salinity water. Death of oysters occurs mostly in the warm season; the winter loss is minor. MSX is now in its tenth year in Virginia with no reduction of its activity.

MSX IMMUNITY

Laboratory-bred stocks held in trays, and natural sets in MSX areas, have demonstrated that oysters can acquire immunity to the disease if exposed when young. Dr. Andrews says that survival has been consistently favorable even through drought years, which raise the salinity that makes MSX more virulent. Losses have been about 20% per year or less, not including losses from predation and smothering.

Culture Program

The following program for commercial culture in MSX areas is recommended:

(1) Seed oysters must come from areas where MSX is active during spawning and setting period. Immunity is acquired early and remains fairly constant as oysters become larger and older. The Institute will check MSX activity in major seed areas using oysters from low-salinity, disease-free, areas.

(2) Oysters must grow rapidly and be harvested early if they are to be raised successfully. This will involve critical decisions on time and size of seed oysters transplanted. They must be planted on firm bottoms suitable for small seed--relatively free from drill predation. Rapid growth is obtained by early transplanting (current year spat if bottom is hard) but this increases danger of predation.

Where to Buy Seed

The program is feasible if Piankatank seed oysters are available. Seed from the lower James River would be as suitable for planting in MSX-infested areas as Piankatank seed, but buy-boats buy oysters indiscriminately from tongers anywhere on the river. The risk of buying seed from up-river beds, which are not immune to MSX, is too great for planters to take.

Other Problems

Smothering, predation, Dermocystidium, and other problems--as well as MSX infection--can destroy beds of oysters. Trial planting on one bed, or involving one boatload of seed, should precede large plants in areas where MSX has destroyed oysters.

Michigan

CONSERVATION COMMISSION ACTS ON SALMON

In August, the Michigan Conservati Commission increased from 3 to 6 the li of coho and chinook salmon in a sport fishe man's possession. Fishermen still may have more than 3 salmon in their possess while fishing or aboard boats--but they have up to 6 salmon when ashore and fishing.

To Sell Surplus Salmon

The Commission approved the Michig Department of Conservation plan to sell su plus salmon for commercial purposes. Hi bidder for the surplus was Blackport Packi Co. of Grand Rapids. It received a contra to buy the salmon at 15.6 cents a pound.

Most of the salmon will be taken at wei on 3 rivers tributary to Lake Michigan. Sa money will go to Michigan's Game and Fi Protection Fund.

Oregon

DISEASES HIT SPRING CHINOOK

The Oregon Fish Commission reported September 6 that spring chinook salmo adult holding ponds on the Middle Fork W lamette were being attacked by several se ous diseases. Pathologists isolated and id tified Ceratomyxa, Henneguya, columnar furunculosis and kidney disease. Each di ease alone can be serious; combined, t caused large-scale mortality.

Death Rate Rose

Only 1 or 2 fish a day died in late June, b the death rate later increased to 100 a da Over 2,500 salmon had died by Septembe More than 10,000 big chinook, almost on third the Willamette Falls escapement, we estimated to be in the holding ponds, or wa ing to get in from the river immediately bel Dexter Dam.

Ponds Chemically Treated

Commission pathologists began treati the ponds 3 times a week with a chemical th reduces the effects of columnaris and figh

spread of external fungus. The treatment largely a holding action because there are specific cures for some of the diseases--no facilities to handle the mass of fish olved.

Past efforts to develop drugs and chem- to control disease, and to administer ication on a large scale, have been ham- d by lack of funds, specialized equipment, facilities to take care of large numbers dult salmon. Several serious diseases been eliminated or minimized in hatch- reared juvenile salmon by adding medi- on to hatchery feed. Use of oral medi- ons at Dexter is impractical because adult mon generally do not eat after leaving the an and entering fresh water. In the future, logists hope to develop serums that can be rporated into hatchery feed to immunize all fish against major adult diseases.

ny Fish Return

Despite the high mortalities, large num- s of returning fish guarantee sufficient s for hatchery operations. Increasing bers of adult spring chinook have returned he holding ponds in recent years. In 1960, 800 fish returned, but more than 10,000 rned in 1967 and in 1968.

The two holding ponds and the Willamette chery, 30 miles upstream, compensate for losses caused by Dexter and Lookout t Dams. The dams, built without fish age facilities, block all anadromous fish the Upper Middle Fork Williamette. Re- ing adults are collected in the ponds at base of Dexter Dam and held until matu- . The eggs are taken, fertilized, and sferred to the hatchery for incubation and ing. The small fish are trucked back and ased below Dexter Dam.

* * *

ENS NEW SPAWNING AREA

The construction of a fish ladder at Valsetz n makes available to Siletz River salmon steelhead 30 miles of new spawning unds this fall. The dam on the South Fork the Siletz, about 72 river miles from the an, was built in the 1920s, without fish- sage facilities. Since 1950, when an im- ssable falls about 7 miles downstream was dered, it blocked upstream fish passage. fish ladder should be completed in time pass coho and winter steelhead this year.

In 1964 and 1965, hatchery surplus adult steelhead, and coho fingerlings and adults, were released above the dam. Later, spawning-ground surveys, and trapping of downstream migrants at the dam, confirmed a belief that the area had excellent natural production potential.

Valsetz Latest In Program

The Valsetz Dam fish ladder is the latest project in a program begun in 1965 to provide adequate fish passage at every dam on Oregon salmon and steelhead streams. Fish passage has been improved or established on more than 840 miles of stream so far. New fishways have been built, old ones improved, and dams removed at 40 different sites throughout the state. Total natural salmon and steelhead production from these areas should add 50,000 chinook, coho, and steelhead annually to sport and commercial catches.

California

ACTS TO PROTECT KING SALMON

In August, the California Fish and Game Commission adopted a 3-point emergency program to protect the declining fall run of king salmon in the Central Valley.

The bag limit was reduced from 3 to 1 salmon on major streams in the Central Valley from Sept. 1 through Dec. 31. The streams include the Sacramento, San Joaquin, American, Feather, Merced, Mokelumne, Napa, Stanislaus, Tuolumne, and Yuba rivers and Elder, Putah, Stony, and Thomes creeks.

The spawning closure on the Sacramento River was extended from Keswick Dam to the Red Bluff Diversion Dam from Sept. 1 through Dec. 31.

The 3-mile stretch of the Sacramento River from the Highway 99 Bridge downstream to the Cypress Street (Old Highway 44) Bridge in Redding was closed to all fishing year round.

Ocean Catch Down

The ocean catch of king salmon has declined steadily from about 800,000 in 1964 to 400,000 in 1967. The fall run of salmon returning to spawn in the Central Valley dropped from 300,000 to 175,000 in the same period.

* * *

1968/69 ANCHOVY REDUCTION FISHERY QUOTA SET

The California Fish and Game Commission has set a 75,000-ton quota for the 1968/69 anchovy reduction fishery, the same as the past 3 seasons. The season for the northern permit area opened August 1 will close May 15, 1969, and the area quota remains 10,000 tons.

Southern Area

The season for the southern permit area's 5 zones will be Sept. 15-May 15. Each of 4 inshore zones will have a 5,000-ton quota; the offshore zone has 45,000 tons.

If the quota for either permit area is reached, the Commission will consider increasing the quota for that area. Last season, there was no fishing in one zone and light effort in several others. Landings of anchovy for reduction were 6,505 tons for the 1967/68 season.

The anchovy population in California waters is estimated at a minimum of 2 million tons.

Texas

TOXIC ALGAE KILLS HATCHERY CATFISH

The killer of fish in ponds of the Parks and Wildlife Department's hatchery at Sheldon, northeast of Houston, has been discovered and controlled after 2 destructive years. It was one of the toxic blue-green algaes of the genus Anabaena.

A school of fry (baby fish less than 2 inches long) would be alive and healthy--and the next minute, hundreds would be dead. In summer 1967, only a few fish were killed, but in 1968 the loss ran into thousands. The hatchery production of catfish seemed seriously affected.

Cause Discovered

Two hatchery men watching a large school of baby catfish fry gulping their way through the water saw them feed on microscopic bits of food on the surface. The fry's route took them into blue-green scum Immediately, hundreds of the little fish showed signs of distress and died. The green scum, an algae, was the killer.

Hot weather had caused the algae to "bloom," rise to the surface, and form scum. Ironically, the care hatchery fish received added to their mortality. Small catfish in hatcheries are accustomed to feeding on the surface. Their diet is supplemented with finely ground food scattered on the water. The fish had mistaken the toxic algae (few algae are toxic) for food.

Once identified, chemical control of the plant is simple. Catfish farmers should look for the phenomenon in their hatcheries, advises the Texas Parks and Wildlife Department.

There are 1,356.5 acres of water in Texas being used for catfish cultivation. These should produce an estimated 3,694 tons of fish in 1968.

Commonwealth of Puerto Rico Receives Former BCF Lab

In 1941, the University of Puerto Rico gave BCF 2 acres of land on which to build a $25,000 fishery research laboratory. Since 1941 when BCF personnel were withdrawn, the lab has served the university's marine-biology program. The lab was declared surplus government property and recently was donated to the university.

The BCF lab had sought better methods of using available species and taught refrigeration and marketing techniques. Some exploration for pelagic species, such as tuna and mackerel, was done.

Puerto Rican Industry

Puerto Ricans eat much more fish than is available from the immediate vicinity. Abundance of fish is limited because the island, peak of a high ocean mountain, lacks the "shelf" formation that provides fishing grounds for most coastal areas.

There are 4 tuna canneries on the island. Most of the tuna is caught in the tropical Pacific, transported through the Panama Canal, and landed at Puerto Rico for processing.

BUREAU OF COMMERCIAL FISHERIES PROGRAMS

Thread Herring Reared in Miami Lab

For the first time, the "thread" herring (Opisthonema oglinum) has been reared from egg through juvenile stages in a marine laboratory. This was achieved in BCF's Miami Tropical Atlantic Biological Laboratory (TABL).

According to Laboratory Director Dr. Carl J. Sindermann, research scientists there strive for many months to devise means of maturing pelagic (open-sea) fish native to tropical Atlantic waters, under artificial circumstances, from egg to healthy adult. Their work with the thread herring proved a startling success.

The silvery, compressed fish is plentiful in the waters around the southeast U. S. It is considered a good source of fish meal and a potential source of fish protein concentrate (FPC). It is called thread herring because of a long, slender filament that extends back from the dorsal fin almost to the tail.

Operation

Dr. Sindermann said it was the first time marine biologists had been able to identify the thread herring in its larval stage (between egg and almost fully formed juvenile).

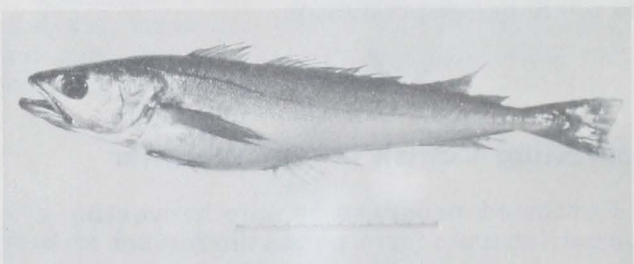
The 300 eggs measuring about 1 millimeter that began the project were caught in the Stream by plankton sampler manned by ratory scientists Dr. William J. Richards Barbara Palko. The eggs were transferred to a TABL aquarium containing water the site of capture. Two days later, hatched into the larval stage: tiny creas about 4 millimeters long. The third day capture, the larval fish began to feed on kton gathered from nearby Biscayne Bay. er temperature was maintained at 80° F. ughout the experiment.

Within 30 days, the larvae had developed juvenile fish 1 to 2 inches long--big gh for biologists to be sure of the species. vival rates are considered excellent at 30 0 percent of the original 300 eggs, or well r 100 healthy thread herring. The survis are expected to reach their normal size to 10 inches.

The TABL scientists say that although a number of freshwater species of fish have been cultured from egg to maturity, each successful rearing of a marine fish represents a rare and significant achievement.

Genetic Variants Point to Isolated Populations of Pacific Hake

"Studies on genetic variants in Pacific hake (Merluccius productus) strongly support the hypothesis that there are at least two distinct and isolated populations--one in Puget Sound and another off the coasts of Washington, Oregon, and California." This was reported by Rae R. Mitsuoka, writer-editor, BCF Biological Laboratory, Seattle, Wash.



Pacific Hake (gauge = 15 cm.).

He disclosed: "Puget Sound hake are generally smaller (average, 35 cm.) than those in coastal waters (average, 50 cm.). The otoliths, or ear bones, of the two populations also vary. It is more difficult to assign ages to hake from Puget Sound because the annular zones are more irregular (although this difference may not necessarily be a function of the smaller size). Hake of oceanic size have occasionally been caught in Puget Sound, which raised the question of whether the larger fish were migratory or indigenous.

"Two enzyme systems, which directly reflect basic genetic differences of hake, were studied. These systems included esterase variants in the eye fluids and lactate dehydrogenase (LDH) variants in extracts of liver tissue.

"The gene frequencies of the large and normal fish in Puget Sound agreed with those of smaller fish from the same area. This

indicated that the larger fish are indigenous to Puget Sound. It is interesting that all the large hake caught in Puget Sound were females, which are larger at maturity than males."

The genetic studies were conducted by his colleague, Fred M. Utter.

55,000 Fur Seals Harvested on Pribilofs

The harvest of fur seals on the Pribilof Islands through August 13 was about 55,000: 45,000 males and 10,000 females. The harvest of males ended August 13; that of females continued through August 19 until the quota of 13,000 was reached.

Below 1967 & Prediction

The male harvest was 10,000 below 1967's and 5,000 below prediction.

Harvesting Catfish in Hot Weather

Continued progress on safe harvesting of live catfish from farm ponds during hot summer months resulted from experiments at the BCF Exploratory Fishing Station, Kelso, Ark.

A floating 300-gallon-per-minute pump was used to circulate water through catches in a fish bag during seining operations. Four catches, ranging from 3,000 to 10,000 pounds each, were successfully handled even when water temperatures exceeded 90° Fahrenheit.

BCF's Fast-Sinking Tuna Purse Seine Catches Elusive School

BCF's experimental fast-sinking purse seine, fished by the "Liberty" in the Pacific, took 30 tons of bonito in one set. This followed unsunsuccessful attempts by 2 other vessels using conventional seines to catch the school.

'Hero' Conducts Fishing Gear Trials

The new National Science Foundation (NSF) vessel Hero left the Washington, D. C., Navy Yard on Sept. 10 to carry out fishing-gear trials while en route to Miami, Fla.

The Hero is a 125-foot, diesel-powered but sail-equipped, wooden ship built for research in Antarctic waters. BCF's Seattle (Wash.) Exploratory Fishing and Gear Research Base recently received an NSF grant to conduct surveys of midwater and demersal (bottom dwelling) species from the Hero in the Antarctic. The Seattle staff will begin to participate in the Antarctic program in April-May 1969.

Seattle Aids Hero

Before the Hero left Washington, Miles Alton and Ian Ellis of the Seattle Base installed midwater trawl gear and depth-telemetry equipment. They accompanied the vessel to Miami to handle any problems.

Vacuum-Stern Thawing of Frozen Fish Is Tested

Scientists of the BCF Gloucester (Mass.) Technological Laboratory recently tested the vacuum-steam thawing process for rapidly thawing blocks of frozen fish. They were permitted to use the test facilities of the Crolls Reynolds Company in New Jersey.

In one test, the internal temperature of frozen and glazed block of shrimp was raised from the low 20s F. to about 65°-70° F. by exposing the shrimp to a 10-second burst of steam under vacuum. Almost all ice was removed; the individual shrimp were separated very easily.

Process Has Good Potential

The researchers believe these results show the good potential of the process for the shrimp industry--and suggest that the possible usefulness of the process to the tuna industry be investigated.

Vacuum-steam thawing has these advantages: thawing is achieved very quickly because it takes place in a vacuum; oxidation

blems are almost eliminated; weight ses are minimal because thawing occurs a moist atmosphere; bacteriologic prob- s of water thawing are eliminated; heat age to the product is minimal.

trolled Atmosphere Shipment resh Fish Studied

CF Technological Laboratories at Ann or, Mich., and Seattle, Wash., have con- ted research on the use of controlled at- sphere to extend the shelf life of fresh fish. liminary tests showed that fresh salmon be kept under refrigeration for 20 days a controlled-atmosphere container without iling.

To evaluate the benefits of this new pre- vation method, BCF staff is working with ansfresh Corp. on a trial shipment of fresh er salmon by truck to a Washington, D. C., ail chain.

Truck shipments using controlled-atmos- re containers and refrigeration may offer lternative to the more expensive air ship- nts.

sh Coastal Fishery Products wn to Midwest

CF's marketing staff helped to increase mount of fresh coastal species airshipped U. S. Midwest markets this summer. d chains in Minneapolis, Minn., and Cleve- d, Ohio, were the latest to introduce fresh ery products.

One chain sold over 40,000 pounds of silver mon in a short period. Another sold 6,000 nds of fresh halibut and salmon this sum- r; last year it successfully introduced sh rainbow trout.

Planes flying to the Midwest from the sts are developing delivery "routes" for hery products--and servicing retailers in lwaukee, Wisc., and Minneapolis on the ne flight.

Plankton Workshop Held at La Jolla

Scientists from BCF labs, the Bureau of Sport Fisheries & Wildlife, and the Scripps Institution of Oceanography took part in a BCF-sponsored Plankton Workshop at the Bureau's Fishery-Oceanography Center at LaJolla, Calif., in late July.

They discussed problems of accuracy, such as extrusion of plankton through the mesh of a net, avoidance of nets, effect of patchy plankton distribution on sampling precision, and experiences in such large cooperative surveys as EASTROPAC (Eastern Tropical Pacific program).

Plankton Survey Effectiveness

They showed much interest in the effectiveness of plankton surveys in evaluating distribution and spawning intensity of commercially valuable fish stocks.

Plankton voluming and sorting, data analysis, larval fish identification, net towing, and new approaches to plankton sorting and collection were demonstrated.

Miami Lab Releases More Drift Bottles

Thirty-six hundred empty beer bottles, inanimate researchers in a study of surface current patterns in the tropical Atlantic and Caribbean, were released by BCF's R/V "Undaunted" as she steamed to Africa last August. The bottles were donated to the BCF Tropical Atlantic Biological Laboratory (TABL) by the Miller Brewing Co. of Milwaukee.

During 1967, almost 5,000 drift bottles from a previous donation were released in and around the Florida Straits, Caribbean, and in the eastern tropical Atlantic off Africa. Five hundred and eighty-two were recovered--an overall return of 13%. Some areas yielded a 58% return.

Each bottle contains sand for ballast and a fluorescent, bright-orange card printed with a message in Spanish, French, Portuguese, and English. The message asks finder to fill in details about his discovery on an attached postcard addressed to TABL. TABL thanks

the finder, sends him a small chart showing track the bottle might have followed, and a cookbook of fish recipes in Spanish and English.

Finders Send Personal Messages

Many finders send personal messages. An ex-school teacher from Guyana was irate when he did not receive "a special reward like even a small outboard engine;" a fisherman from St. Jean du Sud Island requested "things necessary to subsidize my needs for fishing," and added: "I expect you will make me a researcher;" a Bahamian wrote that he had borrowed postage money and asked for "a pocket full" in return; still another expected a transistor radio.

A poignant communication in Spanish came from San Blas: "I saw a bottle which contained a card and also dry sand. The sand had some particles which sparkled and the sparkles of sand and the card inside frightened me. I bent over and seized the bottle; I wanted to show it . . . . We began to open the bottle and take out the card, but we did not want to touch the sand because we were afraid of the glistening particles. The card is wrinkled because we could not take it out. Please excuse us for that."

Lobster Tagging Study Off New England

Scientists of BCF's Biological Laboratory at Boothbay Harbor, Maine, have tagged over 2,000 lobsters off the southern New England coast. Their purpose is to learn about migration, growth, and survival of deep-sea lobsters--and their relationship, if any, with native coastal stocks.

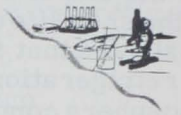
30 Recaptured

Commercial fishermen have caught 30 tagged lobsters. Several lobsters had made long shoreward migrations: one covered 97 miles of ocean bottom in 27 days; another--an egg-bearing female--traveled 77 miles in 28 days.

'National Geographic' Features Research of Auke Bay Lab

The research of BCF's Biological Laboratory at Auke Bay, Alaska, was a major theme in the article on salmon appearing in the August issue of the National Geographic magazine.

Photos included pink salmon spawning at Little Port Walter, Alaska, micro-wire tagging and fluorescent pigment marking of fry at Traitors Cove, Alaska, and tracing migration of pink and chum salmon at Olsen Bay, Alaska.



Attraction of Herring to Artificial Lights Studied

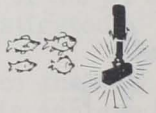
Biologists at BCF's Boothbay Harbor (Maine) Biological Laboratory have completed studies on the attraction of herring to artificial lights. Repeated experiments have confirmed that attraction increases at lower temperatures, lights are more effective below the surface than above, and optimum light intensity is greater below.

Prior Adaptation

The effect of prior adaptation on response is still uncertain. Although previous experiments indicated that prior adaptation to darkness produced a weaker response than prior adaptation to light, differences were not significant, and the experiments are being repeated.

Feeding Habits of Herring

Other studies at the lab have shown that herring feed on herring. Larval herring remains were found in the alimentary tract of 46% of the adult herring samples collected this summer. Continued sampling will enable researchers to estimate the frequency with which the adults prey on their young.



'Delaware's' Gloucester Trawl Catches Exceed Commercial Catches

The primary objective of the BCF Delaware's August cruise was to measure opening and other factors in 3 models of the Gloucester trawl under actual fishing conditions in 35 to 100 fathoms. (Cruise 68-7, Aug. 13-22.) A secondary objective was to get similar data on a #36 trawl for BCF's Biological Laboratory at Woods Hole, Mass.

Twenty tows of various duration were made in the Bay of Fundy area, mostly where New England based trawlers were fishing. The researchers used 3 sizes of the BCF Gloucester trawl developed at the Exploratory Fishing and Gear Research Base, Gloucester, Mass. One tow was made off Cape Ann, Mass., with a manila #36 trawl. The Delaware's catches were equal or superior to the catches of the commercial vessels.

Gloucester Trawls

The 3 sizes of Gloucester trawls fished and measured were: (1) an 88-foot headrope, 100-foot footrope trawl with $4\frac{1}{2}$-inch mesh throughout the net, (2) an 86-foot headrope, 96-foot footrope trawl with 6-inch mesh in wings and square and $4\frac{1}{2}$-inch mesh in remainder of the trawl, and (3) a 106-foot headrope, 128-foot footrope trawl with 6-inch mesh in wings and square and $4\frac{1}{2}$-inch mesh in remainder of the trawl. Trawl number 3 was made up and measured in anticipation of future use aboard the new stern trawler research vessel "Delaware II." All these trawls used the same set of rubber roller gear. This gear was made up of discs and 18-inch wing rollers in the wings and 22-inch rollers in the bosom (see illustration).

Results

Trawl net factors in the 4 trawls used were:

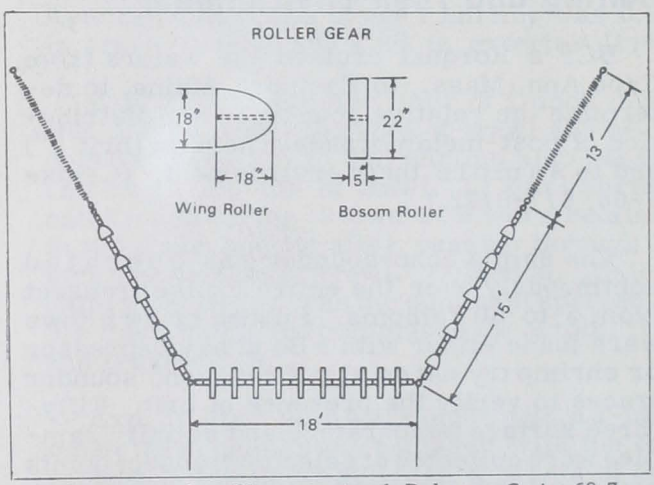
	Trawl Net Measurements Under Tow			
	Footrope	Wing End	Headrope Height	Wing Spread
	100'	12'	17'	50'
	106'	13'	16'	48'
	128'	-	27'	40'
	#36 trawl	6'	6'	41'

Notes: (1) Figures shown are averages from all data collected on each trawl.

(2) Data collected on Net B were influenced by numerous changes to trawl and rigging. The lack of a wing end height for net C was due to damage to wing end transducer.

The figures given are those recorded when the net had settled down and was being towed in a straight line. Over the years, trawl instrumentation activities at the BCF Gloucester base have resulted in compilation of many readings on various trawl nets. With few exceptions, it has been found that trawls require time to settle down before reasonably steady readings occur; also, that tides, rough seas, and types of bottom towed over are factors that affect trawls.

The researchers report that use of the wing end transducer sounding downward indicates that the Gloucester trawls offer a considerable wing end height. This has 2 obvious advantages: (1) the fish-herding effect of a wing is acting at a far greater height off the bottom, and (2) the possibility of a headrope hangup is reduced considerably. This was demonstrated on a previous trip. At that time, with the vertical wing-end transducer on the wing, a Gloucester trawl was towed up a precipitous ridge from 94 to 62 fathoms depth. The wing end was 14 feet off the bottom at the start of the climb. This height diminished to 4 feet before the trawl climbed over the ridge. Had the #36 trawl with its 6-foot wing end height been towed over this ridge, it is reasonable to believe that the headrope would have touched bottom.



Roller gear used on Gloucester trawl; Delaware Cruise 68-7.

Advantages of Trawl's Opening

The trawl achieves a higher opening. At the same time, other fishing characteristics, such as bottom contact and wing spread, remain constant--or comparable to a standard trawl. Obviously, the trawl should take better catches of groundfish species, such as cod, pollock, haddock, and others that sometimes swim up off the bottom. Fishing results of the Delaware's Cruise 68-7 bear out this advantage. To compare catch rates, tows 1

through 13 were made in an area in which commercial trawlers were operating. During these tows, catches of the Delaware always equaled or exceeded catches of commercial vessels, although the Delaware's tows were much shorter. Tows 14 through 20 were not made in company with commercial trawlers but on grounds where fish apparently were much less abundant.

There was no incident of damage to the gear under tow during the entire cruise. Reports of damage among the trawlers were heard over the radiotelephone. The results of this cruise and Cruise 68-2 suggest the roller rig used (illustrated on page 29) is more effective at reducing damage than the standard wooden rollers. More trials with this gear will be undertaken.

Note: For additional information, contact Keith A. Smith, Base Director, or Robert A. Bruce, Fishery Methods and Equipment Specialist, EF&GR Base, State Fish Pier, Gloucester, Mass., 01930, Telephone: 617-283-6554.

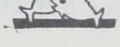
'Rorqual' Studies Post-Metamorphosed Herring and Their Environment

BCF's Rorqual cruised the waters from Cape Ann, Mass., to Eastport, Maine, to determine the relative abundance and distribution of post-metamorphosed herring (brit 3") and to sample their environment. (Cruise 7-68, 8/7-8/22.)

The ship's echo-sounder was operated continuously over the entire cruise transect from 5 to 50 fathoms. Fifteen trawl tows were made either with a Boothbay Depressor or shrimp try net on significant echo sounder traces to verify the presence of brit. Fifty-three surface temperature and salinity samples were collected at selected transect points and at all tow locations.

Preliminary Findings

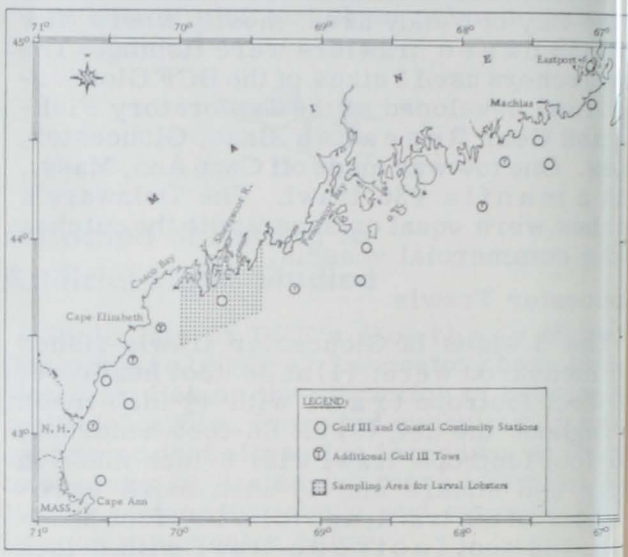
Medium-to-heavy surface traces were observed only from Penobscot Bay to Petit Manan. These traces were particularly heavy around the headlands from Dyer Bay to Mount Desert. From Penobscot Bay to Casco Bay, the traces were light and scattered. Repeated tows through the waters where the traces occurred failed to take any fish.



'Rorqual' Checks Distribution of Larval Lobsters Off New England

The Rorqual investigated the distributi of larval lobsters and other zooplankton the waters from Cape Ann, Mass., to Eas port, Maine. (Cruise 6-68, 7/17-8/6.)

During Phase 1 (July 17-26), a 2x1m neu ton net was towed to collect lobster larvae the surface for 30 minutes in the area sho on the chart.



R/V Rorqual Cruise 6-68, July 17-Aug. 6, 1968.

During Phase 2 (July 29-Aug. 6), obliq tows were made simultaneously from 0 to 2 for 30 minutes. The researchers used pai bongo nets (0.03 mouth area) and a Gulf sampler at 10 coastal continuity station and at 6 other stations shown on the cha Neuston tows also were made at each sampl location.

Preliminary Findings

During Phase 1, 65 lobster larvae w collected on 3 inshore-offshore transec sampled off Casco Bay, Boothbay Harbor, a Muscongus Bay. Most of the larvae, 57 88%, were in the first larval stage; 8 were the second stage. First-stage larvae we widely distributed; second-stage larvae o curred only offshore. The catch-per-tow larvae decreased from inshore to offshore a distribution pattern that suggests insho origin. The catch of larvae in the neust tows made along the outer coastal area, fr Cape Ann to Eastport, was limited to fo stage one specimens.

Zooplankton standing crop in summer decreased to 2.28 cc/100m^3 (of water strained) from the preceding spring mean of 8.92 cc/100m^3. The greatest decrease was in the western area. Volumes in the central and eastern Gulf coast were not significantly different from the spring values. In previous summers, volumes generally decreased from west to east. During the cruise, however, zooplankton volumes among the 3 areas sampled were not significantly different.

. S.-USSR Cooperation

As part of the U. S.-USSR cooperative investigation of plankton sampling methods, comparisons were made between the catching efficiencies of the Gulf III sampler and paired bongo nets (0.03 mouth area) used during the cruise. In 9 of 10 simultaneous tows made with the samplers, the bongos collected more zooplankton. The smaller zooplankters apparently were extruded through the rigid meshes of the Gulf III. The smaller copepod species--Pseudocalanus minutus, Acartia sp., and Centropages hamatus--were 5 to 30 times more numerous in the bongos. Catches of the larger copepods, particularly Calanus finmarchicus, were similar in the 2 samplers.

Cobb' Tests Shrimp Trawl Separator

BCF's John N. Cobb cruised for 26 days off Oregon testing shrimp trawls equipped with experimental devices for separating shrimp, Pandalus jordani, from other bottom-dwelling invertebrates and from fish. (Cruise 66, ended 8/2.)

Gear

Basic gear was two 57-foot headrope length semiballoon shrimp trawls having 2-inch stretch mesh webbing. Some tows were made using a shrimp try net with a panel of 3-inch web separating the trawl into upper and lower sections.

Methods

Scuba-equipped gear specialists observed the trawls in operation and determined trawl configuration for various modifications.

In several experiments, various portions of the trawls were covered with lightweight $\frac{3}{4}$-inch mesh web to determine escapement of shrimp and fish through the larger trawl web. Later, large areas of the trawl were covered with $\frac{3}{4}$-inch web and the catch was isolated from the main trawl codend.

Comparative tows between 2 trawls were made simultaneously by joining one wing of each trawl and towing from a 3-warp system. The vessel trawl net reel was equipped with tow cable to pull the common center wing.

An Oregon Fish Commission biologist gathered data on size, age, and sex composition of shrimp retained in various experimental net configurations.

Results

Experiment 1: Exterior liners of $\frac{3}{4}$-inch mesh web, attached along each side panel of trawl from wings to intermediate, retained shrimp and fish that normally escaped through that part. Of the total catch made during 4 tows, 60% of the shrimp were retained in the liner codend after passing through the 2-inch mesh trawl. Only 4% of the fish and invertebrates passed through to exterior section. Average proportion of age 1 shrimp was 0.7% in trawl codend and 4.8% in exterior liner.

Exp. 2: An exterior liner of $\frac{3}{4}$-inch mesh web placed over top panel of trawl and aft to codend indicated that shrimp also passed through the top of trawl. Of total shrimp catch made during 10 tows, 29% were retained in the liner codend after passing through 2-inch top portion of trawl. Eulachon, Thaleichthys pacificus, was the dominant species in the liner catch and comprised 2% of total fish and trash catch.

Exp. 3: Four tows were made with a 2-inch mesh trawl completely enclosed, with the exception of the trawl belly, in a series of exterior $\frac{3}{4}$-inch mesh covers. Riblines added to trawl side seams allowed side panel meshes to open fully so shrimp could pass through and be separated from remainder of the catch. Ninety-three percent of the shrimp captured did pass through the 2-inch trawl web and were retained by the external covers.

Exp. 4: A small Gulf-of-Mexico-type try net, which incorporated a horizontal 3-inch mesh web panel to separate upper and lower parts of the trawl, successfully restricted nearly all trash species to bottom portion of trawl. Unfortunately, although most unwanted

species were separated, only about 17% of the shrimp passed through the separator panel into the top section.

Exp. 5: A dual net trawling technique was tested that permitted an experimental net to be fished simultaneously with a control net. It was necessary to use more tow cable than when towing a single trawl to hold the center wings at the ocean floor. The two 57-foot shrimp trawls covered a path about 45 feet wide; a single trawl covered only a 25-foot path. Both trawls were wound onto a single trawl net reel.

Results

The experiments provided useful information for effective trawl design. None of trawl configurations tested was intended to operate as a commercial net. However, 2 prototype commercial trawls were constructed following cruise that used the experiment results. These trawls will be tested during Cobb Cruise No. 97.

Note: For further information contact: Dayton L. Alverson, Base Director, Exploratory Fishing and Gear Research Base, 2725 Montlake Blvd. E., Seattle, Wash. 98102. Phone: 583-7729.

'Commando' Evaluates Mark II Universal Trawl

The BCF chartered research vessel Commando conducted a 17-day study in the coastal waters of Washington and northern Oregon in cooperation with the Atomic Energy Commission. (Cruise 15, ended 6/30.)

Cruise objectives were to (1) evaluate the Mark II Universal trawl for sampling off-bottom fish populations; (2) determine relative distribution of midwater biomass (amount of living matter) in relation to sound-scattering layers; (3) assess feasibility of using a drone to increase efficiency of searching for midwater fish schools.

Gear

Fish populations were sampled with a Mark II Universal trawl. This net has a 94-ft. headrope and footrope. It was rigged with 41 floats equally spaced on the headrope, and $\frac{1}{2}$- and $\frac{3}{8}$-inch chain on the footrope. The forward part of the net was 5-inch polyethylene web with intermediate and codend sections of $3\frac{1}{2}$-inch mesh polyethylene web. The codend was completely lined with $1\frac{1}{8}$-inch mesh. All tows were made using 5-ft. by 9-ft. aluminum V-doors weighing about 675 pounds each. Three-leg, 30-fathom bridles attached the doors to the net. The gear was towed with $\frac{5}{8}$-inch diameter electromechanical cable. Pressure-sensitive depth-telemetry equipment was used to determine depth of fishing.

A 6-foot Isaac-Kidd trawl was used to sample nekton. Body and intermediate sections of the net were $3\frac{1}{2}$-inch mesh webbing lined with $\frac{1}{8}$-inch mesh nylon netting; codend was $\frac{1}{8}$-inch mesh nylon netting.

The 23-ft. auxiliary research vessel "Sea Probe" was used to determine the feasibility of scouting for fish using a small vessel. This vessel worked with Commando during fishing trials and was equipped with a radio-telephone and a 200-fathom sounder having a fish-discrimination feature.

Method of Operation

A survey was conducted in the offshore area from Cape Flattery, Wash., to Tillamook Head, Ore., from nearshore to 30 miles off the coast. The area contiguous to the Columbia River mouth was emphasized. All fishing was conducted in less than 75 fathoms.

Fish were located by offshore-inshore sounding transects. When scattering layers were recorded by the high resolution, low frequency echosounder, they were fished with Universal and Isaac-Kidd trawls to determine their composition. Trawl hauls also were made above and below sound-scattering layers appearing on the echograms to ascertain availability of fauna at these depths.

Towing speed for the Universal trawl ranged from 2.5 to 3 knots and for Isaac-Kidd trawl from 5 to 6 knots. Twenty-six Universal and 9 Isaac-Kidd trawl hauls were made during cruise at depths to 62 fathoms.

Evaluation of the Mark II Universal Trawl

The trawl was rigged with 31 floats and fished in 10 fathoms at 2.1 knots. Scuba equipped divers determined the trawl's vertical opening as 22 to 24 feet at the wingtips and 27 to 28 feet at the center of the net. Tension was about 2,000 pounds on each warp. The aluminum V-doors performed satisfactorily; because weight was concentrated in the

sle, doors were very stable when fished both
or and off-bottom. The net tended bottom
wl during the tow but, because of the dis-
proportionate weight of chain on the footrope,
1 more floats were added to lighten the trawl.

Mark II Universal trawl fished on- and
o-bottom fish populations satisfactorily.
Groundfish catches exceeded 4,000 pounds per
1-hour tow. Also catches from off-bottom
concentrations of hake up to 12,600 pounds
per 1-hour tow were made on moderate sign.
A slight gilling problem in the net's after
belly occurred when fishing hake. In one tow,
100 pounds of white bait smelt, Allosmerus
elongatus, averaging 9 cm. in length were
taken. This suggested that the net effectively
samples small fish populations.

Distribution of Midwater Biomass

Two series of Universal trawl and Isaac-
Kidd trawl hauls were made at various levels
to ascertain vertical distribution of midwater
biomass in relation to sound-scattering lay-
ers.

The first series was made over a bottom
depth of 40 fathoms off the mouth of the
Columbia River at 46°11' N. latitude and
124°13' W. longitude. Three sound-scatter-
ing layers were found. The upper two were
diffuse, while the layer just above bottom was
more distinct and typical of "sign" usually
ascribed to hake.

Nothing of consequence was caught at any
depth not showing a scattering layer.

Drone Simulation

The auxiliary research vessel Sea Probe
is operating with Commando simulated a
drone vessel for fish scouting. Sea Probe
scouted for and reported location of schools
to Commando, increasing search effective-
ness. The former also determined areas of
highest abundance in front of Commando dur-
ing actual fishing. This information was use-
ful in directing Commando during the opera-
tions. Visual reconnaissance of Sea Probe's
position was not possible beyond 3 miles, and
radar was ineffective due to interference
from sea return.

Technological Studies

Technologists checked incidence of a
myxosporidian parasite in hake from 10 lots
samples. Initial observation of high overall
parasitization of stocks, with hake from in-
shore hauls having a somewhat higher inci-
dence, continued as in previous years.

Technologists also tested the enzymatic
softening of hake at various storage temper-
atures--and the effect of blood upon oxidative
rancidity of rockfish fillets during storage.
Two hundred pounds of fillets of various spe-
cies and 300 pounds of whole hake were col-
lected for studies to determine possibility of
making "surimi" (minced fish flesh) and
"kamaboko" (fish paste).

Biological Studies

Groundfish Program personnel sampled
and processed 1,500 hake at sea for length,
sex, and age. Twelve hundred more hake
were returned to the Seattle Lab to be proc-
essed for length, sex and age--and for phys-
iological work on livers, hearts, and eye
fluids. This research is part of a program to
monitor the condition of hake stocks off the
Pacific coast.

Note: For further information contact: Dayton L. Alverson, Base Director, Exploratory Fishing and Gear Research Base, 2725 Montlake Boulevard East, Seattle, Wash. 98102. Phone: 583-7729.

'Gilbert' Finds Threadfin Shad & Nehu About Equal Tuna Bait

BCF's Charles H. Gilbert cruised Hawai-
ian waters to test threadfin shad as a live
bait in the pole-and-line fishery for skipjack
tuna. The nehu is the bait used in this fish-
ery. (Cruise 109, 5/16-8/3.)

Experimental pole-and-line fishing was
conducted with 12 skipjack tuna schools using
threadfin shad as bait--and with 10 skipjack
tuna schools using nehu as bait. Pole-and-
line fishing was conducted with one other skip-
jack tuna school using both threadfin shad and
nehu.

The experimental fishing results are sum-
marized in table.

The researchers report: "There is no
significant statistical difference between the
catch per unit of effort (mean number of tuna
per minute) ($p > 0.4$) between threadfin shad
and nehu."

Experimental Fishing Results, Charles H. Gilbert, Cruise 109									
Bait	No. of Schools	No. of Tuna Caught	Wt. of Tuna Caught	Size of Tuna Caught (Avg. Wt.)	Avg. No. of Tuna/Min. 1/	Avg. Lbs. Tuna/Min.	Avg. Lbs. Tuna/ Lb. Bait	Avg. No. Passes/ School	Avg. No. Bait Buck School
Shad	12	1,286	6,726	5.2	8.1	42.1	21.5	3.1	3.7
Nehu	10	1,250	9,236	7.4	9.8	72.5	28.3	3.1	4.6
Total	22	2,536	15,962	-	-	-	-	-	-

1/Four men fishing almost constantly.

The 2 Baits

In general, threadfin shad swim downward at angles estimated to be 45° to 60° after being chummed into the water. Nehu tend to dive down at somewhat steeper angles, estimated at 60° to 80°. Threadfin shad do not appear to dodge as vigorously as nehu--but appear to be much more visible than nehu from the Gilbert's stern underwater chamber. All sizes of threadfin shad ($1\frac{1}{2}$"-$2\frac{1}{2}$") appear to exhibit the same swimming behavior.

The Gilbert researchers also tested various "transporting, handling, and acclimatizing techniques" to obtain better survival and use of bait. They also collected specimens for themselves and for other scientists in the U. S. and Great Britain.

'Cromwell' Studies Ultrasonic Tags in Sonar Tracking of Tunas

One mission of BCF Honolulu's vessel Townsend Cromwell in a recent cruise in Hawaiian waters was to determine the feasibility of using ultrasonic tags to improve the tracking of tunas with the CTFM sonar. (Cruise 37, 6/5-7/31.)

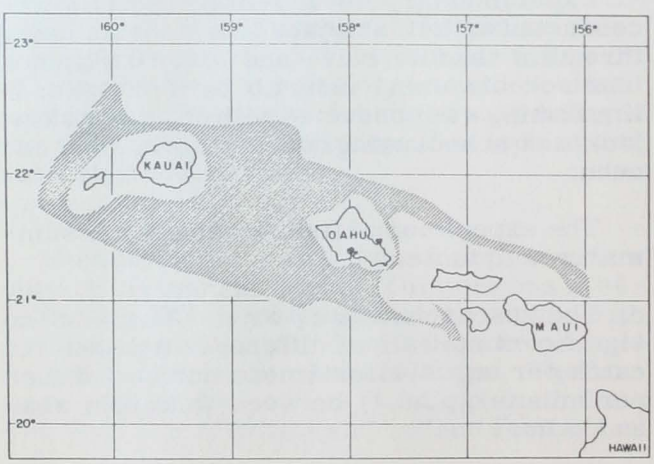
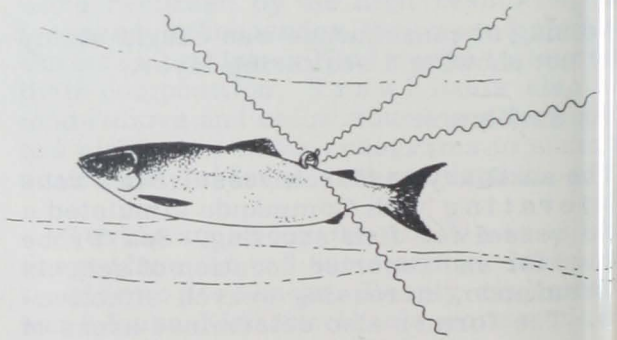


Fig. 1 - Area of sonar operations.

The scientists used cylindrical ta inches long and $1\frac{1}{8}$ inches in diameter. tags transmitted pulses at a rate of 1 second that were readily detectable 1 away. Because the vessel did not have fa ities for holding skipjack tuna, 3 little t held in captivity for 15 months were tag and released at sea on separate occasio

The Operation

Each tag was attached to the fish in same manner. It was tied securely to shank of a fish hook. The hook was inser across the midline immediately posterior the second dorsal fin. The tunny first was leased in a school of skipjack, the second w no fish in sight, and the third in a schoo yellowfin. Tracking durations were 77, 1 and 21 min., respectively. On the last occasions, tracking ended when the tags s out of range. Neither of the 2 fish relea in schools appeared to have joined the scho All 3 swam off at about 2 knots.



Tag Burdens Small Fish

Later, one of 4 little tunny in a pool at Honolulu Laboratory's Kewalo Basin tagged and observed. It was soon obvious t the tag was a burden to the 4-pound fi which was the size of the others tagged. tag carrier beat its tail continuously, in c trast to the untagged fish. It always sw closer to the bottom than the other, and it not school with them except for short, int mittent, periods. After 117 min., the slipped off the fish.

Sharks Tagged

Two gray reef sharks (Carcharhinus menisorrah) were caught off Niihau, taken out to sea, tagged, and released. Only brief contact was made with the first shark. Failure to track this shark resulted from a combination of factors: the tag did not start transmitting immediately, and the sea was very choppy.

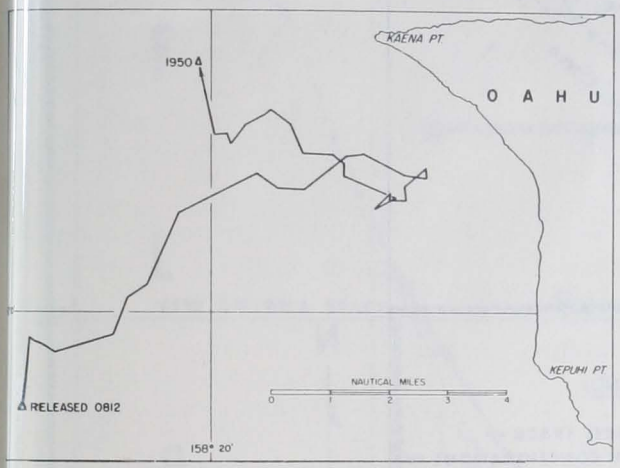


Fig. 2 - Path of tagged shark.

The other shark had a tag introduced into its gut before it was released off leeward Oahu. The shark moved about 17½ miles in the first 12 hours (fig. 2). Then, at sundown, it moved toward the bottom, which was 500 m. deep. When it remained stationary throughout the night and past sunrise, the researchers assumed the shark had ejected the tag. Tracking was discontinued.

Following Tagged Fish Practical

The researchers concluded from the ultrasonic tagging experiences that: (1) following tagged fish with a ship is practical; (2) tag dimensions must be reduced if fish the size of skipjack tuna are to be tagged; (3) a tag placed inside the fish works as well as one placed externally.

'Oregon' Conducts Midwater Schoolfish Survey Off East Coast

BCF's Oregon completed the fourth in a series of 6 bimonthly midwater schoolfish survey cruises. (Cruise 131, 7/16-26.)

The series is designed to obtain information on seasonal distribution and schooling density of pelagic schoolfish in coastal waters (5-20 fms.) between Cape Hatteras, N. C., and Jupiter Inlet, Florida. The information will be used to establish criteria for exploratory and experimental fishery operations along the southeast coast. (See chart p. 36.)

High-resolution vertical echo tracings were obtained on 26 standard transects. Continuous surface temperature data and vertical temperature profiles were obtained on all transects.

Findings of Fourth Cruise

Preliminary examination of echo tracings indicated that midwater fish were more prevalent in school size and number than on previous cruises. Heaviest fish concentrations off Florida were located east of Mayport and St. Augustine and off Cape Kennedy. Off Georgia, concentrations were recorded east of St. Simons and Sapelo Islands and east of Savannah. Off the Carolinas, extensive concentrations were located south of Cape Romain in South Carolina, and south and southeast of Cape Fear in North Carolina.

'Oregon' Explores Florida's Scallop Grounds

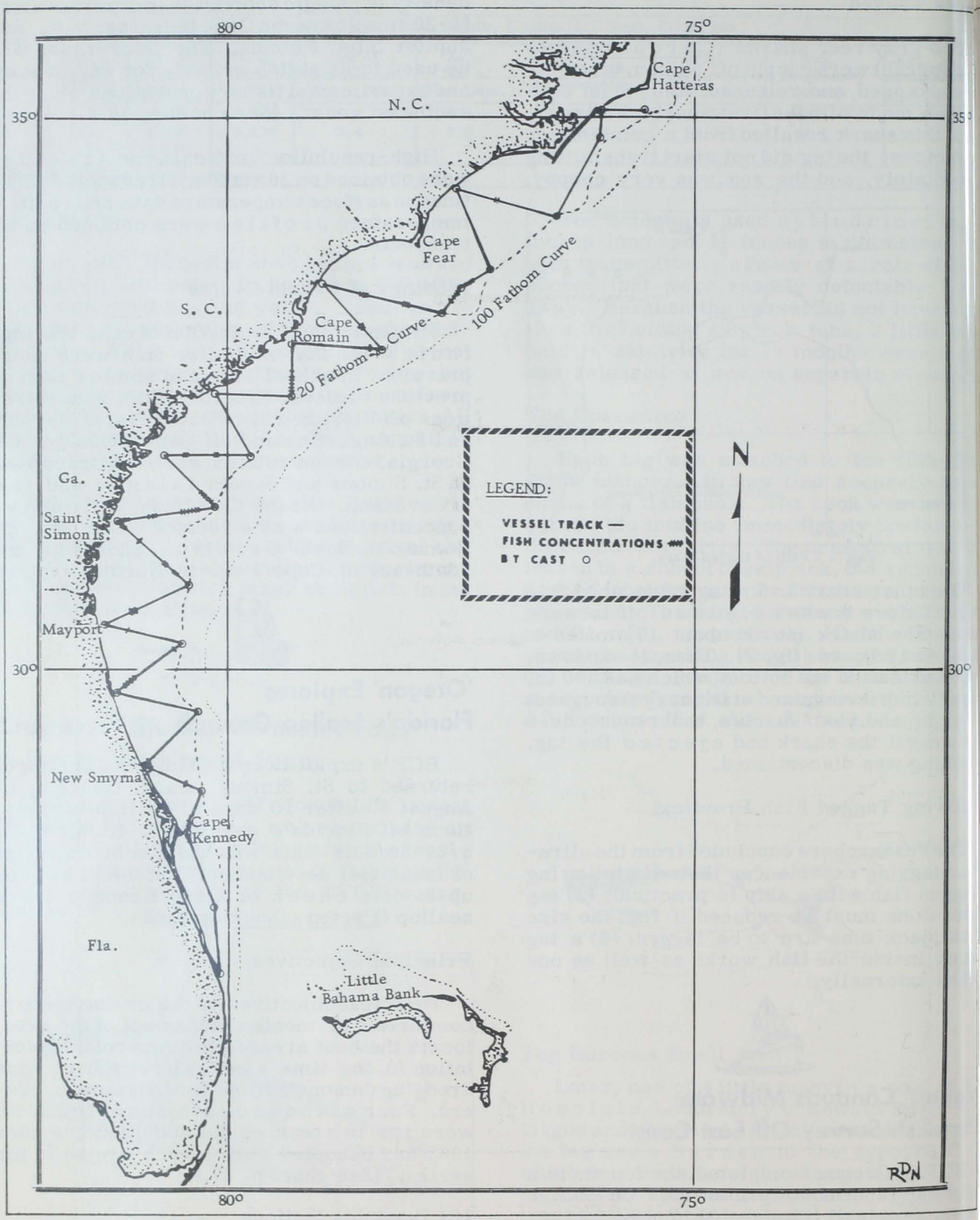
BCF's exploratory fishing vessel Oregon returned to St. Simons Island, Georgia, on August 30 after 10 days of scallop explorations off Florida's east coast. (Cruise 132, 8/21-30/68.) This was the eighth in a series of industrial development cruises to keep an up-to-date check on Cape Kennedy calico scallop (Pecten gibbus) grounds.

Principal Objectives

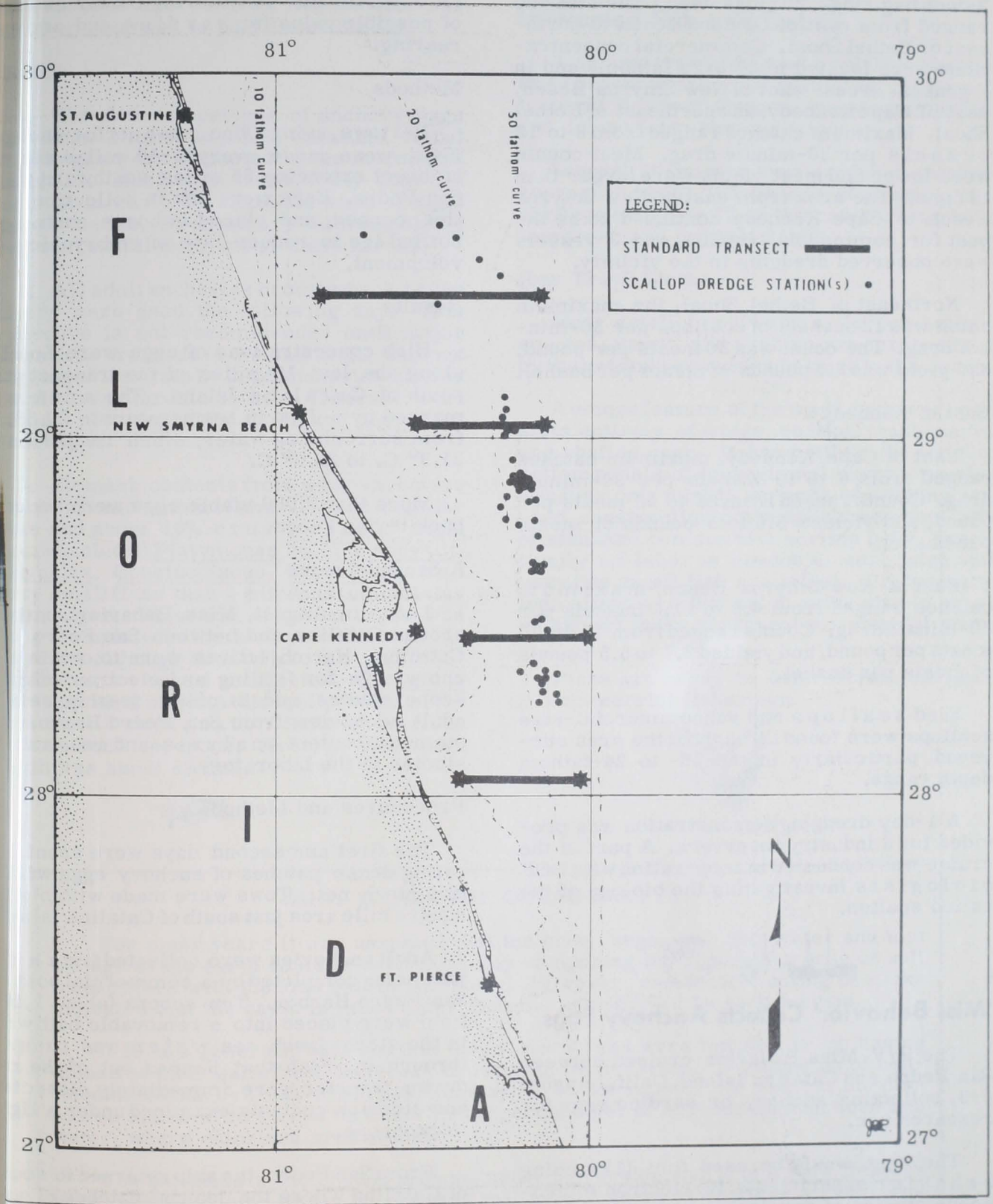
Principal objectives of the cruise were to complete a 12-month assessment of the area, locate the best areas for commercial exploitation in the time available, and provide dredging demonstrations for industry observers. Four standard assessment transects were run in areas established in September 1967 and occupied during each cruise in the series. (See chart p. 37.)

104 Dredging Stations

A total of 104 dredging stations were occupied with 8-foot tumbler dredges fitted with



R/V Oregon, Cruise 131, July 15-26, 1968.



R/V Oregon Cruise 132, August 21-30, 1968.

2-inch bag rings, 20 rings deep. The stations ranged from east of Ormond Beach to northeast of Bethel Shoal. Commercial concentrations were located in 22 to 26 fathoms and in 3 general areas: east of New Smyrna Beach, east of Cape Kennedy, and northeast of Bethel Shoal. Maximum catches ranged from 8 to 19 bushels per 30-minute drag. Meat counts were lower and meat yields were larger than in June. The area from east of New Smyrna Beach to Cape Kennedy continued to be the best for commercial fishing, and 2 vessels were observed dredging in the vicinity.

Northeast of Bethel Shoal, the maximum catch was 12 bushels of scallops per 30-minute drag. The count was 80 meats per pound, and yield was 3.5 pounds of meats per bushel.

East of Kennedy

East of Cape Kennedy, maximum catches ranged from 6 to 19 bushels per 30-minute drag. Counts ranged from 50 to 68 meats per pound, and yielded 3.5 to 5 pounds of meats per bushel.

East of New Smyrna Beach, maximum catches ranged from 6.6 to 11.8 bushels per 30-minute drag. Counts ranged from 55 to 75 meats per pound, and yielded 2.7 to 5.5 pounds of meats per bushel.

Seed scallops and subcommercial-size scallops were found throughout the area surveyed, particularly in the 16- to 24-fathom depth range.

A 1-day dredging demonstration was provided for 6 industry observers. A part of the cruise was conducted in cooperation with BCF biologists investigating the biology of the calico scallop.

'Miss Behavior' Collects Anchovy Eggs

The R/V Miss Behavior cruised between San Pedro and Catalina Island, Calif., August 6-8, collecting anchovy or sardine eggs for research use.

The eggs would be used for: (1) feeding behavior experiments; (2) electron microscope studies of developing chloride cells within the epidermis of anchovy and sardine; (3) experiments considering container siz of possible value for sardine and ancho rearing.

Methods

Net tows, using a fine mesh net for anch eggs, were made every 5-10 miles alo transect extending 35 miles southward f San Pedro. Eggs were left in collection b tles, capped, and placed in boxes contain bottled ice to reduce rate of embryonic velopment.

Results

High concentrations of eggs were fou along the last 10 miles of the transect ju south of Catalina Island. The area w marked by a drop in temperature to 20.5° from surrounding water, which ranged fr 21.3° C. to 22.0° C.

More than 7,000 viable eggs were brou back to San Diego.

A Second Cruise

Later in August, Miss Behavior cruis around Catalina and between San Pedro a Catalina. Her objectives were to obtain a chovy eggs for feeding and electron mic scope studies, and to obtain freshly sei adult anchovies from San Pedro Harbor stomach-content analysis and respira studies at the laboratory.

Procedures and Methods

The first and second days were spent cating dense patches of anchovy eggs wi fine mesh net. Tows were made within a square mile area just south of Catalina Isla

Adult anchovies were collected from a just being completed by a commercial boat San Pedro Harbor. Ten scoops (about 1,5 fish) were placed into a removable bait w in the stern; fresh sea water was pump through it. Fish that jumped out of the during transfer were immediately dissect and stomach contents examined under a li microscope.

From San Pedro, the ship returned to so of Catalina where the densest patches of a chovy eggs had been found. Fifteen tows w made and collected eggs were transferred

ethylene buckets. All eggs were collected
een 0200 and 0430 on August 22. The
then returned to port immediately.

lts

The densest patches of anchovy eggs
found 8 miles south of Catalina. About
0 eggs were collected on the morning of
ust 22. Most eggs were newly spawned
still in early development when brought
to the lab. Preliminary results indicate
successful survival of these larvae.

All adult anchovies brought back to the
ery were dead the following day. This
edure is not recommended until major
rations are made to the bait well. Serious
gging of the drain by dead anchovies caused
rflow of water into the boat. It necessitated
quent clearing of the drain and decreased
er flow.

Stomach contents from adult anchovies
wed a composition of about 90% unicellular
ae and about 10% crustaceans. Algal
era included Platymonas sp., Phaeocystit,
nyaulax, Coscinodiscus, Rhizolenia, and
ny small (less than 5 microns) unicellular
en algae. Digestion of green algae was
rly complete in the last one-third of the
estine, although both diatoms and dino-
gellates seemed unaffected. Gonyaulax
s found still alive in this last portion of the
estine. Zooplankton included various
clusae and copepods. Average adult fish
gth was about 82 mm.

New Shrimp Trawl Sorts Out Unwanted Fish and Debris

A shrimp trawl designed by BCF's Seattle Base produced excellent results during recent tests off Newport, Oregon, in separating fish and debris from shrimp catches.

Several 30-minute tows produced catches averaging about 700 pounds of nearly pure shrimp; less than 3% of the catches was bottom trash and unwanted fish.

How Trawl Works

Most small flatfishes, larger bottom species, smelt, and urchins are screened out by the net and returned unharmed to the ocean.

A unique feature of the trawl is that it consists entirely of wings, codend, trash chute, and chafing gear. It has neither the top nor bottom panels of conventional shrimp trawls. Because only minute amounts of webbing are used, construction costs should be about 50% of standard commercial shrimp nets. Practically no labor is needed to sort catch and very few small fish are killed. Preliminary indications are that catch rates should equal or exceed those of present commercial gear.

Plans are ready to demonstrate the gear to commercial fishermen.

WHAT MAKES THE OCEAN SALTY?

For many years it was assumed that the ocean began as fresh water and that the age of the earth could be determined by comparing the annual increase of salt from rivers with the total salt in the ocean. However, radioactive dating of rocks indicates that the earth is much older than the age derived by such method.

It is now generally believed that the primeval seas were initially salty, having dissolved their salts from the rocks underlying their basins. Breaking up of continental rocks by frost and erosion has added to the salts of the sea, but the dissolved material in rivers contains higher percentages of carbonates than does sea water, where chlorides predominate.

The saltiness of the oceans is undoubtedly increasing, but it is a slow process which has been going on for hundreds of millions of years. ("Questions About The Oceans," U. S. Naval Oceanographic Office.)